

O. R. TAMBO DISTRICT MUNICIPALITY



O.R. TAMBO
DISTRICT MUNICIPALITY

PROJECT NUMBER: MIS 478 793 A

**SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B –
CONSTRUCTION OF ABSTRACTION WORKS AND MALEPELEPE
WATER TREATMENT WORKS**

CONTRACT 1

MAY 2025

NAME OF BIDDER:

BID AMOUNT:

CSD SUPPLIER NUMBER:

CLOSING DATE & TIME:

03 JULY 2025 @12H00

Prepared for:

The Municipal Manager
O. R. Tambo District Municipality
Private Bag X6043
MTHATHA
5099

Tel. No. (047) 501 6400

Prepared by:

Infrastructure Water and Sanitation
O. R. Tambo District Municipality
Private Bag X6043
MTHATHA
5099

Tel. No. (047) 501 6425

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PLEASE CHECK

x / √

- That you have read all the pages of the bid document.
- That you have completed ALL the forms required to be completed
in NON-ERASEABLE INK.
- That your arithmetic calculation in the bill of quantities is correct.
- That you have attached ALL necessary documentation relating to the
composition of the bidding entity, i.e.
- Company registration documents naming the shareholders and Directors / members of the
company, close corporation etc.
 - Joint venture agreement if bidding entity is a joint venture.
- That the COMPLETE bid document is submitted.
- That the FORM OF OFFER is completed in full and signed.
- That ALL returnable documents are completed and signed.
- Ensure that your bid is submitted by 12H00PM on the closing date of the bid.

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T1.2	Tender Data	Pink
T1.3	Standard Conditions of Tender	Pink
Part T2: Returnable documents		
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T2.2	Returnable Documents for Tender Evaluation Purposes	Yellow
T2.3	Returnable Documents Incorporated into the Contract.	Yellow
The Contract		
Part C1: Agreements and Contract Data		
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C1.5	Performance Guarantee (Pro Forma)	White
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Part C2: Pricing data		
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APPENDIX A	Locality Layout
APPENDIX B	Monthly Reporting Templates
APPENDIX C	Environmental Specifications
APPENDIX D	OHS Specs
APPENDIX E	Geotechnical Investigation
APPENDIX F	Rainfall Data
APPENDIX G	Book of Drawings

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T1.1: TENDER NOTICE AND INVITATION TO TENDER

Tenders are hereby invited from suitably qualified and experienced contractors who are registered with CIDB for a project funded by the Municipal Infrastructure Grant under the O. R. Tambo District Municipality.

Project Number	Name and Description	CIDB Grading	Bid Closing Date and Time
Contract No.: MIS 478 793 A	Sidwadweni Regional Water Supply Scheme Phase 5B – Construction of Abstraction Works and Malepelepe Water Treatment Works – Contract 1	9CE	03 JULY 2025 @12pm

A **compulsory clarification meeting** with representatives of the Employer will take place at **10H00** on, **06 June 2025 at Mhlontlo Local Municipality, Tsolo Town Hall.**

The municipality will not repeat any matters already covered in the compulsory briefing meeting to the tenderers who arrive more than 10 minutes late to the meeting, nor will it allow such tenderers to complete the attendance register. Any bid received from a tenderer who did not attend the briefing meeting and sign the attendance register will not be considered.

Bid documents should be downloaded on the e-Tender website (www.etenders.gov.za) alternatively on the O.R. Tambo website (www.ortambo.gov.za) at no cost.

Bids must be completed in black ink, enclosed in a sealed envelope, and clearly marked with the **“Project number, project name and description”**, deposited in the Open Tender Box, Ground Floor, O. R. Tambo District Municipality Building, Nelson Mandela Drive, Myezo Park, Mthatha, Eastern Cape, not later than 12H00pm on 03 July 2025.

It must be expressly understood that the Municipality does not accept responsibility for ensuring that bid submissions sent by courier or post, or delivered in any other way, are deposited in the Tender Box. It is therefore preferable for the tenderer to ensure that its bid submission is placed in the Tender Box by its own staff or representative(s).

Tender submissions will be opened in public at **12H00pm on 03 July 2025**. The Municipality reserves the right not to accept the lowest priced tender or any tender at all, or to accept the whole or part of any tender.

In terms of the O. R. Tambo District Municipality SCM Policy Section 72 and 73, the Municipality will apply Fair Distribution of Municipal Resources on Capital Infrastructure Projects, Objective criteria on the evaluation and award of bids.

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RETURNABLE DOCUMENTS TO BE SUBMITTED WITH THE BID:

- Copy of business registration documents, as issued by CIPC.
- Certified copy of identity documents of directors/ shareholders/ partners / members, as the case maybe.
- Original Valid Tax Clearance Certificate or a Confirmation of Tax Validity with the pin issued by SARS.

INVALID OR NON-SUBMISSION OF THE FOLLOWING RETURNABLE DOCUMENTS WILL DISQUALIFY A BID SUBMISSION:

- Complete fully the bid document or to provide the information requested, or to sign the bid at the appropriate spaces provided or next to errors.
- Fill and properly sign the form of offer.
- Attach proof of registration with CSD.
- Attach joint Venture Agreement or Consortium Agreement signed and initialled on each page (if applicable).
- Attach consolidated company registration documents, bank account, SARS Tax pin, CSD (for JV or Consortium).
- Attach audited annual financial statements of the bidding entity for the past three years (for projects in excess of R10 million).
- Attach unaudited annual financial statements for close corporations and companies if the public interest score is below 350 in line with the Companies Act of 2008.
- Attach proof of latest municipal rates and taxes statement **of the bidder and each company director** and each company indicating that rates and taxes are not in arrears for more than 3 months.
- Attach proof of latest municipal water and sanitation charges statement of the bidder and each company director indicating that rates and taxes are not in arrears for more than 3 months
- Attach a confirmation of address from a ward councillor where the bidder and company directors operate and reside in a peri-urban area where rates and taxes and service charges are not billed.
- Attach a copy of a valid lease agreement where the bidder does not own the property they are operating from.
- Attach proof or registration with the Construction Industry Development Board (CIDB).

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EVALUATION OF BIDS IN TERMS OF THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK REGULATIONS, 2022:

Bids will be evaluated in three stages, namely:

- Stage 1 – Compliance with Bid Rules and other Requirements
- Stage 2 – Functionality Assessment
- Stage 3 – Price and Specific Goals Points

Tenders will be evaluated in terms of the Supply Chain Management policy of the O. R. Tambo District Municipality. The lowest tender will not necessarily be accepted, and the Municipality reserves right to accept the whole or part of any tender or not to consider any tender not suitably endorsed. An 90/10-point system shall apply where 90 points is allocated for price and 10 points allocated for specific goals of contributor as follows:

The specific goals allocated points in terms of this tender	Number of points Allocated on 90/10 system
51% Black-owned enterprises	04
100% Women-owned enterprises	02
100% Youth-owned enterprises	02
Where the enterprise head office or primary place of business is located within O. R. Tambo District.	02

CONDITIONS OF THE TENDER WITH REGARDS TO SUB-CONTRACTING

IT IS A CONDITION OF THIS TENDER THAT THE SUCCESSFUL TENDERER MUST SUBCONTRACT A **MINIMUM OF 20%** OF THE VALUE OF THE CONTRACT SUM (EXCLUDING SPECIALIST SUPPLY ITEMS, PROVISIONAL SUMS, CPA AND CONTINGENCIES) TO THE DESIGNATED GROUPS AS INDICATED IN THE TENDER DOCUMENT.

Tenders may only be submitted on tender documentation issued. No late, faxed, e-mailed, or other form of tender will be accepted.

Technical enquiries: Mr. N. Noto, telephone number 047 501 6425 or email: nkosiyabon@ortambodm.gov.za

All Supply Chain Management enquiries may be directed to Mr. S. Hopa, telephone number 047 501 6449 or Email: sakhiwoh@ortambodm.org.za during office hours: Monday to Friday 08H00-13H00 and 13H30-16H30.

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Tenderers must submit copies of all supporting documents necessary to prove conformance with Specific Goal criteria listed above in order to be eligible for Specific Goal points.

B. Mase

Municipal Manager

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T1.2: TENDER DATA

The Standard Conditions of Tender are those contained in Annexure C of the Construction Industry Development Board (CIDB) *Standard for Uniformity in Engineering and Construction Works Contracts (August 2019)* as published in Board Notice 423 of 2019, in Government Gazette No. 42622, on 08 August 2019.

The Standard Conditions of Tender Procurement make several references to the Tender Data for details that apply specifically to the Tender. The Tender Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the standard Conditions of Tender.

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

Clause	Wording / Data
C.1.1	General
C.1.1.1	<div> <div>The Employer is:</div> <div> O. R. Tambo District Municipality Private Bag X6043 Mthatha 5099 </div> </div> <div> <div>Telephone:</div> <div>047 501 6425</div> </div> <div> <div>Email:</div> <div>nkosiyabon@ortambodm.gov.za</div> </div>
C.1.1.2	Tenderers shall declare any perceived, known and potential conflict of interest under Returnable Documents: Declaration of Intent of Persons in Service of State and Declaration of Tenderers Supply Chain Management Practices.
C.1.2	<div>The Tender documents issued by the Employer comprise:</div> <div>Tender</div> <div> T1.1 Tender Notice and Invitation to Tender. T1.2 Tender Data T1.3 Standard Conditions of Tender T2.1 List of Returnable Documents T2.2 Returnable Documents for Tender Evaluation Purposes </div>

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Clause	Wording / Data
	<p>T2.3 Returnable Documents to be Incorporated into the Contract</p> <p>Contract</p> <p>Part C1: Agreements and Contract data</p> <p>C1.1 Forms of Offer and Acceptance C1.2 Contract Data C1.3 Tenderer's Direct Participation of Targeted Labour C1.4 Specification for SMME Sub-contractor Employment C1.5 Performance Guarantee (Pro forma) C1.6 Adjudication C1.7 Agreement in Terms of the Occupational Health and Safety Act 1993 (Act 85 of 1993)</p> <p>Part C2: Pricing Data</p> <p>C2.1 Pricing Instructions C2.2 Bill of Quantities</p> <p>Part C3: Scope of Works</p> <p>C3.1 Description of the Works C3.2 Engineering C3.3 Procurement C3.4 Construction C3.5 Management C3.6 Health and Safety C3.7 Project Specifications</p> <p>Part C4: Site Information</p> <p>Part C5: List of Tender Drawings</p> <p>Appendices A – G.</p> <p>Documents not issued to Tenderer's, but available from the S.A. Federation of Civil Engineering Contractors, the S.A. Institution of Civil Engineering, the S.A. Bureau of Standards, the Government printers, the Construction Industry Development Board, and the Employer, as applicable:</p> <p>a) GCC2015 "General Conditions of Contract for Construction Works", Third Edition, second</p>

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Clause	Wording / Data
	<p>print, 2015 published by the South African Institute of Civil Engineering (SAICE) *Tel 011 805 5947)</p> <p>b) S.A. National Standards SANS 1200 Standardised Specifications for Civil Engineering Construction.</p> <p>c) The Preferential Procurement Policy Framework Act No 5 of 2000, and the Preferential Procurement Policy Framework Act Regulations (November 2022).</p> <p>d) The Occupational Health and Safety Act No 85 and Amendment Act No 181 of 1993, and Construction Regulations (2014) and COVID-19 requirements for Construction Sites.</p>
C1.3	<p>Interpretation</p> <p>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.</p>
C.1.4	<p>Communication:</p> <p>Attention is drawn to the fact that verbal information, given by the Employer's Agent during site visits/clarification meetings or at any other time prior to the award of the Contract, will not be regarded as binding on the Employer. Only information issued formally by the Employer's Agent in writing to tenderers will be regarded as amending the Tender Documents.</p> <p>The Employer's Agent is:</p> <p>Name: Zutari (Pty) Ltd Address: 1 Pearce Street Berea EAST LONDON 5241</p> <p>Contact person: Gcobani Tshayana Telephone: 043 721 0900 Email: Gcobani.Tshayana@zutari.com</p>
C.2	<p>Tenderer's obligations</p>
C.2.1.1	<p>Only those tenderers who are registered with the Construction Industry Development Board (CIDB) (as "Active" at the time of tender closing) or are capable of being so prior to the</p>

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Clause	Wording / Data
	<p>evaluation of submissions, in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tender for an 9CE class of construction work, are eligible to submit a tender offer.</p> <p>Joint ventures are eligible to submit a tender offer provided that:</p> <ul style="list-style-type: none"> a) Every member of the joint venture is registered (as “Active”) with the CIDB (at the time of tender closing). b) The Lead partner has a contractor grading designation in the CE class of construction work and not lower than one level below the required grading designation in the class of construction works under considerations and possess the required recognition status. c) The combined contractor grading designation calculated in accordance with the Construction Industry Development Board Regulations is equal to or higher than a contractor grading designation determined in accordance with the sum tendered for 9CE class of construction work or a value determined in accordance with Regulation 25(1B) or 25(7A) of the Construction Industry Development Regulations. d) Tenders submitted by joint ventures of two or more firms must be accompanied by the document of formation of the joint venture, authenticated by a notary public or other official deputed to witness sworn statements, in which it defines precisely the conditions under which the joint venture will function, its period of duration, the persons authorised to represent and obligate it, the participation of the several firms forming the joint venture, and any other information necessary to permit a full appraisal of its functioning. e) The Tenderer, if a Joint Venture, must submit a signed JV Agreement with the tender specific to the tendered Contract and clearly showing the percentage contribution of each partner to the Joint Venture. The value of work to be undertaken by each partner must be within their CIDB grading limit. <p>Tenderers are eligible to submit a tender offer, provided they have submitted the following tender requirements listed below:</p> <ul style="list-style-type: none"> a) Tax Tenderers shall be registered and in good standing with the South African Revenue Services (SARS) and must submit/append documentary evidence/proof in the form of a valid Tax Clearance PIN Number and/or a valid Tax Number issued by SARS. Failure to provide a valid Tax Clearance PIN number and/or Tax Number will result in the tender being rejected. <p>Each party to a Consortium/Joint Venture shall submit a separate Tax Clearance PIN Number and/or Tax Number.</p>

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	<p>b) The tenderer is registered on the National Treasury Central Supplier Database (CSD) and provide proof of registration must be in the form of CSD registration number. Also note the following:</p> <ul style="list-style-type: none"> i. Tenderers who are not registered are not precluded from submitting bids but must be registered prior to Contract Award. ii. In the case of Joint Venture partnerships this requirement will apply individually to each party to the Joint Venture. iii. Tenderers who wish to register as service providers on the CSD can register online at https://secure.csd.gov.za/Account/Register. iv. For further enquiries contact the Supply Chain Management Unit on Tel: 047 501 6449. <p>c) A resolution authorizing a person to sign the bid documents (Full completion and signing of Form 2.2.2 or resolution on company letter head).</p> <p>d) Attendance of Compulsory Site Briefing:</p> <p>Only Tenderers who have attended the compulsory site briefing, signed the attendance register and have Form 2.2.8 Certificate of Attendance at Clarification Meeting signed by the Employer's Agent or his representative, will be eligible to submit a tender offer.</p> <p>e) A valid CIDB registration with a minimum grading of 9CE. In case of JV, the tenderer has submitted a combined CIDB grading form and mandatory JV agreement that includes the agreement and banking details and stipulates the JV lead partner's as well as JV partners CRS numbers are indicated on the form (proof must be attached).</p> <p>f) A signed Form of Offer in the Contract Section C1.1.</p> <p>g) The tenderer or any of its directors 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.</p> <p>h) The Tenderer has not failed to perform on any previous contract and has not been given written notice to this effect.</p> <p>i) Further Compulsory Documents to be submitted by the Tenderer:</p> <p>In addition to all the documents listed from a) to j) above and all other documents requested in Section T2.1 and T2.2 and T2.3 (Returnable Documents), it is further required that copies of the following current and valid company certificates be provided:</p>

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Clause	Wording / Data
	<ul style="list-style-type: none"> i. Letter of Good Standing (Form 2.2.5) from Compensation Commissioner or Insurer in terms of Section 80 of the Compensation for Occupational Injuries and Diseases (COID) Act (Act No 130 of 1993). ii. Letter of Good Standing from Department of Labour (UIF). iii. In the case of Joint Ventures, the above shall be provided for each JV Partner. <p>The above documents shall be included in the Supporting Documents file.</p>
C.2.3	<p><i>Amend the Clause to read:</i></p> <p>“.....and notify the Employer’s Agent of any discrepancy....”</p>
C.2.6	<p>Receipt of Addenda’s: All tenderers to acknowledge receipt of any Addendums issued and to complete Form 2.3.1: RECORD OF ADDENDA TO TENDER DOCUMENTS in the Returnable Documents.</p> <p>Failure to apply instructions contained in addenda may render a tenderer’s offer non-responsive in terms of Condition of Tender clause C.3.8.</p>
C.2.7	<p>For particulars regarding the compulsory clarification meeting (site inspection meeting) refer to the Tender Notice and Invitation to Tender (T1.1) of this document.</p> <p>The onus rests with the tenderer to ensure that the person attending the clarification meeting on his behalf is appropriately qualified to understand all directives and clarifications given at that meeting.</p> <p>Tenderers must sign the attendance register in the name of the tendering entity. Addenda will be issued to, and only tenders will be received from, those entities appearing on the attendance register.</p>
C.2.8	<p>The employer shall respond to clarifications received up to 7 working days before the tender closing time.</p>
C.2.9	<p>The employer does not provide insurance. The contractor is responsible for providing full insurance cover for the contract.</p>
C.2.10	<p>Pricing the Tender Offer</p>

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Clause	Wording / Data
	<p>Tenderers are requested to state the rates and currencies in Rand.</p> <p><i>Delete the contents of Clause C.2.10.3 and replace with the following:</i></p> <p>“This tender is subject to Contract Price Adjustment as set out in the Contract Data. An alternative offer of fixed rates will not be accepted.”</p>
C.2.11	<p><i>Add the following to the Clause:</i></p> <p>“In the event of a mistake having been made on Bill of Quantities, it shall be crossed out in non-erasable ink and be accompanied by an initial of each signatory to the Tender at each and every price alteration. No correction fluid is allowed.</p> <p>The Employer and/or Employer’s Agent will reject and classify the tender non-responsive if corrections are not made in accordance with the above.”</p>
C.2.12	<p>Alternative Tender Offers</p> <p><i>Delete the contents of Clause C.2.12 and replace with the following:</i></p> <p>“No alternative offers will be accepted. This includes changes to the ‘as-scheduled’ allowance for Contingencies.”</p>
C.2.13.2	<p><i>Delete the contents of Clause C.2.13.2 and replace with the following:</i></p> <p>“Return all returnable documents to the Employer after completing them in their entirety by writing legibly in non-erasable ink. Notwithstanding the format in which the tender documents are issued to Tenderers, no electronic form of tender offers will be accepted.</p> <p>The Original to be submitted shall comprise:</p> <ul style="list-style-type: none"> • Entire Tender Document, as proof of specifications tendered on and duly completed and signed. • Indexed Lever-Arch file (or files) with all supporting documentation clearly marked with Tenderer’s name clearly marked on the spine or cover. • Tender Drawings (Book of Drawings) need NOT be submitted. <p>Failure to comply with these requirements may result in the tender being declared non-responsive.</p> <p>Notwithstanding any statement in any of the Returnable Documents listed in T2 to the effect that supporting documentation must be attached to the associated Returnable Document,</p>

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Clause	Wording / Data
	<p>the supporting documentation must be placed in the supporting documentation files as stipulated above.</p> <p>The Bill of Quantities must be fully and correctly filled in by hand in black ink.</p> <p>The binding of the original volume of the Tender Document may NOT be dismantled.</p>
C.2.13.3	Number of Duplicate Copies required is none.
C.2.13.4	<p><i>Add the following to the clause:</i></p> <p>“Only authorised signatories may sign the original and all copies of the tender offer where required in terms of C.2.13.3</p> <p>In the case of a ONE-PERSON CONCERN submitting a tender, this shall be clearly stated.</p> <p>In case of a COMPANY submitting a tender, include a copy of a <u>resolution by its board of directors</u> authorising a director or other official of the company to sign the documents on behalf of the company.</p> <p>In the case of a CLOSE CORPORATION submitting a tender, include a copy of a <u>resolution by its members</u> authorising a member or other official of the corporation to sign the documents on each member’s behalf.</p> <p>In the case of a PARTNERSHIP submitting a tender, <u>all the partners</u> shall sign the documents, unless one partner or a group of partners has been authorised to sign on behalf of each partner, in which case <u>proof of such authorisation</u> shall be included in the Tender.</p> <p>In the case of a JOINT VENTURE/CONSORTIUM submitting a tender, include <u>a resolution</u> of each company of the Joint Venture together with a resolution by its members authorising a member of the Joint Venture to sign the documents on behalf of the Joint Venture.</p> <p><u>Failure to submit proof of authorisation to sign the tender, shall result in a Tender Offer being regarded as non-responsive.”</u></p>
C.2.13.5	<p>The employer’s address for delivery of tender offers is given under Clause C.2.15.1</p> <p>The identification details are:</p> <p>TENDER FOR CONTRACT NO.: MIS 478 793 A</p>

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C.2.13.6	A two-envelope system will not be followed.
C.2.13.7	Place and seal the printed and completed tender document in an envelope clearly marked "TENDER" and bearing the Employer's name, the contract number and description, the tenderer's authorised representative's name, the tenderer's postal address and contact telephone numbers.
C.2.13.9	Electronic, telephonic, telegraphic, telex, facsimile or e-mailed tender offers will not be accepted.
C.2.14	<p>The tenderer is required to provide all the data or information as requested below:</p> <ul style="list-style-type: none"> • All the documents and schedules as listed under T2.1 & T2.2: Returnable Documents required for tender evaluation purposes. • All the documents and schedules as listed under T2.3: Returnable Documents that will be incorporated in the Contract. <p>Should a Tenderer not provide all the above-mentioned data or information, the Tenderer will be considered non-responsive.</p> <p><i>Add the following to the clause:</i></p> <p>"Accept that the Employer shall in the evaluation of tenders take due account of the Tenderer's past performance in executing similar construction works of comparable magnitude, and the degree to which he possesses the necessary technical, financial, and other resources to enable him to complete the Works successfully within the contract period. Satisfy the Employer as to his ability to perform and complete the Works timeously, safely and with satisfactory quality, by furnishing details in Part T2 – Returnable Documents.</p> <p>Accept that the Employer is restricted in accordance with clause 4. (4) of the Construction Regulations, 2014, to only appoint a contractor who he is satisfied has the necessary competencies and resources to carry out the work safely. Accept that submitting inferior and inadequate information relating to health and safety (as required in clause C2.23) shall be regarded as justifiable and compelling reasons not to award a contract to a Tenderer."</p>
C.2.15.1	The closing date and time for submission of tender offers is on the 03 July 2025 at 12:00am.

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Clause	Wording / Data
	<p>The employer's address for the delivery of tender offers and identification details to be shown on each tender offer package are given below. Only tenders submitted to this tender box will be opened and considered. It is the Tenderer's responsibility to make sure it is delivered into the tender box before closing.</p> <p>Location of Tender Box: O. R. Tambo District Municipality</p> <p>Physical Address: O. R. Tambo District Municipality Myezo Park Nelson Mandela Drive Mthatha 5099</p> <p>Identification Details: Place the signed tender offer in a package marked</p> <p style="text-align: center;">“TENDER FOR CONTRACT NO.: MIS 478 793 A</p> <p style="text-align: center;">SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B – CONSTRUCTION OF ABSTRACTION WORKS AND MALEPELEPE WATER TREATMENT WORKS – CONTRACT1”</p> <p>Telephonic, telegraphic, telex, facsimile, e-mailed or posted tender offers will not be accepted.</p>
C.2.16.1	<p>Tender Offer Validity</p> <p><i>Add the following to the end of Clause C.2.16.1:</i></p> <p>“The tender offer validity period is 90 days.</p> <p>If the tender validity expires on a Saturday, Sunday or public holiday, the tender shall remain valid and open for acceptance until the closure of business on the following working day.”</p>
C.2.16.3	<p>Where a tenderer, at any time after the opening of his tender offer but prior to entering a contract based on his tender offer:</p> <ul style="list-style-type: none"> • withdraws his tender. • gives notice of his inability to execute the contract in terms of his tender; or • fails to comply with a request made in terms of C.2.17, C.2.18 or C.3.9.

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Clause	Wording / Data
	Withdrawal is accepted and tenderers shall sign a letter to acknowledge withdrawal of bid.
C.2.17	<p>Clarification of Tender Offer after Submission</p> <p><i>Add the following to the end of Clause C.2.17:</i></p> <p>“A tender may be rejected as non-responsive if the Tenderer fails to provide any clarification requested by the Employer, or confirmation of registration with CIDB within the time for submission stated in the Employer’s written request for such clarification or confirmation. A tender may be rejected if the unit rates or lump sums for some of the items in the Bill of Quantities are, in the opinion of the Employer, unreasonable or out of proportion, and the Tenderer fails, within the time stated in writing by the Employer to justify any specific rates or lump sums (i.e. to provide a financial breakdown of how such rates or sums were obtained) or to adjust the unit rates or lump sums for such items while retaining the total of the prices unchanged.”</p>
C.2.18	The Tenderer shall, when requested by the Employer to do so, submit any additional information requested under this clause within 7 working days of the date of request.
C.2.22	The tenderer is required to return all tender documents with the Tender Offer, prior to the closing time for the submission of Tender Offers.
C.2.23	<p>The tenderer is required to submit the following with his tender:</p> <p>CSD Supplier Number and Tax compliance PIN numbers in case of Bidder only / Consortia / JV:</p> <ul style="list-style-type: none"> a) Bidders must ensure compliance with their tax obligations. b) 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. c) Application for tax compliance status (TCS) 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. d) Bidders may also submit a printed TCS together with the bid.

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Clause	Wording / Data
	<p>e) In bids where Consortia / Joint Ventures / Sub-contractors are involved; each party must submit a separate proof of their TCS / PIN / CSD number.</p> <p>f) Where no TCS is available, but the bidder is registered on the central supplier database (CSD), a CSD number must be provided.</p> <p>g) Proof of Contractor Registration drawn from the Construction Industry Development Board website should be attached to Returnable Document Form 2.2.18.</p> <p>h) Evidence of registration and proof of good standing with a compensation insurer who is approved by the Department of Labour in terms of Section 80 of the Compensation for Occupational Injuries and Diseases Act (Act No 130 of 1993) (COID). The Tenderer is required to disclose all inspections, investigations and their outcomes conducted by the Department of Labour into the conduct of the Tenderer at a time during the 36 months preceding the date of this Tender (Refer Returnable Document Form 2.2.5).</p> <p>i) Proof of Registration in respect of each partner, where a tenderer satisfied the CIDB contractor grading designation requirements through the formation of a joint venture.</p>
C.3.1.1	<p><i>Delete the contents of Clause C.3.1.1 and replace with the following:</i></p> <p>“The Employer will respond to a request for clarification received up to seven working days before the tender closing time stated in the Tender Data.”</p>
C.3.2	<p>The Employer shall issue addenda until three working days before the tender closing time.</p> <p><i>Add the following to Clause 3.2:</i></p> <p>Notwithstanding any requests for confirmation of receipt of Addenda issued, the tenderer shall be deemed to have received such addenda if the employer can show proof of transmission thereof (or a notice in respect thereof) via electronic mail, facsimile or registered post.</p>
C.3.4.1	<p>The time and location for the opening of tender offers are:</p> <p>Time: 12:00pm on the 03 July 2025</p>
C.3.4.2	<p>Tenders will be opened immediately after the closing time for tenders at:</p>

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Clause	Wording / Data
	Location: O. R. Tambo District Municipality Physical Address: O. R. Tambo District Municipality Myezo Park Nelson Mandela Drive Mthatha 5099
C.3.5	A two-envelope procedure <u>will not</u> be followed.
C.3.7	<p>Grounds for rejection and disqualification</p> <p><i>Add the following to the end of Clause C.3.7:</i></p> <p>“Tenderers will be disqualified if:</p> <ul style="list-style-type: none"> a) Any of the directors/shareholders of the Tenderer are listed on the National Treasury Register of Tender Defaulters in terms of the Prevention and Combating of Corrupt Activities Act of 2004 as a person prohibited from doing business in the public sector. b) If, from information given in the completed Compulsory Enterprise Questionnaire, the Employer considers that there is a potential conflict of interest which may potentially compromise the tender process. <p>In the event of disqualification, the Employer may, at his sole discretion, impose a specified period during which tender offers will not be accepted from the offending tenderer and report same to the CIDB and National Treasury.</p>
C.3.8.2	<p><i>Add the following directly after Clause C.3.8.2 c):</i></p> <p>“A tender offer that does not meet the requirements as specified below, will be deemed non-responsive:</p> <ul style="list-style-type: none"> • The Tenderer offer does not meet any one of the eligibility criteria specified in Clause C.2.1 as amended. • The Tenderer has not fully and correctly completed the Offer portion of C1.1 Form of Offer and Acceptance i.e., the price has not been completed in words and numbers, the Tenderers details are not completed fully and correctly, and the Tenderer has failed to sign the Offer portion of C1.1. • If requested by the Employer during the tender evaluation process, the Tenderer has failed to clarify or submit any supporting documentation within the time for submission stated in the Employer’s written request.

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Clause	Wording / Data
	<ul style="list-style-type: none"> • The Tenderer's price is based on fixed rates in lieu of Contract Price Adjustment. • There are any other material deficiencies whereby the price submitted is not for the identical requirements and scope of work as other correctly completed tenders (such as changing any quantity or percentage allowance in the Bill of Quantities or failing to incorporate the requirements of Addenda where these materially affected the pricing e.g. where the Notice to Tenderers required any amendments or replacements of part or all of the Bill of Quantities and the submitted Bill of Quantities does not reflect these changes)."
C.3.9.	<p>Arithmetical errors, omissions, discrepancies and imbalanced unit rates</p> <p><i>Delete the text of Clause C.3.9 and replace with:</i></p> <p>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 appearing in words shall govern. Where there is a discrepancy between the amount in the Form of Offer and the Pricing Data Summary to the BOQ, the amount in the Form of Offer shall govern.</p> <p>Check responsive tender offers for:</p> <ol style="list-style-type: none"> the gross misplacement of the decimal point in any unit rate; omissions made in completing the bills of quantities; or arithmetic errors in: <ol style="list-style-type: none"> line-item totals resulting from the product of a unit rate and a quantity in bills of quantities or schedules of prices; or the summation of the prices. imbalanced unit rates. <p>Notify shortlisted tenderers of all errors, omissions or imbalanced rates that are identified in their tender offers.</p> <p>Where the tenderer elects to confirm the errors, omissions or re-balancing of imbalanced rates the tender offer shall be corrected as follows:</p> <ol style="list-style-type: none"> If bills of quantities apply and there is an error in the line-item total resulting from the product of the unit rate and the quantity, the unit rate shall govern, and the line item total shall be corrected. Where there is an obviously gross misplacement of the decimal point in the unit rate, the line-item total as quoted, and the unit rate shall be corrected. 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.

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	<p>c) Where the unit rates are imbalanced adjust such rates by increasing or decreasing them and selected others while retaining the total of the prices derived after any other corrections made under a) and b) above.</p> <p>Where there is an omission of a line item, no correction is possible, and the offer may be declared non-responsive.</p> <p>Declare as non-responsive and reject any offer from a tenderer who elects not to accept the corrections proposed and subject the tenderer to the sanction under C.2.16.3.</p> <p>The tenderer is required to submit balanced unit rates for rate only items in the bill of quantities. The rates submitted for these items will be taken into account in the evaluation of tenders.</p>
C.3.11	<p>Tenders will be evaluated in terms of the O.R. Tambo District Municipality procurement policy.</p> <p>The Employer reserves the right to contact references and make enquiries to determine the tenderer's competence, reliability, experience, reputation, and capability to perform the contract.</p>
C.3.11.1	<p><i>Add the following new paragraph directly under Clause C.3.11.1.</i></p> <p>The Evaluation of tender offers will be undertaken as follows:</p> <p><i>Replace the contents of the entire sub-clause with the following:</i></p> <p>The procedure for evaluation of responsive tender offers will be method 2 of table F.1 of SANS 294: 2004. Financial offer & Preferences. The bid will be awarded to the bidder who has scored the highest points for price and preferences combined BUT the prerequisite will be to obtain at least 80 points for quality (functionality), which will be explained in Stage 2 below.</p> <p>Nevertheless, O. R. Tambo District Municipality retains the right to accept any bid.</p> <p>Stage 1: Compliance with Bid Rules and other Requirements</p> <p>The bids will be checked to ensure that they comply with the bid rules and all other requirements of the project document. Tender offers will be screened to identify schedules and requested documents that are incomplete or have not been submitted. In particular, the following documentation must be completed and/or included within the bid.</p>

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	<ul style="list-style-type: none"> • The Form of Offer and Acceptance. • Audited financial statements for the past three years for any tender price over R10 million. • Certified company registration documents and ID of members. • Form 2.2.1 General Information of Tenderer. • Form 2.2.2: Certificate of Authority for Signature. • Form 2.2.4: Schedule of Previous Experience. • Form 2.2.6: Certificate of Good Standing Regarding Tax. • Form 2.2.11 - MBD 6.1: Preference Points Claim Form in Terms of the Preferential Procurement Regulations 2022. • Form 2.3.7: Proposed Key Personnel. • All information supporting the above forms. • Addenda issued during the bid period, if any. • The Bill of Quantities. <p>Tender offers will be tested for compliance with all the requirements of the as-amended Standard Conditions of Tender including the following:</p> <ul style="list-style-type: none"> a) Eligibility (C.2.1) b) Pricing the tender offer (C.2.10.3) c) Alterations to documents (C.2.11) d) Alternative tenders offer (C.2.12) e) Submitting a tender offer (C.2.13) f) MBD4 – Bidders' Disclosure. <p>Tender offers will be declared non-responsive should they fail to comply with any one of the requirements of 1) above. Failure to supply the required and requested information will render the Bid Non-responsive, and the Bid will be disqualified.</p> <p>STEP 2: Minimum Conditions of Tender / Functionality</p> <p>The next state in the evaluation process will consist of evaluating Functionality scores, as follows.</p>

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Clause	Wording / Data														
	<div>FUNCTIONALITY EVALUATION</div> <table><tr><th>ITEM</th><th>WEIGHT</th></tr><tr><td>Minimum Conditions of Tender / Functionality (see detailed criteria below)</td><td>100</td></tr><tr><td>• Experience with respect to similar projects</td><td>60</td></tr><tr><td>• Qualifications and experience of key staff assigned to the contract</td><td>40</td></tr></table> <p>Only bidders who score 80 points or more on stage 2 will be evaluated further and therefore eligible for award.</p> <p>The maximum score for functionality shall be 100, distributed as follows:</p> <table><tr><th></th><th>Minimum conditions of tender / Functionality</th><th>Max tender evaluation points</th></tr><tr><td>B1.1</td><td><p>Experience on similar projects, further broken down into three types of projects:</p><p>B1.1 – A: Civil and structural components of river intake structure requiring river diversion or coffer dams or dewatering [20]</p><p>B1.1 – B: Civil and structural components of water treatment works, with a minimum capacity of 2 MI/day [20]</p><p>B1.1 – C: Pressurised bulk water supply pipelines with a nominal diameter of at least 300mm [20]</p><p>Appointment Letter from the client and Practical Completion Certificates not older than 12 months or Completion Certificate for each Contract shall be included in the supporting documentation submitted with the bid document as evidence with the Contract No, Contract Name, Employer and Employer’s Agent and Date of Completion clearly shown.</p><p>Copies of the Certificate of Completion MUST be submitted with the bid. No points will be awarded where Certificates of Completion have not been submitted with the Bid. Reference letters will not be accepted.</p></td><td>60</td></tr></table>	ITEM	WEIGHT	Minimum Conditions of Tender / Functionality (see detailed criteria below)	100	• Experience with respect to similar projects	60	• Qualifications and experience of key staff assigned to the contract	40		Minimum conditions of tender / Functionality	Max tender evaluation points	B1.1	<p>Experience on similar projects, further broken down into three types of projects:</p> <p>B1.1 – A: Civil and structural components of river intake structure requiring river diversion or coffer dams or dewatering [20]</p> <p>B1.1 – B: Civil and structural components of water treatment works, with a minimum capacity of 2 MI/day [20]</p> <p>B1.1 – C: Pressurised bulk water supply pipelines with a nominal diameter of at least 300mm [20]</p> <p>Appointment Letter from the client and Practical Completion Certificates not older than 12 months or Completion Certificate for each Contract shall be included in the supporting documentation submitted with the bid document as evidence with the Contract No, Contract Name, Employer and Employer’s Agent and Date of Completion clearly shown.</p> <p>Copies of the Certificate of Completion MUST be submitted with the bid. No points will be awarded where Certificates of Completion have not been submitted with the Bid. Reference letters will not be accepted.</p>	60
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Clause	Wording / Data			
	B1.1 A	Civil and structural components of river intake structure requiring river diversion or coffer dams or dewatering	20	
		<ul style="list-style-type: none"> At least two (2) relevant construction contracts, each of an individual value of at least R 20 million, successfully completed within the last 15 years. 	20	
		<ul style="list-style-type: none"> At least one (1) relevant construction contract with a value of at least R 20 million, successfully completed within the last 15 years. 	10	
		<ul style="list-style-type: none"> The Contractor has no completed projects, or the Contractor failed to provide evidence of experience. 	0	
	B1.1 B	Civil and structural components of water treatment works, with a minimum capacity of 2 Ml/day	20	
		<ul style="list-style-type: none"> At least three (3) construction contracts of a similar nature of a Total Sum of R150 million, successfully completed within the last 10 years. 	20	
		<ul style="list-style-type: none"> At least two (2) construction contracts of a similar nature of Total Sum of R100 million, successfully completed within the last 10 years. 	10	
		<ul style="list-style-type: none"> The Contractor has less than two (2) construction contracts of Total Sum of less than R100 million, successfully completed within the last 10 years. 	0	
	B1.1 C	Pressurised bulk water supply pipelines with a nominal diameter of at least 300mm	20	
		<ul style="list-style-type: none"> At least three (3) construction contracts of a similar nature of Total Sum of R 120 million in total, successfully completed within the last 10 years. 	20	
		<ul style="list-style-type: none"> At least two (2) construction contracts of a similar nature of Total Sum of R 100 million in total, successfully completed within the last 10 years. 	10	
		<ul style="list-style-type: none"> The Contractor has less than two (2) completed projects of less than R100 million or the Contractor failed to provide evidence of experience. 	0	
	B1.2	Qualifications and Experience of Key Personnel NB: No key personnel member may be assigned more than one duty on the Contract, i.e. different personnel must be assigned for each of the following key positions.	40	

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Clause	Wording / Data			
		<p>Contracts Manager = Minimum B-Tech or BSC Civil Engineering or higher NQF level 7 with Professional Registration with ECSA as Pr. Eng or Pr. Tech or with Professional Registration with SACPCMP as a Pr. CPM or Pr. CM.</p> <p>Construction Manager (Site Agent, full – time on Site) = Minimum B-Tech or BSC Civil Engineering or higher NQF level 7 with Professional Registration with ECSA as Pr. Eng or Pr. Tech or with Professional Registration with SACPCMP as a Pr. CPM or Pr. CM</p> <p>SMME Construction Manager (Full – time on Site) = Minimum B-Tech or BSC Civil Engineering or higher NQF level 7 with Professional Registration with ECSA as Pr. Eng or Pr. Tech or with Professional Registration with SACPCMP as a Pr. CPM or Pr. CM</p> <p>Health and Safety Officer (Full – time on Site) = Hold Professional Registration with SACPCMP in the category of Professional Health and Safety Officer and have at least three years' experience in the role of Health and Safety Officer on Civil Engineering construction sites.</p> <p>Bidders must submit signed Resume and contactable references. Proposed key personnel will be contacted by the Employer as part of the tender evaluation process to confirm their availability for the contract.</p>		
		The forty (40) points will be further broken down as follows:	40	
		<p>Contracts Manager:</p> <p>Favourable previous experience in the Civil Engineering field with a minimum of :</p> <p>10 years; = 15 points 6-9 years = 10 points 3-5 years = 8 points Less than 3 years = 0 points</p>	15	
		Construction Manager (Site Agent):	10	

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		Favourable previous experience in the Civil Engineering field with a minimum of: 5 years; = 10 points 3-4 years = 8 points 1-2 years = 6 points Less than 1 year: 0 points		
		SMME Construction Manager: Favourable previous experience in Managing SMME's in the Civil Engineering field with a minimum of 5 years; = 8 points 3-4 years = 6 points 1-2 years = 4 points Less than 1 year = 0 points	8	
		Health and Safety Officer: Favourable previous experience in the Civil Engineering field with a minimum of: 5 years = 7 points 3-4 years = 5 points 1-2 years = 3 points Less than 1 year = 0 points	7	
		Contractor failed to provide evidence of qualification, registration and experience.	0	
STEP 3: PRICE AND SPECIFIC GOALS The procedure for Stage 3 of evaluation is as follows: <div style="text-align: right;"> a) PRICE.....90 b) SPECIFIC GOALS.....10 </div> a) Points Awarded for Price (Ps) 90/10 preference point system for acquisition of goods or services with a Rand value above R50 000 000 (all applicable taxes included).				

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	<p>Scoring of Price:</p> <ol style="list-style-type: none"> 1. Review financial offer and correct discrepancies between totals and calculations / summations in accordance with the Tender Data (C.3.9). 2. Reduce all tender offers to a common base i.e. comparative offer. 3. Confirm the tenderers are eligible for the specific goals claimed. 4. Score Tender Offer for Specific Goals. 5. Score Tender Offer for Price. <p>A maximum of 90 points is allocated for price on the following basis, Total Points and rank Tender Offers.</p> <p>b) Points awarded for Specific Goals</p> <p>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 a table below as may be supported by proof/ documentation included with:</p> <p>Scoring of Specific Goals:</p> <p>In accordance with the Preferential Procurement Policy Framework Act, 2000: Preferential Procurement Regulations, 2022, the points allocation for Specific Goals are as follows:</p> <table border="1"> <thead> <tr> <th>The specific goals allocated points in terms of this tender</th><th>Number of points Allocated on 90/10 system</th></tr> </thead> <tbody> <tr> <td>51% Black-owned enterprises</td><td>04</td></tr> <tr> <td>100% Women-owned enterprises</td><td>02</td></tr> <tr> <td>100% Youth-owned enterprises</td><td>02</td></tr> <tr> <td>Where the enterprise head office or primary place of business is located within O. R. Tambo District.</td><td>02</td></tr> </tbody> </table> <p>Points will be awarded to tenderers who are eligible for preference Specific Goals The terms and conditions of the Preference Schedule shall apply in all respects to the tender evaluation process and any subsequent contract.</p> <p>Tenderers must submit certified copies of all supporting documents necessary to prove conformance with Specific Goal criteria listed above in order to be eligible for Specific Goal points.</p>	The specific goals allocated points in terms of this tender	Number of points Allocated on 90/10 system	51% Black-owned enterprises	04	100% Women-owned enterprises	02	100% Youth-owned enterprises	02	Where the enterprise head office or primary place of business is located within O. R. Tambo District.	02
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Clause	Wording / Data
	<p>Note that the objective Criteria as per the SCM Policy Paragraph 72 and 73 will be applied:</p> <p>Fair Distribution of Municipal Resources on Capital Infrastructure Projects on Awards</p> <ul style="list-style-type: none"> • Tenders will be evaluated and adjudicated as per legislation requirements, treasury guidelines and municipal policy. Fair distribution will be achieved as follows: • A bidder will not be awarded the same commodity of work more than once in within a period of three months. • If the highest scoring bidder has been previously awarded for the same commodity tender within that three months, then the next highest scoring bidder will be considered for recommendation and award. • If the highest scoring bidder has been previously recommended for award in the same sitting for a tender of the same commodity, the next highest scoring bidder will be considered for recommendation and award. <p>Objective criteria on the evaluation and award of bids</p> <ul style="list-style-type: none"> • The objective criteria on the evaluation and awards of bids by the municipality will be based on the following criteria and reasoning: • Where the bidders price offer is below the engineer's estimate, that bid will be rejected as it will pose a risk to the municipality of non-completion of the project to be implemented thus leading to underspending on grants and delays in completion of projects within projected time period. • Further in line with CIDB Practice Note 5, paragraph 3.4 (3), the municipality will judge the reasonableness of financial offers and reject all tender offers with unrealistic financial offers. <p>Having made the final selection:</p> <ol style="list-style-type: none"> 1. ORTDM publishes Intention to Award on its website. 2. If no objection is received within fourteen (14) working days of publishing the Intention to Award, the successful Tenderer will be notified of OR Tambo District Municipality's acceptance of his/her bid.
C.3.11.3	<p>Risk Analysis</p> <p><i>Add the following new clause:</i></p>

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Clause	Wording / Data
	<p>Notwithstanding compliance with regards to CIDB registration or any other requirements of the tender, the employer will perform a risk analysis in respect of the following:</p> <ul style="list-style-type: none"> a) reasonableness of the financial offer; b) reasonableness of unit rates and prices. <p>No tenderer will be recommended for award unless the tenderer has demonstrated that he/she has the resources and skills required to complete the project successfully.</p>
C.3.12	<p><i>Replace the contents of Clause 3.12 with the following:</i></p> <p>Full insurances to be provided by the Contractor. The Contractor must provide the Employer with the insurance policy information and certificates of insurance prior to the commencement of the contract.</p>
C3.13	<p><i>In addition to the requirements of Clause C3.13, a tender will only be accepted if:</i></p> <ul style="list-style-type: none"> a) The Tenderer's tax matters are in order with the South African Revenue Services. b) The Tenderer is registered with the Construction Industry Development Board in an appropriate contractor grading designation (CRS Number or print out to be provided). c) 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. d) The Tenderer is registered in the Department of National Treasury - Central Supplier Database (CSD Number to be provided). e) The Tenderer has not: <ul style="list-style-type: none"> i) abused the Employer's Supply Chain Management System or ii) failed to perform on any previous contract and has been given a written notice to this effect. f) The tenderer has completed the Compulsory Enterprise Questionnaire and there are no conflicts of interest which may impact on the tenderer's ability to perform the contract in the best interests of the employer or potentially compromise the tender process and persons in the employ of the state are not permitted to submit tenders or participate in the contract; In the case of Joint Ventures all members of the JV are to complete the Compulsory Enterprise Questionnaire. g) The tenderer is registered and in good standing with the compensation fund or with a licensed compensation insurer. h) Attended a compulsory briefing session and site inspection. Signing the briefing and site inspection attendance register is mandatory. i) The Form of Offer and Acceptance is correctly completed and signed.
C.3.16	<p>An Employer must, within twenty-one (21) working days from the date on which a contractor's offer to perform a construction works contract is accepted in writing by the</p>

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Clause	Wording / Data
	Employer, register and publish the award on the CIDB Register of Projects.
C.3.17	The number of paper copies of the signed contract to be provided by the employer is one .
C.3.18	All requests shall be in writing.
C.3.19	<p><i>Add the following new clause below Clause C.3.18:</i></p> <p>“Jurisdiction” unless stated otherwise in the tender data, each Tenderer and the Employer undertake to accept the jurisdiction of the law courts of the Republic of South Africa.</p>
C.3.20	<p><i>Add the following new clause below Clause C.3.18:</i></p> <p>The successful tenderer will be encouraged to include as much of the Direct Participation required minimum % spend by subcontracting to local EMEs or QSEs from the immediate area of the Site.</p> <p>The details of any EMEs / QSEs need not be submitted with the tender but will be required from the appointed bidder as part of an SMME strategy to be developed and submitted to the Employer and Employer’s Agent for consideration.</p>

T1.3: STANDARD CONDITIONS OF TENDER
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Annex C
(normative)

Standard Conditions of Tender

As published in Annexure C of the Construction Industry Development Board (CIDB) Standard for Uniformity for construction Procurement, Board Notice 423 Government Gazette No 42622 of 08 August 2019.

C.1 General
C.1.1 Actions

C.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 C.2 and C.3, timeously and with integrity, and behave equitably, honestly and transparently, comply with all legal obligations and not engage in anticompetitive practices.

C.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.

C.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.

C.1.2 Tender Documents

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

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C.1.3 Interpretation

C.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.

C.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.

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; s
 - ii) an individual or tenderer is in a position to exploit a professional or official capacity in some way for their personal or corporate benefit; or
 - iii) incompatibility or contradictory interests exist between an employee and the organisation which employs that employee.
- b) **comparative offer** means the price after the factors of a non-firm price and all unconditional discounts it can be utilised to have been taken into consideration;
- 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 in the tender process;
- 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;

C.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.

C.1.5 Cancellation and Re-Invitation of Tenders

C.1.5.1 An employer may, prior to the award of the tender, cancel a tender if-

- (a) due to changed circumstances, there is no longer a need for the services, works or goods requested; or
- (b) funds are no longer available to cover the total envisaged expenditure; or
- (c) no acceptable tenders are received.
- (d) there is a material irregularity in the tender process.

C1.5.2 The decision to cancel a tender must be published in the CIDB website and in the government

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Tender Bulletin for the media in which the original tender invitation was advertised.

C1.5.3 An employer may only with the prior approval of the relevant treasury cancel a tender invitation for the second time.

C.1.6 Procurement procedures

C.1.6.1 General

Unless otherwise stated in the tender data, a contract will, subject to C.3.13, be concluded with the tenderer who in terms of C.3.11 is the highest ranked or the tenderer scoring the highest number of tender evaluation points, as relevant, based on the tender submissions that are received at the closing time for tenders.

C.1.6.2 Competitive negotiation procedure

C.1.6.2.1 Where the tender data require that the competitive negotiation procedure is to be followed, tenderers shall submit tender offers in response to the proposed contract in the first round of submissions. Notwithstanding the requirements of C.3.4, the employer shall announce only the names of the tenderers who make a submission. The requirements of C.3.8 relating to the material deviations or qualifications which affect the competitive position of tenderers shall not apply.

C.1.6.2.2 All responsive tenderers, or at least a minimum of not less than three responsive tenderers that are highest ranked in terms of the evaluation criteria stated in the tender data, shall be invited to enter into competitive negotiations, based on the principle of equal treatment and keeping confidential the proposed solutions and associated information.

Notwithstanding the provisions of C.2.17, the employer may request that tenders be clarified, specified and fine-tuned in order to improve a tenderer's competitive position provided that such clarification, specification, fine-tuning or additional information does not alter any fundamental aspects of the offers or impose substantial new requirements which restrict or distort competition or have a discriminatory effect.

C.1.6.2.3 At the conclusion of each round of negotiations, tenderers shall be invited by the employer to revise their tender offer based on the same evaluation criteria, with or without adjusted weightings. Tenderers shall be advised when they are to submit their best and final offer.

C.1.6.2.4 The contract shall be awarded in accordance with the provisions of C.3.11 and C.3.13 after tenderers have been requested to submit their best and final offer.

C.1.6.3 Proposal procedure using the two stage-system

C.1.6.3.1 Option 1

Tenderers shall in the first stage submit technical proposals and, if required, cost parameters around which a contract may be negotiated. The employer shall evaluate each responsive submission in terms of the method of evaluation stated in the tender data, and in the second stage negotiate a contract with the tenderer scoring the highest number of evaluation points and award the contract in terms of these

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C.1.6.3.2 Option 2

C.1.6.3.2.1 Tenderers shall submit in the first stage only technical proposals. The employer shall invite all responsive tenderers to submit tender offers in the second stage, following the issuing of procurement documents.

C.1.6.3.2.2 The employer shall evaluate tenders received during the second stage in terms of the method of evaluation stated in the tender data, and award the contract in terms of these conditions of tender.

C.2 Tenderer's obligations

C.2.1 Eligibility

C.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 employer.

C.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.

C.2.2 Cost of tendering

C.2.2.1 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 any testing necessary to demonstrate that aspects of the offer complies with requirements.

C.2.2.2 The cost of the tender documents charged by the employer shall be limited to the actual cost incurred by the employer for printing the documents. Employers must attempt to make available the tender documents on its website so as not to incur any costs pertaining to the printing of the tender documents.

C.2.3 Check documents

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

C.2.4 Confidentiality and copyright of documents

Treat as confidential 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.

C.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

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incorporated into the tender documents by reference.

C.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.

C.2.7 Clarification meeting

Attend, where required, a clarification meeting at which tenderers may familiarise themselves with aspects of the proposed work, services or supply and raise questions. Details of the meeting(s) are stated in the tender data.

C.2.8 Seek clarification

Request clarification of the tender documents, if necessary, by notifying the employer at least five (5) working days before the closing time stated in the tender data.

C.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.

C.2.10 Pricing the tender offer

C.2.10.1 Include in the rates, prices, and the tendered total of the prices (if any) all duties, taxes except Value Added Tax (VAT), and other levies payable by the successful tenderer, such duties, taxes and levies being those applicable fourteen (14) days before the closing time stated in the tender data.

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

C.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.

C.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.

C.2.11 Alterations to documents

Do 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.

C.2.12 Alternative tender offers

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C.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.

C.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.

C.2.12.3 An alternative tender offer may only be considered if the main tender offer is the winning tender.

C.2.13 Submitting a tender offer

C.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 identified in the contract data and described in the scope of works, unless stated otherwise in the tender data.

C.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.

C.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.

C.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 authorised 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.

C.2.13.5 Seal the original and each copy of the tender offer as separate packages marking the packages as "ORIGINAL" and "COPY". 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.

C.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.

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

C.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.

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C.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.

C.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.

C.2.15 Closing time

C.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.

C.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.

C.2.16 Tender offer validity

C.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.

C.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.

C.2.16.3 Accept that a tender submission that has been submitted to the employer may only be withdrawn or substituted by giving the employer's agent written notice before the closing time for tenders that a tender is to be withdrawn or substituted. If the validity period stated in C.2.16 lapses before the employer evaluating tender, the contractor reserves the right to review the price based on Consumer Price Index (CPI).

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

C.2.17 Clarification of tender offer after submission

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 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.

Note: *Sub-clause C.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.*

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C.2.18 Provide other material

C.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 notarised 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.

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

C.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.

C.2.20 Submit securities, bonds and policies

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.

C.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.

C.2.22 Return of other tender documents

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

C.2.23 Certificates

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

C.2 The employer's undertakings

C.2.1 Respond to requests from the tenderer

C.3.1.1 Unless otherwise stated in the tender Data, respond to a request for clarification received up to five (5) working days before the tender closing time stated in the Tender Data and notify all tenderers who drew procurement documents.

C.3.1.2 Consider any request to make a material change in the capabilities or formation of the

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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.

C.2.2 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 (3) 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 documents.

C.2.3 Return late tender offers

Return tender offers 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.

C.2.4 Opening of tender submissions

C.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.

C.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, number of points claimed for its BBBEE status level and time for completion for the main tender offer only.

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

C.2.5 Two-envelope system

C.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.

C.3.5.2 Evaluate functionality 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 functionality evaluation more than the minimum number of points for functionality stated in the tender data, and announce the score obtained for the technical proposals and the total price and

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any points claimed on BBBEE status level. Return unopened financial proposals to tenderers whose technical proposals failed to achieve the minimum number of points for functionality.

C.2.6 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.

C.2.7 Grounds for rejection and disqualification

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.

C.2.8 Test for responsiveness

C.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.

C.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.

C.2.9 Arithmetical errors, omissions and discrepancies

C.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.

C.3.9.2 Check the highest ranked tender or tenderer with the highest number of tender evaluation points after the evaluation of tender offers in accordance with C.3.11 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

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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.

C.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.

C.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 item 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 line item total as quoted shall govern, and 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 govern and the tenderer will be asked to revise selected item prices (and their rates if bills of quantities apply) to achieve the tendered total of the prices.

C.2.10 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.

C.2.11 Evaluation of a tender offer

The Standard Conditions of Tender standardise the procurement processes, methods and procedures from the time that tenders are invited to the time that a contract is awarded. They are generic in nature and are made project specific through choices that are made in developing the Tender Data associated with a specific project.

Conditions of tender are by definition the document that establishes a tenderer's obligations in submitting a tender and the employer's undertakings in soliciting and evaluating tender offers. Such conditions establish the rules from the time a tender is advertised to the time that a contract is awarded and require employers to conduct the process of offer and acceptance in terms of a set of standard procedures.

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The CIDB Standard Conditions of Tender are based on a procurement system that satisfies the following system requirements:

Requirement	Qualitative interpretation of goal
Fair	The process of offer and acceptance is conducted impartially without bias, providing simultaneous and timely access to participating parties to the same information.
Equitable	Terms and conditions for performing the work do not unfairly prejudice the interests of the parties.
Transparent	The only grounds for not awarding a contract to a tenderer who satisfies all requirements are restrictions from doing business with the employer, lack of capability or capacity, legal impediments and conflicts of interest.
Competitive	The system provides for appropriate levels of competition to ensure cost effective and best value outcomes.
Cost effective	Cost effective

The activities associated with evaluating tender offers are as follows:

- a) Open and record tender offers received
- b) Determine whether or not tender offers are complete
- c) Determine whether or not tender offers are responsive
- d) Evaluate tender offers
- e) Determine if there are any grounds for disqualification
- f) Determine acceptability of preferred tenderer
- g) Prepare a tender evaluation report
- h) Confirm the recommendation contained in the tender evaluation report

C.3.11.1 General

The Employer must appoint an evaluation panel of not less than three persons conversant with the proposed scope of works to evaluate each responsive tender offer using the tender evaluation methods and associated evaluation criteria and weightings that are specified on tender data.

C.2.12 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.

C.2.13 Acceptance of tender offer

Accept the tender offer, if in the opinion of the employer, it does not present any 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

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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, under Business Rescue as provided for in chapter 6 of the Companies Act, 2008, bankrupt or being wound up, has his/her affairs administered by a court or a judicial officer, has suspended his/her 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.

C.2.14 Prepare contract documents

C.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.

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

C.2.15 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.

C.2.16 Registration of the award

An employer must, within twenty-one (21) days from the date on which a contractor's offer to perform a construction works contract is accepted in writing by the Employer, register and publish the award on the CIDB Register of Projects.

C.2.17 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.

C.2.18 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

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T2.1 RETURNABLE DOCUMENTS

Each tenderer is required to complete and return the tender documents issued. The following documents are also to be completed and returned, as they constitute part of the tender. Whilst many of the returnable are required for the purpose of evaluating the tenders, some will form part of the subsequent contract, as they form the basis of the tender offer. **For this reason, it is very important that tenderers complete, sign submit and return all information, documents and schedules, as requested and relevant.**

T2.2 List of Returnable Documents Required for Tender Evaluation Purposes		
	Form 2.2.1	General Information of the Tenderer
	Form 2.2.2	Authority for Signatory
	Form 2.2.3	Procurement Form
	Form 2.2.4	Schedule of Previous Experience
	Form 2.2.5	Schedule of Current Projects
	Form 2.2.6	Declaration of Good Standing Regarding Tax
	Form 2.2.7	Registration at the Central Supplier Database
	Form 2.2.8	Certificate of Attendance at Site Meeting
	Form 2.2.9	Schedule of Proposed Sub-Contractors
	Form 2.2.10	Financial References
	Form 2.2.11	Municipal Bidding Documents (MBD forms): MBD 1 – Invitation to bid MBD 4 – Declaration of Interest MBD 5 – Declaration for Procurement above R10 million MBD 6.1 – Preference Points Claim Form in Terms of PPPFA MBD 8 – Declaration of Bidder's Past Supply Chain Management Practices MBD 9 – Certificate of Independent Bid Determination
	Form 2.2.12	Schedule of proposed plant and equipment
	Form 2.2.13	Health and safety plan
	Form 2.2.14	Preliminary programme
	Form 2.2.15	Estimated monthly expenditure
	Form 2.2.16	Declaration regarding fulfilment of the Construction Regulations, 2014
	Form 2.2.17	UIF Letter of Good Standing
T2.3 Returnable Documents that will be Incorporated into the Contract		
	Form 2.3.1	Record of Addenda to Tender Documents
	Form 2.3.2	Original Tax Clearance Certificate / Confirmation of Tax Validity With Pin
	Form 2.3.3	National Treasury: Central Supplier Database
	Form 2.3.4	CIDB Registration
	Form 2.3.5	Letter of Good Standing
	Form 2.3.6	Proposed Organisation and staffing
	Form 2.3.7	Proposed Key Personnel
	Form 2.3.8	Electrical Data Sheets (Returnable)
	Form 2.3.9	Fire Safety Data Sheets (Returnable)

T2.2 RETURNABLE DOCUMENTS FOR TENDER EVALUATION PURPOSES

RETURNABLE DOCUMENTS REQUIRED FOR TENDER EVALUATION PURPOSES

Form 2.2.1 General Information of Tenderer

Form 2.2.2 Authority of Signatory

Form 2.2.3 Procurement Form

Form 2.2.4 Schedule of Previous Experience

Form 2.2.5 Schedule of Current Projects

Form 2.2.6 Declaration of Good Standing Regarding Tax

Form 2.2.7 Registration on the Central Supplier Database

Form 2.2.8 Certificate of Attendance at Site Meeting

Form 2.2.9 Schedule of Proposed Sub-consultants

Form 2.2.10 Financial References

Form 2.2.11 Municipal Bidding Documents (MBDs)

- MBD 1 – Invitation to bid
- MBD 4 – Declaration of Interest
- MBD 5 – Declaration for Procurement above R10 million
- MBD 6.1 – Preference Points Claim Form in Terms of PPPFA
- MBD 8 – Declaration of Bidder's Past Supply Chain Management Practices
- MBD 9 – Certificate of Independent Bid Determination

Form 2.2.12 Schedule of Proposed Plant and Equipment

Form 2.2.13 Health and Safety Plan

Form 2.2.14 Preliminary Programme

Form 2.2.15 Estimated Monthly Expenditure

Form 2.2.16 Declaration Concerning Fulfilment of The Construction Regulations, 2014

Form 2.2.17 UIF Letter of Good Standing

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FORM 2.2.1 GENERAL INFORMATION OF TENDERER

1. Name of Tenderer:

2. Contact details

Address :

Tel no :

Fax no :

Cell no :

E-mail address:

3. Legal entity: **Mark with an X.**

Sole proprietor	
Partnership	
Close corporation	
Company (Pty) Ltd	
Joint venture	

In the case of a Joint venture, provide details on joint venture members:

Joint venture member	Type of entity (as defined above)

4. Income tax reference number:

(in case of a joint venture, provide for all joint venture members)

5. Municipal services area where the enterprise is registered:

(in case of a joint venture, provide for all joint venture members)

6. Company / close corporation Registration Number:

(in case of a joint venture, provide for all joint venture members)

7. VAT Registration number:

(in case of a joint venture, provide for all joint venture members)

8. CIDB registration number:

(in case of a joint venture, provide for all joint venture members)

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ATTACH THE FOLLOWING DOCUMENTS HERETO
--

1. For Closed Corporations

Certified copies of CK1 or CK2 as applicable (Founding Statement)

2. For Companies

Certified copies of Shareholders register

3. ID copies

Certified ID Copies for members

4. CIDB registration

Proof of valid registration with CIDB

5. CSD registration

Proof of registration with Central Supplier Database

6. For Joint Venture Agreements

Copy of the Joint Venture Agreement between all the parties, as well as the certified documents in (1), and or (2) and (4) and (4) of each Joint Venture member.

7. Copy of the latest municipal service account where enterprise is registered

8. Director's / Shareholder's Municipal Rates

9. Specific Goal Points Contribution

10. Central Supplier Database Summary Report

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FORM 2.2.2 AUTHORITY OF SIGNATORY

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.

A Company	B Partnership	C Joint Venture	D Sole Proprietor	E Close Corporation

A. Certificate for Company

I,, chairperson of the board of directors of, hereby confirm that by resolution of the board (copy attached) taken on.....202..., Mr/Mrs.....acting in the capacity of ,was authorised to sign all documents in connection with this tender and any contract resulting from it on behalf of the company.

As witness

1.....
Chairman

2.....
Date

B. Certificate of Partnership

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

hereby authorise Mr/Mrs....., acting in the capacity of.....to sign all documents in connection with the tender for Contract.....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.

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C. Certificate for Joint Venture

We, the undersigned, are submitting this tender offer in Joint Venture and hereby authorise Mr./Mrs, authorised signatory of the company.....,

acting in the capacity of lead partner, to sign all documents in connection with the tender offer for Contract, and any other contract resulting from it on our behalf.

This authorisation is evidenced by the attached power of attorney signed by legally authorised signatories of all the partners to the Joint Venture.

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

A copy of the Joint Venture Agreement showing clearly the percentage contribution of each partner to the Joint Venture shall be appended to this Schedule.

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D. Certificate for Sole Proprietor

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

As Witness:

1.....
Signature: Sole owner

2.....
Date

E. Certificate for Close Corporation

We, the undersigned, being the key members in the business trading as.....hereby authorise Mr/Mrs.....

Acting in the capacity of... , to sign all documents in connection with the tender

for Contract... and any contract resulting from it on our behalf.

NAME	ADDRESS	SIGNATURE	DATE

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

**ATTACH HERETO THE DULY SIGNED AND DATED ORIGINAL OR CERTIFIED COPY OF
AUTHORITY OF SIGNATORY ON COMPANY LETTERHEAD**

FORM 2.2.3 PROCUREMENT FORM

Acceptable Tenders will be evaluated using a system that awards points on the basis of Tender price and the meeting of specific goals.

DEFINITIONS

“Acceptable Tender” means any Tender which, in all respects, complies with the conditions of Tender and specifications as set out in the Tender document, including conditions as specified in the Preferential Procurement Policy Framework Act (Act 5 of 2000) and the Supply Chain Management of Council.

“Council” refers to the O. R. TAMBO DISTRICT Municipality.

“Equity ownership” refers to the percentage ownership and control, exercised by individuals within an enterprise and they are involved in the day to day running of the Company.

“HDI equity ownership” refers to the percentage of an enterprise, which is owned by individuals, or in the case of a company, the percentage shares that are owned by individuals meeting the requirements of the definition of a HDI.

“Historically disadvantaged individuals (HDIs)” means all South African citizens –

- (i) Who had no franchise in national elections prior to the introduction of the 1983 and 1993 constitutions (Referred to as Previously Disadvantaged Individuals (PDIs) in this document)
- (ii) Women
- (iii) Disabled persons.

“SMME’s” (small, medium and micro enterprises) refers to separate and distinct business entities, including co-operative enterprises and NGOs, managed by one owner or more, as defined in the National Small Business (Act 102 of 1996). Refer to the attached addendum for a definition of SMME’s for different economic sectors.

Tenders are adjudicated in terms of ORTDM Procurement Policy, and the following framework is provided as a guideline in this regard.

1 Technical adjudication and General Criteria

- Tenders will be adjudicated in terms of inter alia:
- Compliance with Tender conditions
- Technical specifications

If the Tender does not comply with the Tender conditions, the Tender will be rejected. If technical specifications are not met, the Tender may also be rejected.

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With regards to the above, certain actions or errors are unacceptable, and warrants **REJECTION OF THE TENDER**, for example:

- A Tax Verification Pin. (**Only valid tax verification pin** must be attached to the Tender document).
- Pages to be completed, removed from the Tender document, and have therefore not been submitted.
- Failure to complete the Bill of Quantities as required.
- Scratching out without initialling next to the amended rates or information.
- Writing over / painting out rates / the use of tippex or any erasable ink, e.g. pencil.
- Failure to attend compulsory site inspections.
- The Tender has not been properly signed by a party having the authority to do so, according to the Form 2.2.2 – “Authority for Signatory”.
- Form of Offer not completed.
- Particulars required in respect of the Tender have not been provided – non-compliance of Tender requirements and/or specifications.
- The Tenderer’s attempts to influence or has in fact influenced the evaluation and/or awarding of the contract.
- The Tender has been submitted after the relevant closing date and time.
- Each page of the Contract portion of this Tender document (Part C1 – C5) must be initialled by the authorised person in order for the document to constitute a proper Contract between the Employer (ORTDM) and the undersigned.
- If any municipal rates and taxes or municipal service charges owed by that Tenderer or any of its directors to the municipality, or to any other municipality or municipal entity, are in arrears for more than three months.
- If any Tenderer who during the last five years has failed to perform satisfactorily on a previous contract with the municipality or any other organ of state after written notice was given to that Tenderer that performance was unsatisfactory.

2 Size of enterprise and current workload

Evaluation of the Tenderer’s position in terms of:

- Previous and expected current annual turnover.
- Current contractual obligations.
- Capacity to execute the contract.

3 Staffing profile

Evaluation of the Tenderer’s position in terms of:

- Staff available for this contract being Tendered for
- Qualifications and experience of key staff to be utilised on this contract.

4 Financial ability to execute the contract:

Evaluation of the Tenderer’s financial ability to execute the contract. Emphasis will be placed on the following:

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- Contact the Tenderer's bank manager to assess the Tenderer's financial ability to execute the contract and the Tenderer hereby grants his consent for this purpose.

5 Good standing with RSA Revenue Services

- Determine whether an original tax pin or an original valid tax clearance certificate has been submitted.
- The Tenderer must affix a Tax Verification Pin to page T2.3.2 of the Tender document.

6 Penalties

The O. R. Tambo District Municipality will if upon investigation it is found that a preference in terms of the Contract has been obtained on a fraudulent basis, or any specified goals are not attained in the performance of the contract, on discretion of the Municipal Manager, one or more of the following penalties will be imposed:

- Cancel the contract and recover all losses or damages incurred or sustained from the Tenderer.
- Impose a financial penalty of twice the theoretical financial preference associated with the claim, which was made in the Tender.
- Restrict the suppliers, its shareholders, and directors on obtaining any business from the O. R. Tambo District Municipality for a period of 5 years.

DECLARATION

I/We the undersigned, who warrants that he/she is duly authorised to do so on behalf of the firm, certifies that the items mentioned in part of the foregoing procurement form and returnable documents qualifies/qualify for the preference(s) shown and acknowledge(s) that:

The information furnished is true and correct.

The contractor may be required to furnish documentary proof to the satisfaction of the O. R. Tambo District Municipality that the claims are correct.

If the claims are found to be inflated, the O. R. Tambo District Municipality may, in addition to any other remedy it may have, recover from the contractor all cost, losses or damages incurred or sustained by the O. R. Tambo District Municipality as a result of the award of the Contract and/or cancel the contract and claim any damages which the O. R. Tambo District Municipality may suffer by having to make less favourable arrangements after such cancellation.

Signature of Tenderer

Signed at _____ on _____ day of _____ 202_____

For the tenderer

WITNESSES:

1. _____

2. _____

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FORM 2.2.4 SCHEDULE OF PREVIOUS EXPERIENCE

Provide the following information on relevant previous experience (indicate specifically projects of similar or larger size and/or which is similar with regard to type of work, as defined in Tender Data, Clause C3.11.1).

Practical Completion not older than 12 months or Completion certificates must be submitted for project to be considered for evaluation of Compliance as per Tender Data, Clause C3.11.1.

Description	Value (R) VAT excluded	Year(s) work executed	Reference		
			Name	Organisation	Tel no

Name of Tenderer: Date:

Signature:

Full name of signatory:

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FORM 2.2.5 SCHEDULE OF CURRENT PROJECTS

Provide the following information on current relevant projects.

Description	Value (R)	Date	Reference		
	VAT excluded	Appointed	Name	Organisation	Tel no

Name of Tenderer: Date:

Signature:

Full name of signatory:

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FORM 2.2.6 DECLARATION OF GOOD STANDING REGARDING TAX

SOUTH AFRICAN REVENUE SERVICES	Tender No: Closing Date:
DECLARATION OF GOOD STANDING REGARDING TAX	
PARTICULARS	
1. Name of Taxpayer/Tenderer:	
2. Trade Name	
3. Identification Number: (If applicable)	
4. Company / Close Corporation registration number:	
5. Income Tax reference number:	
6. VAT registration number: (If applicable)	
7. PAYE employer's registration number: (If applicable)	
8. Monetary value of Bid:	
DECLARATION	
<p>I,the undersigned, the above taxpayer/Tenderer, hereby declare that my Income Tax, Pay-As-You-Earn (PAYE) and Value-Added-Tax (VAT) obligations of the above-mentioned taxpayer, which include the rendition of returns and payment of the relevant taxes:</p> <p>(i) Have been satisfied in terms of the relevant Acts; or</p> <p>(ii) That suitable arrangements have been made with the Receiver of Revenue, to satisfy them.*</p>	
..... SIGNATURE CAPACITY
..... DATE	
<p>PLEASE NOTE:* The declaration (ii) cannot be made unless formal arrangements have been made with the Receiver of Revenue with regard to any outstanding revenue/outstanding tax returns.</p>	

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In terms of Clause 43 of the Municipal Supply Chain Management Policy, tenderers must ensure that they are up-to-date with their payments of taxes. It is a condition of bid that the taxes of the successful tenderer must be in order, or that satisfactory arrangements have been made with South African Revenue Service (SARS) to meet the tenderer's tax obligations.

The tenderer must attach to this page an **Original(s)** of a **Valid Tax Clearance Certificate(s)**.

1. In order to meet this requirement tenderers are required to complete in full the form TCC 001 "Application for a Tax Clearance Certificate" and submit it to any SARS branch office nationally. The Tax Clearance Certificate Requirements are also applicable to foreign tenderers / individuals who wish to submit bids.
2. SARS will then furnish the tenderer with a Tax Clearance Certificate that will be valid for a period of 1 (one) year from the date of approval.
3. The original Tax Clearance Certificate must be submitted together with the bid. Failure to submit the original and valid Tax Clearance Certificate will result in the invalidation of the bid. Certified copies of the Tax Clearance Certificate will not be acceptable.

Alternatively, the tenderer must submit a Tax Compliance Status PIN to allow Supply Chain Management to verify the real-time compliance status.

Tax Compliance Status PIN
---------------------------	-------

4. In bids where Consortia / Joint Ventures / Sub-contractors are involved; each party must submit a separate Tax Clearance Certificate.
5. Copies of the TCC 001 "Application for a Tax Clearance Certificate" form are available from any SARS branch office nationally or on the website www.sars.gov.za.
6. Applications for the Tax Clearance Certificates may also be made via eFiling. In order to use this provision, taxpayers will need to register with SARS as eFilers through the website www.sars.gov.za

No contract shall be awarded to a Tenderer who does not have a valid Tax Clearance Certificate.

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FORM 2.2.7 REGISTRATION ON THE CENTRAL SUPPLIER DATABASE
--

Attach proof of registration with the National Treasury Central Supplier Database. **This information is material to the award of the Contract.**

ATTACH CERTIFIED PROOF OF REGISTRATION ON THE NATIONAL CENTRAL SUPPLIER DATABASE

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FORM 2.2.8 CERTIFICATE OF ATTENDANCE AT SITE MEETING
--

This is to certify that

.....(Tenderer)

of (address)

.....

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

..... (location) on (date),

starting at

We acknowledge that the purpose of the meeting was to acquaint ourselves with the site of the works and / or matters incidental to doing the work specified in the tender documents in order for us to take account of everything necessary when compiling our rates and prices included in the tender.

Particulars of person(s) attending the meeting:

Name

Signature

Capacity

Name

Signature

Capacity

Attendance of the above persons at the meeting is confirmed by the Employer's representative, namely:

Name

Signature

Capacity

Date & Time

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FORM 2.2.9 SCHEDULE OF PROPOSED SUB-CONTRACTORS

NAME OF SUB-CONTRACTOR	FULL DESCRIPTION OF WORK TO BE PERFORMED BY SUB- CONTRACTORS

NB: It is a Condition of Contract that a minimum of 20% of the construction work (excluding specialist supply items, contingencies, CPA and provisional sums) shall be subcontracted to local (within ORTDM) QSEs and EMEs as contemplated in the ‘The Broad-Based Black Economic Empowerment Act (No. 53 of 2003) as amended by B-BBEE Act 46 of 2013 (The Act)’. The Contractor shall take all reasonable and practical measures to support, mentor, train, upskill and supervise such subcontractors as envisaged in the Strategic Objectives of the Amended Construction Sector Code.

Acceptance of this tender shall not be construed as approval of all or any of the listed subcontractors. Should any of the subcontractors not be approved subsequent to acceptance of the tender, this shall in no way invalidate this tender, and the tendered unit rates for the various items of work shall remain final and binding, even in the event of a subcontractor not listed above being approved by the Employer’s Agent.

Name of Tenderer: Date:

Signature:

Full name of signatory:

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FORM 2.2.10 FINANCIAL REFERENCES

FINANCIAL STATEMENTS

I/We agree to furnish a copy of the latest set of audited financial statements for the past three years, together with my/our Directors' and Auditors' report for consideration by the Employer.

DETAILS OF TENDERERS BANKING INFORMATION

I/We hereby authorise the Employer/Employer's Agent to approach all or any of the following banks for the purposes of obtaining a financial reference:

BANK NAME:											
ACCOUNT NAME: (e.g. ABC Civil Construction cc)											
ACCOUNT TYPE: (e.g. Savings, Cheque etc)											
ACCOUNT NO:											
ADDRESS OF BANK:											
CONTACT PERSON:											
TEL. NO. OF BANK / CONTACT:											
How long has this account been in existence:	(Tick which is appropriate)	<table border="1" style="display: inline-table;"><tr><td>0-6 months</td><td></td></tr><tr><td>7-12 months</td><td></td></tr><tr><td>13-24 months</td><td></td></tr><tr><td>More than 24 months</td><td></td></tr></table>	0-6 months		7-12 months		13-24 months		More than 24 months		
0-6 months											
7-12 months											
13-24 months											
More than 24 months											

Name of Tenderer: OBJ..... Date:

Signature:

Full name of signatory:

ATTACH AUDITED FINANCIAL STATEMENTS (THREE YEARS)
--

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FORM 2.2.11 MUNICIPAL BIDDING DOCUMENTS (MBD)

MBD 1 - PART A INVITATION TO BID

BID NUMBER:	MIS 478 793 A	CLOSING DATE:	03 July 2025	CLOSING TIME:	12:00PM
DESCRIPTION:	SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B – CONSTRUCTION OF ABSTRACTION WORKS AND MALEPELEPE WATER TREATMENT WORKS - CONTRACT 1				

BID RESPONSE DOCUMENTS MAY BE DEPOSITED IN THE BID BOX SITUATED AT:

TENDER BOX, GROUND FLOOR, O. R. TAMBO DISTRICT MUNICIPALITY BUILDING					
NELSON MANDELA DRIVE					
MYEZO PARK					
MTHATHA					
EASTERN CAPE					
SUPPLIER INFORMATION					
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	TCS PIN:		CSD No:		
STATEMENT OF RATES AND TAXES OF THE BIDDER	Yes No		STATEMENT OF RATES AND TAXES OF THE COMPANY	Yes No	

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[STATEMENT OF RATES AND TAXES OF THE BIDDER AND OF THE COMPANY/ LEASE AGREEMENT FOR LEASED PROPERTY MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS]			
ARE YOU THE ACCREDITED REPRESENTATIVE IN SOUTH AFRICA FOR THE GOODS /SERVICES /WORKS OFFERED?	Yes No [IF YES ENCLOSE PROOF]	ARE YOU A FOREIGN BASED SUPPLIER FOR THE GOODS /SERVICES /WORKS OFFERED?	Yes No [IF YES, ANSWER PART B:3]
TOTAL NUMBER OF ITEMS OFFERED		TOTAL BID PRICE	R
SIGNATURE OF BIDDER	DATE	
CAPACITY UNDER WHICH THIS BID IS SIGNED			
BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO:		TECHNICAL INFORMATION MAY BE DIRECTED TO:	
DEPARTMENT	SCM DEPARTMENT	CONTACT PERSON	Mr. N. Noto
CONTACT PERSON	Mr. Sakhiwo Hopa	TELEPHONE NUMBER	047 501 6425
TELEPHONE NUMBER	047 501 6449	FACSIMILE NUMBER	N/A
FACSIMILE NUMBER	N/A	E-MAIL ADDRESS	nkosiyabon@ortambodm.gov.za
E-MAIL ADDRESS	sakhiwoh@ortambodm.gov.za		

PART B TERMS AND CONDITIONS FOR BIDDING

1. BID SUBMISSION:	
1.1.	BIDS MUST BE DELIVERED BY THE STIPULATED TIME TO THE CORRECT ADDRESS. LATE BIDS WILL NOT BE ACCEPTED FOR CONSIDERATION. ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS PROVIDED–(NOT TO BE RE-TYPED).
1.2.	THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT AND THE PREFERENTIAL PROCUREMENT REGULATIONS, 2022, THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER SPECIAL CONDITIONS OF CONTRACT.
2. TAX COMPLIANCE REQUIREMENTS	
2.1	BIDDERS MUST ENSURE COMPLIANCE WITH THEIR TAX OBLIGATIONS.
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.

- 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.
- 2.4 FOREIGN SUPPLIERS MUST COMPLETE THE PRE-AWARD QUESTIONNAIRE IN PART B:3.
- 2.5 BIDDERS MAY ALSO SUBMIT A PRINTED TCS CERTIFICATE TOGETHER WITH THE BID.
- 2.6 IN BIDS WHERE CONSORTIA / JOINT VENTURES / SUB-CONTRACTORS ARE INVOLVED, EACH PARTY MUST SUBMIT A SEPARATE TCS CERTIFICATE / PIN / CSD NUMBER.
- 2.7 WHERE NO TCS IS AVAILABLE BUT THE BIDDER IS REGISTERED ON THE CENTRAL SUPPLIER DATABASE (CSD), A CSD NUMBER MUST BE PROVIDED.
3. QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS

3.1. IS THE ENTITY A RESIDENT OF THE REPUBLIC OF SOUTH AFRICA (RSA)?	YES	NO
3.2. DOES THE ENTITY HAVE A BRANCH IN THE RSA?	YES	NO
3.3. DOES THE ENTITY HAVE A PERMANENT ESTABLISHMENT IN THE RSA?	YES	NO
3.4. DOES THE ENTITY HAVE ANY SOURCE OF INCOME IN THE RSA?	YES	NO
3.5. IS THE ENTITY LIABLE IN THE RSA FOR ANY FORM OF TAXATION?	YES	NO

3.6. 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.

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 state¹.
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, shareholder²):

.....

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.....

.....¹

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.

² 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.

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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 or not they are bidding for this contract? YES / NO

3.14.1 If yes, furnish particulars

.....

.....

4. Full details of directors / trustees / members / shareholders.

.....

Signature Date

[illegible]

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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:

NO.	QUESTION	ANSWER (TICK WHICH RESPONSE IS APPLICABLE)	
		YES	NO
1.	Are you by law required to prepare annual financial statements?		
1.1	If yes, submit audited annual financial statements for the past three years or since the date of establishment if established during the last 3 years.		
2.	Do you have any outstanding undisputed commitments for municipal services towards any municipality for more than 3 months or any other service provider in respect of which payment is overdue for more than 30 days?		
2.1	If no, this serves to certify that the bidder has no undisputed commitments for municipal services towards any municipality for more than 3 months or other service provider in respect of which payment is overdue for more than 30 days.		
2.2	If yes, provide details:		
3.	Has any contract been awarded to you by an organ of state during the past five years, including particulars of any material non-compliance or dispute concerning the execution of such contract?		
3.1	If yes, provide details:		

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NO.	QUESTION	ANSWER (TICK WHICH RESPONSE IS APPLICABLE)	
		YES	NO
4.	Will any portion of the goods or services be sourced from outside the Republic, and if so, what portion, and whether any portion of payment from the municipality is expected to be transferred outside of the Republic?		
4.1	If yes, provide details:		

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 THIS DECLARATION PROVE TO BE FALSE.

.....

Signature _____ Date _____

Position	Name of Bidder
----------	----------------

**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

(delete whichever is not applicable for this tender).

- a) The applicable preference point system for this tender is the 90/10 preference point system.
- b) The applicable preference point system for this tender is the 80/20 preference point system.
- c) Either the 90/10 or 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	POINTS
PRICE	90	80
SPECIFIC GOALS	10	20
Total points for Price and SPECIFIC GOALS	100	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:

80/20 or 90/10

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

Where

Ps	=	Points scored for price of tender under consideration
Pt	=	Price of tender under consideration
Pmin	=	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:

80/20 or 90/10

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

Where

P_s = Points scored for price of tender under consideration

P_t = Price of tender under consideration

P_{max} = 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 organs of state: Where either the 90/10 or 80/20 preference point system is applicable, corresponding points must also be indicated as such.)

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

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The specific goals allocated points in terms of this tender	Number of points allocated (90/10 system) (To be completed by the organ of state)	Number of points claimed (90/10 system) (To be completed by the tenderer)
51% Black-owned enterprises	04	
100% Women-owned enterprises	02	
100% Youth-owned enterprises	02	
Where the enterprise head office or primary place of business is located within O. R. Tambo District.	02	

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 –

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- (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:

.....

.....

.....

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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. wilfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past five years; or
 - d. been listed in the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004).
- 4 In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.

Item	Question	Yes	No
4.1	Is the bidder or any of its directors listed on the National Treasury's Database of Restricted Suppliers as companies or persons prohibited from doing business with the public sector? (Companies or persons who are listed on this Database were informed in writing of this restriction by the Accounting Officer/Authority of the institution that imposed the restriction after the <i>audi alteram partem</i> rule was applied). The Database of Restricted Suppliers now resides on the National Treasury's website (www.treasury.gov.za) and can be accessed by clicking on its link at the bottom of the home page.	<input type="checkbox"/>	<input type="checkbox"/>
4.1.1	If so, furnish particulars:		
4.2	Is the bidder or any of its directors listed on the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004)? The Register for Tender Defaulters can be accessed on the National Treasury's website (www.treasury.gov.za) by clicking on its link at the bottom of the homepage.	<input type="checkbox"/>	<input type="checkbox"/>
4.2.1	If so, furnish particulars:		
4.3	Was the bidder or any of its directors convicted by a court of law (including a court of law outside the Republic of South Africa) for fraud or corruption during the past five years?	<input type="checkbox"/>	<input type="checkbox"/>
4.3.1	If so, furnish particulars:		

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Item	Question	Yes	No
4.4	Does the bidder or any of its directors owe any municipal rates and taxes or municipal charges to the municipality / municipal entity, or to any other municipality / municipal entity, that is in arrears for more than three months?	<input type="checkbox"/>	<input type="checkbox"/>
4.4.1	If so, furnish particulars:		
4.5	Was any contract between the bidder and the municipality / municipal entity or any other organ of state terminated during the past five years on account of failure to perform on or comply with the contract?	<input type="checkbox"/>	<input type="checkbox"/>
4.7.1	If so, furnish particulars:		

CERTIFICATION

I, THE UNDERSIGNED (FULL NAME) _____
 CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM TRUE AND CORRECT.

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

.....

Signature

.....

Date

.....

Position

.....

Name of Bidder

MBD 9 - CERTIFICATE OF INDEPENDENT BID DETERMINATION

- 1 This Municipal Bidding Document (MBD) must form part of all bids¹ invited.
- 2 Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging).² Collusive bidding is a *pe se* prohibition meaning that it cannot be justified under any grounds.
- 3 Municipal Supply Regulation 38 (1) prescribes that a supply chain management policy must provide measures for the combating of abuse of the supply chain management system, and must enable the accounting officer, among others, to:
 - a. take all reasonable steps to prevent such abuse;
 - b. reject the bid of any bidder if that bidder or any of its directors has abused the supply chain management system of the municipality or municipal entity or has committed any improper conduct in relation to such system; and
 - c. cancel a contract awarded to a person if the person committed any corrupt or fraudulent act during the bidding process or the execution of the contract.
- 4 This MBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.
- 5 In order to give effect to the above, the attached Certificate of Bid Determination (MBD 9) must be completed and submitted with the bid:

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

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

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

PROJECT NO.: MIS 478 793 A

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in response to the invitation for the bid made by:

O. R. TAMBO DISTRICT MUNICIPALITY

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

I certify, on behalf of: _____(Name of Bidder) that:

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 authorised 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 authorised 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 organisation, other than the bidder, whether or not affiliated with the bidder, who:
 - (a) has been requested to submit a bid in response to this bid invitation;
 - (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
 - (c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder
6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium³ will not be construed as collusive bidding.
7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:

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- (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.

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

10. I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

.....

Signature	Date
-----------	------

.....

Position	Name of Bidder
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FORM 2.2.12 SCHEDULE OF PROPOSED EQUIPMENT

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

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

Quantity	Description, Size, Capacity, etc

Attach additional pages if more space is required.

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

Quantity	Description, Size, Capacity, etc

Attach additional pages if more space is required.

SIGNED BY/ON BEHALF OF TENDERER:

Signed

Date

Name

Position

FORM 2.2.13 HEALTH AND SAFETY PLAN

Tenderers are to note the requirements of the Occupational Health and Safety Act No. 85 of 1993 and the Construction Regulations 2014 issued in terms of Section 43 of the Act as well as COVID-19 requirements. The Tenderer shall be deemed to have read and fully understood the requirements of the above Act and Regulations and to have allowed for all costs in compliance therewith.

In this regard, the Tenderer shall prepare and attach a Health and Safety Plan in relation to the Client Health and Safety Specification in respect of the Works in order to demonstrate the necessary competencies and resources to perform the construction work all in accordance with the Act and Regulations. The Tenderer's Health and Safety Plan shall cover inter-alia the following details:

- 1) Management Structure, Site Supervision and Responsible Persons including a succession plan.
- 2) Contractor's induction training programme for employees, sub-contractors and visitors to the Site.
- 3) Risk management systems and monitoring
- 4) Health and safety precautions and Procedures to be adhered to in order to ensure compliance with the Act, Regulations and Safety Specifications.
- 5) Regular monitoring Procedures to be performed.
- 6) Regular liaison, consultation and review meetings with all parties.
- 7) Site security, welfare facilities and first aid.
- 8) Site rules and fire and emergency Procedures.

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

The Tenderer shall also take into account the additional requirements stated in the Scope of Work when drawing up the Health and Safety Plan for the contract.

Details of the Health and Safety Plan shall be appended to this Schedule.

Number of sheets appended by the Tenderer to this Schedule (If nil, enter NIL)

SIGNED BY/ON BEHALF OF TENDERER:

Signed Date

Name Position

FORM 2.2.14 PRELIMINARY PROGRAMME
--

The Tenderer shall provide a preliminary programme in Gantt Chart format showing how the requirements of C1.2: Contract Data and Part C3: Scope of Work will be met; and outlining the key activities and milestones and Critical Path for the Works and the sequencing thereof. In addition, a preliminary cash flow forecast, matching the progress of the programme must be submitted.

The programme must be based on the tendered Time for Completion.

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FORM 2.2.15 ESTIMATED MONTHLY EXPENDITURE

The Tenderer shall state his estimated cashflow on the contract based on his/her preliminary programme, tendered rates and submission of payment certificates to the Employer in the table below. Amounts for Contract Price Adjustment shall not be included.

Payment Certificate No.	Amount (VAT Included)					Cumulative cash flow
	A	B	A - B			
	Payments Received	Expenditure		Net cash flow		
1	None		d		j=d	
2			e		k=j+e	
3			f		l=k+f	
4			g		m=l+g	
5			h		n=m+h	
6			etc		etc	
7						
8						
9						
10						
11						
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24						
25						
26						
27						

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[illegible]

SIGNED BY/ON BEHALF OF TENDERER:

Signed

Date

Name

Position

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**FORM 2.2.16 DECLARATION CONCERNING FULFILMENT OF THE CONSTRUCTION
 REGULATIONS, 2014**

In terms of Regulation 4(3) of the Construction Regulations, (hereinafter referred to as the Regulations), promulgated on 18 July 2014 in terms of Section 43 of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) the Employer shall not appoint a Contractor to perform construction work unless the Contractor can satisfy the Employer that his/her firm has the necessary competencies and resources to carry out the work safely and has allowed adequately in his/her tender for the due fulfilment of all the applicable requirements of the Act and the Regulations.

Tenderers shall answer the questions below:

1. I confirm that I am fully conversant with the Regulations and that my company has (or will acquire/procure) the necessary competencies and resources to timeously, safely and successfully comply with all of the requirements of the Regulations.

(Tick)

YES	<input type="checkbox"/>
NO	<input type="checkbox"/>

2. Indicate which approach shall be employed to achieve compliance with the Regulations.
(Tick)

Own resources, competent in terms of the Regulations (refer to 3 below)	<input type="checkbox"/>
Own resources, still to be hired and/or trained (until competency is achieved)	<input type="checkbox"/>
Specialist subcontract resources (competent) - Specify:	
.....	
.....	
.....	
.....	
.....	

3. Provide details of proposed key persons, competent in terms of the Regulations, who will form part of the Contract team as specified in the Regulations (signed CVs to be attached):

.....

.....

.....

.....

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4. Provide details of proposed training (if any) that will be undergone:

.....

.....

.....

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5. List potential key risks identified and measures for addressing risks:

.....

.....

.....

.....

.....

.....

6. I have fully included in my tendered rates and prices (in the appropriate payment items provided in the Bill of Quantities) for all resources, actions, training and any other costs required for the due fulfilment of the Regulations for the duration of the construction and defects repair period

(Tick)

YES	
NO	

SIGNATURE OF PERSON(S) AUTHORISED TO SIGN THIS TENDER:

1.

ID NO:

(Name in Print):

2.

ID NO:

(Name in Print):

FORM 2.2.17 UIF LETTER OF GOOD STANDING
--

Proof of good standing with the Department of Labour regarding UIF to be attached here.

T2.3 RETURNABLE DOCUMENTS INCORPORATED INTO THE CONTRACT
--

RETURNABLE DOCUMENTS THAT WILL BE INCORPORATED INTO THE CONTRACT

- Form 2.3.1 Record of Addenda to Tender Documents
- Form 2.3.2 Original Tax Clearance Certificate / Confirmation of Tax Validity with PIN
- Form 2.3.3 National Treasury: Central Data Supplier Base
- Form 2.3.4 CIDB Registration
- Form 2.3.5 COID Letter of Good Standing
- Form 2.3.6 Proposed Organisation and Staffing
- Form 2.3.7 Proposed Key Personnel
- Form 2.3.8 Electrical Data Sheets (Returnable)
- Form 2.3.9 Fire Safety Data Sheets (Returnable)

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FORM 2.3.1 RECORD OF ADDENDA TO TENDER DOCUMENTS
--

(Addenda received from Employer's Agent for amendments on Tender Documentation)

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

Name of Tenderer: Date:

Signature:

Full name of signatory:

FORM 2.3.2 ORIGINAL TAX CLEARANCE CERTIFICATE / CONFIRMATION OF TAX VALIDITY WITH PIN

To be attached by tenderer.

FORM 2.3.3 NATIONAL TREASURY: CENTRAL SUPPLIER DATABASE
--

Proof of registration on the National Treasury Central Supplier Database to be attached here (alternatively the tenderer to provide MAAA number).

FORM 2.3.4 CIDB REGISTRATION

Proof of Contractor's (active) registration on the Construction Industry Development Board (CIDB).

FORM 2.3.5 COID LETTER OF GOOD STANDING
--

Provide a certified copy of letter proof of good standing with a compensation insurer who is approved by the Department of Labour in terms of Section 80 of the Compensation for Occupational Injuries and Diseases Act (Act No 130 of 1993) (COIDA).

FORM 2.3.6 PROPOSED ORGANISATION AND STAFFING

The tender offer shall include an organogram clearly showing the team of key personnel the Tenderer proposes to assign to the Contract and how responsibilities for the various disciplines or work and components of the Works will be assigned. The name, roles and responsibilities of each person and the name of their employer must be clearly set out, and corresponding job descriptions must be provided as an addendum to the organogram.

In the case of a Joint Venture or where major sub-contractors are made use of, the organogram must show how respective responsibilities are to be allocated.

As a minimum, the organogram must show how respective responsibilities are to be allocated. As a minimum, the organogram must include for the personnel detailed in Returnable Document **Form 2.3.7: Proposed Key Personnel**.

The Tenderer shall include the requisite organogram and addendums in the Supporting Documentation file, to be submitted in accordance with Clause C2.13.3 of T1.2.2 Variations to the Standard Conditions of Tender.

FORM 2.3.7 PROPOSED KEY PERSONNEL

Signed Curriculum Vitae (CV), up to a maximum of five (5) pages must be submitted, for each of the key personnel (at least Contracts Manager, Construction Manager, SMME Construction Manager and Construction Health and Safety Officer proposed in Returnable Document: **FORM 2.3.6: Proposed Organisation and Staffing**. The CVs must specifically include the qualifications, professional accreditation, experience of **10 years** (Contracts Manager) and **5 years** (Construction Manager, SMME Construction Manager and Construction Health and Safety Officer) roles and responsibilities in construction projects of a similar nature. Contact details of at least three (3) contactable referees must also be provided.

A template for CV's is provided overleaf.

Each CV must be clearly cross-referenced to and labelled to correspond with the organogram submitted in terms of Returnable Document: FORM 2.3.6: Proposed Organisation and Staffing, so as to indicate which role the person in question is proposed to fulfil in the Contract.

The Tenderer shall include the requisite signed CVs in the Supporting Documentation file, to be submitted in accordance with Clause C2.13.3 of T1.2 Variations to the Standard Conditions of Tenders.

The proposed key personnel will be evaluated for Compliance based on Clause C3.11.1.

Name and Surname	Position	Qualifications and Years of Experience (Post qualification)
	Contracts Manager	
	Construction Manager (Site Agent)	
	SMME Construction Manger	

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Name and Surname	Position	Qualifications and Years of Experience (Post qualification)
	Construction Health and Safety Officer (SACPCMP: CHSO.....) Attach signed CV and proof of registration and qualification	
	Other	

Note: Separate individuals are required for each of the above positions.

INSERT KEY PERSONNEL CVs HERE ACCORDING TO THE TEMPLATE BELOW

Name:

Professional:

Date of Birth:

Parent Firm:

Position in Firm: Indicate if Director, Contractor's Representative, Design Engineer (with component of responsibility), Installation/construction Foreman (with component of responsibility) etc.

Years with Firm:

Nationality:

Tertiary Education (and year obtained):

Professional Accreditation (and year obtained):

Years of Relevant Experience:

Languages: Indicate first language. If the first language is not English, please indicate proficiency in English. In other languages, including South African indigenous languages, please show speaking, reading and writing ability.

Language	Speaking	Reading	Writing
English			

Countries of Work Experience

Proposed Position of Team

Key Qualifications

Under this heading, give outline of staff members experience and training most pertinent to the assigned work on the team.

Relevant Experience

Describe degree of responsibility held by staff member on relevant previous assignments, and give dates, project values and locations. For experience in the last ten years, also give types of activities performed and Client references where appropriate.

Summary of Other Experience

Under this heading, list all positions held by staff member since graduation, giving dates, names of employing organisation, title of position held and location, type and value of construction projects.

References

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Declaration

I confirm that the above information contained in the CV is an accurate description of my experience and qualifications and that, at the time of signature, I am available and will serve in the position indicated for me in the proposal for **TENDER NUMBER: MIS 478 793 A: SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B– CONSTRUCTION OF ABSTRACTION WORKS AND MALEPELEPE WATER TREATMENT WORKS - CONTRACT 1**

Signed **Date**

Name **Position**

CV – CONTRACTS MANAGER

CV – CONSTRUCTION MANAGER (SITE AGENT)

CV – SMME CONSTRUCTION MANAGER (MENTOR TO SMMEs)

CV – CONSTRUCTION HEALTH AND SAFETY OFFICER

FORM 2.3.8 ELECTRICAL DATA SHEETS (RETURNABLE)

List of returnable data sheets to be completed and returned:

Data Sheet DS-EE-0010S DISTRIBUTION BOARDS AND KIOSKS (2 PAGES)

Data Sheet DS-EE-0013 SMALL POWER AND LIGHTING (4 PAGES)

Data Sheet DS-EE-0014 LUMINAIRE SCHEDULE (1 PAGE)

Data Sheet DS-EL-0002 BUILDING SERVICES NETWORK (2 PAGES)

Data Sheet DS-EL-0003 CCTV (4 PAGES)

DATA SHEET No. DS-EE-0010S**DISTRIBUTION BOARDS AND KIOSKS**

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	ELECTRICAL CHARACTERISTICS			
1.01	Supply Voltage	V	230V / 400V	
1.02	Frequency	Hz	50	
1.03	DB Main Busbar Rating	A	As per SLDs	
1.04	Fault Level Rating	kA	As per SLDs	
1.05	Number of Phases	Num	1 / 3	
1.06	Cascading Allowed	Yes / No	No	
1.07	Control Voltage	V	230	
1.08	Supplied From		Various	
1.09	Upstream Supply size	kVA	Various	
1.10	Estimated Load (After Diversification)	kVA	Various	
1.11	Earthing	Earth Bar / Earth Stud	Earth Bar	
1.12	Neutral	Full / Half	Full Neutral	
2	STREETLIGHTING KIOSKS			
2.01	Manufacturer			
2.02	Material		1.6mm Mild Steel, epoxy coated	
2.03	Type		Plinth mounted	
2.04	Details		As per SLDs	
2.05	Surge Arrestors	Yes/No	Yes	
2.06	SANS compliant	Yes/No	Yes	
3	DISTRIBUTION BOARDS			
3.01	Manufacturer			
3.02	Material		1.6mm Mild Steel, epoxy coated	
3.03	Type			
3.04	Details		As per SLDs	
3.05	Surge Arrestors	Yes/No	Yes	
3.06	SABS approved	Yes/No	Yes	
	COMPONENTS			
4	Busbars			
4.01	Material		Copper	
4.02	Tinned	Yes / No	Yes	
4.03	Current Density	A/mm ²	<2 or as per type test	

DATA SHEET No. DS-EE-0010S
DISTRIBUTION BOARDS AND KIOSKS

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified

Name (Print): _____ Signature: _____

DATA SHEET No. DS-EE-0013
SMALL POWER AND LIGHTING

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
	POWER OUTLETS			
1	Double and Single Normal 3-pin (SANS 164-1) Switched Socket Outlet			
1.01	Manufacturer & Type		Crabtree Classic or similar approved	
1.02	Ingress Protection	IP	54 or unless otherwise stated	
1.03	Faceplate Colour		White	
1.04	Mounting	Flush/wall/recessed in power skirting	Various	
1.05	SABS approved	Yes / No	Yes	
2	Double and Single Dedicated 3-pin (SANS 164-1) Switched Socket Outlet			
2.01	Manufacturer & Type		Crabtree Classic or similar approved	
2.02	Ingress Protection	IP	54 or unless otherwise stated	
2.03	Faceplate Colour		Red	
2.04	Mounting	Flush/recessed in power skirting	Various	
2.05	SABS approved	Yes / No	Yes	
3	Double and Single Normal 3-pin (SANS 164-2) Switched Socket Outlet			
3.01	Manufacturer & Type		Crabtree Classic or similar approved	
3.02	Ingress Protection	IP	54 or unless otherwise stated	
3.03	Faceplate Colour		White	
3.04	Mounting	Flush/wall/recessed in power skirting	Various	
3.05	SABS approved	Yes / No	Yes	
4	Double and Single Dedicated 3-pin (SANS 164-2) Switched Socket Outlet			
4.01	Manufacturer & Type		Crabtree Classic or similar approved	
4.02	Ingress Protection	IP	54 or unless otherwise stated	
4.03	Faceplate Colour		Red	
4.04	Mounting	Flush/recessed in power skirting	Various	
4.05	SABS approved	Yes / No	Yes	

DATA SHEET No. DS-EE-0013**SMALL POWER AND LIGHTING**

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
5	Weatherproof Switched Socket Outlets			
5.01	Manufacturer & Type			
5.02	Ingress Protection	IP	65 or unless otherwise stated	
5.03	Faceplate Colour		White	
5.04	Mounting	Flush/wall/recessed in power skirting	Wall	
5.05	SABS approved	Yes / No	Yes	
6	32A 5-pin 400V Industrial Switched Socket Outlet			
6.01	Manufacturer & Type			
6.02	Ingress Protection	IP	55	
6.03	Mounting	Flush/wall/recessed in power skirting	Wall	
6.04	SABS approved	Yes / No	Yes	
	SWITCH-DISCONNECTORS			
7	2 Pole			
7.01	Manufacturer & Type		Crabtree Classic or similar approved	
7.02	Ingress Protection	IP	55	
7.03	Mounting		Flush	
7.04	SABS approved	Yes / No	Yes	
8	2 Pole - Industrial Areas			
8.01	Manufacturer		Waco or similar approved	
8.02	Type			
8.03	Ingress Protection	IP	65	
8.04	Mounting		Flush	
8.05	SABS approved	Yes / No	Yes	
9	3 Pole - Industrial Areas			
9.01	Manufacturer		Waco or similar approved	
9.02	Type			
9.03	Ingress Protection	IP	65	
9.04	Mounting		Flush	
9.05	SABS approved	Yes / No	Yes	
10	DATA OUTLETS			
10.01	Manufacturer			
10.02	Type		RJ45/RJ11 combo	
10.03	Colour		White	
10.04	Mounting	Flush/recessed in power skirting	Various	
10.05	SABS approved	Yes / No	Yes	







DATA SHEET No. DS-EE-0013**SMALL POWER AND LIGHTING**

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
	LIGHTING (FOR LUMINAIRES SEE EE-0014)			
11	Photocell (Day/Night Switch)			
11.01	Manufacturer			
11.02	Model			
11.03	SABS approved	Yes / No	Yes	
12	Light Switches			
12.01	Manufacturer & Type		Crabtree Classic or similar approved	
12.02	Colour		White	
12.03	Flush mounted	Yes/No	Yes	
13	Galvanized Steel Poles			
13.01	Manufacturer /Supplier		Regent Lighting Solutions or similar and approved	
13.02	Height		Various, refer to drawings	
14	SINGLE CORE PVC INSULATED CABLE			
14.01	Manufacturer			
14.02	Type			
15	HOUSE WIRE			
15.01	Manufacturer			
15.02	Type			
16	CABLE TRAY			
16.01	Manufacturer		O-line / Cabstrut or similar approved	
16.02	Type		Return-flange	
16.03	Material		HDG	
16.04	Duty	Heavy / Medium		
16.05	Application			
17	WIRE MESH			
17.01	Manufacturer		O-line / Cabstrut or similar approved	
17.02	Type		Return-flange	
17.03	Material		HDG	
17.04	Duty	Heavy / Medium		
17.05	Application			

DATA SHEET No. DS-EE-0013
SMALL POWER AND LIGHTING

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified


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DATA SHEET No. DS-EE-0014 LUMINAIRE SCHEDULE										
Luminaire / Device Type:	Description	Supplier / Manufacturer:	Product Name / Code:	Mounting Location:	Image:	Lamp Type:	Housing Finish	Colour Temperature (K)	Luminaire Size (mm)	Datasheet required?
A	Vapourproof LED fitting	BEKA Schröder or similar approved	BEKA VLN LED 41W	Wall mounted/ Ceiling Mounted		41W, 230V, LED	Telegrey 1 (RAL 7045)	4000	97x1165x92	Yes
B	LED Outdoor Bulkhead	BEKA Schröder or similar approved	BEKABULK LED	Wall Mounted		19W, 230V, LED	Telegrey 1 (RAL 7045)	4000	462x283x83	Yes
C	Linear LED fitting	Regent or similar approved	LINEAR PRO 70	Wall mounted/ Ceiling Mounted		35 W, 230V, LED	Black	4000	95x900x70	Yes
D	LED Outdoor Lozenge Bulkhead	BEKA Schröder or similar approved	SERIES 300 LED BULKHEAD	Wall Mounted		21W, 230V, LED	Black	4000	Ø290xØ265x67	Yes
S	LED Streetlight	BEKA Schröder or similar approved	LEDLUME 2	Pole Mounted/ Bracket mounted		103W, 230V, LED	Unpainted aluminium	4000	235x450x88	Yes
L1	LED Indoor Bulkhead fitting	Eagle Lighting or similar approved	LGW5201	Wall mounted/ Ceiling Mounted		13W, 230V, LED	White	4000	Ø250x60	Yes

DATA SHEET No. DS-EL-0002**BUILDING SERVICES NETWORK**

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	NETWORK SWITCH			
1.01	Manufacturer			
1.02	Model			
1.03	Minimum number of fibre optic	No.	2	
1.04	Number of Ethernet ports	No.		
1.05	Minimum uplink/backbone network	Gbps	1	
1.06	PoE+ Capability	Yes/No	Yes	
2	NETWORK ACCESS POINT			
2.01	Manufacturer			
2.02	Model			
2.03	Wi-Fi 6 (802.11ax)	Yes/No	Yes	
2.04	Installation		Ceiling	
2.05	Minimum uplink network speed	Gbps	1	
2.06	PoE+ Capability	Yes/No	Yes	
3	SMALL FORM FACTOR			
3.01	Manufacturer			
3.02	Transceiver Type		Single mode	
3.03	Connector Type		LC	
3.04	Termination Type		Duplex	
3.05	Splice Type		APC	
3.06	Typical wavelength	nm	1310	
3.07	Minimum network speed	Gbps	1	
4	CAT CABLES			
4.01	Manufacturer			
4.02	Type		CAT 6	
4.03	Shielding		U/UTP	
5	CAT PATCH PANEL			
5.01	Manufacturer			
5.02	Model			
5.03	Type		CAT 6	
5.04	Number of ports	No.	24	
5.05	Casing		Rack mounted	
5.06	Size		1U	
5.07	Material		Electrostatic power-coated steel	
5.08	Colour		Black	
6	SINGLE-MODE FIBRE OPTIC			
6.01	Manufacturer			
6.02	Type		Single Mode	
6.03	Armouring	Yes / No	Yes	
6.04	Armouring Type		Steel Tape Armoured	
6.05	Termination preference type		LC	
6.06	Cores	No.	min 8	
6.07	Cable Category		OS 2	
6.08	Modal Bandwidth	MHz/km		

DATA SHEET No. DS-EL-0002
BUILDING SERVICES NETWORK

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
7	CABLE MANAGEMENT PANEL			
7.01	Manufacturer			
7.02	Model			
7.03	Number of rings	No.	24	
7.04	Casing		19" Rack	
7.05	Size		1U	
7.06	Colour		Black	
8	NETWORK ENCLOSURE			
8.01	Manufacturer			
8.02	Type		19" Rack	
8.03	Size	U	4U	
8.04	Depth	mm	550	
8.05	Installation		Wall mounted	
8.06	Frame type		90° Swing	
8.07	Loading Capacity	kg	60	
8.08	IP rating	No.	IP20	
8.09	Forced ventilation (fans)	Yes/No	Yes	
8.10	Material		Steel	
8.11	Coating		Powder coated	
8.12	Colour		Black	
8.13	Lockable	Yes/No	Yes	
8.14	DIN rail mount kit	Yes/No	Yes	
8.15	Internal Power Rail	Yes/No	Yes	
9	FIBRE-OPTIC DRAWPIT			
9.01	Manufacturer			
9.02	Material		HDPE	
9.03	IP Rating	IP	65	
9.04	Colour			
9.05	Reference			
10	SUPPLEMENTARY DETAILS			

Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with the specified requirements

Name (Print): _____ Signature: _____

DATA SHEET No. DS-EL-0003**CCTV**

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
1	MINIMUM GENERAL SPECIFICATIONS FOR CAMERAS			
1.01	Type	IP / Analogue	IP	
1.02	Vandalproof Camera housing	Yes/No	Yes, IK10	
1.03	Resolution	MP	>8MP	
1.04	Automatic and manual backlight compensation	Yes/No	Yes	
1.05	Warranty	Yrs	3	
1.06	Power Supply		PoE	
1.07	Facial recognition	Yes/No	Yes	
1.08	Human detection	Yes/No	Yes	
1.09	Motion Detection	Yes/No	Yes	
1.10	ONVIF Compliant	Yes/No	Yes	
1.11	Storage Type		micro-SD, 1TB Class 10	
1.12	Infrared	Yes/No	Yes	
2	TYPE A: INDOOR DOME CAMERAS			
2.01	Manufacturer			
2.02	Model			
2.03	Lens		Fixed	
2.04	Angle of View			
2.05	Minimum frame rate	fps	20	
2.06	Ingress Protection (Housing)	IP	IP66 and IP67, weatherproof	
3	TYPE B: OUTDOOR BULLET CAMERAS			
3.01	Manufacturer			
3.02	Model			
3.03	Ingress Protection (Housing)	IP	IP66 and IP67, weatherproof	
3.04	Lens			
3.05	Angle of View			
3.06	Minimum frame rate	fps	20	
3.07	Securing and mounting brackets material		Stainless steel	
4	TYPE C: PTZ CAMERA			
4.01	Manufacturer			
4.02	Model			
4.03	Zoom	°	x36	
4.04	Pan travel range	°	360 cont.	
4.05	Tilt angle	°	-20 yo 90	
4.06	Motion tracking	Yes/No	Yes	
4.07	Resolution	MP	>8MP	
4.08	Vandal proof	Yes/No	Yes, IK10	
4.09	Ingress Protection (Housing)	IP	IP66	
4.10	Lens			
4.11	Angle of View			
4.12	Minimum frame rate	fps	20	
4.13	Securing and mounting brackets material		Stainless steel	

DATA SHEET No. DS-EL-0003**CCTV**

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
5	CONTROL PAD			
5.01	Manufacturer			
5.02	Model			
5.03	Levels of access	Num	3	
5.04	Max number of PTZ cameras that can be	Num	3	
5.05	Programmable presets and patrolling	Yes/No	Yes	
6	CCTV SERVER C/W SOFTWARE			
6.01	Manufacturer			
6.02	Model			
6.03	CPU			
6.04	Type			
6.05	Speed	GHz		
6.06	RAM	GB	2 x 8 GB DDR4	
6.07	Hard Drive Storage	GB	2 x 240 GB M.2 SSD Drives	
6.08	Hard Drive Type		Raid Level 1	
6.09	Network Video Storage	Time	> 3 month	
6.10	Expandable storage	Yes/No	Yes	
6.11	Minimum Number of 1GB RJ45 Ethernet ports	No.	2	
6.12	USB ports	No.		
6.13	Casing		Rack Mounted	
6.14	Operating System			
6.15	CCTV Software			
6.16	Version			
7	OPERATOR STATION COMPUTER			
7.01	Manufacturer			
7.02	Model			
7.03	CPU		i7 or better	
7.04	Type			
7.05	Speed	GHz		
7.06	RAM	GB	8GB	
7.07	Hard Drive Storage	GB		
7.08	Communication Ports	No.		
7.09	USB ports	No.		
7.10	Com 1 (Plug/Interface e.g. RJ 45/RS 485)			
7.11	Com 2			
7.12	Com 3			
7.13	Casing		Tower	
7.14	Operating System		Windows 8	
8	DISPLAYS			
8.01	Manufacturer			
8.02	Model			
8.03	Type		LED	
8.04	Size		32" & 55"	
8.05	Wall mounting brackets Included	Yes/No	Yes	

DATA SHEET No. DS-EL-0003**CCTV**

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
9	SOFTWARE			
9.01	CCTV software name			
9.02	Anti-virus software			
9.03	Spare Camera Licences	%	20% Spare Licenses for additional cameras	
9.04	Minimum software package requirements:			
9.04.01	Motion detection activation of recording	Yes/No	Yes	
9.04.02	Object identification	Yes/No	Yes	
9.04.03	People counting	Yes/No	Yes	
9.04.04	Camera manipulation	Yes/No	Yes	
9.04.05	Picture in picture function	Yes/No	Yes	
9.04.06	Picture and picture function	Yes/No	Yes	
9.04.07	Network bandwidth control	Yes/No	Yes	
9.04.08	Web interface capabilities	Yes/No	Yes	
9.05	Formats for expotable events logging			
10	UPS			
10.01	Manufacturer			
10.02	Model			
10.03	Type		Inline rackmountable type	
10.04	Load type		CCTV System	
10.05	Nominal input voltage	V	230V ± 15%	
10.06	Number of phases	Num	Single	
10.07	Nominal input frequency	Hz	50 Hz ± 5%	
10.08	Rated output power		To suit load plus 30% (minimum 1	
10.09	Configuration		Bypass	
10.10	Backup Time	min	30	
10.11	Communication		Serial / Ethernet interface	
10.12	Battery life	Years	Min 10	
10.13	Battery type		LiFePO4	
11	EQUIPMENT RACK			
11.01	Manufacturer			
11.02	Type			
11.03	Height	mm		
11.04	Length	mm		
11.05	Depth	mm		
12	POWER OVER ETHERNET (PoE) SWITCH			
12.01	Manufacturer			
12.02	Type			
12.03	Number of Fibre optic ports	Num		
12.04	Number of Ethernet ports	Num		
12.05	Data rate	Mbps		
12.06	Processor speed	Mhz		
12.07	Memory	MB		
12.08	Storage	MB		

DATA SHEET No. DS-EL-0003**CCTV**

	DESCRIPTION	UNIT	SPECIFIED	OFFERED
13	SMALL FORM-FACTOR PLUGGABLE (SFP)			
13.01	Manufacturer		MOXA or equivalent	
13.02	Model			
13.03	Transceiver Type		Single mode	
13.04	Connector Type		LC	
13.05	Termination Type		Duplex	
13.06	Splice Type		APC	
13.07	Typical wavelength	nm	1310	
13.08	Minimum network speed	Gbps	1	
14	CCTV UTILITY BOX			
14.01	Manufacturer			
14.02	Material		316 stainless steel	
14.03	Colour		Grey	
14.04	Lockable	Yes/No	Yes	
14.05	Backplate	Yes/No	Yes, SMC	
14.06	PoE Switch	Yes/No	Yes	
14.07	Battery Charger			
14.08	Battery Type		LiFePO4	
15	CCTV NETWORK PANEL			
15.01	Manufacturer			
15.02	Type		19" Rack	
15.03	Size	U	4U	
15.04	Depth	mm	550	
15.05	Installation		Wall mounted	
15.06	Frame type		90° Swing	
15.07	Loading Capacity	kg	60	
15.08	IP rating	No.	IP20	
15.09	Forced ventilation (fans)	Yes/No	Yes	
15.10	Material		Steel	
15.11	Coating		Powder coated	
15.12	Colour		Black	
15.13	Lockable	Yes/No	Yes	
15.14	DIN rail mount kit	Yes/No	Yes	
15.15	Internal Power Rail	Yes/No	Yes	
15.16	PoE Switch	Yes/No	Yes	
16	CABLES			
16.01	Manufacturer			
16.02	Type		CAT 6e	
17	SUPPLEMENTARY DETAILS			
Regardless of any information provided in this technical data sheet, the equipment to be provided will comply with				
Name (Print):		Signature: .		

FORM 2.3.9 FIRE SAFETY DATA SHEETS (RETURNABLE)
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O.R. TAMBO DISTRICT MUNICIPALITY
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SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B – CONSTRUCTION OF
ABSTRACTION WORKS AND MALEPELEPE WATER TREATMENT WORKS - CONTRACT 1

Fire and Safety Technical Data Schedule – Abstraction Works
--

Materials and equipment which might be procured, supplied and installed under this contract. The tenderer shall provide the following information completed in BLACK INK at tender stage.

Fire Extinguisher (C02)

Manufacturer:	
Country of Origin:	
Model:	
Size:	

Fire and Safety Technical Data Schedule – Malepelepe WTW and Pumpstation

Materials and equipment which might be procured, supplied and installed under this contract. The tenderer shall provide the following information completed in BLACK INK at tender stage.

Butterfly Valves > Ø50 mm

Manufacturer:	
Type:	
Model:	
Country of origin:	
Valve body material:	
Butterfly material:	
Rated working pressure (kPa):	

Globe Valves ≤ Ø50 mm

Manufacturer:	
Type:	
Model:	
Country of origin:	
Valve body material:	
Wedge material:	
Rated working pressure (kPa):	

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Strainers

Manufacturer:	
Type:	
Model:	
Country of origin:	
Body material:	
Strainer element material:	
Rated working pressure (kPa):	

Non-Return Valves

Manufacturer:	
Type:	
Model:	
Country of origin:	
Valve body material:	
Type of check and material:	
Rated working pressure (kPa):	

Pressure Gauges

Manufacturer:	
Type:	
Model:	
Country of origin:	
Pressure range:	
Rated working pressure (kPa):	

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Piping > Ø50 mm

Manufacturer:	
Type:	
Code and class:	
Country of origin:	
Method of jointing:	
Rated working pressure (kPa):	

Piping ≤ Ø50 mm

Manufacturer:	
Type:	
Code and class:	
Country of origin:	
Method of jointing:	
Rated working pressure (kPa):	

Fire Department Booster Connection

Manufacturer:	
Country of Origin:	
Model Nr:	
Number of Inlets:	
Type:	
Size:	

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Fire Extinguisher (DCP)

Manufacturer:	
Country of Origin:	
Model:	
Size:	

Fire Extinguisher (C02)

Manufacturer:	
Country of Origin:	
Model:	
Size:	

Fire Hose Reels

Manufacturer:	
Country of Origin:	
Model Nr:	
Hose length:	
Hose material:	
Nozzle type & size:	

Nozzles

Manufacturer:	
Country of Origin:	
Model Nr:	
Type	
Size:	

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Valves > Ø50 mm

Manufacturer:	
Type:	
Model:	
Country of origin:	
Valve body material:	
Butterfly material:	
Rated working pressure (kPa):	

Valves ≤ Ø50 mm

Manufacturer:	
Type:	
Model:	
Country of origin:	
Valve body material:	
Wedge material:	
Rated working pressure (kPa):	

Storage Sump Equipment

Manufacturer:	
Country of Origin:	
Model Nr:	
Type	
Size:	

Main Electric Pump

Manufacturer:	
Country of Origin:	
Model Nr:	
Type	
Size:	

Jockey Pump

Manufacturer:	
Country of Origin:	
Model Nr:	
Type	
Size:	

CONTRACT

C1 AGREEMENT AND CONTRACT DATA
--

- C1.1 Form of Offer and Acceptance
- C1.2 Contract Data (Part 1 & Part 2)
- C1.3 Tenderer's Direct Participation of Targeted Labour
- C1.4 Specification for SMME Sub-contractor Employment
- C1.5 Performance Guarantee (Pro forma)
- C1.6 Adjudication
- C1.7 Agreement in terms of the Occupational Health and Safety Act 1993 (Act 85 of 1993)

C1.1 FORM OF OFFER AND ACCEPTANCE
--

1. OFFER

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract for the procurement of:

CONTRACT NO.: MIS 478 793 A - SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B – CONSTRUCTION OF ABSTRACTION WORKS AND MALEPELEPE WATER TREATMENT WORKS - CONTRACT 1

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 Tender Schedules, and by submitting this Offer has accepted the Conditions of Tender.

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

THE OFFERED TOTAL OF THE PRICES INCLUSIVE OF 15% VALUE ADDED TAX IS:

_____ Rand (in words);
R_____ (in figures).

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

Signature(s) _____ Date _____

Name(s) _____

Capacity _____

For the **Tenderer** (Name and address of organisation):

Name & Signature of Witness

Signature

Name

Date

2. ACCEPTANCE

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

The terms of the contract are contained in:

Part C1: Agreements and Contract Data (which includes this Agreement)

Part C2: Pricing Data

Part C3: Scope of Work

Part C4: Site Information

Part C5: List of Drawings

and documents or parts thereof, which may be incorporated by reference into the above listed Parts.

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

The tenderer shall, within two (2) weeks after receiving a completed copy of this agreement including the schedule of deviation (if any), contact the Employer's Agent (whose details are given in the contract data) to arrange the delivery of any securities, bonds, guarantees, proof insurance and any other documentation to be provided in terms of the Conditions of Contract identified in the Contract Data. Failure to fulfil any of the obligations in accordance with those terms shall constitute a repudiation of this Agreement.

Notwithstanding anything contained herein, this Agreement comes into effect on the date when the Tenderer receives one fully completed original copy of this document, including the Schedule of Deviations (if any). Unless the Tenderer (now contractor), within five (5) 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(s) _____

Name(s) _____ Date _____

Capacity _____

For the **Employer** (Name and address of organisation):

Name & Signature

Of Witness _____

Name and Signature

Date

3. SCHEDULE OF DEVIATIONS

Notes:

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

- | | | |
|----|---------|-------|
| 1. | Subject | _____ |
| | Details | _____ |
| 2. | Subject | _____ |
| | Details | _____ |
| 3. | Subject | _____ |
| | Details | _____ |
| 4. | Subject | _____ |
| | Details | _____ |
| 5. | Subject | _____ |
| | Details | _____ |
| 6. | Subject | _____ |
| | Details | _____ |

O.R. TAMBO DISTRICT MUNICIPALITY
CONTRACT NO.: MIS 478 793 A
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CONTRACT 1

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, as well as any confirmation, clarification, or changes 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 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:

Signatures (s) _____

Name(s) _____

Capacity _____

(Name and address of Organisation)

Name & Signature

Of Witness _____ Date _____

FOR THE EMPLOYER:

Signatures (s) _____

Name(s) _____

Capacity _____

(Name and address of Organisation)

Name & Signature

Of Witness _____ Date _____

4. **CONFIRMATION OF RECEIPT**

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

the (day)

of (month)

20..... (year)

at (place)

For the Contractor:

.....
Signature

.....
Name

.....
Capacity

Signature and name of witness:

.....
Signature

.....
Name

C1.2 CONTRACT DATA (PART 1)

PART 1: DATA PROVIDED BY THE EMPLOYER

The General Conditions of Contract for Construction Works, Third edition, 2015 (GCC 2015), third print plus any amendments, published by the South African Institution of Civil Engineering (SAICE), Private Bag X200, Halfway House, 1685, is applicable to this contract and is obtainable from www.saice.org.za.

Copies of the GCC 2015 may be obtained from the South African Institution of Civil Engineering
 Tel: 011 – 805 5947

The GCC 2015 shall be read in conjunction with the variations, amendments and additions set out in the Contract Specific Data below. Each item of data given below is cross-referenced to the clause in the GCC 2015 to which it mainly applies.

The GCC 2015 makes several references to the Contract Data for specific data, which together with these conditions collectively describe the risks, liabilities and obligations of the contracting parties and the procedures for the administration of the Contract. The Contract Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the general conditions of contract.

CONTRACT SPECIFIC DATA, INCLUDING VARIATIONS/AMENDMENTS AND ADDITIONS

The following contract specific data, amendments, additions or omissions, referring to the GCC 2015, are applicable to this Contract:

The following amendments and additions to the Clauses are the contract specific data applicable to this Contract:

Clause	Description / Wording
1.1.1.13	<p>The Defects Liability Period is 365 days.</p> <p>This period will only commence when the entire Works, i.e. both Portion A and Portion B as defined in the Scope of Works, has been certified for completion.</p>
1.1.1.14	<p>The Works will be divided into two distinct Portions as noted in Clause 5.14.1 and described in C3.5.1 of Part C3 - Scope of Works, with separate Due Completion Dates. The time-span indicated below for Portion A and Portion B will run concurrently.</p> <p>The time for achieving Practical Completion for:</p> <ul style="list-style-type: none"> • Portion A is 730 days, calculated as (W + X+ YA) days, and • Portion B is 1095 days, calculated as (W + X+ YB) days, where: <ul style="list-style-type: none"> - W = 35 days, being the total contractual documentation period as defined in Clauses 5.3.2 and 5.3.3 (28 and 7 days respectively), and forming part

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Clause	Description / Wording
	<p>of the Pre-Commencement of Work Notice Period, defined in Clause 1.1.1.56;</p> <ul style="list-style-type: none"> - X = 44 days (provisional), being the time to allow for the Department of Labour to process and issue the required work permit, and for the Employer's Agent to instruct the Contractor to commence carrying out the Works, forming part of the Pre-Commencement of Work Notice Period, defined in Clause 1.1.1.56; and - YA = 651 days (provisional), being the Post-Commencement of Work Notice Period, defined in Clause 1.1.1.57, applicable to Portion A. - YB = 1016 days (provisional), being the Post-Commencement of Work Notice Period, defined in Clause 1.1.1.57, applicable to Portion B. <p>Should the period allowed for "W" and "X" end up being less than the above total of 79 days allowed, the remaining number of days shall be added to "YA" and "YB", and therefore also the time for achieving Practical Completion.</p>
1.1.1.15	<p>The Employer is:</p> <p>O. R. Tambo District Municipality, represented by the DIRECTOR: INFRASTRUCTURE AND ENGINEERING and/or such other person or persons duly authorised thereto by the Employer in writing.</p>
1.1.1.16	<p>The Employer's Agent is Zutari (Pty) Ltd, also referred to in the contract as "ZUTARI", or "Zutari" or "Employer's Agent".</p> <p>Any reference to the "Engineer," when referring to the Employer's appointee, will have the same meaning and reference as the "Employer's Agent"</p>
1.1.1.17	<p>Any reference to the "Engineer's Representative", when referring to the Employer's Agent's appointee, will have the same meaning and reference as the "Employer's Agent's Representative".</p>
1.1.1.26	<p>The Pricing Strategy is: A re-measurement contract</p>
1.1	<p>Definitions</p> <p><i>Add the following new clauses:</i></p>
1.1.1.35 (new)	<p>"Acceptable" means acceptable to the Employer's Agent.</p>
1.1.1.36 (new)	<p>"Approved" means approved by the Employer's Agent.</p>

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Clause	Description / Wording
1.1.1.37 (new)	“Act No. 85” means Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), as amended and including any regulations made thereunder.
1.1.1.38 (new)	“Adequate” means adequate in the opinion of the Employer’s Agent.
1.1.1.39 (new)	“Approved Programme” means the latest programme submitted by the Contractor and approved by the Employer’s Agent. The latest programme agreed and approved by the Employer’s Agent supersedes previous approved programmes.
1.1.1.40 (new)	“As detailed” means as detailed on drawings.
1.1.1.41 (new)	“Authorised/ordered/rejected” means authorised/ordered/rejected by the Employer’s Agent.
1.1.1.42 (new)	“Contractor’s Personnel” means the Contractor’s Representative and all personnel who the Contractor utilises on Site, who may include the staff, labour and other employees of the Contractor and of each Subcontractor, and any other personnel assisting the Contractor in the execution of the Works.
1.1.1.43 (new)	“Cost” means all expenditure reasonably incurred (or to be incurred) by the Contractor, whether on or off the Site, including overhead and similar charges, but does not include profit.
1.1.1.44 (new)	“Country” means the country in which the Site is located, where the Permanent Works are to be executed.
1.1.1.45 (new)	“Designated” means shown on a drawing, or otherwise specified by the Employer’s Agent or, in relation to an item scheduled in the tender document, descriptive of an item to be priced by a tenderer.
1.1.1.46 (new)	“Drawings” means all drawings, calculations and technical information forming part of the Contract Documents (other than information contained in the Specifications) and any modifications thereof or additions thereto from time to time approved in writing by the Employer’s Agent or delivered to the Contractor by the Employer’s Agent.
1.1.1.47 (new)	“Employer’s Personnel” means the Employer’s Agent, the Employer’s Agent’s Representative and all other staff, labour and other employees of the Employer’s Agent and of the Employer; and any other personnel notified to the Contractor, by the Employer or the Employer’s Agent, as Employer’s Personnel.
1.1.1.48 (new)	“Goods” means the Contractor’s Equipment, Materials, Plant and Temporary Work, or any of them as appropriate.

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Clause	Description / Wording
1.1.1.49 (new)	“Indicated” means indicated in or reasonably to be inferred from the Contract, or indicated by the Employer’s Agent in writing.
1.1.1.50 (new)	“Instructed/directed/permitted” means instructed/directed/ permitted by the Employer’s Agent.
1.1.1.51 (new)	“Laws” means all national (or provincial or state) legislation, statutes, ordinances and other laws, and regulations and by-laws of any legally constituted public authority.
1.1.1.52 (new)	“Letter of Notification” means the letters of formal notification, signed by the Employer, of the decision of the Supply Chain Management Bid Adjudication Committee sent to all tenderers. The notification of the decision does not form part of the Employer’s Acceptance of the successful Tenderer’s Offer and no rights shall accrue.
1.1.1.53 (new)	“Party” means the Employer or the Contractor, as the context requires.
1.1.1.54 (new)	“Plant” is synonymous with “Contractor’s Equipment” where the context so indicates.
1.1.1.55 (new)	“Portion” means a part of the Works specified in the Contract Data, or subsequently agreed, as a Portion (if any).
1.1.1.56 (new)	<p>“Pre-Commencement of Work Notice Period” means the number of days within which the Contractor has to submit acceptable documentation, and the approval thereof, as specified in Clauses 5.3.2 and 5.3.3, designated as “W” in Clause 1.1.1.14, plus the following;</p> <p>The number of days to add, designated as “X” in Clause 1.1.1.14, is variable, and is subject to the Department of Labour’s time required to process and issue the required construction work permit, and for the Employer’s Agent to instruct the Contractor to commence carrying out the Works.</p>
1.1.1.57 (new)	“Post-Commencement of Work Notice Period” , designated as “YA” for Portion A of the Works, and “YB” for Portion B of the Works, in Clause 1.1.1.14, means the number of days within which the Contractor has to complete the construction of the relevant Portions of the Works as detailed in the Scope of Work, from the date he receives the instruction to commence carrying out the Works.”
1.1.1.58 (new)	“Satisfactory” means capable of fulfilling or having fulfilled the intended function.
1.1.1.59 (new)	“Service” means any pipeline, duct, cable, buried or otherwise, or overhead wire for conveying, as appropriate, any liquid or gas, or electricity for lighting or power or telecommunication transmissions.

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Clause	Description / Wording
1.1.1.60 (new)	“Submitted” means submitted with the tender or submitted to the Employer’s Agent, as appropriate.
1.1.1.61 (new)	“Time for Completion” means the time for achieving Practical Completion of the Works or a Portion (as the case may be) as stated in the Contract Data calculated from the Commencement Date.
1.1.1.62 (new)	“Tests on Completion” means the tests which are specified in the Contract or agreed by both Parties or instructed as a Variation, and which are carried out successfully, before the Works or a Portion (as the case may be) can be considered for a Certificate of Practical Completion.
1.1.1.63 (new)	“Unforeseeable” means not reasonably foreseeable by an experienced contractor by the date for submission of the Tender.
1.1.1.64 (new)	“Variation” means any change to the Scope of Work or the Works, which is instructed or approved as a variation under Clause 6.3.
1.2	Interpretations
1.2.1	<p><i>Add the following to the end of Clause 1.2.1:</i></p> <p>“Any notice or claim required in accordance with this Contract shall be communicated separately from other communications, on a separate cover with specific reference to the clause in terms of which the communication was made.”</p>
1.2.1.2	<p>The Employer's address for receipt of communications is:</p> <p>Telephone: 047 501 6425</p> <p>Email: nkosiyabon@ortambodm.gov.za</p> <p>Address (Postal): O.R. Tambo District Municipality Private Bag X6043 Mthatha 5099</p> <p>Address (Physical): O. R. Tambo District Municipality Building Nelson Mandela Drive Myezo Park Mthatha</p> <p>The Employer's Agent's address for receipt of communications is:</p> <p>Telephone: 043 721 0900</p>

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Clause	Description / Wording
	<p>Email: Gcobani.tshayana@zutari.com</p> <p>Address (Postal): P.O BOX 19553 Tecoma 5214</p> <p>Address (Physical): No.1 Pearce Street Berea East London 5241</p>
1.2	<p><u>Interpretations</u></p> <p><i>Add the following new clauses:</i></p>
1.2.1.3 (new)	“Sent by facsimile, electronic or any like communication irrespective of it being during office hours or otherwise.”
1.2.1.4 (new)	“Posted to the Contractor’s address and delivered by the postal authorities.”
1.2.1.5 (new)	“Delivered by a courier service and signed for by the recipient or his representative.”
1.2.1.6 (new)	<p>“The priority of the documents in this Contract shall be as follows:</p> <ul style="list-style-type: none"> a) The Agreement, comprising the Offer, Acceptance and Schedule of Deviations; b) The Contract Data; c) The Project Specifications in the Scope of Work; d) The Drawings; e) The Bill of Quantities; f) The Variations and Additions to Standard Specifications in the Scope of Work; g) The Particular Specifications in the Scope of Works; and h) The SANS 1200 Standardized Specifications.”
3.2.3	<p>The Employer’s Agent shall obtain specific approval from the Employer before executing any of his functions or duties according to the following Clauses of the General Condition of Contract:</p> <ul style="list-style-type: none"> a) Clause 3.3.1 Nomination of Employer’s Agent’s Representative b) Clause 3.3.4 Employer’s Agent’s authority to delegate c) Clause 5.7.3 Acceleration d) Clause 5.11.2 Suspension of the Works by the Employer’s Agent e) Clause 5.12.4 Acceleration instead of extension of time f) Clause 6.3.1 Approval of Variation Orders.
3.2.4	<p><i>Add the following to the end of Clause 3.2.4:</i></p> <p>“The Employer has appointed an independent Health and Safety Agent on this contract in terms of the Construction Regulations, 2014 as promulgated in terms of Section 43 of the</p>

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Clause	Description / Wording
	<p>Occupational Health and Safety Act, 1993. This agent will work in close collaboration with the Employer's relevant Officials.</p> <p>The Contractor shall perform a preliminary assessment of the project-generated health and safety plan and submit such to the appointed agent and the Employer for legal compliance assessment & verification / approval prior to any works commencing.</p> <p>The duly appointed construction health and safety Agent will be responsible for further monitoring and the auditing of the approved health and safety plan for legal compliance."</p>
3.3.6	<p><i>Add the following to the end of Clause 3.3.6:</i></p> <p>"The limit of time for referring the matter to the Employer's Agent by the Contractor shall be twenty-one (21) days after the decision in question was given by the Employer's Agent's Representative."</p>
4.3.1	<p><i>Add the following to the end of Clause 4.3.1:</i></p> <p>"These laws shall include but not be limited to the following:</p> <p>For conventional construction works the Basic Conditions of Employment Act of 1997 (Act No 75 of 1997) shall apply and the minimum employment conditions which will apply shall be guided by the latest Sectorial Determination: Civil Engineering Sector published from time to time.</p> <p>Basic Conditions of Employment Act of 1997 (Act No 75 of 1997) as per Government Notice R39 of 22 January 2020, shall apply to works described in the Scope of Work as being labour intensive and which are undertaken by unskilled or semi-skilled workers.</p> <p>Compliance with the National Environmental Management Act (NEMA), Act 107 of 1998.</p> <p>The Contractor shall comply with the Occupational Health and Safety Specification prepared by the Employer in terms of the Construction Regulations, 2014 promulgated in terms of Section 43 of the Occupational Health and Safety Act (Act No. 85 of 1993) and COVID-19 requirements.</p> <p>Without limiting the Contractor's obligations in terms of the Contract, the Contractor shall before commencement of the Works or any part thereof, be in the possession of an approved Health and Safety Plan."</p>
4.3.3 (new)	<p><i>Add the following new clause:</i></p> <p>"With regard to the Compensation for Occupational Injuries and Diseases Act (Act No. 130 of 1993), the Contractor shall, within such time as is stated for the production of insurance policies in terms of Clause 8.6.6, deliver to the Employer a letter, either</p> <p>a) from his Insurance Company certifying that the Contractor has affected insurance with the Company for the full extent of his potential liability in respect of all workmen employed by him on the Contract and undertaking to notify the Employer of the expiry date of the policy at least one calendar month before such date, or</p>

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Clause	Description / Wording
	b) from the Compensation Commissioner certifying that the Contractor has complied with the requirements of the above-mentioned Act and is at present in good standing with the Compensation Fund."
4.3.4 (new)	<p><i>Add the following new clause:</i></p> <p>"The Employer and the Contractor hereby agree, in terms of the provisions of Section 37(2) of the Occupational Health and Safety Amendment Act, 1993 (Act 85 of 1993), hereinafter referred to as 'the Act', that the following arrangements and procedures shall apply between them to ensure compliance by the Contractor with the provisions of the Act:</p> <ul style="list-style-type: none"> (i) The Contractor undertakes to acquaint the appropriate officials and employees of the Contractor with all relevant provisions of the Act and the Regulations promulgated in terms of the Act. (ii) The Contractor undertakes that all relevant duties, obligations and prohibitions imposed in terms of the Act and Regulations on the Contractor will be fully complied with. The Contractor accepts sole liability for such due compliance with the relevant duties, obligations and prohibitions imposed by the Act and Regulations and expressly absolves the Employer from himself being obliged to comply with any of the aforesaid duties, obligations and prohibitions, with the exception of such duties, obligations and prohibitions expressly assigned to the Employer in terms of the Act and its associated Regulations. (iii) The Contractor agrees that any duly authorised officials of the Employer shall be entitled, although not obliged, to take such steps as may be necessary to monitor that the Contractor has conformed to his undertakings as described in paragraphs (i) and (ii) above, which steps may include, but will not be limited to, the right to inspect any appropriate site or premises occupied by the Contractor, or any appropriate records or safety plans held by the Contractor. <p>The Contractor shall be obliged to report forthwith to the Employer and Employer's Agent any investigation, complaint or criminal charge which may arise as a consequence of the provisions of the Act and Regulations, pursuant to work performed in terms of this Contract, and shall, on written demand, provide full details in writing, to the Employer and Employer's Agent, of such investigation, complaint or criminal charge."</p>
4.3.5 (new)	<p><i>Add the following new clause:</i></p> <p>The Contractor shall furthermore, in compliance with Constructional Regulations 2014 to the Act:</p> <ul style="list-style-type: none"> (i) Acquaint himself with the requirements of the Employer's health and safety specification as laid down in regulation 4(1)(a) of the Construction Regulation 2014 and prepare a suitably and sufficiently documented health and safety plan as contemplated in regulation 5(1) of the Construction Regulation 2014 for approval by the Employer or his assigned agent. The Contractor's health and safety plan and risk assessment shall be submitted to the Employer for approval within fourteen (14) days after the Commencement Date for each assignment and shall be implemented and maintained from the Commencement of the Works. (ii) The Employer, or his assigned agent, reserves the right to conduct periodic audits, as contemplated in the Construction Regulations 2014, to ensure that the Contractor is compliant in respect of his obligations. Failure by the Contractor to

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Clause	Description / Wording
	<p>comply with the requirements of these Regulations shall entitle the Employer's Agent, at the request of the Employer or his agent, to suspend all or any part of the Works, with no recourse whatsoever by the Contractor for any damages incurred as a result of such suspension, until such time that the Employer or his agents are satisfied that the issues in which the Contractor has been in default have been rectified."</p> <p>The Employer, or his assigned agent, reserves the right to conduct periodic audits, as contemplated in the Construction Regulations 2014, to ensure that the Contractor is compliant in respect of his obligations. Failure by the Contractor to comply with the requirements of these Regulations shall entitle the Employer's Agent, at the request of the Employer or his agent, to suspend all or any part of the Works, with no recourse whatsoever by the Contractor for any damages incurred as a result of such suspension, until such time that the Employer or his agents are satisfied that the issues in which the Contractor has been in default have been rectified."</p>
4.3.6 (new)	<p><i>Add the following new clause:</i></p> <p>"Contractor's Designer</p> <p>The Contractor and his designer shall accept full responsibility and liability for compliance with the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and the Construction Regulations, 2014, for the design of the Temporary Works and those parts of the Permanent Works which the Contractor is responsible to design in terms of the Contract."</p>
4.4.2	<p><i>Delete the following from Clause 4.4.2:</i></p> <p>", which consent shall not be unreasonably withheld"</p>
4.5.4	<p><i>Delete the contents of Clause 4.5.4 and replace with the following:</i></p> <p>"For this contract the fees, taxes, levies and other charges to be paid by the Contractor in terms of Clause 4.5.1.1 will not be refunded by the Employer. The cost thereof shall be deemed to be included in the prices tendered for relevant items in the Bill of Quantities."</p>
4.12.2	<p><i>Add the following to the end of Clause 4.12.2:</i></p> <p>"The Employer's minimum requirements for approval of the Contracts Manager:</p> <ul style="list-style-type: none"> a) Must be in the employment of the Contractor; b) Must be registered with the Engineering Council of South Africa (ECSA) as Pr. Eng or Pr. Tech Eng or SACPCMP as a Pr. CPM or Pr. CM; and c) Must have a minimum of 10 years' experience." <p>The Employer's minimum requirements for approval of the Construction Manager:</p> <ul style="list-style-type: none"> a) Must be in the employment of the Contractor; b) Must be registered with the Engineering Council of South Africa (ECSA) as Pr. Eng or Pr. Tech Eng or SACPCMP as a Pr. CPM or Pr. CM; and c) Must have a minimum of 5 years' experience."

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Clause	Description / Wording
	<p>The Employer's minimum requirements for approval of the SMME Manager:</p> <ul style="list-style-type: none"> a) Must be in the employment of the Contractor; b) Must be registered with the Engineering Council of South Africa (ECSA) as Pr. Eng or Pr. Tech Eng or SACPCMP as a Pr. CPM or Pr. CM; and c) Must have a minimum of 5 years' experience in water supply and concrete reservoir structures." <p>The Employer's minimum requirements for approval of the CHSO:</p> <ul style="list-style-type: none"> a) Must be in the employment of the Contractor; b) Must be registered with SACPCMP in the category of Professional Health and Safety Officer; and c) Must have a minimum of 3 years' experience."
	<i>Add the following new clauses:</i>
4.13 (new)	Contractor's further obligations
4.13.1 (new)	Environmental non-conformance(s)/non-compliance(s)
4.13.1.1 (new)	<p>The Contractor shall treat all environmental non-conformances/non-compliances based on the outcome of the monthly environmental audit as follows:</p> <ul style="list-style-type: none"> • Finding(s) in the audit of month 1 (i.e., the first month when a non-conformance(s)/non-compliance(s) is noted) are considered as a warning to the contractor. The Contractor must affect the necessary changes to correct the non-conformance(s)/non-compliance(s) by the date of the following audit. • Finding(s) in the audit of month 2 are considered as an official non-conformance(s)/non-compliance(s). • Finding(s) in the audit of month 3 are considered as a recurring non-conformance(s)/non-compliance(s) and the Contractor will be charged a penalty of R2000.00 for each non-conformance/non-compliance finding for each month. <p><u>Note:</u> That recurring non-conformances/non-compliances do not have to take place consecutively for the fine to be charged and that each non-conformance/non-compliance will be charged individually. Recurring non-conformance/non-compliance findings will be charged to the contractor as per the following formula: $f_{(x)} = R2000.00 \times (x)$ where (x) increases by (x)+1 each month, with (x) starting at one (1) as per the example below. The penalty will be deducted from the amount due in the monthly payment certificate.</p> <p>Example:</p>

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Clause	Description / Wording														
	<table> <tr> <th>Description</th><th>Amount (per non-conformance finding)</th></tr> <tr> <td>Month 1 warning of non-conformance</td><td>R0</td></tr> <tr> <td>Month 2 official non-conformance</td><td>R0</td></tr> <tr> <td>Month 3 recurring non-conformance</td><td>(R2000.00) x 1 = R2000.00</td></tr> <tr> <td>Month 4 recurring non-conformance</td><td>(R2000.00) x 2 = R4000.00</td></tr> <tr> <td>Month 5 recurring non-conformance</td><td>(R2000.00) x 3 = R6000.00</td></tr> <tr> <td>etc</td><td></td></tr> </table>	Description	Amount (per non-conformance finding)	Month 1 warning of non-conformance	R0	Month 2 official non-conformance	R0	Month 3 recurring non-conformance	(R2000.00) x 1 = R2000.00	Month 4 recurring non-conformance	(R2000.00) x 2 = R4000.00	Month 5 recurring non-conformance	(R2000.00) x 3 = R6000.00	etc	
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etc															
4.13.1.2 (new)	Poaching of any wildlife by any means within the surrounding area of the Site will be penalised per offence at R20 000.00. If the culprit is caught, he/she shall be removed from the Site with immediate effect and shall not return to the Site.														
4.13.1.3 (new)	A fine for unnecessarily disturbing, damaging or destroying trees, shrubs or vegetation within or outside the Site at R1 000.00 per offence will be instituted.														
4.13.2 (new)	<p>Health and Safety non-conformance(s)/non-compliance(s)</p> <p>The Contractor shall treat all Health and Safety non-conformances/non-compliances based on the outcome of the monthly health and safety audit as follows:</p> <ul style="list-style-type: none"> Finding(s) in the audit of month 1 (i.e., the first month when a non-conformance(s)/non-compliance(s) is noted) are considered as a warning to the Contractor. The Contractor must affect the necessary changes to correct the non-conformance(s)/non-compliance(s) by the date of the following audit. Finding(s) in the audit of month 2 are considered as an official non-conformance(s)/non-compliance(s). Finding(s) in the audit of month 3 are considered as a recurring non-conformance(s)/non-compliance(s) and the contractor will be charged a penalty of R2000.00 for each non-conformance/non-compliance finding for each month. <p><u>Note:</u> That recurring non-conformances/non-compliances do not have to take place consecutively for the fine to be charged and that each non-conformance/non-compliance will be charged individually. Recurring non-conformance/non-compliance findings will be charged to the contractor as per the following formula: $f(x) = R2000.00 \times (x)$ where (x) increases by (x)+1 each month, with (x) starting at one (1) as per the example below). The penalty will be deducted from the amount due in the monthly payment certificate.</p> <p>Example:</p> <table> <tr> <th>Description</th><th>Amount (per non-conformance finding)</th></tr> <tr> <td>Month 1 warning of non-conformance</td><td>R0</td></tr> <tr> <td>Month 2 official non-conformance</td><td>R0</td></tr> <tr> <td>Month 3 recurring non-conformance</td><td>(R2000.00) x 1 = R2000.00</td></tr> <tr> <td>Month 4 recurring non-conformance</td><td>(R2000.00) x 2 = R4000.00</td></tr> <tr> <td>Month 5 recurring non-conformance</td><td>(R2000.00) x 3 = R6000.00</td></tr> <tr> <td>etc</td><td></td></tr> </table>	Description	Amount (per non-conformance finding)	Month 1 warning of non-conformance	R0	Month 2 official non-conformance	R0	Month 3 recurring non-conformance	(R2000.00) x 1 = R2000.00	Month 4 recurring non-conformance	(R2000.00) x 2 = R4000.00	Month 5 recurring non-conformance	(R2000.00) x 3 = R6000.00	etc	
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5.3.1	"The documents required from the Contractor before commencement of the Works are:														

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Clause	Description / Wording
	<ul style="list-style-type: none"> a) Health and Safety Plan in terms of Clause 7(1) of the 2014 Construction Regulations (refer to Clause 4.3) b) A copy of the Health and Safety Mandatory Agreement required in terms of Section 37(2) of the Occupational Health and Safety Act 85 of 1993 as amended, per the proforma in C1.4. c) Initial Programme (refer to Clause 5.6) d) Security (refer to Clause 6.2) e) Insurance (refer to Clause 8.6) f) Cashflow projection g) Overall construction methodology with quality management plan h) Method statement in terms of EMP i) Letter of Good Standing from the Compensation Commissioner (if not insured with a Licensed Compensation Insurer)" j) Letter of Good Standing with the BCCEI - Bargaining Council for the Civil Engineering Industry." <p>"The documentation required from the Provincial Director of the Department of Labour (DoL) before commencement of the Works are:</p> <ul style="list-style-type: none"> a) Construction Work Permit (CWP) and site-specific number for each construction site in terms of Regulation 3(3) of Construction Regulation, 2014. b) In terms of Regulation 3(1) of Construction Regulations, 2014, the Employer must apply to the Provincial Director (DoL) in writing for a Construction Work Permit at least (thirty) 30 days before Commencement of the Works, said application must be in terms of Regulation 3(2) of the Construction Regulations, 2014 and including documentation in terms of the Regulations 3(2) of Construction Regulations, 2014.
5.3.2	The number of days within which the required documentation (other than the Construction Work Permit if required) is to be provided is 28.
5.3.3	<p><i>Replace the content of Clause 5.3.3 with the following:</i></p> <p>"Time to instruct commencement of the Works</p> <p>The Employer's Agent's instruction to commence carrying out the Works will be subject to the following:</p>
5.3.3.1	If necessary, the Employer's Agent shall, within 7 days of receipt (which receipt he has acknowledged in writing) of the documentation referred to in Clause 5.3.1, issue to the Contractor an instruction to resubmit specified documentation. If no instruction is issued, approval will be taken to be on the expiry of the 7 days from the actual date of submission of acceptable documentation referred to in Clause 5.3.1, or in the case of unacceptable documentation, within 7 days of the date of resubmission of acceptable documentation, and so on until acceptable documentation has been received.

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5.3.3.2	The Employer's Agent shall give the Contractor 7 days' notice in writing, unless otherwise agreed by the parties in writing, to commence carrying out the Works
5.3.3.3	Any instruction issued in terms of this Clause shall not entitle the Contractor to additional time beyond the allocated number of days to submit acceptable documentation, as specified in Clause 5.3.2. Any additional time required for the submission of acceptable documentation shall be excluded from the calculation of the Due Completion Date."
5.3.4	<p><i>Add the following clause after Clause 5.3.3.3:</i></p> <p>"Delay due to late issuing of the Instruction for the Contractor to commence carrying out the Works.</p> <p>Notwithstanding the provisions of Clause 5.3.3, should the Employer's Agent notify the Contractor that the instruction to commence carrying out the Works is to be delayed, over and above the periods of "W" days, and/or "X" days, as provided for in GCC Clause 1.1.1.14, or for any other reason, all due to circumstances beyond the Contractor's control, the Contractor will be granted an extension of time equal to the delay suffered, and compensation at the rate tendered for the corresponding item provided in the Bill of Quantities.</p> <p>The period of the delay shall be calculated from the end of the "W" + "X" days period, to the date when the Employer's Agent gives the instruction to commence carrying out the Works.</p> <p>Payment under the item in the Bill of Quantities shall cover all compensation contemplated in terms of Clause 5.12.3 of the GCC."</p>
5.4.1	<p><i>Between the words "... access to the Site," and "the Location of which....", add the following:</i></p> <p>"subject to the Contractor having an approved project specific Health and Safety Plan in terms of the Occupational Health and Safety Act 1993: Construction Regulations 2014 and complied with the initial requirements thereof,"</p> <p><i>Other than in Part C4, where the words, "Site Information" appear, substitute the words, "Scope of Work".</i></p>
5.4.2	<p>The access and possession of Site shall not be exclusive to the Contractor but as set out in the Scope of Works.</p> <p><i>Add the following to the end of Clause 5.4.2:</i></p> <p>"The Contractor shall bear all costs and charges for special and temporary rights of way required by him in connection with access to the Site. The Contractor shall also provide at his own cost any additional facilities outside the Site required by him for the purposes of the Works."</p>

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Clause	Description / Wording
5.6.3	<p><i>Substitute the words, "... within 7 days...", with the words, "...within 14 days...".</i></p> <p><i>After the words, "... or adjusted programme, ", insert the words, "and he has acknowledged receipt in writing,"</i></p>
5.6.6 (new)	<p><i>Add the following new clause:</i></p> <p>"The Contractor shall submit the following documents monthly in electronic format, no later than the 5th day of the following month:</p> <ul style="list-style-type: none"> • Updated realistic cash flow • Progress report • An adjusted programme as contemplated in Clause 5.7.1, whether or not any progress of the Works has fallen behind programme, including showing percentage complete."
5.8.1	<p><i>Delete the words "between sunset and sunrise" in the first line and replace with "outside normal working hours".</i></p> <p>Normal working hours shall be those as stated in the applicable Sectoral Determination applicable to a 6 (six) day week (Monday to Saturday) from sunrise to sunset.</p> <p>"Non-working" days shall be Sundays.</p> <p>The "special" non-working days are:</p> <ol style="list-style-type: none"> a) Any statutory public holiday in terms of the Public Holidays Act, and, where such statutory public holiday falls on a Sunday, and the next Monday subsequently becomes a statutory public holiday in terms of the Public Holidays Act, then both the relevant Sunday and the relevant Monday shall be special non-working days under the contract; b) any proclaimed statutory day of mourning; c) any proclaimed statutory election day which is proclaimed as a statutory public holiday; and d) all annual year-end shutdown periods as recommended by the South African Bargaining Council for the Civil Engineering Industry (or other relevant body). In the event that these dates are not published, the shutdown period may be assumed to be from the second working Friday of December to the second working Monday in January of the next year.
5.9.3	<p><i>Replace the content of Clause 5.9.3 with the following:</i></p> <p>"The Contractor shall give adequate written notice to the Employer's Agent of any instructions or drawings, which the Contractor may require for the execution of the Works and the Employer's Agent shall deliver such instructions and/or drawings to the Contractor. The notice shall include details of the necessary drawing or instruction, details of by when it should be issued, and details of the nature and amount of the delay likely to be suffered if it is late."</p>

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Clause	Description / Wording
5.12.2.2	<p>Add the following to Clause 5.12.2.2:</p> <p>“Extension of time resulting from abnormal weather will be calculated as per the provisions in C3.4.2.6 of the Contract.”</p>
5.12.2.4	<p>Replace the content of Clause 5.12.2.4 with the following:</p> <p>“Any disruption which is entirely beyond the Contractor’s control except for internal unrest (labour of Contractor and subcontractors), strikes, lockouts etc.”</p>
5.12.4	<p>Replace the content of Clause 5.12.4 with the following:</p> <p>“Instead of granting extension of time, if feasible, the Employer’s Agent may request the Contractor to accelerate the rate of progress to achieve Practical Completion without extension of time and agree the cost for payment of such acceleration in accordance with Clause 5.7.3.”</p>
5.12.5 (new)	<p>Add the following new clause:</p> <p>“Critical Path Provision</p> <p>A delay in so far as extension of time is concerned, will be regarded as a delay only if, on a claim by the Contractor in accordance with the General Conditions of Contract, the Employer’s Agent rules that all progress on an item or items of work on the critical path of the approved programme for the execution of the Works by the Contractor, has been brought to a halt or significantly delayed. Delays on normal working days only, based on a working week, of six normal working days, will be taken into account for the extension of time.”</p>
5.12.6 (new)	<p>Add the following new clause:</p> <p>“Notwithstanding any principles of concurrent delays, the effect of any variations required in terms of Clause 6.3 after the Due Completion Date will be evaluated in terms of Clause 5.12 as if the variation had already been required prior to the Due Completion Date.”</p>
5.13.1	<p>Add the following to the end of Clause 5.13.1:</p> <p>With reference to Clause 1.1.1.14, certain Portions of the Works will be subject to partial practical completion as described and tabulated in C3.5.1 of Part C3 - Scope of Works, and in accordance with the approved programme. Partial practical completion is necessary to allow access for the Mechanical and Electrical Contractor to carry out his work on the various process units. If the Civil Contractor fails to meet the relevant Due Completion Dates , penalties will be applied for the relevant Portion of the Works.</p> <p>The penalty for failing to complete Portion A of the Works shall be R50 000.00 (excl. VAT) per day, and/or for failing to complete Portion B of the Works shall be R30 000.00 (excl. VAT) per day.</p>

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5.13.3 (new)	<p><i>Add the following new clause:</i></p> <p>“5.13.3 Secondary Penalty for Delay</p> <p>If the Contractor fails to complete the Works or any Portion of the Works to the extent which entitles him to receive a Certificate of Completion in terms of Clause 5.14.4, before the Due Completion Date, a “secondary” penalty shall apply. The penalty shall apply separately with respect to each Portion.</p> <p>If the Contractor receives a Certificate of Practical Completion before the Due Completion Date, but fails to receive a Certificate of Completion before the Due Completion Date, the Contractor shall be liable to the Employer for a sum equal to 20% of the relevant penalty in Clause 5.13.1, per day, as a penalty for every day that elapses between the Due Completion Date and the date of the issuing of the Certificate of Completion, including special nonworking days.</p> <p>If the Contractor receives a Certificate of Practical Completion after the Due Completion Date, but fails to receive a Certificate of Completion at the same time, in addition to the relevant penalty applicable in terms of Clause 5.13.1, the Contractor shall also be liable to the Employer for a “secondary” penalty in an amount equal to 20% of the relevant penalty in Clause 5.13.1, per day, as an additional penalty for every day that elapses between the date that he received the Certificate of Practical Completion and the date of the issuing of the Certificate of Completion, including special nonworking days.</p> <p>The imposition of such penalty shall not relieve the Contractor from his obligation to complete the Works (or Portion of the Works as the case may be) or from any of his obligations and liabilities under the Contract.”</p>
5.14.1	<p>The requirements for achieving Practical Completion are:</p> <p>Portion A: All civil, structural and general works defined to be part of Portion A, as described in C3.5.1 of Part C3 – Scope of Works, to be fit/ready for a mechanical and electrical contractor to be able to safely access, install and test equipment. This should include all work necessary to successfully pass water tightness testing of these structures.</p> <p>Portion B: All Civil and General Works, complete, including all compliance tests.</p> <p><i>Insert the following in the second paragraph after the words, “...Practical Completion and”:</i></p> <p>“, provided that he agrees that the Works are about to reach the said stage, “</p> <p><i>Delete the last sentence of the second paragraph:</i></p> <p>"Should the Employer's Agent not issue such a list..... on expiry of the 14 days."</p> <p><i>Add the following at the end of the clause:</i></p> <p>"Should the Contractor wish to receive a Certificate of Practical Completion, prior to full Completion of the Works, he shall provide a list of minor items ("snags") not yet fully accepted or approved, with a motivation as to why he should be permitted to attend to these items after having received a Certificate of Practical Completion. The Employer</p>

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	may consider granting such a request or part thereof at his entire discretion. However, the terms of Clause 5.13.3 will still apply.”
5.14.2	<p><i>Insert the following after the words, "...has been duly completed, “:</i></p> <p>"the Contractor shall notify the Employer's Agent, who shall inspect the Works. Provided the Employer's Agent finds that the work has been completed satisfactorily, failing which he shall issue an updated list,"</p> <p><i>Add at the end of the clause”</i></p> <p>“The practical completion of Portion A will be regarded as a milestone event within the contract programme, with penalties (as stipulated in Clause 5.13.1) attached to the late completion of this milestone.</p> <p>Once the Contractor has reached the milestone of practical completion for Portion A, and a Certificate of Practical Completion has been issued, the Employer will take occupation of Portion A. The Contractor will be required to maintain full securities, guarantees and insurances, and fulfil all their obligations in terms of the Contract (including but not limited to maintaining a presence on site, securing the site, etc.) until the final completion of the project when the entire Works, i.e. both Portions A and B, is complete.</p> <p>The objective of the milestone practical completion of Portion A of the Works, is to align this Contract with various other construction contracts for the same project planned by the Employer, as presented in Part C3 - Scope of Works, and manage critical schedule interfaces between these various construction contracts. The intended purpose/use of Portion A is for the civil and structural works to be appropriately ready for a mechanical and electrical contractor to be able to safely access, install and test equipment required as part of Contract 3 (as defined in Part C3 Scope of Works.”</p>
5.14.4	<p><i>Insert the following after the words, "...has been duly completed, “:</i></p> <p>" the Contractor shall notify the Employer's Agent, who shall inspect the Works. Provided the Employer's Agent finds that the Works has been completed satisfactorily, failing which he shall issue an updated list,"</p> <p><i>Add at the end of the clause:</i></p> <p>“A Certificate of Completion will only be provided for the entire project (both Portions A and B) once the whole project reaches final completion.”</p>
5.14.7	<i>Replace the words, “the aforesaid provisions” with, “all provisions applicable to the Works”.</i>
5.16.3	The latent defect period is ten (10) years .
6.2.1	<i>Add the following to the end of Clause 6.2.1:</i>

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	<p>"The security to be provided by the Contractor shall be:</p> <ul style="list-style-type: none"> A performance guarantee of ten percent (10%) of the Contract Sum (worded exactly as per the pro forma included in C1.5). The performance guarantee shall be from an approved South African Insurance Company or Bank to be jointly and severally bound with the Contractor, in accordance with the provisions of the Form of Guarantee."
6.2.2	Delete Clause 6.2.2 in its entirety.
6.2.3	<p>Add the following to the end of Clause 6.2.3:</p> <p>"The Contractor shall submit proof of renewal to the Employer's Agent."</p>
6.3.1	<p>Add the following to the end of the clause:</p> <p>"Variations that have a financial implication shall be approved by ORTDM in line with their approved Supply Chain Management Delegation of Authority prior to work commencement.</p> <p>Contingencies are under the sole control of the of ORTDM and may only be used upon approval by the delegated authority of ORTDM."</p>
6.4.1.3	<p>Add the end of Clause 6.4.1.3 after the word, "Contractor", insert the following:</p> <p>“, and to this end in the make-up of the Contractor's proposed expenditure, the percentage allowance (mark-up) on labour, materials and construction equipment shall be limited to 10%, which allowance shall be held to cover all charges for the Contractor's and subcontractor's sourcing of quotes, timekeeping, clerical work, insurance, establishment and superintendence, and all other management, overheads and profit."</p>
6.5.1.2.1	<p>Add the following to the end of Clause 6.5.1.2.1:</p> <p>"Gross remuneration" referred to above shall be the nominal hourly or monthly remuneration actually paid to workmen and foremen before any additions for the Contractor's contribution to pension, medical aid, housing, tools, unemployment insurance, site allowance etc., and also before any deductions for tax, pension, medical aid, unemployment insurance, etc."</p>
6.5.1.2.2	<p>Add the following to the end of Clause 6.5.1.2.2:</p> <p>"Net cost of materials" referred to above shall be the net invoiced cost of materials after the deductions of all discounts, direct or indirect."</p>
6.8.2	A Contract Price Adjustment Factor is applicable, calculated and applied in accordance with the following new clauses:

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6.8.2.1	<p>“General</p> <p>The Contract Sum shall be deemed to have included amounts to cover the contingency of all other rises and falls in costs not covered by the provisions of this or other Clauses.</p> <p>The following general provisions shall apply in all cases:</p> <ul style="list-style-type: none"> a) The base month (where “Base Date” is specified it shall be the 1st of the base month) is the month preceding the month in which the tender closes. b) Adjustments for changes in cost shall be calculated as if the Works are executed within the time for completion, and no additional costs due to any work being executed outside the time for completion, shall be payable unless the Employer’s Agent allows an extension of time in accordance with Clause 5.12 [Extension of Time for Practical Completion]. c) Claims for adjustments for changes in cost shall be supported by such documentary evidence that may be required by the Employer’s Agent. Failure to render this information may result in the rejection of claims for price adjustment. d) No claims for adjustments for changes in cost will be accepted which are submitted later than 28 days after the date of issue of the Certificate of Completion.”
6.8.2.2	<p>For General Works and Civil Works</p> <p>The Contract Price Adjustment Factor shall be calculated according to the formula and the conditions set out in the Contract Price Adjustment Schedule, subject to the following:</p> <p>The value of “x” is 0.10</p> <p>The values of the coefficients are:</p> <ul style="list-style-type: none"> a = 0.20 [Labour] b = 0.25 [Contractor’s equipment] c = 0.50 [Material] d = 0.05 [Fuel]. <p>The definitions of “L”, “P”, “M” and “F” referred to in Clause 1 of the Contract Price Adjustment Schedule are as follows:</p> <p>" 'L' is the 'Labour Index' and shall be the Consumer Price Index as published in the Statistical Release, P0141, Table A – Consumer Price Index: Main Indices – Geographic Indices: CPI for Province: Eastern Cape”, of Statistics South Africa.</p> <p>'P' is the Contractor’s Equipment Index' and shall be the Construction Materials Price Indices applicable to “Plant and Equipment” as published in the Statistical Release P0151.1, Table 4, of Statistics South Africa.</p> <p>'M' is the 'Materials Index' and shall be the Construction Materials Price Indices applicable to “Civil engineering material – total”, as published in the Statistical Release P0151.1, Table 6, of Statistics South Africa.</p>

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	'F' is the 'Fuel Index' and shall be the Producer Price Index applicable to "Diesel" as published in the Statistical Release P0142.1, Table 1 – PPI for final manufactured goods, of Statistics South Africa."
6.8.3	Price adjustments for variations in the costs of special materials are allowed. Refer to C1.2 Contract Data (Part 2).
6.9.1	<i>Add to the end of Clause 6.9.1:</i> "The Contractor shall where practicable before delivery, and in any event not later than 24 hours after delivery to the Site, inform the Employer's Agent of any materials which are not his sole property."
6.10.1.5	The percentage advance on materials not yet built into the Permanent Works is 80% on submission of proof of payment for the materials.
6.10.1.7	<i>Add the following to Clause 6.10.1.7 after, "...Clause 5.13":</i> ", or any other fines or penalties that become due under the Contract."
6.10.1.9 (new)	<i>Add the following new clause:</i> "Payment for works identified in the Scope of Work as being labour-intensive shall only be made in accordance with the provisions of the Contract if the works are constructed strictly in accordance with the provisions of the Scope of Work. Any non-payment for such works shall not relieve the Contractor in any way from his obligations either in Contract or in delict."
6.10.3	The Retention Money shall be 10% (ten percent) of the value of the Works. The "Limit of the retention money" is 5% (five percent) of the Contract Sum.
6.11	<u>Variations exceeding 15 per cent</u> <i>Replace, "15 per cent" wherever it occurs, with, "20 per cent".</i>
7.2.1	<i>Add the following to the end of Clause 7.2.1:</i> "Unless otherwise directed in writing by the Employer's Agent, materials for the Permanent Works shall be new and unused."
7.4.4.1	<i>Replace the comma after the word "them" in the last line of Clause 7.4.4.1 with a full stop, and replace the word "and" with the following:</i>

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	"The cost of all tests and testing required as part of the Contractor's own quality control programme, whether particularised or not, shall be deemed to have been allowed for in his tender; and"
7.8.2.2	<i>Add the following to the end of Clause 7.8.2.2:</i> ", subject to such work being done on a written instruction by the Employer's Agent."
8.3.1.9	<i>Insert the following at the beginning of Clause 8.3.1.9:</i> "Except where the Contract specifically so provides,".
8.6.1	<i>Add the following to the end of Clause 8.6.1:</i> "Insurances shall be maintained in force for the duration of the Contract, and in respect of Sub-Contractors, the Contractor shall be deemed to have complied with the provisions of the requirements relating to insurance by ensuring that the Sub-Contractors have effected such insurances."
8.6.1.1.2	The value of Plant and materials supplied by the Employer to be included in the insurance sum is Nil.
8.6.1.1.3	The amount to cover professional fees is R1 million .
8.6.1.2	<i>Add the following to the end of Clause 8.6.1.2:</i> "SASRIA (Riot) Certificate to be issued in joint names of Employer and Contractor for the full value of the Works (including VAT)."
8.6.1.3	The limit of indemnity liability insurance shall be Twenty Million (R20 000 000.00). <i>Add the following to the end of Clause 8.6.1.3:</i> "The minimum amount of insurance required in terms of this Clause shall be per event, the number of events being unlimited.
8.6.1.5	<i>Add the following to the end of Clause 8.6.1.5:</i> The Contractor and/or his subcontractors shall provide, and maintain in force for the duration of the contract, the following additional cover: a) Complying with the provisions of the Compensation for Occupational Injuries and Diseases Act 1993, as amended; b) Insure all persons employed on the contract who do not fall within the provisions of the Compensation for Occupational Injuries and Diseases Act, against the

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	<p>contractor's Common Law Liability to such employees for the sum of not less than R1 000 000 (one million rand) for any one accident;</p> <p>c) Motor Vehicle Liability insurance comprising:</p> <ul style="list-style-type: none"> • Insurance in accordance with the Road Accident Fund; • "Balance of Third Party" Motor Risks including Passenger Liability; <p>d) "All Risks" insurance on all constructional plant and machinery and allied equipment including all temporary accommodation brought onto site.</p> <p>Furthermore, the insurance cover effected by the Contractor shall meet the following requirements:</p> <p>a) The insurance policy held by the Contractor shall cover "wet risks" where a portion of the works is subject to possible, occasional or regular inundation."</p> <p>b) Where one or more hired vehicles or Contractor's own vehicles are required for the Employer's Agent's site monitoring staff, such vehicles are to be fully comprehensively insured.</p> <p>Insurance of all materials stored off Site, and intended for incorporation in the Permanent Works, including their delivery to the Site and off-loading on Site, to the value of such materials for which payment is made in terms of Clause 6.10.1.1 hereof.</p>
8.6.5	<p><i>In the second line of Clause 8.6.5, after the word "effected" add the words "in the joint names of the Employer and the Contractor"</i></p> <p><i>Add the following to the end of Clause 8.6.5:</i></p> <p>"The insurance policy shall contain a specific provision whereby cancellation of the policy prior to the end of the period referred to in Cause 8.2.1 cannot take place without the prior written approval of the Employer."</p> <p>"The Employer shall approve (or disapprove) the terms of the insurances within fourteen (14) days from the date of receipt of the policies provided in terms of Clause 8.6.5."</p>
8.6.8 (new)	<p><i>Add the following new clause:</i></p> <p>"In the event of any claim arising under the policies held in terms of this Clause, the Contractor shall forthwith take all necessary steps to lodge his claim on the joint behalf of himself and the Employer, and to secure settlement of such claim, and he shall submit to the Employer's Agent copies of all claims and associated documents.</p> <p>The claim submitted by the Contractor shall cover the cost of repairing and making good as required by Clauses 8.2.2.1 and 8.2.2.3."</p>
9.2.1.3.2	<p><i>Add the following to the end of Clause 9.2.1.3.2:</i></p> <p>"or to maintain and extend the validity of the performance guarantee until the Certificate of Completion; or"</p>

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9.2.1.3.8	<i>Add the following to the end of Clause 9.2.1.3.8:</i> “or”
9.2.1.3.9 (new)	<i>Add the following new clause:</i> “The Contractor committed a corrupt or fraudulent act during the procurement process or the execution of the contract; or”
10.1.1.1.3	<i>Replace the contents of Clause 10.1.1.1.3 with the following:</i> “The length of the extension of time, if any, claimed and the basis of the calculation by incorporating the effects of each circumstance, event, act or omission on the critical path of an approved programme, indicating the delay to Practical Completion, and”
10.1.1.4 (new)	<i>Add the following new clause :</i> “Discussions of claims during site meetings and minutes of such discussions shall not be regarded as a claim or notice by the Contractor of his intention to make a claim unless it is supported by a written submission in terms of Clause 10.1.1.1”
10.1.2	<i>Add the following to the end of Clause 10.1.2:</i> “The Contractor shall issue a notice to the Employer's Agent as soon as he becomes aware of any circumstance, event, act or omission which could: a) Increase the Contract Prices, b) Delay Practical Completion, or c) Impact on quality, or d) Impair the performance of the Works in use.”
10.3.2	<i>Add the following to the end of Clause 10.3.2:</i> “Amicable settlement in terms of Clause 10.4 shall be utilised for all disputes prior to referring any dispute to adjudication.”
10.5.1	Dispute resolution shall be by ad-hoc adjudication
10.5.3	The number of Adjudication Board Members to be appointed is One .
10.5.4	<i>After the words, “...the Adjudication Board's decision”, insert the following:</i> “, only insofar as such decision or any part thereof is agreed in writing by the parties,”

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10.6.1.1	<p><i>Replace the contents of Clause 10.6.1.1 with the following:</i></p> <p>“The decision shall be binding on both parties, only insofar as such decision or any part thereof is agreed in writing by the parties.”.</p>
10.7.1	<p>The determination of disputes which are unresolved in terms of Clause 10.5.3 shall be referred to arbitration for final settlement.</p>
10.10.1	<p><i>Replace the contents of Clause 10.10.1 with the following:</i></p> <p>“Nothing herein contained shall deprive the Contractor or the Employer of either party's right to institute immediate court proceedings in respect of failure by the Employer or the Contractor, as the case may be, to pay the amount of a payment certificate on its due date, or to pay any amount of retention money on its due date for payment.”</p>
10.10.3	<p><i>Replace the contents of Clause 10.10.3 with the following:</i></p> <p>“The Adjudication Board, arbitrator and the court shall have full power to open up, review and revise any ruling, decision, order, instruction, certificate or valuation of the Employer's Agent. The Arbitrator and the court shall have full power to and to reconsider any decision by the Adjudication Board relevant to the matter in dispute, and neither party shall be limited in such proceedings before such arbitrator or court to the evidence or arguments put before the Employer's Agent for the purpose of obtaining his ruling, or the Adjudication Board for the purpose of obtaining a decision.”</p>
11 (new)	<p><i>Add the following new clauses:</i></p> <p>Targeted Participation Goals</p>
11.1 (new)	<p>“The following additional clause shall apply:</p> <p>The Contract Participation Goal (CPG) of 20% applies to this bid: 10% of the Contract Value for Direct Participation by local Labour and 10% for Direct Participation by local enterprises. Local labour and local enterprises are defined as those within Mhlontlo Local Municipality.</p> <p>The Targeted SMME Participation Goal is a minimum of 20% of value of work excluding specialist supply / work items, contingencies, CPA and provisional sums. Targeted SMME's are to be from within OR Tambo District Municipality.</p> <p>The information provided in Section C.1.3 and C.1.4 of this document shall be contractually binding, and penalties will be imposed as per the Clauses included in the Sections should the tendered participation goals not be achieved.”</p>
11.2 (new)	<p>“Penalty for failure to meet proposed direct participation of targeted enterprise (new clause)</p>

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	<p>In the event that the Tenderer fails to substantiate that any failure to achieve the Contract Participation Goal was due to quantitative under runs, the elimination of items, or any other reasons beyond the Contractor's control which may be acceptable to the Employer, it shall be liable to pay to the Employer a financial penalty (P) calculated in the following manner:</p> $P = 0.50 \times (L_M - L_A) \times V_A$ <p>Where:</p> <p>L_M = SMME Subcontractors or Local Resources Goal % stated in the Contract Document</p> <p>L_A = SMME Subcontractors or Local Resources component % which the Employer's Agent certifies as being achieved upon completion of the Contract.</p> <p>V_A = Award Value (Contract Price exclusive of VAT, all provisional or prime cost sums and allowances for contingencies and escalation)</p> <p>P = Rand value of penalty payable."</p>

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Clause	Description / Wording																																				
	<p>.....</p> <p>Should the Contractor choose to be compensated per the above he shall provide the base cost of the special material as at the base date, supported with documentation acceptable to the Employer's Agent, in the space below.</p> <table><tr><th>Type of material</th><th>Unit</th><th>Base cost in Rand per unit</th></tr><tr><td>.....</td><td>.....</td><td>.....</td></tr><tr><td>.....</td><td>.....</td><td>.....</td></tr><tr><td>.....</td><td>.....</td><td>.....</td></tr><tr><td>.....</td><td>.....</td><td>.....</td></tr><tr><td>.....</td><td>.....</td><td>.....</td></tr><tr><td>.....</td><td>.....</td><td>.....</td></tr><tr><td>.....</td><td>.....</td><td>.....</td></tr><tr><td>.....</td><td>.....</td><td>.....</td></tr><tr><td>.....</td><td>.....</td><td>.....</td></tr><tr><td>.....</td><td>.....</td><td>.....</td></tr><tr><td>.....</td><td>.....</td><td>.....</td></tr></table>	Type of material	Unit	Base cost in Rand per unit
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SIGNED BY/ON BEHALF OF TENDERER:

Signed

Date

Name

Position

C1.3: TENDERER'S DIRECT PARTICIPATION OF TARGETED LABOUR

1. Applicable Standard Specification

The applicable Standard Specification is **SANS 10845 – Part 8 (2015): Construction Procurement – Part 8: Participation of targeted labour (local resources) in contracts.**

2. Definitions

With reference to clause 3 of SANS 10845-8, the following definitions shall apply to this schedule:

2.1 Targeted Labour

Individuals, employed by the Contractor in the performance of the contract, who are defined as the target group in the contract and who permanently reside in the target area or who are recognised as being residents of the target area on the basis of identification and association with and recognition by the residents of the target area.

2.2 Target Group

The Contractor shall endeavour to ensure that the expenditure on the employment of temporary workers is in the following proportions:

- i) 55 % women;
- ii) 55% youth; and
- iii) 2% on persons with disabilities

Target Group specifically excluded contractor's own staff unless such staff are also from the Target Area.

2.3 Target Area

For this project, the target area is defined as the areas within the proximity of the site in the Mhlontlo Local Municipality, Eastern Cape Province.

2.4 Targeted Labour Contract Participation Goal (CPGL)

Sum of the wages (excluding any benefits), for which the Contractor, or any of his/her sub-contractors contracts targeted labour in the performance of the contract, expressed as a percentage of the value of the contract.

2.5 Threshold Value

Sectorial Determined Wage Rate for the Civil Engineering Industry as adjusted from time to time (excluding any benefits). As determined in accordance with the Basic Conditions of Employment Act, 75 of 1977.

2.6 Value of the Contract

The contract sum (accepted contract amount) less allowances for specialist supply work, provisional sums, contingencies and VAT.

2.7 Labour Maximisation

Labour maximisation shall contribute a minimum of 10% of the value of the contract.

3. Conditions associated with the granting of preferences

The tenderer, undertakes to:

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- a) engage one or more targeted labour in accordance with the provisions of the SANS 10845-8 as varied in Section 4 hereunder;
- b) accept the sanctions set out in Section 5 below, should such conditions be breached;
- c) complete the Targeted Labour (CPG) calculation form contained in Section 8 below; and
- d) complete the Supporting Contract Participation Goal Calculation contained in Section 9 below.

4. Variations to the targeted construction procurement specification SANS 10845-8

The variations to SANS 10845-8 are set out below. Should any requirements of the variations conflict with the requirements of SANS 10845-8, the requirements of the variations shall prevail.

Calculations shall be based as a % of targeted labour costs of the Tender Sum (excluding VAT) and not calculated in accordance with methods 1 or 2 in Annexure G of SANS 10845-8.

5. Labour Intensive Work

(a) Competencies of Supervisory and Management

Established contractors shall only engage supervisory and management staff in labour-intensive works who have either completed, or are registered for training towards, the skills programme outlined in Table 1.

Emerging contractors shall have personally completed or be registered on a skills programme for the NQF level 2-unit standard. All other site supervisory staff in the employ of emerging contractors must have completed, or be registered on a skills programme for, the NQF level 2-unit standards or NQF level 4-unit standards.

Table 1: Skills programme for supervisory and management staff

Personnel	NQF level	Unit standard titles	Skills programme description
Team leader / Supervisor	2	Apply Labour-Intensive Construction Systems and Techniques to Work Activities	This unit standard must be completed, and
		Use Labour-Intensive Construction Methods to Construct and Maintain Roads and Stormwater Drainage	Any one of these 3-unit standards.
		Use Labour-Intensive Construction Methods to Construct and Maintain Water and Sanitation Services	
		Use Labour-Intensive Construction Methods to Construct, Repair and Maintain Structures	
Foreman / Supervisor	4	Implement Labour-Intensive Construction Systems and Techniques	This unit standard must be completed, and
		Use Labour-Intensive Construction Methods to Construct and Maintain Roads and Stormwater Drainage	Any one of these 3 unit standards
		Use Labour-Intensive Construction Methods to Construct and Maintain Water and Sanitation Services	
		Use Labour-Intensive Construction Methods to Construct and Maintain Structures	

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Personnel	NQF level	Unit standard titles	Skills programme description
		Methods to Construct, Repair and Maintain Structures	
Construction Manager/ Manager (i.e. the Contractor's most senior representative that is resident on the site)	5	Manage Labour-Intensive against this Construction Processes	Skills Programme against this single unit standard

Details of these skills programmes may be obtained from the CETA ETQA manager (e-mail: gerard@ceta.co.za, Tel: 011-265 5900)

(b) Employment of unskilled and semi-skilled workers

- (i) Unskilled and semi-skilled labour required for the execution of all labour-intensive works shall be engaged strictly in accordance with prevailing legislation and SANS 1914-5, Participation of Targeted Labour.
- (ii) The rate of pay shall be as per the latest sectoral determination for the Civil Engineering industry.
- (iii) Tasks established by the Contractor shall be such that:
 - the average worker completes 5 tasks per week in 45 hours or less; and
 - the weakest worker completes 5 tasks per week in 55 hours or less.
- (iv) The Contractor shall revise the time taken to complete a task whenever it is established that the time taken to complete a weekly task is not within the requirements of (iii) above.
- (v) The Contractor shall, through all available community structures, inform the local community of the labour-intensive works and the employment opportunities presented thereby. Preference shall be given to people with previous practical experience in construction and / or who come from households:
 - where the head of the household has less than a primary school education;
 - that have less than one full time person earning an income;
 - where subsistence agriculture is the source of income;
 - those who are not in receipt of any social security pension income
- (vi) The Contractor shall endeavour to ensure that the expenditure on the employment of temporary workers is in the following proportions:
 - 55 % women;
 - 55% youth; and
 - 2% on persons with disabilities.

(c) Contract Participation Goals

Established contractors shall only engage supervisory and management staff in labour-intensive works who have either completed

In support of the National Department of Public Works' Expanded Public Works Programme which is aimed at the alleviation of poverty through the creation of employment opportunities, the Employer is seeking to increase the intensity of labour, as appropriate, in all of its infrastructure sector projects.

It is a requirement of this contract, therefore, that the work be executed in such a manner so as to maximise the use of labour intensive construction methods in order to provide low and semi-skilled employment opportunities.

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To this end, a minimum targeted labour contract participation goal is specified below, which shall be achieved by the Contractor in the performance of the contract, failing which, penalties as described will be applied.

The specified minimum targeted labour contract participation goal (CPGL) using labour intensive method is 10%.

The minimum CPGL is such that the Contractor will have to carry out some of the work that would normally have been undertaken using mechanised construction methods, by using labour intensive construction methods instead. It is left to the discretion of the Contractor to identify suitable work activities for the intensification of labour. The Contractor shall, within 5 working days of being requested in writing by the Employer's Agent to do so, submit details of his/her plan to achieve the minimum CPGL.

(d) Training of targeted labour

The Contractor shall provide all the necessary on-the-job training to targeted labour to enable such labour to master the basic work techniques required to undertake the work in accordance with the requirements of the Contract in a manner that does not compromise worker health and safety.

The cost of the formal training of targeted labour, will be funded by the local office of the Department of Labour. This training will take place as close to the project site as practically possible.

The Contractor shall access this training by informing the relevant regional office of the Department of Labour in writing, within 14 days of being awarded the Contract, of the likely number of persons that will undergo training and when such training is required. The Employer and the Department of Public Works (Fax: 012 3258625/ EPWP Unit, Private Bag X65, Pretoria 0001) shall be furnished with a copy of this request.

The Contractor shall do nothing to dissuade targeted labour from participating in training programmes and shall take all reasonable steps to ensure that each beneficiary is provided with two days of formal training for every 22 days worked.

An allowance equal to 100% of the task rate or daily rate shall be paid by the Contractor to workers who attend formal training.

Proof of compliance with the requirements of the above shall be provided by the Contractor to the Employer prior to submission of the final payment certificate.

It is envisaged that all local labour employed on this Contract shall receive a level of training for which they will receive accreditation.

An employee shall, upon termination of his services, be entitled to a certificate of service showing the full names of his employer (i.e. the Contractor) and the employee, the type of work done by the employee, the date of commencement, a record of training received and the date of termination of his services.

(e) Generic labour-intensive specification

(i) Scope

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

- a) trenches having a depth of less than 1,5 meters
- b) stormwater drainage
- c) low-volume roads and sidewalks

(ii) Precedence

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

(iii) Hand excavatable material

Hand excavatable material is material:

- a) Granular materials:
 - i) whose consistency when profiled may in terms of table 1 be classified as very loose, loose, medium dense, or dense; or
 - ii) where the material is a gravel having a maximum particle size of 10 mm and contains no cobbles or isolated boulders, no more than 15 blows of a dynamic cone penetrometer is required to penetrate 100 mm;
- b) Cohesive materials:
 - i) whose consistency when profiled may in terms of table 1 be classified as very soft, soft, firm, stiff and stiff / very stiff; or
 - ii) where the material is a gravel having a maximum particle size of 10 mm and contains no cobbles or isolated boulders, no more than 8 blows of a dynamic cone penetrometer is required to penetrate 100 mm;

Note:

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

Table 1: Consistency of materials when profiled

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

(iv) Trench excavation

Hand excavatable material has to have a consistency of:

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Granular Materials – Very loose or Loose

Cohesive Materials – Very soft or Soft

All other consistencies are regarded machine excavatable materials.

Hand excavation only for trenches having a depth of less than 1,5 metres, all other trenches to be done by machine.

(v) Compaction of backfilling to trenches (areas not subject to traffic)

Backfilling to trenches shall be placed in layers of thickness (before compaction) not exceeding 100 mm. Each layer shall be compacted using hand stampers

- a) to 90% Proctor density;
- b) such that in excess of 5 blows of a dynamic cone penetrometer (DCP) is required to penetrate 100 mm of the backfill, provided that backfill does not comprise more than 10% gravel of size less than 10 mm and contains no isolated boulders, or
- c) such that the density of the compacted trench backfill is not less than that of the surrounding undisturbed soil when tested comparatively with a DCP.

(vi) Excavation

All excavation, as listed under C3.4.2.6(f)(iv) classified as hand excavatable shall be excavated by hand.

The excavation of any material which presents the possibility of danger or injury to workers shall not be excavated by hand.

(vii) Clearing and grubbing

Grass and small bushes shall be cleared by hand.

(viii) Shaping

All shaping shall be undertaken by hand.

(ix) Spreading

All material shall be spread by hand.

6. Community Participation

The Contractor shall make allowance for the employment of a CLO in accordance with the following terms of reference (TOR), and four Graduate Engineers (from disciplines of engineering, environmental science and health and safety management), and six in-service training candidates (from disciplines of engineering, environmental science and health and safety management), throughout the duration of the contract.

(a) Terms of Reference of CLO

The Community Liaison Officer (CLO) will be responsible to the Project Steering Committee (PSC), who will be involved in the appointment of the CLO. The CLO should be the person with a good standing and respect in the local community and would be selected according to the set criteria by the interviewing panel consisting of Local and District Municipality, ISD Consultant, PSC, Ward Councillor and selected local leadership.

One (1) CLO will appointed for the period of physical construction, plus a period of 14 days prior to this period.

The period will include times where small team works are busy in the area e.g. chambers, standpipes and reservoirs. The period will end when no further work is required.

The Contractor will provide office space and stationery for the CLO to carry out his / her duties.

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Remuneration for the CLO will be **R10 000 per CLO per month** for the period of employment. Where the CLO is engaged for part of the month, they shall be paid an equivalent daily amount. The unit for measurement shall be the man-month of CLO employment.

A CLO who fails in their responsibilities may be replaced in consultation with the PSC and ISD Consultant.

The CLO will liaise with the following people in performing these activities:

Contractor:

- a. Organise and assist the contractor in explaining to all workers the labour-based construction model.
- b. Ensure labourers understand their task and the principles behind task work.
- c. Ensure labourers are informed of their conditions of temporal employment.
- d. Attend all site meetings and briefing for work procedures.
- e. Keep written record of interviews and community liaison which should be summarised and included in the monthly progress reports.
- f. Collect monthly welfare reports and submit to social facilitators.
- g. Ensure that contractor's workers are paid what is due to them and in time.
- h. Assist in the recruitment of labour.
- i. Promote and maintain sound relations with community stakeholders and other role players.
- j. Screen the supplied labour by the community through Project Steering Committees to ensure compliance with the agreed upon recruitment policy and the government's labour employment targets.
- k. Inform local labour about their conditions of temporary employment, to ensure their timeous availability and inform them timeously when they would be relieved, where the rotation of labour is applicable.
- l. Keep the labour register of labour and manage records of project local labourers and be able to provide reports on employment statistics.
- m. Consult on all decisions regarding local problems and any matters of importance that, in any way will be of relevance to the Contract.
- n. To be on site on a daily basis.
- o. To register concerns / perceptions and raise them in the PSC meetings.
- p. Attend site and PSC meetings to present monthly report on the local community labour involvement and site matters.
- q. Identify possible labour dispute and any disciplinary matter and advise the Construction Manager / foreman and assist in the resolution, where necessary must call for the assistance of the Social Consultant for the resolution of the conflicts.
- r. Assist the contractor in preparing records of project employees. Assist the contractor in making task measurements and the records thereof.
- s. Monitor the production of individual task workers and arrange replacement of those workers who fail to produce a reasonable task output.
- t. Attend disciplinary proceedings to ensure that hearings are fair and reasonable.
- u. Communicate daily with the contractor to determine additional labour requirements with regard to numbers and skills and pass this to the PSC.
- v. Attend weekly meetings with the contractor and make a weekly written report which shall be a prerequisite to being paid.

Social Facilitator:

- a. Assist in convening of workshops.
- b. Disseminate information to PSC members.
- c. Articulate implementing agency policies to PSC members.

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- d. Communicate labour requirements.
- e. Attend induction training programmes for workers and induct labourers.
- f. Submit monthly welfare reports to the social facilitators PSC.
- g. Communicate labour and skills requirements to the PSC.
- h. Assist in the recruitment and engagement of work force.
- i. Verify labour records and ensure all engaged qualify as per the Contract requirements.
- j. Investigate and report all labour dispute matters to the PSC, advise Construction Manager on resolution.

The residents of each village being served by the scheme are represented by a PSC. All liaison with the community and the committees is the responsibility of the Social Facilitator in conjunction with the Project Manager. The Contractor will be required to liaise through them for any matters to do with the community.

(b) Graduate Engineer and In-Service Training

The Contractor shall employ, for the duration of the contract, four (4) Graduate Engineers (National Diploma or BTech) and six (6) in-service training candidates from disciplines of engineering, environmental science and health and safety management. The PSC will provide a list of suitable candidates which will be interviewed by the Contractor before selecting a suitable person. If this person has never done similar work before the Contractor must make allowance to train the person. The Graduate Engineer will be responsible to the Contractor and a short-term contract must be set up to formalise the conditions of the appointment.

The contractor will provide office space, stationery and all other tools and equipment for the graduates / in-service training candidates to carry out his / her duties.

At completion of the contract the Contractor must provide the graduates / in-service training candidates with a certificate of service.

Remuneration for a qualified graduate will be R 15 000 per month for the period of employment and for in-service training candidates will be R 8 000 per month for the period of employment. Where a person is engaged for part of the month, they shall be paid an equivalent daily amount. The unit for measurement shall be the man-month of employment.

The Graduate Engineer shall be trained and mentored in:

- Contract Administration
- Quality Control
- Measurement of Works,
- Site Management System
- Survey

A graduate or in-service training candidate who fails in their responsibilities as outlined in the agreement, may be replaced in consultation with the PSC and ISD.

7. Sanctions

In the event that the Tenderer fails to substantiate that any failure to achieve the Contract Participation Goal was due to quantitative under runs, the elimination of items, or any other reasons beyond the Contractor's control which may be acceptable to the Employer, it shall be liable to pay to the Employer a financial penalty calculated in the following manner:

$$P = 0.5 \times \frac{(D-D_0)}{(100)} \times C_A$$

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Where:

D = tendered Contract Participation Goal percentage.

D₀ = the Contract Participation Goal which the Employer's representative certifies, based on the credits passed, as being achieved upon completion of the contract.

C_A = Contract Amount

P = Monetary value of penalty payable

8. Tender Contract Participation Goal in respect of targeted labour and local enterprises

I/We hereby tender a Contract Participation Goal of.....% (minimum: **20%**) in compliance with the Employer's Socio-Economic Requirements.

The undersigned, who warrants that he/she is duly authorised to do so on behalf of the firm or sole proprietor confirms that he/she understands the conditions under which such preferences are granted.

Signature:

Name:

Duly authorised to sign on behalf of:

Telephone:

Fax:

9. Supporting Targeted Labour (CPG) calculation

TYPE OF TARGETED LABOUR	WORKING HOURS	RATE	TOTAL WAGE COST
Permanent labour*			
Temporary labour			
SMME labour			
Local Enterprises			
		TOTAL	

*Note: A tenderer may only claim permanent staff as eligible for preference points if said staff are also from the Target Area. Permanent staff are considered to be those who have been continuously employed by the tenderer for at least three months prior to the commencement of this project.

C1.4: SPECIFICATION FOR SMME SUB-CONTRACTOR EMPLOYMENT

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ACRONYMS

CIDB	-	CONSTRUCTION INDUSTRY DEVELOPMENT BOARD
CM	-	CONSTRUCTION MANAGER (MENTOR)
ECSA	-	ENGINEERING COUNCIL OF SOUTH AFRICA
GCC	-	GENERAL CONDITIONS OF CONTRACT FOR CONSTRUCTION WORKS
EA	-	EMPLOYER'S AGENT
MC	-	MAIN CONTRACTOR (MENTOR)
PM	-	PROJECT MANAGER (MENTOR)
PMT	-	PROJECT MANAGEMENT TEAM
SAICE	-	SOUTH AFRICAN INSTITUTION OF CIVIL ENGINEERING
SARS	-	SOUTH AFRICAN RECEIVER OF REVENUE
SMME	-	SMALL MEDIUM & MICRO ENTERPRISE
SANS	-	SOUTH AFRICAN NATIONAL STANDARDS

1 DEFINITIONS AND INTERPRETATIONS

For the purposes of this section of the Project Specification, the definitions given in the General Conditions of Contract for Construction Works 3rd Edition 2015, the Standard Specifications and the Project Specifications, together with the following definitions shall apply:

- a) Main Contract: Any contract for the execution of civil engineering or building or similar construction works, in which the liabilities and responsibilities of the two parties thereto are assigned essentially in a manner which is consistent with that set out in the General Conditions of Contract for Construction Works 3rd Edition, 2015.
- b) Project Management Team (PMT): A team that is set up after award of the contract, consisting of a delegate from each of the Main Contractor, the Employer's Agent and the Employer. The function of the PMT will be to consult regarding the management of the subcontracts involving SMMEs. The PMT will also evaluate the Main Contractor's performance regarding the goals set for SMME involvement. The Employer's Project Manager will decide which party is to chair and lead the team. Minutes of these meetings will be taken by the Employer's Agent.
- c) SMME Construction Manager: Person provided by Main Contractor to guide, assist and mentor all eligible potential SMMEs tendering and awarded a contract as SMME Sub-Contractors.
- d) Small, Medium and Micro Enterprises: An Affirmable Business Enterprise which adheres to statutory labour practices, is a legal entity, registered with SARS and the Compensation Commissioner or FEMA and continues to operate as an independent enterprise for profit.
- e) SMME Sub-Contractor: An Emerging Contractor referred to as an SMME, who has been identified through a process as detailed in Section 2.1 to tender for and, if successful, to provide works as part of the total service required by the Employer for the Contract.
- f) Sub-Contractor: A Contractor who contracts with the Main Contractor to provide works as part of the total services required by the Employer for that Contract.
- g) SMME Package: Specified work package identified for execution by SMMEs. The identifiers are Employer, Employer's Agent and Main Contractor.
- h) Joint Venture: An association of firms, companies or businesses for which purpose they combine their expertise, efforts, skills and knowledge to execute the Contract.

2 SMME TENDER PHASE

2.1 Identification of SMME Contractors

The process for identifying potential targeted SMME Contractors from within the ORTDM shall be advised by the Employer, following award. Allowance has been made for an Expression of Interest process to be followed, if required.

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2.2 Identification of Works Opportunities

General items to be considered as possible work packages for the sub-contractors are listed below. These packages are not all inclusive and contractors are encouraged to exceed the minimum requirements. Specific work items to be performed by subcontractors will be agreed to post-award. It remains the main contractor's responsibility to ensure compliance with the stipulated contract participation goals.

- Site clearance
- Hand excavation
- Construction of chambers
- Installation of valve and pipeline markers
- Fencing
- Concrete block paving
- General building work / brickwork.

2.3 Tender process for SMMEs

A minimum of 3 (three) potential SMME subcontractors as identified by process mentioned in 2.1 shall be invited to tender for each work package.

2.4 Compilation and issue of tender documents

The Main Contractor (supported where required by the Employer's Agent) shall compile the tender documents in such a manner that it will facilitate the achievement of all objectives and principles pertaining to procurement and development of SMMEs as stated in or as may reasonably be inferred from the conditions of this contract.

All tender documentation shall be reviewed, approved and issued by the Main Contractor with all copies of tender documents compiled deemed to be included in the tendered rates or mark-up provision allowed for the various SMME work packages. The tender or quotation document will be issued to invited SMMEs at NO COST and the Main Contractor is to make allowance for such cost in his tendered rates.

2.5 Site Briefing Session

The Main Contractor shall facilitate a Site Briefing Session for the invited SMMEs. The Main Contractor will also make sure that all relevant parties including the PMT are present and given an opportunity to present specific aspects of the requirements pertaining to their tender requirements.

2.6 Pre-Tender Assistance to the SMMEs

At the briefing session, the Main Contractor assisted by the PMT will be responsible for ensuring that prospective SMME Tenderers fully comprehend the:

- i. implications of the liabilities and responsibilities inherent in the subcontract applicable;
- ii. scope and extent of the portion of the works included in the subcontract;
- iii. the requirements for quality control of works;
- iv. the requirements for occupational health and safety;
- v. proper procedures for the submission of the tenders;
- vi. procedures and basis on which tenders will be adjudicated and the subcontracts awarded.

2.7 Adjudication

- a) The Main Contractor shall receive all tenders at a location identified by him. All sealed tender submissions will be placed in a proper tender box provided by the Main Contractor for this purpose. A submission register will be maintained by the Main Contractor for all tenders received.
- b) All tenders received shall be evaluated by the Main Contractor for final approval. The draft tender evaluation report shall be distributed to the PMT members 5 working days prior to the PMT meeting for comments and perusal in order to finalise the evaluation before the meeting. The format of the tender evaluation report must be agreed upon at the first PMT meeting.

The evaluation of the Occupational Health and Safety plans will be done by the Main Contractor SHE Officer.

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- c) The PMT shall have the right to interview any tenderer for the purpose of:
 - clarifying any aspect of the tender;
 - querying abnormally high or low rates and prices, and
 - clarifying rates and prices which are not in balance with other tendered rates and prices.
- d) The Main Contractor shall provide all reasonable opportunity to such tenderers who have been interviewed, to correct obvious and patent errors, provided always that this can be achieved without altering the total tendered sum.

2.8 Award of Tender

The Main Contractor will award the work with the successful SMME Tenderers, and a Sub-Contract Agreement will be signed between the Main Contractor and the successful SMME Tenderers.

2.9 Sub-Contract Agreement

A Sub-Contract Agreement in accordance with the General Conditions of Subcontract for Construction Works, SAICE, First Edition 2018 including all amendments will be compiled by the Main Contractor with the assistance of the Employer's Agent. They shall be responsible for ensuring that the terms and conditions are consistent with all requirements as specified in or reasonably may be inferred from the provisions of this Contract. All costs associated with the tender process including the conclusion of the agreement are for the Main Contractor's account.

The final terms and conditions of each subcontract agreement shall be subject to the approval of the PMT, prior to entering into the subcontract agreement. The Main Contractor may not enter into any subcontract agreement that contains terms more onerous or disproportionate to the risks inherent in the main contract for either the SMME or the Main Contractor.

The terms and conditions of the subcontract agreement shall specifically ensure that the provisions of the main contract pertaining to:

- a) The allowable sources from which workers may be drawn in terms of the contract;
- b) The terms and conditions relating to the recruitment, employment and remuneration of workers engaged on the contract works;
- c) Any training to be provided to the temporary workforce;
- d) Occupational health and safety; and
- e) The use of labour-intensive methods.

Shall apply in respect of all SMME Contracts.

3 CONSTRUCTION PHASE

3.1 Mentorship

The Main Contractor shall closely manage and supervise and assist all SMMEs in all aspects of management, execution and completion of subcontracts. This shall typically include assistance with planning the works, sourcing and ordering of materials, labour relations, monthly measurements and invoicing procedures, etc. The extent and level of such management, guidance and assistance to be provided by the Main Contractor shall be directed at enabling the SMMEs to achieve the successful execution and completion of the subcontract. Payment for such on-going assistance is deemed included in the rate tendered for the administrative cost of SMMEs.

3.2 Guide, Assist and Mentor SMMEs

The Main Contractor shall employ on a full-time basis an SMME Construction Manager. The CV of the proposed individual must be submitted to the Employer's Agent for approval based on the requirements shown below.

The SMME Construction Manager will manage the SMMEs and report monthly on progress of each SMME to the Project Management Team (PMT).

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Such Construction Manager must be adequately experienced with SMME work(s) concern and the development thereof and will be subject to the approval of the Employer. The SMME Construction Manager will render full-time assistance to and mentor the SMMEs and shall:

- i. Possess a minimum of five years site-based experience in the civil engineering construction industry and have a sound knowledge of the minimum requirements to carry out construction work effectively and efficiently.
- ii. Be registered with ECSA registration (Engineering Council of South Africa): Pr. Eng or Pr. Tech or SACPCMP (South African Council for the Project and Construction Management Professions) as a Pr. CPM or Pr. CM.
- iii. Would preferably hold a mentoring certificate.
- iv. Maintain the programme of the subcontract.
- v. Ensure continuous supervision and assistance to the SMME sub-contractors.

The SMME Construction Manager will report on performance of the SMME on a monthly basis. On completion, the Main Contractor will issue a Final Certificate as given in the General Conditions of Subcontract for Construction Works, SAICE, First Edition 2018 including all amendments within seven days after the final completion.

3.3 Dispute Resolution Procedures

The Main Contractor shall at all times:

- a) Apply the terms and conditions of the subcontract fairly and justly, taking due cognisance of the level of sophistication and experience of the particular SMME concerned, as well as the level of subcontract applicable.
- b) Closely manage and supervise all SMMEs and wherever feasible, shall give reasonable warning to SMMEs when any contravention of the terms of the subcontract has occurred or appears likely to occur. The Main Contractor shall, whenever feasible, give the SMMEs reasonable opportunity to rectify any such contravention or to avoid such contravention and shall render all reasonable assistance to the SMME in this regard.
- c) If no agreement can be reached between the Main Contractor and the sub-Main Contractor, the matter shall be referred to a mutually acceptable mediator as required in the General Conditions of Subcontract for Construction Works, SAICE, First Edition 2018 including all amendments.

When taking any actions or imposing any penalties as are provided for in the subcontract, the Main Contractor shall explain fully to the SMMEs that such actions are provided for in the subcontract.

3.4 Quality of Work and Performance of the Sub-Main Contractor

If the Sub-Contractor, in the opinion of the Main Contractor, fails to comply with the criteria as listed below, the Main Contractor shall issue a written warning to the Sub-Contractor, stating all the areas of non-compliance. A copy of the letter of warning shall be forwarded to the Employer's Agent. These criteria include:

- a) Acceptable standard of works as set out in the specifications in the sub-contract tender document.
- b) Progress in accordance with the time constraints in the Sub-Contractor's tender document.
- c) Punctual and full payment of the workforce and suppliers.
- d) Occupational health and safety compliance.
- e) Compliance with environmental requirements.

The Sub-Contractor shall have fourteen (14) days from the date of receipt of the warning letter from the Main Contractor to satisfactorily rectify the issues raised by the Main Contractor, with the exception of point (d) and (e), for which the response time shall be 24 hours. If a satisfactory solution cannot be reached after the mediation process this will be sufficient grounds for the Main Contractor to terminate the contract provided the Project Management Team is satisfied that the Main Contractor has made every effort to correct the performance by the Sub-Contractor.

3.5 Payment of SMMEs

- 3.5.1 SMME Sub-Contractors are to be invited to submit their payment certification or claim monthly and are to be paid by the Main Contractor within thirty (30) days of receipt of invoice.

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- 3.5.2 Payment to SMMEs may not be delayed pending payment of the Main Contractor by the Employer.
- 3.5.3 Payment to SMMEs may not be discounted for early payment.
- 3.5.5 No interim payment of the SMME invoice may be unfairly withheld or delayed for whatever reason.
- 3.5.6 The Main Contractor must acknowledge and honour cessions in favour of recognised financiers or suppliers of the SMME if presented to the PMT and approved.

3.6 Main Contractor's Liability

No provision or requirement set out in this specification shall be deemed to relieve the Main Contractor of any liability or obligation under the contract, and in accordance with the provisions of Clause 4.4 of the General Conditions of Contract for Construction Works 2015, the Main Contractor shall be fully liable for the acts, defaults and negligence of any SMMEs, his agents or employees, as fully as if they were the acts, defaults and negligence of the Main Contractor, his agents or employees save as specified in the General Conditions of Subcontract for Construction Works, SAICE, First Edition 2018 including all amendments.

Any failure or neglect by the Main Contractor to comply with the provision of the specifications, or any omission or neglect by the Main Contractor in adhering to or applying the principles as are described and inherent in the specifications, shall be deemed to constitute a warrant for the Employer's Agent to act in terms of Clause 9.2 of the General Conditions of Contract for Construction Works 2015.

3.7 Performance Guarantee

The following Performance Guarantees will be applied on the SMME Sub-Contracts:

- | | | | |
|-------|--------------------------|-----------------------|-------|
| 3.7.1 | up to R1 000 000 | shall be zero percent | (0%); |
| 3.7.2 | R1 000 001 to R4 000 000 | shall be five percent | (5%); |
| 3.7.3 | Exceeding R4 000 000 | shall be ten percent | (10%) |

All the above will be of the accepted SMME Sub-Contract Value and will be required from SMMEs as stated in the General Conditions of Subcontract for Construction Works, SAICE, First Edition 2018 including all amendments.

Where such guarantees are provided by SMME, the return of same will be related to the time when the work carried out by the SMME is complete to the satisfaction of the Main Contractor and the Employer's Agent.

3.8 Retention

No retention monies are to be withheld by the Contractor when processing invoices/payment certificates from SMME's as part of the 20% SMME CPG requirement.

3.9 Measurements

An item has been measured in Bill of Quantities allowing the Main Contractor to price for the cost of the Main Contractor to manage and supervise the SMMEs during the execution of their works. The price tendered will be deemed to include all incidentals by the Main Contractor to comply with the conditions of this specification. No other claims will be entertained should SMMEs affect the contract works in any way, and the Main Contractor shall deem to include such effects in the handling cost percentage for the different SMME work packages above.

3.10 Sub-Contracting by SMME

The Main Contractor shall not permit SMME Sub-Contractors to further subcontract on any other conditions than those applying in the project specification to Sub-Contractors or SMME Sub-Contractors.

3.11 Joint Venturing & Consortium

The Main Contractor shall not permit the SMME Sub-Contractors to enter into a Joint Venture or form a consortium with an external SMME(s) unless PMT approves so before the tender award. The SMME may only be allowed to enter into a Joint Venture or form a consortium with the other invited SMME(s) on the package concerned.

4 PORTFOLIOS OF EVIDENCE & UP-GRADE SUPPORT

4.1 Keeping of Records

The Main Contractor shall assume responsibility for the compilation and maintenance of comprehensive records detailing each SMME's progress during the construction period, starting from the award of a subcontract to an SMME until the successful completion of the subcontract work or termination of the subcontract. To this end the Main Contractor shall arrange for the completion, on behalf of the SMME Sub-Contractor, of the Employer's pro-formas to be provided by the Employer at award of the Main Contract. The Main Contractor must also keep a register of the details of each SMME engaged.

The Main Contractor shall keep comprehensive records of the training given to each trainee and SMME, at the successful completion of each course; each trainee shall be issued with a certificate indicating the course contents as proof of attendance and completion. The Main Contractor shall keep a register of certificates issued. Whenever required, the Main Contractor shall provide copies of such records to the Employer's Agent.

4.2 Monthly Returns

The Main Contractor's participation performance will be measured monthly in order to monitor the extent to which he is striving to reach the targets in this contract. The Main Contractor shall complete and return, on a monthly basis, the following pro-forma forms of the Employer (to be provided by the Employer at award of the Main Contract):

- Report on employment.
- Report on the SMME's Plant and Equipment.
- Report on progress against programme.
- Report on financial status.
- Report on engineering training.
- Report on development training.
- Report on safety training.

The completed forms shall be presented to the Employer's Agent at each site meeting. Failure to adhere to this requirement shall result in the delay of any payment due until the Employer's Agent confirms that the forms have been received.

4.3 Main Contractor's duties upon completion of each sub-contract

The Main Contractor shall, on completion of each and every subcontract completed in accordance with the provisions of this specification, issue free of charge to the SMME within 7 (seven) days of the completion of the subcontract, a Certificate of Experience on a single A4 page containing the following:

- a) Contract data:
 - i. Contract title;
 - ii. Main Contractor's full name and address;
 - iii. Employer's Agent's name and address;
 - iv. Employer's name and address.
- b) Subcontract data:
 - i. SMME name and address;
 - ii. Scope or extent of the subcontract works;
 - iii. Value of the subcontract works;
 - iv. Applicable level of the subcontract;
 - v. Duration of the subcontract;
 - vi. Date of completion of the subcontract;
 - vii. Description of the training undergone by the SMME.

In addition, the SMME Construction Manager must provide comments of the performance of the SMME Sub-Contractor in respect of contract execution, labour management and OHS principles.

- c) Certifying the SMME's successful completion of the subcontract.

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5 MEASUREMENT AND PAYMENT

Payment Ref **Unit**

ASM 01 Expressions of Interest for SMME's.....Number (No)

The tendered sum must include all costs incurred in the preparation of the expressions of interest, advertising and evaluation of the replies for presentation to the PMT.

ASM 02 Tenders for SMME's.....Number (No)

Payment under this item shall be the number of SMME sub-contract, tender processes which the Contractor carries out. The tendered rate shall include full compensation for the compilation and issue of tender documents, tender invitation, training and provision of assistance to tenderers, evaluation of tenders and award of sub-contracts.

ASM 03 Provision of an SMME Construction ManagerMonth

The monthly tendered rate must include for all costs arising from the full-time mentoring, guidance and supervision of the SMME Sub-Contractors, including salary, accommodation, transport and all other expenses incurred.

ASM 04 Administrative costs of mentoring SMME Sub-ContractorsMonth

The tendered sum must include for all costs incurred in the administration of the mentoring of SMME Sub-Contracts but not including the costs of the duties of the SMME Construction Manager or normal site supervision and administration activities. These could include the costs of outside specialists such as estimators, OHS or environmental specialists.

ASM 05 Preliminary and General costs associated with SMME's and fluctuation between the Contractor's tendered rates and the rates of SMME subcontractors Provisional Sum (Prov. Sum)

Measurement and payment shall be in accordance with the provisions of clause 6.6 of the Conditions of Contract.

The Contractor shall, for inclusion in his monthly certificate, produce a schedule of work packages undertaken by SMME subcontractors, clearly indicating the P&G costs incurred which shall be limited to 20% of each SMME package.

The provisional sum makes provision for the SMME subcontractor's establishment on site and general obligations, which will be included in the SMME subcontractors' contracts, and for funds to deal with the fluctuations between the Contractor's tendered rates and the rates of the approved SMME subcontractors."

ASM 06 Handling Costs and Profit Associated with SM10.05 Percentage (%)

The Contractor is required to calculate the total percentage mark up for his handling costs and profit on Item SM10.05 which shall be claimed monthly under this pay item.

6 FINANCIAL PENALTIES

In the event that the Tenderer fails to substantiate that any failure to achieve the Contract Participation Goal was due to quantitative under runs, the elimination of items, or any other reasons beyond the Contractor's control which may be acceptable to the Employer, it shall be liable to pay to the Employer a financial penalty (P) calculated in the following manner:

$$P = 0,50 \times (L_M - L_A) \times V_A$$

Where:

L_M = SMME Subcontractors or Local Resources Goal % stated in the Contract Document

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LA = SMME Subcontractors or Local Resources component % which the Employer's representative certifies as being achieved upon completion of the Contract.

VA = Award Value (Contract Price exclusive of VAT, all provisional or prime cost sums and allowances for contingencies)

P = Rand value of penalty payable

7 ACCEPTANCE OF THE SMME SUB-CONTRACTOR SPECIFICATION

The undersigned, who warrants that he/she is duly authorised to do so on behalf of the firm or sole proprietor. confirms that he/she understands the conditions under which such preferences are granted.

Signature:

Name:

Duly authorised to sign on behalf of:

Telephone:

Fax:

C1.5: PERFORMANCE GUARANTEE (PRO FORMA)
--

For use with the General Conditions of Contract for Construction Works, Third Edition, 2015.

GUARANTOR DETAILS AND DEFINITIONS

"Guarantor" means:

Physical address:

"Employer" means: **O. R. Tambo District Municipality**

"Contractor" means:

"Employer's Agent" means: **Zutari (Pty) Ltd**

"Works" means: **SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B –
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"Site" means: **The Site as defined by Clause 1.1.1.29 of the General Conditions of
Contract, 2015**

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

"Contract Sum" means: **The accepted amount inclusive of tax of R**

Amount in words:

"Guaranteed Sum" means: **The maximum aggregate amount of R**

Amount in words:

Type of Performance Guarantee: **FIXED**

"Expiry Date" means: **Within 14 days after the issue of the Certificate of Completion by the
Employer's Agent in terms of Clause 5.14.4 of the General Conditions of
Contract.**

CONTRACT DETAILS

Employer's Agent issues: Interim Payment Certificates, Final Payment Certificate and the Certificate
Completion of the Works as defined in the Contract.

PERFORMANCE GUARANTEE

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

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

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

Signed at

Date

Guarantor's signatory: (1)

Capacity

Guarantor's signatory (2)

Capacity

Witness signatory: (1)

Witness signatory: (2)

C1.6: ADJUDICATION

Adjudication shall be carried out in terms of Clauses 10.5 and 10.6 of the General Conditions of Contract 2015.

The Disclosure Statement and the Adjudication Board Member Agreement to be used in this Contract are contained Appendices 4 and 5 of the General Conditions of Contract GCC 2015.

C1.7: AGREEMENT IN TERMS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT, 1993 (ACT No 85 OF 1993)

**AGREEMENT IN TERMS OF SECTION 37(2) OF THE OCCUPATIONAL HEALTH AND SAFETY
ACT No 85 OF 1993**

THIS AGREEMENT is made between

(hereinafter called "the Employer") of the one part, herein represented by.....

in his capacity as

and

(hereinafter called "the Mandatary") of the other part, herein represented by:

.....

in his capacity as

duly authorised to sign on behalf of the Mandatary.

WHEREAS the Contractor is the Mandatary of the Employer in consequence of an agreement between the Contractor and the Employer in respect of

CONTRACT No:.....CONTRACT TITLE

for the construction, completion and maintenance of such Works;

AND WHEREAS the Employer and the Mandatary have agreed to certain arrangements and procedures to be followed in order to ensure compliance by the Mandatary with the provisions of the Occupational Health and Safety Act, 1993 (Act 85 of 1993);

NOW THEREFORE THIS AGREEMENT WITNESSED AS FOLLOWS:

- 1 The Mandatary undertakes to acquaint the appropriate officials and employees of the Mandatary with all relevant provisions of the Act and the regulations promulgated in terms thereof.
- 2 The Mandatary shall execute the work in accordance with the Contract Documents pertaining to this Contract.
- 3 This Agreement shall hold good from its Commencement Date, which shall be the date of a written notice from the Employer or Employer's Agent requiring him to commence the execution of the Works, to either
 - (a) the date of the Final Approval Certificate issued in terms of Clause 5.16.1 (GCC 2015) of the General Conditions of Contract (hereinafter referred to as "the GCC"),

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or

- (b) the date of termination of the Contract in terms of Clauses 9.1, 9.2 or 9.3 (GCC 2015) of the GCC.

4 The Mandatary declares himself to be conversant with the following:

- (a) All the requirements, regulations and standards of the Occupational Health and Safety Act (Act 85 of 1993), hereinafter referred to as "The Act", together with its amendments and with special reference to the following Sections of The Act:
 - (i) Section 8 : General duties of employers to their employees;
 - (ii) Section 9 : General duties of employers and self-employed persons to persons other than employees;
 - (iii) Section 37 : Acts or omissions by employees or mandataries, and
 - (iv) Subsection 37(2) relating to the purpose and meaning of this Agreement.
- (b) The procedures and safety rules of the Employer as pertaining to the Mandatary and to all his subcontractors.

5 In addition to the requirements of Clause 8.4 (GCC 2015) of the GCC and all relevant requirements of the Contract, the Mandatary agrees to execute all the Works forming part of this Contract and to operate and utilise all machinery, plant and equipment in accordance with the Act.

6 The Mandatary is responsible for the compliance with the Act by all his subcontractors, whether or not selected and/or approved by the Employer.

7 The Mandatary warrants that all his and his subcontractors' workmen are covered in terms of the Compensation for Occupational Injuries and Diseases Act, 1993 which cover shall remain in force whilst any such workmen are present on site. A letter of good standing from the Compensation Commissioner to this effect must be produced to the Employer upon signature of the agreement.

8. The Mandatary undertakes to ensure that he and/or subcontractors and/or their respective employers will at all times comply with the following conditions:

- (a) The Mandatary shall assume the responsibility in terms of Section 16.1 of the Occupational Health and Safety Act. The Mandatary shall not delegate any duty in terms of Section 16.2 of this Act without the prior written approval of the Employer. If the Mandatary obtains such approval and delegates any duty in terms of section 16.2 a copy of such written delegation shall immediately be forwarded to the Employer.
- (b) All incidents referred to in the Occupational Health and Safety Act shall be reported by the Mandatary to the Department of Labour as well as to the Employer. The Employer will further be provided with copies of all written documentation relating to any incident.
- (c) The Employer hereby obtains an interest in the issue of any formal inquiry

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conducted in terms of section 32 of the Occupational Health and Safety Act into any incident involving the Mandatary and/or his employees and/or his subcontractors.

In witness thereof, the parties hereto have set their signatures hereon in the presence of the subscribing witnesses:

Signature(s) of authorised agents: Date.....

Name(s) (in block letters):

Capacity of authorised agents:

for and on behalf of the Mandatary
(Name and address of organisation)

Witness:(Full name – in block letters – and
signature)

(Name)

.....
(Signature)

Date:

For and on behalf of the Employer:

Signature(s) of authorised agent(s) Date.....

Name(s) (in block letters)

Capacity of authorised agents:

for the Employer: (Name and address of organisation)

Witness:(Full name – in block letters – and
signature)

(Name)

.....
(Signature)

Date:

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C2 PRICING DATA

C2.1 Pricing Instructions

C2.2 Bill of Quantities

C2.1 PRICING INSTRUCTIONS

C2.1.1 PREAMBLE TO THE BILL OF QUANTITIES

C2.1.1.1 The Employer has compiled the Bill of Quantities according to the requirements in the Standard System of Measurement of Civil Engineering Quantities published by SAICE.

C2.1.1.2 The Conditions of Contract, the Contract Data, the Scope of Work, the Site Information, and the Drawings shall be read in conjunction with the Bill of Quantities.

C2.1.1.3 Before the tenderer adds a rate for an item, they must read the following:

- the relevant clauses in the Conditions of Contract
- the relevant measurement and payment clauses in the standard specifications, particular specifications and project specifications
- the relevant information shown on the Drawings

The tenderer must read all that information carefully so that they know what work the item involves. If there are discrepancies between the Bill of Quantities, SAICE's civil engineering quantities and the specifications, the tenderer must accept what is written in the specifications. If the tenderer claims from the Employer because of discrepancies, the Employer will reject the claim.

C2.1.1.4 The Engineer will not use the quantities in the Bill of Quantities to determine how much the Employer must pay the Contractor for work the Contractor has done. The Engineer will measure, accept and certify the work as described in clauses 12 to 14 of the Conditions of Contract and the relevant provisions of clause 8 of each of the SANS 1200 Standardised Specifications for Civil Engineering Construction or the Particular Specifications referred to in the Scope of Work, subject to the variations and amendments contained therein.

The Contract Agreement will stay valid even if the quantities in the Bill of Quantities differ from the quantities the Engineer certifies for payment.

The Employer will measure items net according to what is shown on the Drawings because they have not allowed for wastage.

C2.1.1.5 The Bill of Quantities comprises items covering the Contractor's profit and costs of general liabilities and of the construction of Temporary and Permanent Works.

Although the Tenderer is at liberty to insert a rate of his own choosing for each item in the Bill of Quantities, he should note the fact that the Contractor is entitled, under various circumstances, to payment for additional work carried out and that the Employer's Agent is obliged to base his assessment of the rates to be paid for such additional work on the rates the Contractor inserted in the Bill of Quantities.

Clause 8 of each Standardised Specification, and the measurement and payment

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clause of each Particular Specification, read together with the relevant clauses of the Scope of Work, all set out which ancillary or associated activities are included in the rates for the specified operations.

- C2.1.1.6 Descriptions in the Bill of Quantities are abbreviated and comply generally but may differ from those in the Standardised Specifications and Scope of Work. No consideration will be given to any claim by the Contractor submitted on such a basis. The Bill of Quantities has been drawn up generally in accordance with the latest issue of Civil Engineering Quantities¹. Should any requirement of the measurement and payment clause of the appropriate Standardised or Particular Specifications be contrary to the terms of the Bill of Quantities or, when relevant, to the Civil Engineering Quantities, the requirement of the appropriate Standardised or Particular Specification, as the case may be, shall prevail.
- C2.1.1.7 Unless stated to the contrary, items are measured net in accordance with the Drawings without any allowance having been made for waste.
- C2.1.1.8 The amounts and rates to be inserted in the Bill of Quantities shall be the full inclusive amounts to the Employer for the work described under the several items. Such amounts shall cover all the costs and expenses that may be required in and for the construction of the work described, and shall cover the costs of all general risks, profits, taxes (but excluding Value Added Tax), liabilities and obligations set forth or implied in the documents on which the tender is based.
- C2.1.1.9 An amount or rate shall be entered against each item in the Bill of Quantities, whether or not quantities are stated. An item against which no amount or rate is entered will be considered to be covered by the other amounts or rates in the Bill.
- C2.1.1.10 The Tenderer shall also fill in a rate against the items where the words "rate only" appears in the amount column. Although no work is foreseen under these items and no quantities are consequently given in the quantity column, the tendered rates shall apply should work under these items be required.
- C2.1.1.11 Should the Tenderer group several items together and tender one sum for such group of items, the single tendered sum shall apply to that group of items and not to each individual item, or should he indicate against any item that full compensation for such item has been included in another item, the rate for the item included in another item shall be deemed to be nil.
- C2.1.1.12 The tendered rates, prices and sums shall, subject only to the provisions of the Conditions of Contract, remain valid irrespective of any change in the quantities during the execution of the Contract.
- C2.1.1.12 The quantities of work, as measured and accepted and certified for payment in accordance with the Conditions of Contract, and not the quantities stated in the Bill

¹ The standard system of measurement of civil engineering quantities published by the South African Institution of Civil Engineers.

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of Quantities will be used to determine payments to the Contractor. The validity of the Contract shall in no way be affected by differences between the quantities in the Works Assignment and the quantities certified for payment.

C2.1.1.12 Ordering of materials is not to be based on the Bill of Quantities, but only on information issued for construction purposes.

C2.1.1.13 For the purposes of this Bill of Quantities, the following words shall have the meanings hereby assigned to them:

- Unit: The metric unit the Employer will use to measure the work associated with an item
- Quantity: The number of units of work for each item.
- Rate: The payment per unit of work at which the Tenderer tenders to do the work
- Amount: The quantity of an item multiplied by the tendered rate of the (same) item
- Sum: An amount tendered for an item, the extent of which is described in the Bill of Quantities, the Specifications or elsewhere, but of which the quantity of work is not measured in units

C2.1.1.14 The units of measurement indicated in the Bill of Quantities are metric units. The following abbreviations may appear in the Bill of Quantities:

mm	=	millimetre	h	=	hour
m	=	metre	kg	=	kilogram
km	=	kilometre	t	=	ton (1 000 kg)
m ²	=	square metre	No	=	number
m ² .pass	=	square metre-pass	sum	=	lump sum
ha	=	hectare	MN	=	Meganewton
m ³	=	cubic metre	MN.m	=	Meganewton-metre
m ³ .km	=	cubic metre-kilometre	PC sum	=	Prime Cost sum
ℓ	=	litre	Prov sum	=	Provisional sum
kℓ	=	kilolitre	%	=	per cent
MPa	=	MegaPascal	kW	=	kilowatt
Mℓ	=	Megalitre (1000 kℓ)	kN	=	kilonewton

CORRECTION OF ENTRIES MADE BY TENDERER

Any entry made by the Tenderer in the Bill of Quantities, forms, etc., which the tenderer desires to change, shall not be erased or painted out. A line shall be drawn through the incorrect entry and the correct entry shall be written above in black ink and the full signature of the Tenderer shall be placed next to the correction.

C2.2 BILL OF QUANTITIES

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION AA				
		PRELIMINARY AND GENERAL				
	SANS 1200 A	GENERAL				
	8.3	Scheduled fixed-charge items				
AAA1	8.3.1	Contractual Requirements	Sum	-		
	8.3.2	Establishment of facilities on the Site				
AAA2	8.3.2.1	Facilities for Engineer	Sum	-		
AAA3	8.3.2.2	Facilities for Contractor	Sum	-		
AAA4	8.3.3	Environmental management	Sum	-		
AAA5	8.3.5	Provision of security measures	Sum	-		
AAA6	8.3.6	Accommodating other contractors	Sum	-		
	8.3.7	Dealing with water in areas scheduled				
AAA7		a) Abstraction Works	Sum	-		
AAA8		b) Water Treatment Works	Sum	-		
AAA9	8.3.8	Quality management	Sum	-		
AAA10	8.3.9	Removal of Site establishment	Sum	-		
AAA11	8.3.10	Provision of River Diversion Facility	Sum	-		
AAA12	8.3.11	Removal of River Diversion Facility	Sum	-		
AAA13	8.3.12	Other fixed-charge obligations	Sum	-		
	8.4	Scheduled time-related items				
AAA14	8.4.1	Contractual Requirements	Sum	-		
	8.4.2	Operation and Maintenance of Facilities on Site, for Duration of Construction, except where otherwise stated				
AAA15	8.4.2.1	Facilities for Engineer	Sum	-		
AAA16	8.4.2.2	Facilities for Contractor	Sum	-		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
AAA17	8.4.3	Environmental management	Sum	-		
AAA18	8.4.5	Provision of security measures	Sum	-		
AAA19	8.4.6	Accommodating other contractors	Sum	-		
	8.4.7	Dealing with water in areas scheduled				
AAA20		a) Abstraction Works	Sum	-		
AAA21		b) Water Treatment Works	Sum	-		
AAA22	8.4.8	Quality management	Sum	-		
AAA23	8.4.9	Supervision for duration of construction	Sum	-		
AAA24	8.4.10	Company and Head Office Overhead Costs for the Duration of the Contract	Sum	-		
AAA25	8.4.11	River Diversion Maintenance and Dewatering	Sum	-		
AAA26	8.4.12	Provision of an SMME Manager as per project specification for duration of project	Sum	-		
AAA27	8.4.13	Other time-related obligations	Sum	-		
	8.5	Sums stated provisionally by the Engineer				
		a) For work to be executed (including plant, materials or services to be supplied) by the Contractor, and valued in terms of the variation procedure in the Conditions of Conditions				
		b) For work to be executed by a subcontractor, and/or for goods, materials, plant and/or services to be supplied to the Site				
AAA28		Employment of Community Liaison Officer	Prov Sum	-	360 000	360 000.00
AAA29		Overheads, charges and profit on item above	%	360 000		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
AAA30		Employment of Graduate Engineer	Prov Sum	-	3 888 000	3 888 000.00
AAA31		Overheads, charges and profit on item above	%	3 888 000		
AAA32		Accredited training allowance	Prov Sum	-	1 500 000	1 500 000.00
AAA33		Overheads, charges and profit on item above	%	1 500 000		
AAA34		Provisional sum allowance for land claim settlements.	Prov Sum	-	1 000 000	1 000 000.00
AAA35		Overheads, charges and profit on item above	%	1 000 000		
AAA36		Provisional sum allowance for grave relocation related costs	Prov Sum	-	500 000	500 000.00
AAA37		Overheads, charges and profit on item above	%	500 000		
AAA38		Provisional sum allowance for personal armed security for the Engineer where required on a adhoc basis or area is deemed a high security risk	Prov Sum	-	720 000	720 000.00
AAA39		Overheads, charges and profit on item above	%	720 000		
AAA40		Provisional sum allowance for Engineer's accommodation and Graduate Engineer accommodation	Prov Sum	-	3 500 000	3 500 000.00
AAA41		Overheads, charges and profit on item above	%	3 500 000		
AAA42		Provisional sum allowance for specialist subcontract using Eskom ECOU approved overhead line contractor (refer clause C3.3.4.2 in Part C3 Scope of Works)	Prov Sum	-	40 000 000	40 000 000.00
AAA43		Overheads, charges and profit on item above	%	40 000 000		
AAA44		Provisional sum allowance for CSI Contribution to community	Prov Sum	-	4 000 000	4 000 000.00
AAA45		Overheads, charges and profit on item above	%	4 000 000		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.6	Provisional items				
AAA46		a) All costs related to the provisional delay due to the late issuing of the instruction for the Contractor to Commence Carrying out the Works, as contemplated in Clause 5.3.4 of the Contract Data (Provisional)	days	30		
AAA47		b) All costs related to the provisional delay due to any other delays causing late granting to the Contractor of access to and possession of the Site (Provisional)	days	15		
	8.7	Daywork				
		a) Labour:				
AAA48		Foreman	hr	350		
AAA49		Skilled labourer	hr	350		
AAA50		Semi-skilled labourer	hr	470		
AAA51		Unskilled labourer	hr	470		
AAA52		Electrical foreman	hr	350		
AAA53		Cable joiner	hr	350		
		b) Materials:				
AAA54		Allow for net cost of goods or materials actually used	Prov Sum	-	1 000 000	1 000 000.00
AAA55		Percentage allowance on net cost for above materials	%	1 000 000		
		c) Contractor's own plant:				
AAA56		Bulldozer, Minimum power: 220 kW (35 t)	hr	100		
AAA57		Motor grader, Minimum power: 93 kW (similar to "Cat 120B")	hr	100		
AAA58		Excavator, Minimum power: 103 kW (20 ton, similar to "Cat 302C")	hr	100		
AAA59		Excavator, Minimum power: 103 kW (40 ton, similar to "Cat 302C")	hr	100		
AAA60		T.L. Backactor, Minimum power: 50 kW (similar to "Case 580G")	hr	100		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
AAA61		Front-end loader, Minimum power: 145 kW (22 ton)	hr	100		
AAA62		Vibrating pedestrian roller, Minimum drum width: 0,39 m Minimum power: 3,7 kW	hr	50		
AAA63		Vibrating plate compactor, Minimum power: 2 kW	hr	50		
AAA64		Dump truck, Minimum load mass: 25 t Minimum load capacity: 16 m³	hr	100		
AAA65		Water tank truck, with sprinkler, Minimum capacity: 10 kl	hr	100		
AAA66		Mobile crane, Minimum capacity: 10 t	hr	100		
AAA67		Mobile crane, Minimum capacity: 30 t	hr	50		
AAA68		Sludge pump, 100 mm dia, with hoses	hr	100		
AAA69		Generating set, Minimum output power: 10 kW	hr	100		
AAA70		Water pump, 100 mm dia, with hoses, 1000l capacity	hr	100		
		d) Hired plant				
AAA71		Hired plant exclusively for dayworks	Prov Sum	-	500 000	500 000.00
AAA72		Percentage allowance on net cost for above hired plant	%	500 000		
	8.8	Temporary Works				
AAA73	8.8.1	Main access road to Works	Sum	-		
AAA74	8.8.2	Dealing with traffic	Sum	-		
	8.8.3	Protection of structure until construction in vicinity is complete				
AAA75		a) Existing graves	Sum	-		
AAA76		b) Existing heritage structures as identified in heritage report and EMPr	Sum	-		
AAA77		c) Existing cattle dip structure	Sum	-		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
AAA78		Brought forward / ... d) Existing dwellings along access road to be upgraded / rising main pipeline route (approximately 600m linear length)	Sum	-		
	8.9	Miscellaneous Items				
AAA79	8.9.1	As-built Survey	Sum	-		
AAA80	8.9.2	Wayleaves	Sum	-		
TOTAL OF SECTION AAA CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
	OHS SPEC	SECTION ABA				
	SANS 1200 A	OCCUPATIONAL HEALTH AND SAFETY				
	8.3.4	Scheduled fixed-charge H&S items				
ABA1		Preparation of the contractors site specific health and safety plan and Safety File	Sum	-		
ABA2		Principal contractors initial obligations in respect of the occupational health and safety act and construction regulations	Sum	-		
		Provision of personal protective equipment (PPE)				
ABA3		(a) reflective vest	Sum	-		
ABA4		(b) hard hats	Sum	-		
ABA5		(c) protective foot wear	Sum	-		
ABA6		(d) earplugs	Sum	-		
ABA7		(e) dust masks	Sum	-		
ABA8		(f) gloves	Sum	-		
ABA9		(g) high visibility overalls	Sum	-		
ABA10		(h) gum boots	Sum	-		
		Cost of medical certificates and medical surveillance				
ABA11		(a) Initial (baseline) medical examinations	Sum	-		
ABA12		(b) Exit medical (End of the Project)	Sum	-		
		Method Statements				
ABA13		(a) Risk Assessments CR 9(1)	Sum	-		
ABA14		(b) Fall protection plan CR 10(1)	Sum	-		
ABA15		(c) Electrical and use of machinery CR 24	Sum	-		
ABA16		(d) Emergency Plan and Response Plan	Sum	-		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
ABA17		(e) Fire precautions	Sum	-		
ABA18		(f) Construction Vehicles and Mobile Plant	Sum	-		
ABA19		(g) Use of explosive power tools	Sum	-		
ABA20		(h) Ladders	Sum	-		
ABA21		HIV/AIDS Awareness and training as per SANS 1921	Sum	-		
		Health and Safety Documents				
ABA22		(a) Submission of a health and safety file - Scanned to USB	Sum	-		
ABA23		(b) Close Out Report Electronic	Sum	-		
	8.4.4	Scheduled time-related items				
ABA24		Principal contractor's time related obligations in respect of the occupational health and safety act and construction regulations, unless scheduled separately	Sum	-		
		Provision of personal protective equipment (PPE)				
ABA25		(a) reflective vest	Sum	-		
ABA26		(b) hard hats	Sum	-		
ABA27		(c) protective foot wear	Sum	-		
ABA28		(d) earplugs	Sum	-		
ABA29		(e) dust masks	Sum	-		
ABA30		(f) gloves	Sum	-		
ABA31		(g) high visibility overalls	Sum	-		
ABA32		(h) gum boots	Sum	-		
		Health and Safety Training				
ABA33		Induction Training	Sum	-		
ABA34		Tool Box Talks	Sum	-		
ABA35		Demonstrations	Sum	-		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
ABA36		Provision of first aid boxes to GSR requirements	Sum	-		
ABA37		Provision of a part time construction health and safety Manager	month	36		
ABA38		Provision of a full time construction health and safety officer	month	36		
		Cost of medical certificates and medical surveillance				
ABA39		(a) Periodic examination	Sum	-		
		Noise Monitoring				
ABA40		(a) Establish noise zone (Plant)	Sum	-		
ABA41		(b) Audiograms (Personnel)	Sum	-		
ABA42		HIV/AIDS Awareness and training as per SANS 1921 and C3 Scope of Works	Sum	-		
TOTAL OF SECTION ABA CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
	C1.4 SMME SPEC	SECTION ASM				
		SMME MANAGEMENT				
ASM1	ASM 01	Expressions of Interest for SMME's	No.	1		
ASM2	ASM 02	Tenders for SMME's	No.	20		
		Scheduled time-related items				
ASM3	ASM 03, SANS 1200A 8.4.4	Provision of an SMME Construction Manager	Month	36		
ASM4	ASM 04, SANS 1200A 8.4.4	Administrative costs of mentoring SMME Sub Contractors	Month	36		
		Sums stated provisionally by the Engineer				
		b) For work to be executed by a subcontractor, and/or for goods, materials, plant and/or services to be supplied to the Site				
ASM5	ASM 05, SANS 1200A 8.5	Preliminary and General costs associated with SMME's and fluctuation between the Contractor's tendered rates and the rates of SMME subcontractors	Prov Sum	-	4 000 000	4 000 000.00
ASM6	ASM 06, SANS 1200A 8.5	Overheads, charges and profit on item above	%	4 000 000		
TOTAL OF SECTION ASM CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAA				
		SITE CLEARANCE AND BULK EARTHWORKS				
	SANS 1200 C	SITE CLEARANCE				
	8.2.1	Clear and grub:				
CAA1		Water Treatment Works Area	m ²	50 000		
	8.2.2	Remove and grub large trees and tree stumps of girth				
CAA2		Over 1,0m and up to and including 2,0m	No	5		
	8.2.10	Remove topsoil, stockpile and maintain of depths indicated:				
CAA3		Depth up to 150mm	m ³	7 650		
	SANS 1200 D	EARTHWORKS				
	8.3.2	Bulk excavation				
CAA4		a) Excavate in all materials and use for embankment or backfill, as ordered	m ³	4 000		
CAA5		b) Excavate in all materials and dispose of	m ³	3 650		
CAA6		c) Excavate in all materials and dispose of, and backfill with material from commercial sources (clean sand unless otherwise indicated)	m ³	1 000		
		d) Extra over subitems 8.3.2(a), 8.3.2(b) and 8.3.2(c) for:				
		2) Hard rock excavation				
CAA7		(i) By means of explosives	m ³	2 500		
CAA8		(ii) Without explosives	m ³	2 000		
		3) Boulder Excavation, Class A				
CAA9		(i) By means of explosives	m ³	500		
CAA10		(ii) Without explosives	m ³	1 500		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		4) Boulder Excavation, Class B				
CAA11		(i) By means of explosives	m ³	500		
CAA12		(ii) Without explosives	m ³	1 500		
	8.3.3	Restricted excavation				
		(a) Excavate for restricted foundations, footings and trenches in all materials and use for embankment fills, berms, backfill or dispose, as ordered:				
CAA13		(i) Fill compacted to 90% of modified AASHTO maximum density	m ³	1 700		
CAA14		(ii) Berm compacted to 90% of modified AASHTO maximum density	m ³	75		
		(iii) Spoil				
CAA15		On Site	m ³	5 000		
CAA16		At designated spoil site	m ³	500		
		(b) Extra over for items 8.3.3 (a)				
		2) Hard rock excavation (without explosives)	m ³	100		
CAA17		3) Boulder Excavation, Class A (without explosives)	m ³	100		
CAA18		4) Boulder Excavation, Class B (without explosives)	m ³	100		
	8.3.4	Importing of materials				
CAA19		a) Importation of additional material from commercial sources or from borrow pits and use for fill	m ³	50		
CAA20		c) Dealing with overburden	m ³	50		
CAA21	8.3.10	(a) Topsoiling	m ²	200		
	8.3.11	(b) Grassing or other vegetation cover:				
CAA22		(1) Planting of Grass sods	m ²	500		
CAA23		(2) Hydroseeding	m ²	500		
CAA24	8.3.14	Extra-over to 8.3.2(a) and 8.3.3(a) for items above for temporary stockpiling	m ³	100		
TOTAL OF SECTION CAA CARRIED TO SUMMARY					R	

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAB				
		FLOCCULATION AND SEDIMENTATION COMPLEX				
		FLOCCULATION PORTION				
	SANS 1200 D	EARTHWORKS				
	8.3	Scheduled items:				
	8.3.3	Restricted Excavation:				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose				
CAB1		Sumps and chambers	m ³	6		
		b) Extra-over for items under payment reference 8.3.3(a) (SANS 1200 D) for:				
CAB2		2) Hard rock excavation (without explosives)	m ³	3		
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
	8.2.1	Rough:				
		Plane vertical/battered to:				
CAB3		Sides of walls	m ²	30		
	8.2.2	Smooth:				
		Plane vertical/battered to:				
CAB4		Sides of walls	m ²	370		
	8.2.5	Narrow widths:				
		Rough				
CAB5		Up to 250 mm wide	m	70		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAB6		Brought forward / ... 60 mm wide groove up to 80 mm deep to accommodate handstop frames	m	36		
CAB7		Smooth: up to 200 mm wide	m	35		
	8.3	Scheduled reinforcement items:				
	8.3.1	Steel bars:				
		Mild steel bars:				
CAB8		8 mm dia	t	0.30		
CAB9		10 mm dia	t	0.40		
		High tensile steel bars				
CAB10		10 mm dia	t	0.70		
CAB11		12 mm dia	t	2.20		
CAB12		16 mm dia	t	3		
CAB13		20 mm dia	t	4.40		
CAB14		25 mm dia	t	2.20		
CAB15		32 mm dia	t	1.50		
	8.4	Scheduled concrete items:				
	8.4.2	Blinding layer in grade 15 MPa/19 mm concrete of:				
CAB16		75 mm thickness	m ²	136		
	8.4.3	Strength concrete :				
		Grade 15 MPa/19 mm concrete to:				
CAB17		Sloped benching in corner drainage/scour sumps	m ²	1		
		Grade 35 Mpa/19 mm (watertight reinforced concrete)				
CAB18		Walls	m ³	40		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAB19	8.4.4	Brought forward / ... Slabs (including sloping) Grade 25 Mpa/19 mm (non watertight reinforced concrete)	m ³	35		
CAB20		Apron around the Flocculation tank	m ³	3.98		
		Unformed surface finishes: (b) Steel-floated finish to:				
CAB21		Top of floor slabs	m ²	110		
CAB22		Narrow surfaces up to 350mm wide	m	90		
CAB23	8.5	Apron around the Flocculation tank	m ²	40		
		Joints: Designated joints, complete, as detailed on drawing 503081-WTW1-DRG-CC-1526 and related, and 503081-GENR-DRG-CC-0301				
		Joint Type A:				
CAB24		Joint A2 between Flocculation Tank and Sedimentation Tanks	m	5		
		Joint Type F:				
CAB25	8.12	In walls and slabs	m	120		
		Joint Type H:				
CAB26		between Flocculation Tank and Sedimentation Tank 1.65m high	m	19		
		Granolithic Screeding				
CAB27		263 mm (avg) thick granolithic screed, sloped, in coagulation bay	m ²	4		
CAB28		45 mm (avg) thick granolithic screed, sloped, in surplus overflow portion of coagulation bay	m ²	2		
CAB29		385 mm thick granolithic screed, flat, to first portion of flocculation common channel	m ²	5		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAB30		248 mm (avg) thick granolithic screed, sloped, to second portion of flocculation common channel	m ²	3		
CAB31		93 mm (avg) thick granolithic screed, sloped, to third portion of flocculation common channel	m ²	3		
CAB32		385 mm thick granolithic screed, flat, to first half of Flocculation Basin 1	m ²	13		
CAB33		353 mm (avg) thick granolithic screed, sloped, to channel linking first and second halves of Flocculation Basin 1	m ²	3		
CAB34		320 mm thick granolithic screed, flat, to second half of Flocculation Basin 1	m ²	13		
CAB35		175 mm thick granolithic screed, flat, to first half of Flocculation Basin 2	m ²	13		
CAB36		163 mm (avg) thick granolithic screed, sloped, to channel linking first and second halves of Flocculation Basin 2	m ²	3		
CAB37		150 mm thick granolithic screed, flat, to second half of Flocculation Basin 2	m ²	13		
CAB38		35 mm thick granolithic screed, flat, to first half of Flocculation Basin 3	m ²	13		
CAB39		35 mm thick granolithic screed, flat, to first half of channel linking first and second halves of Flocculation Basin 3	m ²	2		
	8.13	Casting items in concrete				
		Pipe specials as detailed on Drawing 503081-WTW1-DRG-CC-1526 and related, and 503081-WTW1-DRG-CC-1964:				
CAB40		PSS01	No	1		
CAB41		PSS03	No	1		
CAB42		PSS06	No	3		
	8.21	Watertightness testing:				
		Carry out watertightness test for:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAB43		Coagulation Bay and adjacent overflow chamber	No	1		
CAB44		Flocculation Tank, includes all Sub-basins, common channel and upstream rapid mix area	No	1		
	SANS 1200 L	MEDIUM-PRESSURE PIPELINES				
	8.2.5	Supply and place pipes, valves and specials (short pipe runs): Pipe specials as detailed on Drawing 503081-WTW1-DRG-CC-1526 and related, and 503081-WTW1-DRG-CC-1964:				
CAB45		PSS01	No	1		
CAB46		PSS03	No	1		
CAB47		PSS06	No	3		
CAB48		PSS08	No	3		
CAB49		PSS09	No	1		
CAB50		DN 150 flanged RSV gate valve, epoxy coated	No	3		
	SANS 1200 H	Structural Steelwork				
	8.3	Scheduled items				
	8.3.1	Structural Steel				
CAB51		945 mm long 100x50 HDG PC channel section anchored as specified to support grating in common flocculation channel	No.	12		
CAB52		900 mm long 75x50x6mm HDG angle for supporting Flooring Type 7 on one edge in scour valve chamber, anchored with 160mm long M12 SS316 Hilti HAS (or similar approved) anchor fasteners at 250mm (max) centres, chemically anchored 125mm deep using Sika Anchorfix-2+ or Hilti HIT-RE 500 (or similar approved).	No	3		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.3.7	Handrails (refer to typical handrailing details drawings 503081-GENR-DRG-CC-0307-0308):				
CAB53		a) Horizontal top mounted	m	30		
CAB54		j) Bends	No	17		
CAB55		k) End closures	No	3		
	8.3.8	Ladders, complete and installed (refer to Typical Steel Ladder Details drawings 503081-GENR-DRG-CC-0315-0317):				
		Ladder Type 2 , of height:				
CAB56		up to 2.5 m high	No	1		
	8.3.9	Flooring, complete and installed with frames (refer to Typical Flooring Details drawings 503081-GENR-DRG-CC-0304-0306):				
CAB57		Flooring Detail 2, Flooring Type 2 atop coagulation bay	m ²	4		
CAB58		485x680 mm Flooring Type 2 removable panels, placed near handstops. Refer to Detail 2 on Drawing DRG-CC-1527. Centre panel loosely placed, side panels secured with specified clips.	No	9		
	Spec GF	GRP GRID FLOORING				
	8.1	GRP flooring, complete and installed with frames as per typical detail drawing 503081-GENR-DRG-CC-3205 and related):				
		To valve chambers				
CAB59		Flooring Type 7 without supports or frames (measured separately elsewhere), placed on top of scour valve chambers	m ²	4		
CAB60		425x500 mm loose Flooring Type 7 panel without supports or frames, loosely placed in floc basin sumps	No	3		
	Spec PD	BUILDING WORK				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	10.1	Brickwork: in NFX solid engineering bricks, plastered both sides (steel-floated):				
CAB61		110mm thick wall	m ²	156		
CAB62		230mm brickwork	m ²	12		
	10.2	Plasterwork:				
CAB63		15 mm thick plaster to top of 110 mm wide baffle walls	m ²	13		
	10.7	Miscellaneous				
CAB64		Floc basin masonry baffle wall connections to rc wall, complete as per detail on DRG-CC-1528, 1.3m high	No	21		
		Supply and install, complete, the following items:				
CAB65		HS01 (Gereg or similar approved), including shuttering and grouting in	No	1		
CAB66		HS02 (Gereg or similar approved), including shuttering and grouting in	No	2		
CAB67		HS03 (Gereg or similar approved), including shuttering and grouting in	No	1		
CAB68		HS04 (Gereg or similar approved), including shuttering and grouting in	No	2		
CAB69		HS05 (Gereg or similar approved), including shuttering and grouting in	No	1		
CAB70		HS06 (Gereg or similar approved), including shuttering and grouting in	No	2		
CAB71		Item HS07	No	15		
CAB72		Item HS08	No	1		
CAB73		Item HS09	No	3		
		Construct:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAB74		Brought forward / ... Plastered recess/lip in top course of scour basin brickwork, for framing/keeping in place the flooring panel cover SEDIMENTATION PORTION EARTHWORKS	m	10		
	SANS 1200 D					
	8.3	Scheduled items:				
	8.3.3	Restricted Excavation: a) Excavate for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose				
CAB75		Sumps, channels, etc. b) Extra-over for items under payment reference 8.3.3(a) (SANS 1200 D) for:	m ³	20		
CAB76		2) Hard rock excavation	m ³	10		
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
	8.2.1	Rough: Plane vertical/battered to:				
CAB77		Sides of bases/slabs	m ²	70		
CAB78		Sides of walls	m ²	230		
	8.2.2	Smooth: Plane vertical/battered to:				
CAB79		Sides of walls	m ²	1 235		
CAB80		Sides of beams	m ²	25		
CAB81		Sides of benching in inlet channel	m ²	7		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAB82	8.2.5	Brought forward / ... Plane horizontal to: Soffits of stair landings for prop heights of: over 2.0 m and up to and including 3.0 m Soffits of slabs for prop heights of:	m²	4		
CAB83		up to 2.0 m	m²	28		
CAB84		over 2.0 m and up to and including 3.0 m	m²	5		
CAB85		over 3.0 m and up to and including 4.0 m	m²	18		
CAB86		over 4.0 m and up to and including 5.0 m	m²	22		
CAB87		Soffits of beams for prop heights of: over 3.0 m and up to and including 4.0 m Plane sloping to: Soffits of stairs for prop heights of:	m²	19		
CAB88		up to 2.0 m	m²	13		
CAB89		Plane sloping to: top of benching, back shuttered: 35° and up to 80° to the horizontal Narrow widths: Rough: From 200 up to and including 300 mm	m²	160		
CAB90		Sides of bases/slabs	m	18		
CAB91		Smooth: 200 mm up to and including 300 mm Sides of bases/slabs	m	85		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAB92		Sides of stair landings	m	8		
CAB93		Front of steps (risers)	m	70		
		200 mm up to and including 400 mm				
CAB94		Sides of stairs	m	13		
CAB95		Soffit of baffle wall	m	15		
		Other				
CAB96		250 mm wide groove up to 100 mm deep in slab to accommodate soffit of wall-mounted sluice gate	m	1		
	8.2.6	Box out holes/Form voids:				
		b) Small, other than circular, of area up to and including 0,1m²:				
CAB97		Up to and including 0,5m deep	No	25		
		d) Large, other than circular, of area over 0,1m² and up to and including 0.5m²:				
CAB98		Up to and including 0,5m deep	No	9		
	8.3	Scheduled reinforcement items:				
	8.3.1	Steel bars:				
		Mild steel bars:				
CAB99		8 mm dia	t	1.70		
CAB100		10 mm dia	t	2.50		
		High tensile steel bars				
CAB101		10 mm dia	t	4.20		
CAB102		12 mm dia	t	12.60		
CAB103		16 mm dia	t	16.90		
CAB104		20 mm dia	t	25.30		
CAB105		25 mm dia	t	12.60		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAB106		Brought forward / ...				
	8.4	32 mm dia	t	8.40		
	8.4.2	Scheduled concrete items:				
		Blinding layer in grade 15 MPa/19 mm concrete of:				
CAB107		75 mm thickness	m ²	430		
	8.4.3	Strength concrete:				
		Grade 15 MPa/19 mm concrete to:				
CAB108		Mass concrete in stairs and thrust blocks	m ³	8		
		Grade 25 MPa/19 mm concrete to:				
CAB109		Benching	m ³	65		
		Grade 35 MPa/19 mm (watertight reinforced concrete) to:				
CAB110		Walls	m ³	235		
CAB111		Slabs (including sloping)	m ³	290		
CAB112		Beams	m ³	4		
CAB113		Apron	m ³	3		
		Grade 35 Mpa/19 mm (non watertight reinforced concrete) to:				
CAB114		Staircase	m ³	6		
CAB115		Staircase landings	m ³	2		
	8.4.4	Unformed surface finishes:				
		(a) Wood-floated finish to:				
CAB116		Narrow widths of bases/slabs (including sloping) up to 300 mm wide	m	105		
CAB117		Top of bases/slabs (including sloping)	m ²	78		
		(b) Steel-floated finish to:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAB118		Brought forward / ... Top of landings and walkways Narrow widths up to 300 mm wide	m ²	10		
CAB119		Top of walls	m	120		
CAB120		Top of stairs	m	60		
CAB121		Top of bases/slabs (including sloping) Narrow widths over 300 mm and up to 400 mm	m ²	320		
CAB122		Top of walls	m	125		
CAB123		Top of beams	m	15		
	8.5	Joints: Designated joints, complete, as detailed on drawing 503081-WTW1-DRG-CC-1526 and related, and 503081-GENR-DRG-CC-0301 Joint Type F:				
CAB124		In walls and slabs	m	450		
	8.12	Granolithic Screeding				
CAB125		100 mm (avg) thick granolithic screed, sloped, in desludge channel	m ²	17		
CAB126		55 mm (avg) thick granolithic screed, sloped, in desludge channel	m ²	13		
	8.13	Casting items in concrete Pipe specials as detailed on Drawing 503081-WTW1-DRG-CC-1526 and related, and 503081-WTW1-DRG-CC-1964:				
CAB127		PSS02	No	1		
CAB128		PSS04	No	1		
CAB129		PSS05	No	6		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAB130		Brought forward / ...				
CAB131		PSS07	No	6		
CAB132		Casting in stub end of DN 250 vertical pipe (1500 mm long) in 200 to 300 mm thick concrete floor	No	1		
CAB133		DN 300 concrete pipe in 400 to 500 mm thick concrete wall, including polyurethane swellable seal as specified on drawing	No	1		
CAB133		250 mm long DN 75 class 9 uPVC pipes in baffle wall	No	105		
	8.21	Watertightness testing: Carry out watertightness test for:				
CAB134		Sedimentation tanks	No	3		
CAB135		Sedimentation Tank Trough Collection Channel	No	1		
CAB136		Sedimentation Tank Inlet Channel (from floc tank common channel to inlet at each sedimentation basin)	No	1		
CAB137		Desludging channel	No	1		
	8.24	Preparation of base concrete to receive benching:				
CAB138		Floors	m ²	85		
CAB139		Walls	m ²	115		
	8.28	Miscellaneous				
CAB140		When ordered by the engineer, supplying and mixing in 5% by mass Portland Cement into approved soil or gravel backfill, as specified further in 5.5.22 of SANS 1200 G. Measured per m ³ of sorted, mixed and placed backfill, extra over to the rate for bulk excavation and backfill measured elsewhere	m ³	90		
	SANS 1200 H	Structural Steelwork				
	8.3.7	Handrails (refer to typical handrailing details drawings 503081-GENR-DRG-CC-0307-0308):				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAB141		a) Horizontal top mounted	m	120		
CAB142		e) Sloping top mounted	m	12		
CAB143		j) Bends	No.	18		
CAB144		k) End closures	No.	5		
		Flooring, complete and installed with frames (refer to Typical Flooring Details drawings 503081-GENR-DRG-CC-0304-0306):				
CAB145		Flooring Detail 2, Flooring Type 2	m ²	61		
	SANS 1200 DB	EARTHWORKS (PIPE TRENCHES)				
	8.3	Scheduled items:				
	8.3.2	Excavation:				
		a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material:				
		Pipes over DN 125 mm dia and up to DN 315 for depths:				
		Over and Up to				
CAB146		1,5 m 2,5 m	m	4		
		b) Extra-over for items under payment reference 8.3.2(a) (SANS 1200 DB) for:				
CAB147		2) Hard rock excavation	m ³	4		
	SANS 1200 L	MEDIUM-PRESSURE PIPELINES				
	8.2	Scheduled items:				
	8.2.1	Supply, lay, and bed pipes complete with couplings				
CAB148		DN 300 Class 100D spigot and socket concrete pipe	m	4		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
	8.2.5	Brought forward / ... Supply and place pipes, valves and specials (short pipe runs): Pipe specials as detailed on Drawing 503081-WTW1-DRG-CC-1526 and related, and 503081-WTW1-DRG-CC-1964:				
CAB149		PSS02	No	1		
CAB150		PSS04	No	1		
CAB151		PSS05	No	6		
CAB152		PSS07	No	6		
CAB153		PSS09	No	1		
CAB154		PSS10	No	1		
CAB155		Vertical pipe, 1500 mm long DN 250 HDPE PE 100 PN 10 pipe with stub	No	1		
CAB156		250 mm long DN 75 class 9 uPVC pipes for baffle wall	No	105		
TOTAL OF SECTION CAB CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAC				
		CHEMICAL BUILDING				
	SANS 1200 D	EARTHWORKS				
	8.3.3	Restricted excavation:				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and dispose of, and backfill with material from commercial sources (clean sand unless otherwise indicated)				
CAC1		Total depth up to 2,0 m	m ³	15		
		(b) Extra-over item 8.3.3 (a) for:				
CAC2		2) Hard rock excavation (without explosives)	m ³	2		
		(e) Extra-over item 8.3.3 (a) for				
		1) Hand excavation	m ³	2		
CAC3	8.3.5	Extra excavation to provide working space	m ²	45		
	8.3.4	Importing of materials				
		Extra-over for importation of materials from commercial sources or from borrow pits:				
CAC4		G7 compacted to 95% Modified AASHTO (unless otherwise stated) in 150mm thick layers (unless otherwise stated)	m ³	23		
	SANS 1200 DM	EARTHWORKS (ROADS, SUBGRADE)				
	8.3.3	Treatment of road-bed				
		Roadbed preparation and compaction of material to:				
CAC5		Minimum of 93% of modified AASHTO maximum density	m ³	80		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
	8.2.1	Rough:				
		Plane vertical to:				
CAC6		Sides of strip footings	m ²	20		
CAC7		Sides of bases	m ²	15		
CAC8		Sides of columns in foundations	m ²	7		
CAC9		Sides of foundation walls	m ²	4		
	8.2.2	Smooth:				
		Plane vertical to:				
CAC10		Sides of upstand beams and slabs	m ²	10		
CAC11		Sides of downstand beams	m ²	50		
CAC12		Sides of columns	m ²	65		
CAC13		Sides of walls	m ²	20		
CAC14		Sides of plinths	m ²	2		
		Plane horizontal to:				
		Soffits of slabs for prop heights of:				
CAC15		up to 3.0 m	m ²	7		
		Soffits of beams for prop heights of:				
CAC16		up to 3.0 m	m ²	75		
	8.2.5	Narrow widths:				
		Rough:				
CAC17		Up to 200 mm wide	m	10		
CAC18		Over 200 mm and up to and including 300 mm wide	m	50		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAC19		Brought forward / ... Over 300 mm and up to and including 400 mm wide	m	40		
CAC20		Smooth: Up to 200 mm wide	m	10		
CAC21		Over 200 mm and up to and including 300 mm wide	m	50		
CAC22		Over 300 mm and up to and including 400 mm wide	m	40		
	8.3	Scheduled reinforcement items:				
	8.3.1	Steel bars: Mild steel bars:				
CAC23		8mm	t	0.10		
CAC24		10mm	t	0.15		
		High-tensile steel bars:				
CAC25		10mm	t	1		
CAC26		12mm	t	2		
CAC27		16mm	t	4		
CAC28		20mm	t	1		
CAC29		25mm	t	0.50		
CAC30		32mm	t	0.25		
	8.3.2	High-tensile welded mesh:				
CAC31		Ref No 395 in surface beds	m ²	50		
CAC32		Ref No 617 in surface beds	m ²	25		
	8.4	Scheduled concrete items:				
	8.4.2	Blinding layer in grade 15 MPa/19 mm concrete of:				
CAC33		75 mm thickness	m ²	130		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.4.3	Strength concrete:				
		Grade 25 MPa/19 mm concrete to:				
CAC34		Strip footings	m ³	5.20		
		Grade 35 MPa/19 mm concrete watertight to:				
CAC35		Column bases	m ³	5		
CAC36		Surface beds	m ³	10		
CAC37		Plinths	m ³	1		
CAC38		Sump floors	m ³	2		
CAC39		Trench floors	m ³	3		
CAC40		Walls	m ³	8		
CAC41		Slabs	m ³	0.70		
CAC42		Roof slabs	m ³	22		
CAC43		Upstand beams	m ³	3		
CAC44		Downstand beams	m ³	5		
CAC45		Columns	m ³	4		
CAC46		Columns in foundations	m ³	0.50		
CAC47		Aprons	m ³	5		
CAC48		Stairs and landings	m ³	2		
	8.4.4	Unformed surface finishes:				
		(a) Wood-floated finishes to:				
CAC49		Horizontal surfaces	m ²	138		
CAC50		Narrow surfaces up to 350 mm wide	m ²	9		
		(b) Steel-floated finishes to:				
CAC51		Horizontal surfaces	m ²	52		
CAC52		Narrow surfaces up to 350 mm wide	m ²	5		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.5	Joints:				
		Designated joints, complete, as detailed on drawing 503081-GENR-DRG-CC-0301:				
CAC53		Joint Type A2	m	2		
CAC54		Joint Type F	m	20		
CAC55		Joint Type H	m	2		
CAC56		Joint Type R	m	2		
CAC57		Joint Type E2	m	2		
CAC58		Joint Type T	m	40		
CAC59		Joint Type V	m	2		
CAC60		Joint Type W	m	2		
		Designated joints, complete, as detailed on drawing 503081-GENR-DRG-CC-0309:				
CAC61		Sawcut Joint in 200mm thick concrete slabs	m	51		
		Isolation joints:				
CAC62		10 mm Jointex between concrete surfaces, 200 mm high	m	80		
CAC63		20 mm Jointex between concrete surfaces, 200 mm high	m	37		
	8.12	Granolithic Screeding:				
CAC64		80 mm thick average granolithic screed, sloped.	m ²	50		
	8.23	Concrete protection and proprietary floor finishes:				
		As per Room Finishes Schedule:				
		Epoxy Finish:				
CAC65		Type 3	m ²	75		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	SANS 1200 H	STRUCTURAL STEELWORK				
	8.3	Scheduled items				
	8.3.1	Structural Steel				
CAC66		Roof Structural steel:	t	1.05		
	8.3.7	Handrails (refer to typical handrailing details drawing):				
CAC67		a) Horizontal top mounted	m	3		
	8.3.9	Flooring, complete and installed with frames (refer to Typical Flooring Details drawing):				
CAC68		Floor detail 2, flooring type 19;	m ²	3		
	SANS 1200 HB	CLADDING AND SHEETING				
	8.2.2	Supply and install cladding and sheeting:				
		0,53mm Thick "Safintra SAFLOK 700"				
CAC69		Roof sheeting	m ²	45		
	8.2.3	Supply and install ancillaries:				
		Flashing (of the same material, corrosion protection and finish as the roof sheeting/cladding):				
CAC70		Eaves flashing	m	6		
CAC71		Ridge (apex) flashing	m	15		
CAC72		Barge flashing	m	9		
		Rainwater goods				
CAC73		180mm wide x 180mm deep Gutter	m	9		
CAC74		Gutter stop end	No	2		
CAC75		Stop end outlets	No	1		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAC76		Brought forward / ... 100mm dia. Downpipe fixed with clips at 1000mm centres	m	3		
CAC77		Rainwater down pipe for shoes	No	1		
CAC78	8.2.6	Supply and install insulation: 4mm Thick "Alububble" or equivalent 1983 D10 both sides reflective foil insulation under sheeting :	m ²	45		
	SPEC PD	SPECIFICATION PD: BUILDING WORK				
CAC79	10.1	Brickwork: 280 mm thick cavity brick wall, outside skin in unplastered FBS solid engineering bricks (Corobrik Amber Satin or similar approved) and inside skin in plastered (steel-floated) and painted NFX solid engineering bricks. Refer to drawings 503081-GENR-DRG-CC-0326 & 503081-GENR-DRG-CC-0330 in NFX solid engineering bricks, plastered and painted both sides (steel-floated):	m ²	184		
CAC80	10.3	230mm thick wall Roof finishes: Roof screed	m ²	7		
CAC81		Average 75 mm thick screed to roof slabs Crushed stone to roof slab	m ²	75		
CAC82		Average 80mm Crushed sone on roof slabs Torch-on Waterproofing	m ²	75		
CAC83	10.4	To roofs, including sides and tops of upstand beams Doors and Windows: Doors as per schedule drawing 503081-GENR-DRG-CC-0329:	m ²	75		
CAC84		DA5	No	1		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAC85		Brought forward / ... DA7	No	1		
CAC86		DA3	No	2		
CAC87		Windows as per schedule on Drawing 503081-GENR-DRG-CC-0328 & 503081-GENR-DRG-CC-0332: WA3	No	2		
CAC88		WA4	No	2		
CAC89		WA5	No	9		
	10.7	Miscellaneous work Damp- and waterproofing:				
CAC90		375 micron medium density polyethylene damp proof sheeting under floors	m ²	75		
CAC91		375 micron green medium density polyethylene damp proof course in walls	m ²	12		
		Ant poison, aldrin emulsifiable concentrates solution to SANS 618 spread at a rate recommended by the manufacturer:				
CAC92		Bottoms of foundations, footings and column bases	m ²	55		
CAC93		Under floors	m ²	75		
		Fullbore Rainwater Outlets:				
CAC94		Roof outlet type 3 as per drawing 503081-GENR-DRG-CC-0400 cast in concrete with clamped Derbigum laps to manufacturer's specification including connecting to uPVC pipes	No.	4		
CAC95		80mm Diameter uPVC overflow pipe cast into concrete slabs, beams and columns	No.	8		
TOTAL OF SECTION CAC CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAD				
		FILTER FOUNDATIONS AND BACKWASH SUMPS (3 No.)				
	SANS 1200 D	EARTHWORKS				
	8.3	Scheduled items:				
	8.3.3	Restricted Excavation:				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose				
CAD1		Filter foundation and backwash sump	m ³	45		
		b) Extra-over for items under payment reference 8.3.3(a) for:				
CAD2		2) Hard rock excavation (without explosives)	m ³	16		
	SANS 1200 DB	EARTHWORKS (PIPE TRENCHES)				
	8.3	Scheduled items:				
	8.3.2	Excavation:				
		a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material:				
		Pipes over DN 375 and up to and including DN 500 for depths:				
		Over and Up to				
CAD3		0,5 m 1,5 m	m	13		
		b) Extra-over for items under payment reference 8.3.2(a) (SANS 1200 DB) for:				
		2) Hard rock excavation				
CAD4		(i) By means of explosives	m ³	3		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAD5		Brought forward / ...				
		(ii) Without explosives	m ³	4		
	SANS 1200 LB	BEDDING (PIPES)				
	8.2.2	Supply only of bedding by importation:				
	8.2.2.3	From commercial sources:				
CAD6		Selected granular material	m ³	7		
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
	8.2.1	Rough:				
		Plane vertical/battered to:				
CAD7		Sides of sump walls	m ²	29		
	8.2.2	Smooth:				
		Plane vertical/battered to:				
CAD8		Sides of walls and slab	m ²	116		
	8.2.5	Narrow widths:				
		Rough:				
CAD9		Up to 200 mm wide	m	23		
	8.3	Scheduled reinforcement items:				
	8.3.1	Steel bars:				
		Mild steel bars:				
CAD10		8 mm dia	t	0.09		
CAD11		10 mm dia	t	0.15		
		High tensile steel bars:				
CAD12		10 mm dia	t	0.30		
CAD13		12 mm dia	t	1.10		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAD14		Brought forward / ... 16 mm dia	t	1.10		
CAD15		20 mm dia	t	2		
CAD16		25 mm dia	t	1		
CAD17		32 mm dia	t	0.60		
	8.4	Scheduled concrete items:				
	8.4.2	Blinding layer in 15 MPa/19 mm concrete of :				
CAD18		75 mm thickness	m ²	87		
	8.4.3	Strength concrete :				
		Grade 25 MPa/19 mm				
CAD19		Benching	m ³	1		
		Grade 35 Mpa/19 mm (watertight reinforced concrete) to :				
CAD20		Walls	m ³	12		
CAD21		Slabs (including sloping)	m ³	30		
	8.4.4	Unformed surface finishes:				
		(b) Steel-floated finish:				
CAD22		Top of walls	m ²	5.50		
CAD23		Top of floor slabs	m ²	86.50		
	8.5	Joints:				
		Designated joints, complete, as detailed on drawing 503081-WTW1-DRG-CC-1600:				
		Joint Type F:				
CAD24		(i) In 200mm thick vertical walls	m	52		
	8.13	Casting items in concrete :				
		Pipe special as shown on drawing no 503081-WTW1-DRG-CC-1600 and DRG-CC-1964				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAD25	8.21	Brought forward / ... PSF01	No	3		
CAD26	SANS 1200 L	Watertightness testing: Carry out watertightness test for: Filter backwash bund	No	3		
CAD27	8.2.5	MEDIUM-PRESSURE PIPELINES Supply and place pipes, valves and specials (short pipe runs): as shown on drawing no 503081-WTW1-DRG-CC-1600 and DRG-CC-1964	No	3		
CAD28	Spec PD 10.7	PSF01 BUILDING WORK Miscellaneous: Supply and install of 30mm thick mastic asphalt layer as shown on drawing no 503081-WTW1-DRG-CC-1600, complete	No	3		
TOTAL OF SECTION CAD CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAE				
		PUMP AND CLEARWELL COMPLEX				
	SANS 1200 D	EARTHWORKS				
	8.3.3	Restricted excavation:				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and dispose of, and backfill with material from commercial sources (clean sand unless otherwise indicated)				
CAE1		Total depth up to 2,0 m	m ³	210		
CAE2		Total depth up to 4,0 m	m ³	50		
		(b) Extra-over item 8.3.3 (a) for:				
CAE3		2) Hard rock excavation (without explosives)	m ³	32		
		(e) Extra-over item 8.3.3 (a) for				
CAE4		1) Hand excavation	m ³	4		
CAE5	8.3.5	Extra excavation to provide working space	m ²	417		
	8.3.4	Importing of materials				
		Extra-over for importation of materials from commercial sources or from borrow pits:				
CAE6		G7 compacted to 95% Modified AASHTO (unless otherwise stated) in 150mm thick layers (unless otherwise stated)	m ³	327		
	SANS 1200 DM	EARTHWORKS (ROADS, SUBGRADE)				
	8.3.3.3	Treatment of road-bed				
		Roadbed preparation and compaction of material to:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAE7		Brought forward / ...				
		Minimum of 93% of modified AASHTO maximum density (under footings, cable trench floors, and bases)	m ³	420		
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
	8.2.1	Rough:				
		Plane vertical to:				
CAE8		Sides of strip footings	m ²	111		
CAE9		Sides of bases	m ²	70		
CAE10		Sides of columns in foundations	m ²	22		
CAE11		Sides of foundation walls	m ²	32		
	8.2.2	Smooth:				
		Plane vertical to:				
CAE12		Sides of upstand beams and slabs	m ²	210		
CAE13		Sides of downstand beams	m ²	60		
CAE14		smooth fw sides of sump walls	m ²	30		
CAE15		Sides of columns	m ²	210		
CAE16		Sides of walls	m ²	2 100		
CAE17		Sides of door surrounds	m ²	62		
CAE18		Sides of plinths	m ²	32.50		
CAE19		Stepped sides of stairs 360mm high	m ²	2		
		Plane horizontal to:				
		Soffits of slabs for prop heights of:				
CAE20		up to 4.0 m	m ²	170		
CAE21		up to 6.0 m	m ²	530		
		Soffits of beams for prop heights of:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAE22		up to 3.0 m	m ²	30		
CAE23		up to 6.0 m	m ²	75		
	8.2.5	Narrow widths:				
		Rough:				
CAE24		Up to 200 mm wide	m	50		
CAE25		Over 200 mm and up to and including 300 mm wide	m	265		
CAE26		Over 300 mm and up to and including 400 mm wide	m	40		
		Smooth:				
CAE27		Up to 200 mm wide	m	200		
CAE28		Over 200 mm and up to and including 300 mm wide	m	300		
CAE29		Over 300 mm and up to and including 400 mm wide	m	150		
	8.3	Scheduled reinforcement items:				
	8.3.1	Steel bars:				
		Mild steel bars:				
CAE30		8mm	t	2		
CAE31		10mm	t	5		
		High-tensile steel bars:				
CAE32		10mm	t	32		
CAE33		12mm	t	40		
CAE34		16mm	t	24		
CAE35		20mm	t	32		
CAE36		25mm	t	24		
CAE37		32mm	t	8		
	8.3.2	High-tensile welded mesh:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAE38		Ref No 395 in surface beds	m ²	500		
CAE39		Ref No 617 in surface beds	m ²	650		
	8.4	Scheduled concrete items:				
	8.4.2	Blinding layer in grade 15 MPa/19 mm concrete of:				
CAE40		75 mm thickness	m ²	1 150		
	8.4.3	Strength concrete:				
		Grade 25 MPa/19 mm concrete to:				
CAE41		Strip footings	m ³	13		
		Grade 35 MPa/19 mm concrete watertight to:				
CAE42		Column bases	m ³	19		
CAE43		Surface beds	m ³	85		
CAE44		Plinths	m ³	30		
CAE45		Sump floors	m ³	8		
CAE46		Trench floors	m ³	10		
CAE47		Door surrounds	m ³	17		
CAE48		Walls	m ³	350		
CAE49		Slabs	m ³	220		
CAE50		Roof slabs	m ³	215		
CAE51		Upstand beams	m ³	17		
CAE52		Downstand beams	m ³	11		
CAE53		Columns	m ³	18		
CAE54		Columns in foundations	m ³	3		
CAE55		Aprons	m ³	15		
CAE56		Stairs and landings	m ³	2		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.4.4	Unformed surface finishes:				
		(a) Wood-floated finishes to:				
CAE57		Horizontal surfaces	m ²	1 205		
		(b) Steel-floated finishes to:				
CAE58		Horizontal surfaces	m ²	165		
CAE59		Narrow surfaces up to 350 mm wide	m ²	150		
		(c) Power-floated finishes to:				
CAE60		Horizontal surfaces	m ²	515		
	8.5	Joints:				
		Designated joints, complete, as detailed on drawing 503081-GENR-DRG-CC-0301:				
CAE61		Joint Type A2	m	50		
CAE62		Joint Type F	m	5		
CAE63		Joint Type H	m	10		
CAE64		Joint Type R	m	2		
CAE65		Joint Type E2	m	12		
CAE66		Joint Type T	m	100		
CAE67		Joint Type V	m	15		
CAE68		Joint Type W	m	18		
		Designated joints, complete, as detailed on drawing 503081-GENR-DRG-CC-0309:				
CAE69		Sawcut Joint in 200mm thick concrete slabs	m	210		
		Isolation joints:				
CAE70		10 mm Jointex between concrete surfaces, 200 mm high	m	200		
CAE71		20 mm Jointex between concrete surfaces, 200 mm high	m	30		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.12	Granolithic Screeding:				
CAE72		80 mm thick average granolithic screed, sloped.	m²	300		
CAE73		40 mm thick average granolithic screed, sloped.	m²	85		
	8.23	Concrete protection and proprietary floor finishes:				
		As per Room Finishes Schedule:				
		Epoxy Finish:				
CAE74		Type 3	m²	350		
	8.13	Casting items in concrete:				
		Pipe specials as detailed on Drawing 503081-WTW1-DRG-CC-1676:				
CAE75		DN65 spool piece (Item 3 on drawing 503081-WTW1-DRG-CC-1676)	No.	2		
CAE76		DN80 spool piece (Item 6 on drawing 503081-WTW1-DRG-CC-1676)	No.	2		
CAE77		DN150 spool piece (Item 7 on drawing 503081-WTW1-DRG-CC-1676)	No.	2		
CAE78		DN250 spool piece (Item 1, 2, and 4 on drawing 503081-WTW1-DRG-CC-1676)	No.	6		
CAE79		DN350 spool piece (Item 5 on drawing 503081-WTW1-DRG-CC-1676)	No.	1		
	SANS 1200 H	STRUCTURAL STEELWORK				
	8.3	Scheduled items				
	8.3.1	Structural Steel				
CAE80		Roof Structural steel:	t	10		
CAE81		254x146x43 UB Crawl beam	t	3		
CAE82		305x165x46 UB	t	2		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAE83		Brought forward / ... Walkway access staircase, 1800mm high x 1500mm long	No.	4		
	8.3.7	Handrails (refer to typical handrailing details drawing):				
CAE84		a) Horizontal top mounted	m	31		
CAE85		b) Sloping top mounted	m	24		
	8.3.8	Ladders, complete and installed (refer to Steel Ladder Details drawings): Ladder Type 1 with cage, of height:				
CAE86		over 3m up to 4m	No.	3		
CAE87		over 4m up to 5m	No.	2		
	8.3.9	Flooring, complete and installed with frames (refer to Typical Flooring Details drawing):				
CAE88		Floor detail 2, flooring type 6 with cast in steel angle;	m ²	20		
CAE89		Floor detail 2, flooring type 19;	m ²	20		
	8.3.14	Miscellaneous steel items: (a) Items measured by number:				
CAE90		Manway access covers as per detail on Drawing 503081-GENR-DRG-CC-0331.	No.	5		
	SANS 1200 HB	CLADDING AND SHEETING				
	8.2.2	Supply and install cladding and sheeting: 0,53mm Thick "Safintra SAFLOK 700"				
CAE91		Roof sheeting	m ²	335		
	8.2.3	Supply and install ancillaries:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Flashing (of the same material, corrosion protection and finish as the roof sheeting/cladding):				
CAE92		Eaves flashing	m	53		
CAE93		Ridge (apex) flashing	m	50		
CAE94		Barge flashing	m	34		
		Rainwater goods				
CAE95		180mm wide x 180mm deep Gutter	m	34		
CAE96		Gutter stop end	No	2		
CAE97		Stop end outlets	No	1		
CAE98		100mm dia. Downpipe fixed with clips at 1000mm centres	m	60		
CAE99		Rainwater down pipe for shoes	No	10		
	8.2.6	Supply and install insulation:				
CAE100		4mm Thick "Alububble" or equivalent 1983 D10 both sides reflective foil insulation under sheeting :	m²	335		
CAE101		100mm Minimum thickness "LAMBDA BOARD" or equivalent laminated polyisocyanurate core board on both sides, faced with white washable coated fiberglass tissue, fixed above purlins in conjunction with roof covering:	m²	335		
	SPEC PD	SPECIFICATION PD: BUILDING WORK				
	10.1	Brickwork:				
CAE102		280 mm thick cavity brick wall, outside skin in unplastered FBS solid engineering bricks (Corobrik Amber Satin or similar approved) and inside skin in plastered (steel-floated) and painted NFX solid engineering bricks. Refer to drawings 503081-GENR-DRG-CC-0326 & 503081-GENR-DRG-CC-0330	m²	805		
		in NFX solid engineering bricks, plastered and painted both sides (steel-floated):				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAE103	10.3	Brought forward / ... 230mm thick wall	m²	155		
		Roof finishes: Roof screed				
CAE104		Average 75 mm thick screed to roof slabs	m²	670		
		Crushed stone to roof slab				
CAE105		Average 80mm Crushed sone on roof slabs	m³	30		
		Torch-on Waterproofing				
CAE106	10.4	To roofs, including sides and tops of upstand beams	m²	770		
		Doors and Windows: Doors as per schedule drawing 503081-GENR-DRG-CC-0329:				
CAE107		DA4	No	5		
CAE108		DA3	No	1		
CAE109		DA2	No	3		
CAE110		DA1	No	3		
		Windows as per schedule on Drawing 503081-GENR-DRG-CC-0328 & 503081-GENR-DRG-CC-0332:				
CAE111		WA1	No	11		
CAE112		WA2	No	1		
CAE113		WA6	No	1		
	10.7	Miscellaneous work				
		Drainage:				
CAE114		110 mm Diameter UPVC drainage pipes below surface bed from sump to drain.	m	18		
CAE115		Extra over 110 mm diameter pipes for bends	No	6		
		Damp- and waterproofing:				
CAE116		375 micron medium density polyethylene damp proof sheeting under floors	m²	1 050		
		Carried forward / ...				

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAE117		Brought forward / ... 375 micron green medium density polyethylene damp proof course in walls Ant poison, aldrin emulsifiable concentrates solution to SANS 618 spread at a rate recommended by the manufacturer:	m²	125		
CAE118		Bottoms of foundations, footings and column bases	m²	150		
CAE119		Under floors	m²	1 050		
CAE120		Pavers: Supply and install SANS 1058 50mm thick grey concrete bevel bond pavers without jointing.	m²	55		
CAE121		Airvents: Manufacture, supply and install airvents as per drawing no. 503081-GENR-DRG-CC-0314	No.	4		
CAE122		Fullbore Rainwater Outlets: Roof outlet type 3 as per drawing 503081-GENR-DRG-CC-0400 cast in concrete with clamped Derbigum laps to manufacturer's specification including connecting to uPVC pipes	No.	4		
CAE123		80mm Diameter uPVC overflow pipe cast into concrete slabs, beams and columns	No.	8		
	SANS 1200 L	MEDIUM PRESSURE PIPELINES				
	8.2.5	Supply and place pipes, valves, and specials (short pipe runs) Stainless steel grade 304, flanged, 4.5 mm minimum wall thickness, drilled to SANS 1123 Table 1600/3 and Table 4000/3 where applicable (refer drawing number 503081-WTW1-DRG-CC-1676)				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Spool pieces (refer drawing number 503081-WTW1-DRG-CC-1296)				
CAE124		Item 1: DN250 spool piece with puddle flange, fully flanged, 750 mm F/F, PN16	No	3		
CAE125		Item 2: DN250 spool piece with puddle flange, fully flanged, 750 mm F/F, PN16	No	2		
CAE126		Item 3: DN65 spool piece with puddle flange, fully flanged, 750 mm F/F, PN16	No	2		
CAE127		Item 4: DN250 spool piece with puddle flange, fully flanged, 700 mm F/F, PN16	No	1		
CAE128		Item 5: DN350 spool piece with puddle flange, fully flanged, 700 mm F/F, PN40	No	1		
CAE129		Item 6: DN80 spool piece with puddle flange, fully flanged, 750 mm F/F, PN16	No	2		
CAE130		Item 7: DN150 spool piece with puddle flange, fully flanged, 700 mm F/F, PN16	No	2		
		Mild steel grade X52, flanged, 4.5 mm minimum wall thickness, painted internally and externally with two pack epoxy for immersed steel fabrications (D5.5.1), drilled to SANS 1123 Table 1600/3 and Table 4000/3 where applicable (refer drawing number 503081-WTW1-DRG-CC-1676)				
CAE131		Item 11: DN250 pulled bend, 90°, fully flanged, barrel 160 mm C/F, PN16	No	1		
CAE132		Item 12: DN350 pulled bend, 90°, fully flanged, barrel 355 mm C/F, PN40	No	1		
CAE133		Item 13: DN80 pulled bend, flanged one end, PN16	No	2		
CAE134		Item 14: DN150 pulled bend, flanged one end, PN16	No	1		
		High-lift pump station (refer drawing number 503081-WTW1-DRG-CC-1676)				
CAE135		Item 8: DN50 flanged air valve, PN16	No	1		
CAE136		Item 9: DN80 resilient seal gate valve with non-rising spindle, PN16	No	2		
CAE137		Item 10: DN150 resilient seal gate valve with non-rising spindle, PN16	No	1		
CAE138		Item 15: DN50 flanged air valve, PN40	No	1		
TOTAL OF SECTION CAE CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAF				
		ADMINISTRATION BUILDING				
	SANS 1200 D	EARTHWORKS				
	8.3.3	Restricted excavation:				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and dispose of, and backfill with material from commercial sources (clean sand unless otherwise indicated)				
CAF1		Total depth up to 2,0 m	m ³	166		
		(b) Extra-over item 8.3.3 (a) for:				
CAF2		2) Hard rock excavation (without explosives)	m ³	48		
		(e) Extra-over item 8.3.3 (a) for				
CAF3		1) Hand excavation	m ³	48		
CAF4	8.3.14	Extra over item PSD 8.3.3 (a) for temporary stockpiling	m ³	50		
	8.3.4	Importing of materials				
		Extra-over for importation of materials from commercial sources or from borrow pits:				
CAF5		G7 compacted to 95% Modified AASHTO (unless otherwise stated) in 150mm thick layers (unless otherwise stated)	m ³	200		
	SANS 1200 DM	EARTHWORKS (ROADS, SUBGRADE)				
	8.3.3	Treatment of road-bed				
		Roadbed preparation and compaction of material to:				
CAF6		Minimum of 93% of modified AASHTO maximum density	m ³	55		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
	8.2.1	Rough:				
		Plane vertical to:				
CAF7		Sides of strip footings	m ²	91		
CAF8		Sides of bases	m ²	10		
CAF9		Sides of columns in foundations	m ²	4		
	8.2.3	Smooth:				
		Plane vertical to:				
CAF10		Sides of downstand beams	m ²	50		
CAF11		Sides of columns	m ²	14		
CAF12		Stepped sides of stairs 360mm high	m ²	10		
		Plane horizontal to:				
		Soffits of beams for prop heights of:				
CAF13		up to 3.0 m	m ²	33		
	8.2.5	Narrow widths:				
		Rough:				
CAF14		Up to 200 mm wide	m	20		
CAF15		Over 200 mm and up to and including 300 mm wide	m	20		
		Smooth:				
CAF16		Up to 200 mm wide	m	20		
CAF17		Over 200 mm and up to and including 300 mm wide	m	20		
	8.3	Scheduled reinforcement items:				
	8.3.1	Steel bars:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Mild steel bars:				
CAF18		8mm	t	0.83		
CAF19		10mm	t	1.24		
		High-tensile steel bars:				
CAF20		10mm	t	0.80		
CAF21		12mm	t	0.50		
CAF22		16mm	t	0.25		
CAF23		20mm	t	0.10		
CAF24		25mm	t	0.10		
CAF25		32mm	t	0.10		
	8.3.2	High-tensile welded mesh:				
CAF26		Ref No 245 in surface beds	m ²	300		
	8.4	Scheduled concrete items:				
	8.4.2	Blinding layer in grade 15 MPa/19 mm concrete of:				
CAF27		75 mm thickness	m ²	10		
	8.4.3	Strength concrete:				
		Grade 15 MPa/13 mm concrete in:				
CAF28		Below ground cavity wall infill	m ³	12		
		Grade 25 MPa/19 mm concrete in:				
CAF29		Strip footings	m ³	30		
CAF30		Brickwork column infill	m ³	2		
CAF31		Surface beds	m ³	40		
CAF32		Stairs and landing	m ³	7		
		Grade 30 MPa/19 mm concrete in:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAF33	8.4.4	Columns	m³	2		
CAF34		Downstand beams	m³	10		
		Unformed surface finishes:				
		(a) Wood-floated finishes to:				
CAF35		Horizontal surfaces	m²	300		
		(b) Steel-floated finishes to:				
CAF36		Horizontal surfaces	m²	5		
CAF37		Narrow surfaces up to 350 mm wide	m²	2		
		(c) Power-floated finishes to:				
CAF38	8.5	Horizontal surfaces	m²	20		
		Joints:				
		Designated joints, complete, as detailed on drawing 503081-GENR-DRG-CC-0309:				
CAF39		Sawcut Joint in 200mm thick concrete slabs	m	100		
		Isolation joints:				
CAF40	8.12	10 mm Jointex between concrete surfaces, 200 mm high	m	400		
		Granolithic Screeding:				
CAF41		40 mm thick average granolithic screed, sloped.	m²	300		
	SANS 1200 H	STRUCTURAL STEELWORK				
	8.3.7	Handrails (refer to typical handrailing details drawing):				
CAF42		a) Horizontal top mounted	m	56		
CAF43		b) Sloping top mounted	m	24		
	SANS 1200 HB	CLADDING AND SHEETING				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.2.2	Supply and install cladding and sheeting:				
		0,53mm Thick "Safintra SAFLOK 700"				
CAF44		Roof sheeting	m ²	300		
	8.2.3	Supply and install ancillaries:				
		Flashing (of the same material, corrosion protection and finish as the roof sheeting/cladding):				
CAF45		Eaves flashing	m	25		
CAF46		Ridge (apex) flashing	m	24		
CAF47		Barge flashing	m	24		
		Rainwater goods				
CAF48		180mm wide x 180mm deep Gutter	m	25		
CAF49		Gutter stop end	No	2		
CAF50		Stop end outlets	No	2		
CAF51		100mm dia. Downpipe fixed with clips at 1000mm centres	m	24		
CAF52		Rainwater down pipe for shoes	No	8		
	8.2.6	Supply and install insulation:				
CAF53		4mm Thick "Alububble" or equivalent 1983 D10 both sides reflective foil insulation under sheeting, and above roof insulation boards:	m ²	300		
	SPEC PD	SPECIFICATION PD: BUILDING WORK				
	10.1	Brickwork:				
CAF54		280 mm thick cavity brick wall, outside skin in unplastered FBS solid engineering bricks (Corobrik Amber Satin or similar approved) and inside skin in plastered (steel-floated) and painted NFX solid engineering bricks. Refer to drawings 503081-GENR-DRG-CC-0326 & 503081-GENR-DRG-CC-0330	m ²	410		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAF55	10.4	Brought forward / ... in NFX solid engineering bricks, plastered and painted both sides (steel-floated): 230mm thick wall	m ²	775		
CAF56		Doors and Windows: Doors as per schedule drawing 503081-GENR-DRG-CC-0324 & 503081-GENR-CC-0340:				
CAF56		D2	No	6		
CAF57		D3	No	1		
CAF58		D4	No	2		
CAF59		D5	No	4		
		Windows as per window schedule 503081-GENR-DRG-CC-0323 & 503081-GENR-DRG-CC-0331:				
CAF60		W1	No	5		
CAF61		W2	No	1		
CAF62		W3	No	6		
CAF63		W4	No	1		
CAF64		W5	No	1		
CAF65		W7	No	1		
CAF66		W10	No	1		
		Facades as per facade schedule 503081-GENR-DRG-CC-0325:				
CAF67		F1	No	1		
CAF68		F2	No	1		
CAF69		F3	No	1		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	10.5	Ceilings and Bulkheads:				
		Plaster-board ceiling as per finishes schedule on Drawing 503081-GENR-DRG-CC-0326:				
CAF70		Fixed ceiling	m ²	150		
		Fibre-cement ceiling as per finishes schedule on Drawing 503081-GENR-DRG-CC-0326:				
CAF71		Fixed ceiling	m ²	150		
		Cornices:				
CAF72		76mm coved cornices	m	400		
	10.6	Carpentry & Joinery:				
		Roof Trusses:				
CAF73		SANS approved pre-fabricated trusses	Sum	-		
		Cupboards and countertops:				
CAF74		to Rooms as per details on drawings 503081-GENR-DRG-CC-0336, 0337 & 0338	Sum	-		
	10.7	Miscellaneous				
		Plumbing:				
CAF75		Waste pipework for 10 sanitary fittings or points including all bends etc., up to and including gulley or in ground up to 1m from building including all stub-stacks, two-way vent valves, etc.	Sum	-		
CAF76		Hot water pipework reticulation in ceiling voids from geyser, to all drop pipework points feeding 10 sanitary fittings or water points including all bends, isolation valves, insulated, etc.	Sum	-		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAF77		Brought forward / ... Hot water pipework reticulation chased into	Sum	-		
CAF78		Cold water pipework reticulation to walls, in in ceilings voids etc. from main supply to building and to all drop or connection pipework points feeding 34 sanitary fittings and 2 geysers and heat pumps or points including all bends, isolation valves, etc.	Sum	-		
CAF79		Cold water pipework reticulation chased into walls from drop pipework positions to 20 sanitary fittings or water points including all bends, insulated etc. (pipework from ceiling level to fittings or water points)	Sum	-		
CAF80		Sanitaryware: Sanitary fittings taps and bathroom accessories, complete with waste unions, traps, angle valves, connections, etc., as per sanitary schedule	Sum	-		
CAF81		Damp and waterproofing 375 micron medium density polyethylene damp proof sheeting under floors	m ²	300		
CAF82		375 micron green medium density polyethylene damp proof course in walls	m ²	50		
CAF83		Ant poison, aldrin emulsifiable concentrates solution to SANS 618 spread at a rate recommended by the manufacturer: Bottoms of foundations, footings and column bases	m ²	100		
CAF84		Under floors	m ²	300		
CAF85		Other 2500 litre water Tanks incl. all fittings.	No.	2		
CAF86		Floor finishes as per finishes schedule: drawing 503081-GENR-DRG-CC-0326	m ²	300		
	SANS 1200 A 8.5	Sums stated provisionally by the Engineer				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		b) For work to be executed by a subcontractor, and/or for goods, materials, plant and/or services to be supplied to the Site				
CAF87		Furniture	Prov. Sum	-	500 000	500 000.00
CAF88		Overheads, charges and profit on item above	%	500 000		
TOTAL OF SECTION CAF CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAG				
		STAFF HOUSING				
	SANS 1200 D	EARTHWORKS				
	8.3.3	Restricted excavation:				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and dispose of, and backfill with material from commercial sources (clean sand unless otherwise indicated)				
CAG1		Total depth up to 2,0 m	m ³	165		
		(b) Extra-over item 8.3.3 (a) for:				
CAG2		2) Hard rock excavation (without explosives)	m ³	18		
		(e) Extra-over item 8.3.3 (a) for				
CAG3		1) Hand excavation	m ³	18		
	8.3.4	Importing of materials				
		Extra-over for importation of materials from commercial sources or from borrow pits:				
CAG4		G7 compacted to 95% Modified AASHTO (unless otherwise stated) in 150mm thick layers (unless otherwise stated)	m ³	63		
	SANS 1200 DM	EARTHWORKS (ROADS, SUBGRADE)				
	8.3.3	Treatment of road-bed				
		Roadbed preparation and compaction of material to:				
CAG5		Minimum of 93% of modified AASHTO maximum density	m ³	100		
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.2.1	Rough:				
		Plane vertical to:				
CAG6		Sides of strip footings	m ²	75		
	8.2.3	Smooth:				
		Plane vertical to:				
CAG7		Stepped sides of stairs 360mm high	m ²	15		
	8.3	Scheduled reinforcement items:				
		Steel bars:				
		Mild steel bars:				
CAG8		8mm	t	1.50		
CAG9		10mm	t	0.75		
		High-tensile steel bars:				
CAG10		10mm	t	0.75		
CAG11		12mm	t	0.75		
CAG12		16mm	t	0.30		
CAG13		20mm	t	0.10		
CAG14		25mm	t	0.10		
CAG15		32mm	t	0.10		
	8.3.2	High-tensile welded mesh:				
CAG16		Ref No 245 in surface beds	m ²	60		
	8.4	Scheduled concrete items:				
	8.4.2	Blinding layer in grade 15 MPa/19 mm concrete of:				
CAG17		75 mm thickness	m ²	30		
	8.4.3	Strength concrete:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Grade 25 MPa/19 mm concrete to:				
CAG18		Strip footings	m³	54		
CAG19		Surface beds	m³	33		
CAG20		Stairs and landing	m³	6		
	8.4.4	Unformed surface finishes:				
		(a) Wood-floated finishes to:				
CAG21		Horizontal surfaces	m²	225		
		(b) Steel-floated finishes to:				
CAG22		Horizontal surfaces	m²	15		
		(c) Power-floated finishes to:				
CAG23		Horizontal surfaces	m²	15		
	8.5	Joints:				
		Designated joints, complete, as detailed on drawing 503081-GENR-DRG-CC-0309:				
CAG24		Sawcut Joint in 200mm thick concrete slabs	m	60		
		Isolation joints:				
CAG25		10 mm Jointex between concrete surfaces, 200 mm high	m	102		
	SANS 1200 HB	CLADDING AND SHEETING				
	8.2.2	Supply and install cladding and sheeting:				
		0,53mm Thick "Safintra SAFLOK 700"				
CAG26		Roof sheeting	m²	225		
	8.2.3	Supply and install ancillaries:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Flashing (of the same material, corrosion protection and finish as the roof sheeting/cladding):				
CAG27		Eaves flashing	m	42		
CAG28		Ridge (apex) flashing	m	30		
CAG29		Barge flashing	m	60		
		Rainwater goods				
CAG30		180mm wide x 180mm deep Gutter	m	60		
CAG31		Gutter stop end	No	4		
CAG32		Stop end outlets	No	4		
CAG33		100mm dia. Downpipe fixed with clips at 1000mm centres	m	24		
CAG34		Rainwater down pipe for shoes	No	4		
	8.2.6	Supply and install insulation:				
CAG35		4mm Thick "Alububble" or equivalent 1983 D10 both sides reflective foil insulation under sheeting :	m ²	225		
	SPEC PD	SPECIFICATION PD: BUILDING WORK				
	10.1	Brickwork:				
CAG36		280 mm thick cavity brick wall, outside skin in unplastered FBS solid engineering bricks (Corobrik Amber Satin or similar approved) and inside skin in plastered (steel-floated) and painted NFX solid engineering bricks. Refer to drawings 503081-GENR-DRG-CC-0326 & 503081-GENR-DRG-CC-0330	m ²	351		
		in NFX solid engineering bricks, plastered and painted both sides (steel-floated):				
CAG37		230mm thick wall	m ²	261		
	10.4	Doors and Windows:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Doors as per schedule drawing 503081-GENR-DRG-CC-0324 & 503081-GENR-CC-0340:				
CAG38		D1	No	3		
CAG39		D2	No	9		
		Windows as per window schedule 503081-GENR-DRG-CC-0323 & 503081-GENR-DRG-CC-0331:				
CAG40		W2	No	3		
CAG41		W3	No	3		
CAG42		W6	No	9		
CAG43		W7	No	6		
CAG44		W8	No	3		
	10.5	Ceilings and Bulkheads:				
		Plaster-board ceiling as per finishes schedule on Drawing 503081-GENR-DRG-CC-0326:				
CAG45		Fixed ceiling	m ²	225		
		Cornices:				
CAG46		76mm coved cornices	m	400		
	10.6	Carpentry and Joinery:				
		Roof Trusses:				
CAG47		SANS approved pre-fabricated trusses:	Sum	-		
		Cupboards and countertops:				
CAG48		to Rooms as per details on drawings 503081-GENR-DRG-CC-0335	Sum	-		
	10.7	Miscellaneous				
		Plumbing				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Plumbing drainage and Water supply				
CAG49		Waste pipework for 10 sanitary fittings or points including all bends etc., up to and including gulley or in ground up to 1m from building including all stub-stacks, two-way vent valves, etc.	Sum	-		
CAG50		Hot water pipework reticulation in ceiling voids from geyser, to all drop pipework points feeding 10 sanitary fittings or water points including all bends, isolation valves, insulated, etc.	Sum	-		
CAG51		Hot water pipework reticulation chased into walls from drop pipework positions to 20 sanitary fittings or water points including all bends, insulated etc. (pipework from ceiling level to fittings or water points)	Sum	-		
CAG52		Cold water pipework reticulation to walls, in in ceilings voids etc. from main supply to building and to all drop or connection pipework points feeding 34 sanitary fittings and 2 geysers and heat pumps or points including all bends, isolation valves, etc.	Sum	-		
CAG53		Cold water pipework reticulation chased into walls from drop pipework positions to 20 sanitary fittings or water points including all bends, insulated etc. (pipework from ceiling level to fittings or water points)	Sum	-		
		Sanitaryware:				
CAG54		Sanitary fittings taps and bathroom accessories, complete with waste unions, traps, angle valves, connections, etc..., as per sanitary schedule	Sum	-		
		Damp and waterproofing				
CAG55		375 micron medium density polyethylene damp proof sheeting under floors	m ²	225		
CAG56		375 micron green medium density polyethylene damp proof course in walls	m ²	30		
		Ant poison, aldrin emulsifiable concentrates solution to SANS 618 spread at a rate recommended by the manufacturer:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAG57	SANS 1200 A 8.5	Brought forward / ...				
		Bottoms of foundations, footings and column bases	m²	45		
CAG58		Under floors	m²	225		
		Other				
CAG59		2500 litre water Tanks incl. all fittings.	No.	6		
CAG60		Floor finishes as per finishes schedule: drawing 503081-GENR-DRG-CC-0326	m²	225		
		Sums stated provisionally by the Engineer				
		b) For work to be executed by a subcontractor, and/or for goods, materials, plant and/or services to be supplied to the Site				
CAG61		Furniture	Prov. Sum	-	150 000	150 000.00
CAG62		Overheads, charges and profit on item above	%	150 000		
TOTAL OF SECTION CAG CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAH				
		GUARD HOUSE				
	SANS 1200 D	EARTHWORKS				
	8.3.3	Restricted excavation:				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and dispose of, and backfill with material from commercial sources (clean sand unless otherwise indicated)				
CAH1		Total depth up to 2,0 m	m ³	25		
		(b) Extra-over item 8.3.3 (a) for:				
CAH2		2) Hard rock excavation (without explosives)	m ³	3		
		(e) Extra-over item 8.3.3 (a) for				
CAH3		1) Hand excavation	m ³	3		
	8.3.4	Importing of materials for fill under floor and foundations				
CAH4		G7 compacted to 95% Modified AASHTO (unless otherwise stated) in 150mm thick layers (unless otherwise stated)	m ³	8		
	SANS 1200 DM	EARTHWORKS (ROADS, SUBGRADE)				
	8.3.3.3	Treatment of road-bed				
		Roadbed preparation and compaction of material to:				
CAH5		Minimum of 93% of modified AASHTO maximum density	m ³	20		
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
	8.2.1	Rough:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAH6	8.2.3	Brought forward / ... Plane vertical to: Sides of strip footings Smooth: Plane vertical to:	m ²	14		
CAH7	8.3	Stepped sides of stairs 360mm high Scheduled reinforcement items:	m ²	5		
CAH8	8.3.1	Steel bars: Mild steel bars: 8mm	t	0.10		
CAH9		10mm	t	0.25		
CAH10		High-tensile steel bars: 10mm	t	0.25		
CAH11		12mm	t	0.25		
CAH12		16mm	t	0.10		
CAH13		20mm	t	0.10		
CAH14		25mm	t	0.10		
CAH15		32mm	t	0.10		
CAH16	8.3.2	High-tensile welded mesh: Ref No 245 in surface beds	m ²	15		
CAH17	8.4	Scheduled concrete items: 8.4.2 Blinding layer in grade 15 MPa/19 mm concrete of: 75 mm thickness	m ²	20		
	8.4.3	Strength concrete: Grade 15 MPa/13 mm concrete in:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAH18		Brought forward / ... Below ground cavity wall infill	m ³	2		
		Grade 25 MPa/19 mm concrete in:				
CAH19		Strip footings	m ³	5		
CAH20		Surface beds	m ³	5		
CAH21		Stairs and landing	m ³	2		
	8.4.4	Unformed surface finishes:				
		(a) Wood-floated finishes to:				
CAH22		Horizontal surfaces	m ²	24		
		(b) Steel-floated finishes to:				
CAH23		Horizontal surfaces	m ²	5		
		(c) Power-floated finishes to:				
CAH24		Horizontal surfaces	m ²	5		
	8.5	Joints:				
		Designated joints, complete, as detailed on drawing 503081-GENR-DRG-CC-0309:				
CAH25		Sawcut Joint in 200mm thick concrete slabs	m	15		
		Isolation joints:				
CAH26		10 mm Jointex between concrete surfaces, 200 mm high	m	40		
	8.12	Granolithic Screeding:				
CAH27		40 mm thick average granolithic screed, sloped.	m ²	50		
	SANS 1200 HB	CLADDING AND SHEETING				
	8.2.2	Supply and install cladding and sheeting:				
		0,53mm Thick "Safintra SAFLOK 700"				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAH28	8.2.3	Brought forward / ... Roof sheeting	m ²	30		
		Supply and install ancillaries: Flashing (of the same material, corrosion protection and finish as the roof sheeting/cladding):				
CAH29		Eaves flashing	m	8		
CAH30		Ridge (apex) flashing	m	6		
CAH31		Barge flashing	m	12		
		Rainwater goods				
CAH32		180mm wide x 180mm deep Gutter	m	12		
CAH33		Gutter stop end	m	4		
CAH34		Stop end outlets	m	4		
CAH35		100mm dia. Downpipe fixed with clips at 1000mm centres	m	12		
CAH36	8.2.6	Rainwater down pipe for shoes	m	4		
CAH37		Supply and install insulation: 4mm Thick "Alububble" or equivalent 1983 D10 both sides reflective foil insulation under sheeting, and above roof insulation boards:	m ²	30		
	SPEC PD	SPECIFICATION PD: BUILDING WORK				
CAH38	10.1	280 mm thick cavity brick wall, outside skin in unplastered FBS solid engineering bricks (Corobrik Amber Satin or similar approved) and inside skin in plastered (steel-floated) and painted NFX solid engineering bricks. Refer to drawings 503081-GENR-DRG-CC-0326 & 503081-GENR-DRG-CC-0330 in NFX solid engineering bricks, plastered and painted both sides (steel-floated):	m ²	72		
CAH39		230mm thick wall	m ²	16		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	10.4	Doors and Windows:				
		Doors as per schedule drawing 503081-GENR-DRG-CC-0324 & 503081-GENR-CC-0340:				
CAH40		D1	No	1		
CAH41		D5	No	1		
		Windows as per window schedule 503081-GENR-DRG-CC-0323 & 503081-GENR-DRG-CC-0331:				
CAH42		W3	No	1		
CAH43		W9	No	3		
	10.5	Ceilings and Bulkheads:				
		Plaster-board ceiling as per finishes schedule on Drawing 503081-GENR-DRG-CC-0326:				
CAH44		Fixed ceiling	m	30		
		Cornices:				
CAH45		76mm coved cornices	m	24		
	10.6	Carpentry and Joinery:				
		Roof Trusses:				
CAH46		SANS approved pre-fabricated trusses:	Sum	-		
		Cupboards and countertops:				
CAH47		to Rooms as per details on drawings 503081-GENR-DRG-CC-0336, 0337 & 0338	Sum	-		
	10.7	Miscellaneous				
		Plumbing				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAH48		Brought forward / ... Waste pipework for 10 sanitary fittings or	Sum	-		
CAH49		Hot water pipework reticulation in ceiling voids from geyser, to all drop pipework points feeding 10 sanitary fittings or water points including all bends, isolation valves, insulated, etc.	Sum	-		
CAH50		Hot water pipework reticulation chased into walls from drop pipework positions to 20 sanitary fittings or water points including all bends, insulated etc. (pipework from ceiling level to fittings or water points)	Sum	-		
CAH51		Cold water pipework reticulation to walls, in in ceilings voids etc. from main supply to building and to all drop or connection pipework points feeding 34 sanitary fittings and 2 geysers and heat pumps or points including all bends, isolation valves, etc.	Sum	-		
CAH52		Cold water pipework reticulation chased into walls from drop pipework positions to 20 sanitary fittings or water points including all bends, insulated etc. (pipework from ceiling level to fittings or water points)	Sum	-		
CAH53		Sanitaryware: Sanitary fittings taps and bathroom accessories, complete with waste unions, traps, angle valves, connections, etc..., as per sanitary schedule	Sum	-		
CAH54		Damp and waterproofing 375 micron medium density polyethylene damp proof sheeting under floors	m ²	24		
CAH55		375 micron green medium density polyethylene damp proof course in walls	m ²	24		
CAH56		Ant poison, aldrin emulsifiable concentrates solution to SANS 618 spread at a rate recommended by the manufacturer: Bottoms of foundations, footings and column bases	m ²	5		
CAH57		Under floors	m ²	24		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Other				
CAH58		2500 litre water Tanks incl. all fittings.	No.	1		
CAH59		Floor finishes as per finishes schedule: drawing 503081-GENR-DRG-CC-0326	m²	24		
	SANS 1200 A 8.5	Sums stated provisionally by the Engineer				
		b) For work to be executed by a subcontractor, and/or for goods, materials, plant and/or services to be supplied to the Site				
CAH60		Furniture	Prov. Sum	-	25 000	25 000.00
CAH61		Overheads, charges and profit on item above	%	25 000		
TOTAL OF SECTION CAH CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAI1	SANS 1200 D	SECTION CAI: LAGOONS (4 No.) LAGOON INLET STRUCTURE (Drawing DRG-CC-1905 and related) EARTHWORKS Restricted Excavation a) Excavate for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose	m³	14		
CAI2	8.3.3	Inlet Structure b) Extra-over for items under payment reference 8.3.3(a) (SANS 1200 D) for:				
CAI2		2) Hard rock excavation (without explosives)	m³	4		
CAI3	SANS 1200 DB	EARTHWORKS (PIPE TRENCHES) Scheduled items: Excavation: a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material: Pipes over DN 125 mm dia and up to DN 315 for depths: Over and Up to 0,5 m 1,5 m	m	16		
CAI3	8.3	b) Extra-over for items under payment reference 8.3.2(a) (SANS 1200 DB) for:				
CAI3	8.3.2					
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		2) Hard rock excavation				
CAI4		(i) By means of explosives	m ³	4		
CAI5		(ii) Without explosives	m ³	4		
		8) Boulder Excavation, Class A				
CAI6		(i) By means of explosives	m ³	1		
CAI7		(ii) Without explosives	m ³	2		
		9) Boulder Excavation, Class B				
CAI8		(i) By means of explosives	m ³	1		
CAI9		(ii) Without explosives	m ³	2		
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
	8.2.2	Smooth:				
		Plane vertical/battered to:				
CAI10		Sides of walls and mass concrete	m ²	68		
	8.2.5	Narrow widths :				
		Rough:				
CAI11		Up to 250mm	m	34		
	8.3	Scheduled reinforcement items:				
	8.3.1	Steel bars:				
		High-tensile steel bars:				
CAI12		10 mm dia	t	0.40		
CAI13		12 mm dia	t	1		
CAI14		16 mm dia	t	0.40		
	8.4	Scheduled concrete items:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAI15	8.4.2	Blinding layer in 15 MPa/19 mm concrete of : 75 mm thickness	m ²	18		
CAI16	8.4.3	Strength concrete: Grade 15 MPa/19 mm concrete to: Benching to round inlet structure corners, 600mm high with 500mm radius, 30mm min thickness. Class 35 MPa/19 mm concrete in:	m ³	0.50		
CAI17		Base	m ³	4.50		
CAI18		Walls	m ³	7.50		
	8.4.4	Unformed surface finishes: a) Wood-floated finishes to:				
CAI19		Narrow surfaces (outside perimeter of slab) up to 200 mm wide	m	34		
CAI20		Top of slab	m ²	14		
		(b) Steel-floated finish:				
CAI21		Narrow surfaces (top of walls) up to 200 mm wide	m	28		
CAI22		Top of landing	m ²	5.50		
	8.5	Joints: Designated joints, complete, as shown on drawing DRG-CC-1905				
CAI23		Joint Type F	m	36		
	8.13	Casting items in concrete:				
CAI24		DN 300 concrete pipe in 450 mm thick concrete, including polyurethane swellable seal, as shown on inlet structure drawing.	No	4		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAI25		Brought forward / ... DN 80 uPVC baffles in 200 mm thick concrete	No	144		
	SANS 1200 L	MEDIUM-PRESSURE PIPELINES				
	8.2	Scheduled items:				
	8.2.1	Supply, lay, and bed pipes complete with couplings				
CAI26		DN 300 Class 100D spigot and socket concrete pipe	m	20		
	8.2.5	Supply and place pipes, valves and specials (short pipe runs): baffles as detailed on the inlet structure drawing:				
CAI27		200 mm lengths of DN 80 uPVC rainwater downpipes (with cut edges deburred)	No	144		
	SANS 1200 LB	BEDDING (PIPES)				
	8.2.2	Supply only of bedding by importation:				
	8.2.2.3	From commercial sources:				
CAI28		Selected granular material	m ³	18		
	SANS 1200 H	STRUCTURAL STEELWORK				
	8.3	Scheduled items				
	8.3.1	Structural Steel				
	8.3.7	Handrails (refer to typical handrailing details drawings 503081-GENR-DRG-CC-0307-0308):				
CAI29		Horizontal top mounted	m	33.50		
CAI30		Bends	No	16		
CAI31		End closures	No	8		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAI32	GF	Brought forward / ...				
	8.1	GRP GRID FLOORING GRP flooring, complete and installed with frames (to inlet structure of lagoon, as per typical detail drawing DRG-CC-0304 and related): Flooring Detail 2, Flooring Type 7	No	7		
		LAGOON OUTLET STRUCTURE (Drawing DRG-CC-1901 and related)				
CAI33	SANS 1200 D	EARTHWORKS 8.3.3 Restricted Excavation a) Excavate for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose				
		Outlet Structure b) Extra-over for items under payment reference 8.3.3(a) (SANS 1200 D) for:	m ³	52		
CAI34		2) Hard rock excavation	m ³	13		
	SANS 1200 DB	EARTHWORKS (PIPE TRENCHES) 8.3 Scheduled items:				
	8.3.2	Excavation: a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material: Pipes over DN 125 mm dia and up to DN 315 for depths: Over and Up to				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAI35		Brought forward / ... 0,5 m 1,5 m	m	34		
CAI36		1,5 m 2,5 m	m	12		
		b) Extra-over for items under payment reference 8.3.2(a) (SANS 1200 DB) for:				
CAI37		2) Hard rock excavation	m ³	20		
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
	8.2.2	Smooth:				
		Plane vertical/battered to:				
CAI38		Sides of walls	m ²	108		
		Plane horizontal to:				
		Soffits of slabs for prop heights of:				
CAI39		up to 2.0 m	m ²	13.50		
	8.2.5	Narrow widths :				
CAI40		Up to 200mm	m	26		
CAI41		300mm to 400mm	m	29		
	8.3	Scheduled reinforcement items:				
	8.3.1	Steel bars:				
		High-tensile steel bars:				
CAI42		10 mm dia	t	0.80		
CAI43		12 mm dia	t	2		
CAI44		16 mm dia	t	0.80		
	8.4.3	Strength concrete:				
		Grade 15 MPa/19 mm concrete to:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAI45		Brought forward / ... Floor Benching	m ³	1.20		
		Class 35 MPa/19 mm concrete in:				
CAI46		Slabs	m ³	3.20		
CAI47		Walls	m ³	10		
CAI48		Base	m ³	10		
	8.4.4	Unformed surface finishes:				
		Wood floated finishes to:				
CAI49		Floor slabs and top of benching	m ²	25		
CAI50		Narrow surfaces up to 200mm wide	m	40		
		Steel floated finishes to:				
CAI51		Walkway slab	m ²	16		
	8.5	Joints:				
		Designated joints, complete, as shown on drawing DRG-CC-1906				
CAI52		Joint Type F	m	36		
	8.7	Grouting:				
CAI53		Grouting around 450 (w) x 375 (h) mm ND (internal dimensions) Class 200 rectangular portal culvert as shown on drawing DRG-CC-1906	m ³	0.06		
	8.13	Casting items in concrete:				
CAI54		Up to 300 mm nominal bore concrete effluent pipe in up to 450 mm thick including polyurethane swellable seal, as shown on inlet structure drawing.	No	4		
	SANS 1200 L	MEDIUM-PRESSURE PIPELINES				
	8.2	Scheduled items:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAI55		Brought forward / ...				
	8.2.1	Supply, lay, and bed pipes complete with couplings				
		DN 300 Class 100D spigot and socket concrete pipe	m	44		
	SANS 1200 LB	BEDDING (PIPES)				
CAI56	8.2.2	Supply only of bedding by importation:				
	8.2.2.3	From commercial sources:				
		Selected granular material	m ³	40		
	SANS 1200 H	STRUCTURAL STEELWORK				
CAI57	8.3	Scheduled items				
	8.3.7	Handrails (refer to typical handrailing details drawings 503081-GENR-DRG-CC-0307-0308):				
		Horizontal top mounted	m	34		
		Bends	No	8		
CAI58		End closures	No	8		
CAI59	GF	GRP GRID FLOORING				
	8.1	GRP flooring, complete and installed with frames (to outlet structure of lagoon, as per typical detail drawing DRG-CC-0304 and related):				
		Flooring Detail 2, Flooring Type 7	m ²	5.50		
	Spec PD	BUILDING WORK				
CAI60	10.7	Miscellaneous:				
		Supply and install Gereg or similar approved decanting gate (comprising 1 No. OS1, 13 No. OS2, 1 No OS3 AND 1 pair OS4, as shown on drawing DRG-CC-1906), complete with grouting in aluminium frame, adding logs and connecting chain.	No	4		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		DRYING POND LAYERWORKS				
		(Drawing DRG-CC-1900 and related)				
	GC	GEO-CELL WATERPROOF TRAFFICABLE LINER				
CAI62	5.1	Training of Workers	Sum	-		
	5.5	Edge beam excavation				
CAI63		Excavate 300 deep by 200 wide trench	m	640		
	5.6	Blinding Layer				
CAI64		6mm thick blinding and levelling sand layer to bottoms of ponds, max. 25mm thick at localized low points	m ²	4 800		
	5.7	Supply, cutting and installation of Y10 high tensile steel bars for rigging pegs				
CAI65		Plain, with one end cut at 45 degrees, to form anchor pegs for rigging	m	2 900		
	5.8	Hollow Cell Liners				
		Double layer of 300/210x75mm (2x 75mm layers) hollow cell liner system, with keyed cell walls:				
CAI66		150mm thick to bottoms of pond (2x 75 mm layers)	m ²	2 720		
CAI67		150mm thick to sloping sides of pond (2x 75 mm layers)	m ²	2 080		
	5.9	Concrete filling				
CAI68		20 MPa 75mm thick bottom layer	m ²	4 800		
CAI69		30 MPa 75mm thick top layer	m ²	4 800		
	5.10	Edge Beam Concrete				
CAI70		30MPa concrete class 15/19mm (200x300 edge beam)	m ³	40		
	5.11	Surface Finishes				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAI71		Brought forward / ... Wood floated finish to bottom layer	m ²	4 800		
CAI72		Wood floated finish to top layer	m ²	4 800		
	5.12	Bituminous Waterproofing Layer (4mm dry thickness)				
CAI73		Plane to horizontal or sloped	m ²	4 800		
CAI74		Plane to vertical, 275mm high around perimeter of structures and culverts abutting geo-cell layer	m ²	100		
	SANS 1200 LE	STORMWATER DRAINAGE				
	8.2.2	Supply and lay portal and rectangular culverts (including bedding): b) Without precast invert slabs				
CAI75		Class 200 450x375mm SANS 986 PORTAL CULVERT (internal dimensions)rectangular portal culvert as shown on drawing DRG-CC-1902 and 1906, upside down.	m	60		
	8.2.4	Extra over for items under payment reference 8.2.1 and 8.2.2 (SANS 1200 LE) for cutting end units for culverts on site:				
CAI76		a) Straight cut:	No	8		
CAI77		b) Skew cut:	No	4		
	8.2.8	Supply and install manholes, catchpits, inspection chambers, rodding eyes and the like: SANS 1200 LD-5 (or LE-1) DN 1000 precast concrete manhole (for subsoil inspection), including heavy duty cast iron lid and frame Type 2A with square spacer slab and square adaptor slab				
CAI78		Depth 1.5 to 2.0m	No	4		
	8.2.14	Subsurface drains				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAI79		Brought forward / ... Subsurface drains, complete, as per subsoil drainage detail on drawing DRG-CC-1902:	m	240		
CAI80		Gereg or similar approved 110 dia cast iron ground water pressure relief valve, cast into geocell layer, including suitable pipes and fittings to connect to subsoil drain directly underneath, as shown on 'Ground Water Relief Valve Detail' on drawing DRG-CC-1902	No	20		
CAI81	Spec PD	BUILDING WORK Bricking up 450x375mm end of rectangular portal culvert with 230mm thick plastered bricks	No	8		
CAI82	10.7	Miscellaneous Items: Supply and install M10 Stainless steel chemical anchors complete, including nuts and washer, and drilling and epoxying in for fitting geocell liner to perimeter wall or other concrete structures, as per suppliers recommendations. LAGOON DIVERSION CHAMBER (4 No.) (Drawing DRG-CC-1188 and related)	No	400		
	SANS 1200 L	MEDIUM-PRESSURE PIPELINES				
	8.2	Scheduled items:				
	8.2.13	Valve and Hydrant Chambers, etc.:				
CAI83		Construct Lagoon Diversion Chamber, complete as detailed on drawing DRG-CC-1188 and related, including accessories (i.e. pipe special, valve, HDPE gate with aluminium guides, step irons, etc.)	No	4		
TOTAL OF SECTION CAI CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAJ				
		RESIDUE HOLDING TANK				
	SANS 1200 D	EARTHWORKS				
	8.3	Scheduled items:				
	8.3.3	Restricted Excavation:				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose				
CAJ1		Holding tank	m ³	87		
		b) Extra-over for items under payment reference 8.3.3(a) (SANS 1200 D) for:				
CAJ2		2) Hard rock excavation (without explosives)	m ³	39		
	SANS 1200 DB	EARTHWORKS (PIPE TRENCHES)				
	8.3	Scheduled items:				
	8.3.2	Excavation:				
		a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material:				
		Pipes over DN 125 mm dia and up to DN 315 for depths:				
		Over and Up to				
CAJ3		0,5 m 1,5 m	m	14		
CAJ4		1,5 m 2,5 m	m	5		
		b) Extra-over for items under payment reference 8.3.2(a) (SANS 1200 DB) for:				
		2) Hard rock excavation				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAJ5		(i) By means of explosives	m ³	5		
CAJ6		(ii) Without explosives	m ³	4		
		8) Boulder Excavation, Class A				
CAJ7		(i) By means of explosives	m ³	1		
CAJ8		(ii) Without explosives	m ³	1		
		9) Boulder Excavation, Class B				
CAJ9		(i) By means of explosives	m ³	1		
CAJ10		(ii) Without explosives	m ³	1		
	SANS 1200 LB	BEDDING (PIPES)				
	8.2.2	Supply only of bedding by importation:				
	8.2.2.3	From commercial sources:				
CAJ11		Selected granular material	m ³	16		
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
	8.2.1	Rough:				
		Plane vertical/battered to:				
CAJ12		Sides of Walls	m ²	6		
	8.2.2	Smooth:				
		Plane vertical/battered to:				
CAJ13		Sides of walls	m ²	205		
	8.2.5	Narrow widths:				
CAJ14		Over 200 mm and up to and including 300 mm wide	m	30		
	8.3	Scheduled reinforcement items:				
	8.3.1	Steel bars:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		High tensile steel bars:				
CAJ15		10 mm dia	t	1		
CAJ16		12 mm dia	t	5		
CAJ17		16 mm dia	t	5		
	8.4	Scheduled concrete items:				
	8.4.2	Blinding layer in 15 MPa/19 mm concrete of :				
CAJ18		75 mm thickness	m ²	51		
	8.4.3	Strength concrete :				
		Grade 25 MPa/19 mm				
CAJ19		Benching	m ³	7		
		Grade 35 MPa/19 mm concrete (watertight) to:				
CAJ20		Walls	m ³	51		
CAJ21		Slabs (including sloping)	m ³	20		
	8.4.4	Unformed surface finishes:				
		a) Wood-floated finishes to:				
CAJ22		Horizontal surfaces	m ²	35		
		(b) Steel-floated finish:				
CAJ23		Narrow surfaces up to 300 mm wide	m	55		
	8.5	Joints:				
		Designated joints, complete, as detailed on drawing 503081-WTW1-DRG-CC-1600:				
		Joint Type F:				
CAJ24		(i) In 200 to 300 mm thick walls	m	52		
	8.13	Casting items in concrete :				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Pipe special as shown on drawing no 503081-WTW1-DRG-CC-1917 (and related) and DRG-CC-1964				
CAJ25		PSH01	No	1		
CAJ26		PSH02	No	1		
CAJ27		DN 300 concrete pipe in 600mm thick member (300 wall and 300 thickening)	No	2		
	8.21	Watertightness testing: Carry out watertightness test for:				
CAJ28		Sludge Holding Tank	No	1		
	SANS 1200 H	STRUCTURAL STEELWORK				
	8.3	Scheduled items				
	8.3.8	Ladders, complete and installed (refer to Steel Ladder Details drawings): Ladder Type 2, of height:				
CAJ29		over 2.5m up to 3m	No.	1		
	SANS 1200 L	MEDIUM-PRESSURE PIPELINES				
	8.2.1	Supply, lay, and bed pipes complete with couplings				
CAJ30		DN 300 Class 100D concrete spigot and socket joint	m	19		
	8.2.5	Supply and place pipes, valves and specials (short pipe runs): as detailed on Drawing DRG-CC-1916 to DRG-CC-1918:				
CAJ31		PSH01	No	1		
CAJ32		PSH02	No	1		
TOTAL OF SECTION CAJ CARRIED TO SUMMARY					R	

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAL				
		ROADS				
	SANS 1200DM	EARTHWORKS (ROADS, SUBGRADE)				
	8.3.3.3	Treatment of roadbed:				
		(a) Roadbed preparation and compaction of material to:				
CAL1		(i) Minimum 90% of modified AASHTO maximum density	m ³	360		
CAL2		(ii) Minimum 93% of modified AASHTO maximum density	m ³	40		
		(b) In-place treatment of roadbed in hard rock material by:				
CAL3		(i) Ripping	m ³	200		
	8.3.4	Cut to fill, borrow to fill:				
CAL4		(a) Cut to fill compacted to 93% of modified AASHTO maximum density	m ³	50		
CAL5		(b) Borrow to fill from commercial or off site sources located by the Contractor compacted to 93% of modified AASHTO maximum density	m ³	460		
	8.3.5	Selected layers:				
		(a) Selected layers using material cut from the site and compacted to: excavation:				
CAL6		(i) 150mm selected subgrade (SSG), G9 lower selected layer compacted to 93% of modified AASHTO maximum density	m ³	100		
CAL7		(ii) 150mm selected subgrade (SSG), G7 upper selected layer compacted to 95% of modified AASHTO maximum density	m ³	100		
		(b) Selected layers using material from commercial or off site sources located by the Contractor, compacted to:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAL8		(i) 150mm selected subgrade (SSG), G9 lower selected layer compacted to 93% of modified AASHTO maximum density	m ³	100		
CAL9		(ii) 150mm selected subgrade (SSG), G7 upper selected layer compacted to 95% of modified AASHTO maximum density	m ³	600		
CAL10	8.3.6	Extra over items 8.3.5 (a) through to 8.3.5 (b) for excavating and breaking down material in hard excavation	m ³	50		
	8.3.7	Cut to spoil or stockpile from:				
CAL11		(a) Soft excavation	m ³	520		
CAL12		(b) Hard excavation	m ³	60		
CAL13	8.3.11	Extra over items 8.3.7 for temporary stockpiling of material	m ³	100		
	8.3.13	Surface finishes:				
CAL14		(a) Topsoiling (from stockpile)	m ²	1 600		
		(b) Grassing or other vegetation cover:				
CAL15		(1) Planting of Grass sods	m ²	700		
CAL16		(2) Hydroseeding	m ²	1 000		
CAL17		(3) Trim, shape and roll verge	m ²	1 600		
	SABS 1200ME	SUBBASE				
CAL18	8.3.2	Construct the subbase course/shoulders/gravel wearing course with material from designated excavations	m ³	100		
	8.3.3	Construct the subbase course/shoulders/gravel wearing course with material from commercial sources:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAL19		Brought forward / ... 150mm natural gravel sub-base beneath pedestrian walkways, crushed (G5) compacted to 95% of modified AASHTO maximum density	m ³	200		
CAL20		150mm natural gravel sub-base beneath roadways, crushed (G5) compacted to 95% of modified AASHTO maximum density	m ³	130		
CAL21	8.3.5	150mm cemented natural gravel sub-base, crushed (G5), Subbase compacted to 97% of modified AASHTO maximum density (C4)	m ³	330		
		Process subbase material by the following processes, as relevant, and use in the subbase:				
CAL22	8.3.8	Stabilization Stabilizing agent:	m ³	330		
CAL23		Portland cement (CEM II -32.5)	t	21		
	SABS 1200MF	BASE				
CAL24	8.3.3	Construct 150mm base course with material from commercial sources and compact to 98% of modified AASHTO maximum density (G3)	m ³	50		
	SABS 1200MJ	SEGMENTED PAVING as specified in SABS 1200 MJ and in the Scope of Work				
	8.2.1	Construction of edge restraints:				
CAL25		Pre Cast Kerb (Fig. 11)	m	900		
	8.2.2	Construction of paving complete:				
CAL26		(a) 60mm Natural grey bevel edge concrete paving units, class 30/2.1 (Type S-A), laid in herringbone pattern, with header course	m ²	900		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAL27	8.2.3	Brought forward / ... (b) 80mm Natural grey interlocking concrete paving units, class 40/2.6 (Type S-A), laid in herringbone pattern, with header course	m ²	2 200		
		Cutting units to fit edge restraints:				
		(a) For 60mm brick paving				
CAL28		Circular cutting	m	320		
CAL29	8.2.4	Straight cutting	m	590		
		(b) For 80mm brick paving				
CAL30		Circular cutting	m	140		
CAL31		Straight cutting	m	310		
CAL32	8.2.4	Rolling to locked up condition as specified in 5.6.2	m ²	4 000		
	SABS 1200 MK	KERBING AND CHANNELLING				
	8.2.1	Concrete kerbing:				
		(a) Cast in-situ edging strips using class 20/19 concrete as detailed on drawings for curvatures indicated:				
CAL33		(i) 300x250mm	m	10		
		(b) Precast barrier kerbing (Fig. 4) as detailed on drawings for curvatures indicated:				
CAL34		(i) Radius up to 1m	m	20		
CAL35		(ii) Radius exceeding 1m up to 4m	m	20		
CAL36		(iii) Radius exceeding 4m up to 20m	m	77		
CAL37		(iv) Radius exceeding 20m	m	270		
		(c) Precast Mountable kerbing as detailed on drawings for curvatures indicated:				
CAL38		(i) Radius up to 1m	m	5		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAL39		(ii) Radius exceeding 1m up to 4m	m	10		
CAL40		(iii) Radius exceeding 4m up to 20m	m	10		
CAL41		(iv) Radius exceeding 20m	m	25		
	8.2.2	Concrete kerbing and Channelling combined:				
		(a) Precast barrier kerbing as detailed on drawing and 300mm wide cast in-situ class 20/19 concrete channelling for curvatures indicated:				
CAL42		(i) Radius up to 1m	m	20		
CAL43		(ii) Radius exceeding 1m up to 4m	m	20		
CAL44		(iii) Radius exceeding 4m up to 20m	m	80		
CAL45		(iii) Radius exceeding 20m	m	270		
		(b) Precast mountable kerbing as detailed on drawing and 150mm wide cast in-situ class 20/19 concrete channelling for curvatures indicated:				
CAL46		(i) Radius up to 1m	m	5		
CAL47		(ii) Radius exceeding 1m up to 4m	m	10		
CAL48		(iii) Radius exceeding 4m up to 20m	m	10		
CAL49		(iii) Radius exceeding 20m	m	25		
	8.2.3	Tests on cast in-situ or extruded kerbing and channelling:				
CAL50		(a) Core strength test	No	5		
CAL51		(b) Set of three cubes	No	5		
	SABS 1200MM	ANCILLARY ROADWORKS				
	8.2.1(a)	Guardrails on wooden posts:				
CAL52		Galvanized	m	300		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAL53	8.2.2	Brought forward / ... Extra over item 8.2.1(a) for Horizontally curved Guardrails Factory-Bent to a Radius of less than 150m	m	120		
	8.3.1	PERMANENT ROAD SIGNS: Sign faces with painted / galvanized background with painted symbols, characters, legend, and borders in engineering grade retroreflective material with signboards constructed from: (a) Aluminium sheet (2,0mm thick), of area:				
CAL54		(i) Up to 2m ²	m ²	15		
CAL55		(ii) 2m ² up to 10m ²	m ²	15		
	8.3.2	Provision and application of retro-reflective material				
CAL56		(a) Engineering grade retro-reflective background	m ²	15		
	8.3.3	Sign supports				
CAL57		(a) Steel tubing galvanized	No	20		
	8.1.1 & 8.3.4	Excavation and backfilling for sign supports:				
CAL58		(a) Backfill with grade 10 concrete	m ³	10		
	8.3.6	Statutory signs, street names, and the like, supplied and erected complete				
CAL59		(a) R1 – Stop sign	No	2		
CAL60		(b) R2 - Yield sign	No	2		
CAL61		(c) W401 - Danger plate	No	5		
CAL62		(d) W402 - Danger plate	No	5		
		ROAD MARKINGS:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.4.1	Reflectorized road marking paint applied at nominal rate of 0,42ℓ/m² (double coated hand painted)				
CAL63		(a) White lines, 100mm wide (broken or unbroken)	m	500		
CAL64		(b) White lines, 200mm wide (broken or unbroken)	m	50		
CAL65		(c) White lines, 300mm wide (broken or unbroken)	m	50		
CAL66		(d) White characters and symbols	m²	25		
CAL67		(e) Yellow characters and symbols	m²	25		
CAL68		(f) Yellow lines, 100 mm (broken or unbroken)	m	900		
CAL69		(g) Traffic island markings (any colour)	m²	25		
	8.4.2	Variation in rate of application from that stated in items 8.4.1				
CAL70		(a) White paint	ℓ	200		
CAL71		(b) Yellow paint	ℓ	300		
	8.4.4	Setting out Premaking				
CAL72		(a) Lines (excluding traffic island markings, characters, and symbols)	km	2		
CAL73		(b) Special Markings	Sum	1		
		SITE DEVELOPMENT - MISCELLANEOUS (BLOCK RETAINING WALLS)				
	SPEC RW	Dry Laid Concrete Block Retaining Wall				
	6.1.1	Patented Earth Retaining Systems				
		(iii) Terraforce Precast Concrete Blocks				
CAL74		L13 blocks (smooth face)	m²	100		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAL75	6.1.2	Brought forward / ... L15 blocks (smooth face)	m ²	400		
CAL76		Excavation for concrete bases for earth retaining systems (i) In soft material	m ³	100		
CAL77		(ii) Extra over subitem (a) above for excavation in hard material	m ³	50		
CAL78		(iii) Base preparation and compaction to minimum of 90% of modified AASHTO maximum density	m ²	200		
CAL79	6.1.3	Concrete bases for earth retaining systems (i) Class 20MPa/20 concrete footings including formwork and 80 kg/m ³ of reinforcement, to manufacturers detail	m ³	30		
TOTAL OF SECTION CAL CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAM				
	SPEC WA	FENCING				
	8.1.1	Supply and install complete fencing panels to specification, including all required material, excavations, concrete, etc. with new fencing material:				
		(a) Type 1 - 2.4m High Wire Mesh Panel Fence				
CAM1		Erect new fencing, Betafix Secure 70 x 44 x 3800mm long with vertical poles at 3020mm centres, 2.4m high wire mesh, electrified, with security underdig complete as detailed on drawing 503081-000-DRG-CC-1211	m	450		
		(b) Type 2 - 1.4m High Stock Fence				
CAM2		Erect new fencing, 1.2m high stock fence, 2.31mm average wire diameter, single strand, complete as detailed on the drawings 503081-000-DRG-CC-1212	m	420		
	8.1.2	Supply and install new gates				
		(a) Type 1 - 2.4m High Motorised Security Gate				
CAM3		8m x 2.4m high gate complete, including gate track and reinforced concrete beam , complete as detailed on the drawings 503081-000-DRG-CC-1212	No	2		
		(b) Type 2 - 1.4m High Farm Gate				
CAM4		Install new double leaf swing farm gate complete, (1.4m High Swing Gate) , complete as detailed on the drawings 503081-000-DRG-CC-1212	No	4		
TOTAL OF SECTION CAM CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAN				
		FIRE AND SAFETY - WTW				
	503081-ZUT-SPEC-FI-WTW	Supply and install Fire Hydrant Distribution pipes including cutting or drilling for branch outlets, including preparation, cutting, rolling of grooved ends, grooved end pipe couplings, jointing, cleaning, testing, bracketing and hangers as detailed and specified in the particular and technical specifications, for the following pipe sizes:				
CAN1		25mm dia	m	50		
		Hydrant, Hose Reel and Fire Extinguisher Installations:				
CAN2		Supply & Install of 65mm dia Fire Hose and 16MM dia Nozzle to each Hydrant	No.	2		
CAN3		Supply & Install Fire Hose Reels (30m long) c/w chromium plated 25mm valve, fittings, fixings, etc.	No.	2		
		Supply and Install Portable Fire Extinguishers c/w mounting brackets fixed inside cabinets, signage and surface mounted where required mounted inside cabinets for the following types and capacities:				
CAN4		4,5 kg Dry Powder Fire Extinguisher	No.	3		
CAN5		5kg CO2 Fire Extinguisher	No.	2		
		Wet Services Hydrants and Hose Reels General				
CAN6		Painting and identification of all fire pipe work as per SANS	Sum	1		
CAN7		Pipework Flushing as per SANS	Sum	1		
CAN8		Pipework Pressure Test as per SANS	Sum	1		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Regulatory Fire Safety Signage				
		Photoluminescent fire and directional signage, complete with all require fittings, mountings, hangers, brackets etc. Signage to be affixed using screws, no adhesive or double sided tape allowed. 190 mm height signage complete with aluminium black frames				
CAN9		Type F4, Fire extinguisher and hosereel down - Wall Mounted	No.	1		
CAN10		Type F13, Fire extinguisher down - Wall Mounted	No.	4		
CAN11		Twin Booster Connection - Wall Mounted	No.	1		
CAN12		Type E6, EXIT - Illuminated signage (elect to provide power supply)	No.	3		
CAN13		Type F45, Fire Exit Keep Clear - Wall Mounted	No.	2		
		Infrastructure				
		Fire Pumps				
CAN14		Fire pump station 1x Electric Motor-Driven Main Pump, Electrical Jockey Pump, Piping, Electrical Controllers as Packaged Plant Pump Rated Duty: Flow: 1400 l/min @ 6 Bar Skid base mounted and fully imported with jockey pump, control panels and pump accessories. All equipment to be FM/UL listed where applicable. Final pump duty to be confirmed by hydraulic calculation done by fire installation contractor. Variance in cost to be submitted to the Fire Engineer		1		
		Electrical Installation				
CAN15		Electrical wiring, cabling and control equipment	sum	1		
		Piping Installation				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAN16		Brought forward / ... Internal plantroom and piping between plantroom and sump pipework	sum	1		
CAN17		Fire Water Storage Accessories Puddle Flanges, Catladders, Manholes etc	sum	1		
CAN18		Fill Valve, Vortex Inhibitors, Test piping, Overflows etc	sum	1		
CAN19		Municipal Booster and Suction Hydrant Arrangement Twin Booster Point and Suction Hydrant complete with Pipework and Non-return Valve	sum	1		
TOTAL OF SECTION CAN CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAO				
		INTERCONNECTING PIPEWORK				
	SANS 1200 DB	EARTHWORKS (PIPE TRENCHES)				
	8.3	Scheduled items:				
	8.3.2	Excavation:				
		a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material:				
		Pipes up to and including DN 200 for depths:				
		Over and Up to				
CAO1		0,5 m 1,5 m	m	68		
CAO2		1,5 m 2,5 m	m	71		
CAO3		2,5 m 3,5 m	m	11		
CAO4		3,5 m 4,5 m	m	15		
		Pipes over DN 200 and up to and including DN 375 for depths:				
		Over and Up to				
CAO5		0,5 m 1,5 m	m	38		
CAO6		1,5 m 2,5 m	m	43		
		Pipes over DN 375 and up to and including DN 500 for depths:				
		Over and Up to				
CAO7		0,5 m 1,5 m	m	22		
CAO8		1,5 m 2,5 m	m	108		
CAO9		2,5 m 3,5 m	m	24		
CAO10		3,5 m 4,5 m	m	13		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		b) Extra-over for items under payment reference 8.3.2(a) (SANS 1200 DB) for:				
		2) Hard rock excavation				
CAO11		(i) By means of explosives	m ³	130		
CAO12		(ii) Without explosives	m ³	140		
		8) Boulder Excavation, Class A				
CAO13		(i) By means of explosives	m ³	5		
CAO14		(ii) Without explosives	m ³	10		
		9) Boulder Excavation, Class B				
CAO15		(i) By means of explosives	m ³	5		
CAO16		(ii) Without explosives	m ³	10		
	SANS 1200 LB	BEDDING (PIPES)				
	8.2.2	Supply only of bedding by importation:				
	8.2.2.3	From commercial sources:				
CAO17		Selected granular material	m ³	162		
	SANS 1200 L	MEDIUM-PRESSURE PIPELINES				
	8.2	Scheduled items:				
	8.2.1	Supply, lay, and bed pipes complete with couplings				
		HDPE PE 100 PN 10 pipes:				
CAO18		DN 160	m	63		
CAO19		DN 200	m	99		
CAO20		DN 225	m	34		
CAO21		DN 280	m	41		
CAO22		DN 400	m	98		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAO23	8.2.2	Brought forward / ...				
		DN 500	m	67		
		Extra-over 8.2.1 for the supplying, laying and bedding of specials complete with couplings:				
		HDPE PE 100 PN 10:				
		33° bend				
CAO24		DN 200	No	1		
CAO25		DN 500	No	1		
		45° bend				
CAO26		DN 110	No	4		
CAO27		DN 200	No	1		
CAO28		DN 280	No	1		
CAO29		DN 500	No	1		
		90° bend				
CAO30		DN 160	No	1		
CAO31		DN 200	No	1		
CAO32		DN 225	No	2		
CAO33		DN 280	No	1		
CAO34		DN 400	No	5		
		Equal tees				
CAO35		DN 160	No	5		
CAO36		DN 225	No	2		
CAO37		DN 280	No	1		
CAO38		DN 500	No	4		
		Reducing tees				
CAO39		DN 200 to DN 160	No	1		
		Stub flange				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAO40		DN 160	No	3		
CAO41		DN 200	No	3		
CAO42		DN 225	No	2		
CAO43		DN 280	No	3		
CAO44		DN 400	No	4		
CAO45		DN 500	No	6		
		Reducer (at rodding eye)				
CAO46		DN 225 to DN 110	No	3		
CAO47		DN 160 to DN 110	No	1		
		Compression fittings				
CAO48		DN 110 plug as rodding eye cap	No	4		
		Stainless Steel Grade 316				
		Backing ring (for use with HDPE stubs)				
CAO49		DN 160	No	3		
CAO50		DN 200	No	3		
CAO51		DN 225	No	2		
CAO52		DN 280	No	3		
CAO53		DN 400	No	4		
CAO54		DN 500	No	6		
		Blank flange (i.e. used in MH B1 and C1 to blank off HDPE pipework)				
CAO55		DN 200	No	1		
CAO56		DN 500	No	1		
	8.2.5	Supply and place pipes, valves and specials (short pipe runs):				
		HDPE PE 100 PN 10 pipes:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAO57	8.2.13	Brought forward / ... DN 110	m	8		
CAO58		Valve and Hydrant Chambers, etc.: Brick manhole (of 400x400 internal width/length) to accommodate rodding eye, complete with valve box as detailed on drawing DRG-CC-1527	No	2		
TOTAL OF SECTION CAO CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAP				
		HYDROCYCLONE PLATFORM				
	SANS 1200 D	EARTHWORKS				
	8.3	Scheduled items:				
	8.3.3	Restricted Excavation:				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose				
CAP1		Hydrocyclone platform	m ³	9		
		b) Extra-over for items under payment reference 8.3.3(a) (SANS 1200 D) for:				
CAP2		2) Hard rock excavation (without explosives)	m ³	2		
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
	8.2.1	Rough:				
		Plane vertical/battered to:				
CAP3		Sides of platform	m ²	11		
	8.3	Scheduled reinforcement items:				
	8.3.1	Steel bars:				
		Mild steel bars:				
CAP4		8 mm dia	t	0.10		
CAP5		10 mm dia	t	0.10		
		High tensile steel bars:				
CAP6		10 mm dia	t	0.10		
CAP7		12 mm dia	t	0.20		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAP8		Brought forward / ... 16 mm dia	t	0.30		
CAP9		20 mm dia	t	0.30		
	8.4	Scheduled concrete items:				
	8.4.2	Blinding layer in 15 MPa/19 mm concrete of :				
CAP10		75 mm thickness	m ²	20.50		
	8.4.3	Strength concrete :				
		35 Mpa/19 mm (watertight reinforced concrete) to :				
CAP11		Platform	m ³	7.50		
	8.4.4	Unformed surface finishes:				
		(b) Steel-floated finish:				
CAP12		Top of platform	m ²	21		
TOTAL OF SECTION CAP CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAQ				
		STORMWATER				
	SANS 1200DB	EARTHWORKS (PIPE TRENCHES):				
	8.3.2	Excavation:				
		(a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material:				
		(i) Trenches of width 1000mm to accommodate pipe diameters of 300mm up to 450mm:				
CAQ1		Depth up to 1.0m	m	45		
CAQ2		Depth exceeding 1.0m up to 1.5m	m	90		
CAQ3		Depth exceeding 1.5m up to 2.0m	m	135		
CAQ4		Depth exceeding 2.0m up to 2.5m	m	135		
CAQ5		Depth exceeding 2.5m up to 3.0m	m	45		
		(ii) Trenches of width 1200mm to accommodate pipe diameters of 600mm :				
CAQ6		Depth up to 1.0m	m	40		
CAQ7		Depth exceeding 1.0m up to 1.5m	m	80		
CAQ8		Depth exceeding 1.5m up to 2.0m	m	120		
CAQ9		Depth exceeding 2.0m up to 2.5m	m	120		
CAQ10		Depth exceeding 2.5m up to 3.0m	m	40		
		(iii) Trenches of width 1700mm to accommodate pipe diameters of 750mm up to 900mm:				
CAQ11		Depth up to 1.0m	m	5		
CAQ12		Depth exceeding 1.0m up to 1.5m	m	10		
CAQ13		Depth exceeding 1.5m up to 2.0m	m	15		
CAQ14		Depth exceeding 2.0m up to 2.5m	m	15		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAQ15		Brought forward / ... Depth exceeding 2.5m up to 3.0m	m	5		
		(b) Extra over items (8.3.2) for:				
		(2) Hard rock excavation				
CAQ16		(i) By means of explosives	m ³	390		
CAQ17		(ii) Without explosives	m ³	380		
CAQ18		(3) Hand excavation and backfill by hand where ordered	m ³	10		
CAQ19		(4) Backfill stabilised with 5% cement where ordered by the Employer's Agent	m ³	40		
		8) Boulder Excavation, Class A				
CAQ20		(i) By means of explosives	m ³	20		
CAQ21		(ii) Without explosives	m ³	30		
		9) Boulder Excavation, Class B				
CAQ22		(i) By means of explosives	m ³	20		
CAQ23		(ii) Without explosives	m ³	30		
CAQ24		(c) Excavate and dispose of unsuitable material from trench bottom	m ³	50		
	8.3.3	Excavation ancillaries:				
	8.3.3.1	Make up deficiency in backfill material:				
CAQ25		(a) From other necessary excavations on site	m ³	50		
		(b) By importation from commercial or off-site sources selected by the Contractor				
CAQ26		(i) Subbase quality material complying with subclause 3.5 of SABS 1200 DB and PSDB 3.5	m ³	190		
CAQ27	8.3.3.3	Compaction in road crossings	m ³	190		
	SANS 1200DK	GABIONS AND PITCHING				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.2.1	Surface preparation for bedding of gabions				
		b) Cavities filled with grade 15 concrete (provisional)	m ³	35		
	8.2.2	Gabions:				
		Gabion boxes with Mesh Type 80 with Class A Galfan and PVC coated wire and diaphragm spacings of 1m (as applicable), of sizes indicated on drawing 503081-WTW1-DRG-CC-1185:				
CAQ28		(a) 1m x 1m x 1m	m ³	10		
CAQ29		(b) 2m x 1m x 1m	m ³	40		
		Gabion mattresses with Mesh Type 60 with Class A Galfan and PVC coated wire and diaphragm spacings of 1m (as applicable), of sizes indicated on drawing 503081-WTW1-DRG-CC-1185:				
CAQ30		(a) 3m x 1m x 0.3m	m ³	10		
	8.2.4	Geotextile:				
CAQ31		(a) Geotextile "Kaytech Bidim A2" or similar approved placed behind or below gabion boxes and mattresses	m ²	70		
	8.2.5	Pitching:				
CAQ32		(a) Grouted pitching	m ³	50		
CAQ33	8.2.8	Excavation and concrete backfill of footing trenches for pitching	m ³	35		
CAQ34	8.2.12	Cutting and Adjusting mattress to fit around stormwater pipe	m ²	10		
	SABS 1200 LB	BEDDING (PIPES)				
	8.2.1	(a) Provision of bedding from trench excavation:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAQ35		Selected granular material	m ³	5		
CAQ36		Selected fill material	m ³	5		
	8.2.2	(b) Supply only of bedding by importation:				
	8.2.2.1	(i) From other necessary excavations and stockpiles:				
CAQ37		Selected granular material	m ³	5		
CAQ38		Selected fill material	m ³	5		
	8.2.2.3	(ii) From commercial sources:				
CAQ39		Selected granular material	m ³	700		
CAQ40		Selected fill material	m ³	5		
CAQ41		(c) 6.7 mm concrete stone to SABS 1083	m ³	70		
	8.2.3	Concrete bedding cradle:				
CAQ42		Class A, 20MPa/19, section 600x300mm, shuttered on both sides with pipes tied down to prevent floating	m ³	40		
	8.2.4	Encasing of pipes in 20MPa/19 Concrete:				
CAQ43		Up to 450mm diameter pipes	m ³	40		
CAQ44	8.2.6	Supply and install geofabric material (Kaytech A2 or relevant equivalent approved)	m ²	180		
	SABS 1200 LE	STORMWATER DRAINAGE				
		as specified in SABS 1200 LE and in the Scope of Work				
	8.2.1	Supply, lay and bed and test pipeline:				
		(a) Reinforced concrete pipes type SC Spigot & Socket pipes with rubber ring joints on Class B bedding of diameters and class indicated:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAQ45		300mm class 100D	m	120		
CAQ46		450mm class 100D	m	330		
CAQ47		750mm class 100D	m	300		
CAQ48		900mm class 100D	m	70		
	8.2.4	Extra over items 8.2.1 for cutting end units for culverts on site:				
		(a) Straight cut for pipes of diameter indicated:				
CAQ49		300mm class 100D	No	2		
CAQ50		450mm class 100D	No	2		
CAQ51		750mm class 100D	No	2		
CAQ52		900mm class 100D	No	2		
		(b) Skew cut for pipes of diameter indicated:				
CAQ53		300mm class 100D	No	2		
CAQ54		450mm class 100D	No	5		
CAQ55		750mm class 100D	No	5		
CAQ56		900mm class 100D	No	2		
	8.2.8	Supply and install Manhole, Catchpits and the Like				
		(a) Manholes:				
		(i) Brickwork manholes (type C) including covers and frames (complete as per drawing 503081-WTW1-DRG-CC-1182):				
CAQ57		Depth up to 1.0m	No	2		
CAQ58		Depth exceeding 1.0m up to 1.5m	No	8		
CAQ59		Depth exceeding 1.5m up to 2.0m	No	10		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAQ60		Brought forward / ... Depth exceeding 2.0m up to 2.5m (ii) Brickwork double grid inlets (type C) including covers and frames (complete as per drawing 503081-WTW1-DRG-CC-1184):	No	2		
CAQ61		Depth up to 1.0m	No	1		
CAQ62		Depth exceeding 1.0m up to 1.5m	No	1		
CAQ63		Depth exceeding 1.5m up to 2.0m	No	1		
CAQ64		Depth exceeding 2.0m up to 2.5m (iii) Concrete manholes including covers and frames (complete as per drawing 503081-WTW1-DRG-CC-1182):	No	6		
CAQ65		Depth up to 1.0m	No	1		
CAQ66		Depth exceeding 1.0m up to 1.5m	No	1		
CAQ67		Depth exceeding 1.5m up to 2.0m	No	3		
CAQ68		Depth exceeding 2.0m up to 2.5m (iv) Concrete stormwater collection chamber including covers and frames (complete as per drawing 503081-WTW1-DRG-CC-1189):	No	1		
CAQ69	SABS 1200MK	Depth exceeding 2.0m up to 2.5m KERBING AND CHANNELLING	No	1		
	8.2.7	Trimming and compaction to 90% of modified AASHTO maximum density of surface area of unlined open drains and areas to be concrete lined:				
CAQ70		(a) Soft material	m ²	370		
CAQ71		(b) Hard material	m ²	560		
	8.2.8	20MPa/19 concrete lining to:				
CAQ72		Channel - 150mm thick, 1m wide	m ²	240		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAQ73	8.2.10	Brought forward / ...				
CAQ74		Channel - 150mm thick, 2m wide	m ²	680		
CAQ75		Channel - 150mm thick, 4m wide transition	m ²	280		
		Sealed joints in concrete lining:				
		15mm wide expansion joint (complete as per drawing 503081-WTW1-DRG-CC-1168)	m	200		
TOTAL OF SECTION CAQ CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAR				
		SEWERS				
	SABS 1200D	EARTHWORKS:				
	8.3.3	Restricted Excavation:				
CAR1		(a) Excavate for Septic Tank, in all materials, and use for backfill or berm or dispose, as ordered:	m ³	35		
		(b) Extra over 8.3.3(e) for hand excavation where ordered				
CAR2		(2) Hard rock excavation (without explosives)	m ³	15		
		(e) Extra-over item 8.3.3 (a) for				
CAR3		1) Hand excavation	m ³	5		
CAR4		(2) Soilcrete backfill where directed by the Employer's Agent	m ³	15		
		(f) Excavate unsuitable material from bottom of conservancy tank excavations and replace with selected material complying with SABS 1200D 3.2.4				
CAR5		(i) using material from tank excavation	m ³	1		
CAR6		(ii) using material from other excavations on site	m ³	1		
CAR7		(iii) using material from commercial sources	m ³	10		
		(g) Backfill Conservancy tank using selected material complying with SABS 1200D 3.2.4				
CAR8		(i) Material from other excavations on site	m ³	5		
CAR9		(ii) Material from commercial sources	m ³	10		
	SABS 1200DB	EARTHWORKS (PIPE TRENCHES):				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.3.2	Excavation: (a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material: (i) Trenches of width 800mm to accommodate pipes up to 160mm diameter:				
CAR10		Depth up to 1.0m	m	20		
CAR11		Depth exceeding 1.0m up to 1.5m	m	50		
CAR12		Depth exceeding 1.5m up to 2.0m	m	100		
CAR13		Depth exceeding 2.0m up to 2.5m	m	70		
CAR14		Depth exceeding 2.5m up to 3.0m	m	5		
		(b) Extra over items 8.3.2 (a) for: (2) Hard rock excavation				
CAR15		(i) By means of explosives	m ³	160		
CAR16		(ii) Without explosives	m ³	160		
CAR17		(3) Hand excavation and backfilling where ordered by the Employer's Agent	m ³	5		
CAR18		(4) Backfill stabilised with 5% cement where ordered by the Employer's Agent	m ³	10		
		8) Boulder Excavation, Class A				
CAR19		(i) By means of explosives	m ³	20		
CAR20		(ii) Without explosives	m ³	30		
		9) Boulder Excavation, Class B				
CAR21		(i) By means of explosives	m ³	20		
CAR22		(ii) Without explosives	m ³	30		
CAR23		(c) Excavate and dispose of unsuitable material from trench bottom	m ³	40		
	8.3.3	Excavation ancillaries				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.3.3.1	Make up deficiency in backfill material:				
CAR24		(a) From other necessary excavations on site	m ³	10		
		(b) By importation from commercial or off-site sources selected by the Contractor				
CAR25		(i) Subbase quality material complying with subclause 3.5 of SABS 1200 DB and SABS 1200 DB 3.5	m ³	40		
CAR26	8.3.3.3	Compaction in road crossings	m ³	40		
	SABS 1200 LB	BEDDING (PIPES)				
	8.2.1	(a) Provision of bedding from trench excavation:				
CAR27		Selected granular material	m ³	5		
CAR28		Selected fill material	m ³	5		
	8.2.2	(b) Supply only of bedding by importation:				
	8.2.2.1	(i) From other necessary excavations and stockpiles:				
CAR29		Selected granular material	m ³	5		
CAR30		Selected fill material	m ³	5		
	8.2.2.3	(ii) From commercial sources:				
CAR31		Selected granular material	m ³	100		
		Selected fill material				
CAR32		(c) 6.7 mm concrete stone to SABS 1083	m ³	10		
CAR33		(c) 26 mm concrete stone to SABS 1083 for absorption trench	m ³	30		
	8.2.3	Concrete bedding cradle:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAR34		Brought forward / ... Class A, 20MPa/19, section 600x300mm, shuttered on both sides with pipes tied down to prevent floating	m ³	5		
	8.2.4	Encasing of pipes in 20MPa/19 Concrete:				
CAR35		Up to 450mm diameter pipes	m ³	5		
CAR36	8.2.6	Supply and install geofabric material (Kaytech A2 or relevant equivalent approved)	m ²	190		
	SABS 1200LD	SEWERS: as specified in SABS 1200 LD and in the Scope of Work				
	8.2.1	Supply, lay, joint, bed and test pipeline: (a) uPVC Class 34 solid wall pipes including approved couplings in bedding for flexible pipes of outside diameters stated:				
CAR37		110mm	m	25		
CAR38		160mm	m	210		
CAR39		(b) Supply, lay, joint and bed 110mm dia Class 6 uPVC perforated drainage pipe	m	50		
	8.2.2	Extra over item 8.2.1 for specials: (a) uPVC class 34 solid wall sewer specials (Marley or relevant equivalent approved to SABS 791): (i) 45° reducing Y-junctions of nominal diameters indicated for erf sewer connections:				
CAR40		160mm x 110mm (plain)	No	5		
CAR41		160mm x 110mm (acecss)	No	1		
		(ii) Bends of diameters and angles				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAR42		110mm x 22.5°	No	1		
CAR43		110mm x 45°	No	1		
CAR44		110mm x 90°	No	1		
CAR45		160mm x 22.5°	No	1		
CAR46		160mm x 45°	No	1		
CAR47		160mm x 90°	No	1		
		(iii) Female stopend solvent welded to end of erf sewer connection pipe of diameter indicated:				
CAR48		110mm	No	1		
CAR49		160mm	No	1		
		(iv) Male stopend solvent welded to end of erf sewer connection pipe of diameter indicated:				
CAR50		110mm	No	1		
CAR51		160mm	No	1		
		(b) Cast Iron specials:				
CAR52		110mm rodding eye with ABC cover	No	5		
		(v) Short pipe specials of lengths and outside diameters stated, to be built into manhole walls:				
CAR53		Approximately 1000mm long x 110mm diameter	No	10		
CAR54		Approximately 1000mm long x 160mm diameter	No	30		
	8.2.3	Manholes:				
		(a) Precast concrete manhole including heavy duty concrete roof slab and Type 2A modified cover and frame for pipes up to and including 160mm dia:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAR55		Brought forward / ... Depth exceeding 0m up to 1.0m	No	2		
CAR56		Depth exceeding 1.0m up to 1.5m	No	4		
CAR57		Depth exceeding 1.5m up to 2.0m	No	5		
CAR58		Depth exceeding 2.0m up to 2.5m	No	2		
CAR59		Depth exceeding 2.5m up to 3.0m	No	1		
CAR60	8.2.13	Testing of Watertightness of Manholes	No	14		
CAR61	8.2.14	Construction of rodding eye concrete surround - 500mm diameter x 200mm thick	No	5		
CAR62	8.2.15	Construct and Test Septic tank complete with internal specials (as completed on drawing 503081-WTW1-DRG-CC-1192)	No	1		
TOTAL OF SECTION CAR CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAS				
		WATER RETICULATION				
	SABS 1200DB	EARTHWORKS (PIPE TRENCHES):				
	8.3.2	Excavation:				
		(a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material:				
		(i) Trenches of width 600mm to accommodate pipe diameters of up to 50mm:				
CAS1		Depth up to 1.0m	m	30		
CAS2		Depth exceeding 1.0m up to 1.5m	m	5		
		(ii) Trenches of width 800 mm to accommodate pipe diameters of 50mm up to and including 160mm:				
CAS3		Depth up to 1.0m	m	250		
CAS4		Depth exceeding 1.0m up to 1.5m	m	70		
		(b) Extra over items 8.3.2 (a) for:				
		(2) Hard rock excavation				
CAS5		(i) By means of explosives	m ³	60		
CAS6		(ii) Without explosives	m ³	60		
CAS7		(3) Hand excavation and backfilling where ordered by the Employer's Agent	m ³	5		
CAS8		(4) Backfill stabilised with 5% cement where ordered	m ³	10		
		8) Boulder Excavation, Class A				
CAS9		(i) By means of explosives	m ³	3		
CAS10		(ii) Without explosives	m ³	3		
		9) Boulder Excavation, Class B				
CAS11		(i) By means of explosives	m ³	3		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAS12		(ii) Without explosives	m ³	3		
CAS13		(c) Excavate and dispose of unsuitable material from trench bottom	m ³	5		
	8.3.3	Excavation ancillaries				
	8.3.3.1	Make up deficiency in backfill material:				
CAS14		(a) From other necessary excavations on site	m ³	10		
		(b) By importation from commercial or off-site sources selected by the Contractor				
CAS15		(i) Subbase quality material complying with subclause 3.5 of SABS 1200 DB and SABS 1200 DB 3.5	m ³	200		
CAS16	8.3.3.3	Compaction in road crossings	m ³	200		
	SABS 1200LB	BEDDING (PIPES)				
		as specified in SABS 1200LB and Scope of Work				
	8.2.1	(a) From trench excavation:				
CAS17		Selected granular material	m ³	5		
CAS18		Selected fill material	m ³	5		
	8.2.2	(b) Supply only of bedding by importation:				
	8.2.2.1	(i) From other necessary excavations (Provisional)				
CAS19		Selected granular material	m ³	5		
CAS20		Selected fill material	m ³	5		
	8.2.2.3	(ii) From commercial sources:				
CAS21		Selected granular material	m ³	100		
CAS22		Selected fill material	m ³	5		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAS23	8.2.4	Brought forward / ... (c) 6.7 mm concrete stone to SABS 1083	m ³	10		
CAS24		Encasing of pipes in 20MPa/19 Concrete: Up to 450mm diameter pipes	m ³	10		
CAS25	8.2.6	Supply and install geofabric material (Kaytech A2 or relevant equivalent approved)	m ²	90		
	SABS 1200L	MEDIUM PRESSURE PIPELINES as specified in SABS 1200L and Scope of Work				
	8.2.1	Supply, lay, joint, bed and test complete with couplings and including disinfection: (a) PE 100, PN 12,5 black butt-welded HDPE plain ended pipes in bedding for flexible pipes of outside diameters as stated:				
CAS26	8.2.2	75mm dia (OD)	m	250		
CAS27		90mm dia (OD)	m	25		
CAS28		110mm dia (OD)	m	30		
CAS29		160mm dia (OD)	m	25		
		Extra-over 8.2.1 for the supplying, laying and bedding of specials complete with couplings (complete with ancillaries and couplings): (a) uPVC fittings: (i) Socket ended uPVC bends of diameter, degrees and class stated: - 90 degrees:				
CAS30		75mm (both ends plain)	No	3		
CAS31		90mm (both ends plain)	No	1		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CAS32		110mm (both ends plain)	No	1		
		- 45 degrees:				
CAS33		75mm (both ends plain)	No	2		
CAS34		90mm (both ends plain)	No	1		
CAS35		110mm (both ends plain)	No	1		
		- 22.5 degrees:				
CAS36		75mm (both ends plain)	No	5		
CAS37		90mm (both ends plain)	No	1		
CAS38		110mm (both ends plain)	No	1		
		- 11.25 degrees:				
CAS39		75mm (both ends plain)	No	5		
CAS40		90mm (both ends plain)	No	1		
CAS41		110mm (both ends plain)	No	1		
		(b) Cast iron fittings:				
		(i) Reducing tees of outside diameters stated:				
CAS42		90mm x 75mm x 90mm	No	1		
CAS43		110mm x 75mm x 110mm	No	1		
CAS44		160mm x 110mm x 160mm	No	1		
		(ii) Equal tees of outside diameters stated:				
CAS45		75mm dia (OD)	No	2		
CAS46		110mm dia (OD)	No	1		
CAS47		160mm dia (OD)	No	1		
		(iii) End caps of outside diameters stated:				
CAS48		75mm dia (OD)	No	4		
CAS49		90mm dia (OD)	No	1		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAS50		Brought forward / ... 110mm dia (OD)	No	2		
		(iv) Reducers of outside diameters stated:				
CAS51		90mm x 75mm	No	1		
CAS52		110mm x 75mm	No	1		
CAS53		160mm x 110mm	No	1		
		(c) Steel fittings:				
		(i) Valve spindle extension pieces:				
CAS54		300mm long	No	3		
CAS55		600mm long	No	2		
		(ii) Blank flange special with drilled threaded hole to suit Galvanised Mild Steel pipe:				
CAS56		65mm NB dia (OD)	No	5		
CAS57		80mm NB dia (OD)	No	5		
CAS58		(d) Specials and fittings for assembly in Non-Return valve chambers Extra over 3.3.1 through to 3.3.4 for the supplying, fixing and bedding of valves: (a) Class 16 flanged gate valves for uPVC pipes of outside diameters stated:	Prov Sum	1	20 000	20 000.00
CAS59		(i) 75mm	No	4		
CAS60		(ii) 110mm	No	1		
		(b) Class 16 flanged non-return valves for uPVC pipes of outside diameters stated:				
CAS61		(i) 75mm (AVK or similar approved)	No	1		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAS62		Brought forward / ...				
CAS63		(ii) 110mm (AVK or similar approved)	No	1		
		(c) Fire hydrants (pedestal) including double flanged distance piece between hydrant and tee	No	2		
	8.2.11	Anchor/thrust blocks and pedestals:				
CAS64		(a) Concrete (15MPa/19)	m ³	5		
CAS65		(b) Formwork (rough)	m ²	5		
	8.2.13 PSL 8.2.13	Chambers:				
	PSL 8.2.13a	(a) Valve chambers, etc.:				
CAS66		Valve chambers outside carriageways to details shown on drawings	No	5		
	PSL 8.2.13b	(b) Extra over for chambers of depth exceeding 1.5m				
		(i) Gate valve chamber in carriageways, as detailed on drawings:				
CAS67		Depth up to 1.5m	No	1		
	PSL 8.2.16	Supply and install valve, hydrant and pipeline markers:				
CAS68		Valve markers to details on drawings	No	10		
	SABS 1200LF	ERF CONNECTIONS:				
	8.2.1	Supply, lay, joint, bed and test erf water connection pipelines:				
		(a) PE 100 PN12,5 black HDPE pipes in bedding for flexible pipes of outside diameters stated:				
CAS69		25mm dia (OD)	m	100		
	8.2.2	Extra over 8.4.1 and 8.4.2 for specials and fittings:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		(a) Compression fittings:				
		(i) "Plasson 16076" or similar approved 4-bolt clamp polypropylene saddle with threaded female off-take for pipe diameters and tapping sizes stated:				
CAS70		160mm x 2"	No	5		
		(ii) "Plasson 7020" PN 16 or similar approved male adaptors of sizes indicate:				
CAS71		25mm x 1"	No	30		
		(iii) "Plasson 5077" or similar approved threaded caps of sizes stated:				
CAS72		25mm x 1"	No	10		
CAS73		50mm x 1 ½"	No	10		
		(vi) Compression flanged adaptor complete with stainless steel backing ring for pipes of diameter indicated:				
CAS74		75mm x 3"	No	10		
TOTAL OF SECTION CAS CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CAT				
		DUCTS				
	SABS 1200LC	CABLE DUCTS				
	8.2.2	Excavation:				
		(a) Excavate in all materials for trenches, backfill, compact, and dispose of surplus material (Pipe trenches):				
		(i) Trenches of width 600mm to cater for ducts or cables for depths :				
CAT1		Depth up to 1m	m	110		
CAT2		Depth exceeding 1.0m up to 2.0m	m	250		
	8.2.2	(b) Extra over item 8.2.2 (a) for:				
CAT3		(i) Hard rock excavation	m ³	150		
CAT4		(5) (i) Hand excavation where ordered	m ³	25		
CAT5		(6) (iii) Soilcrete backfill where ordered	m ³	25		
CAT6		(c) Excavate and dispose of unsuitable material from trench bottom	m ³	50		
	8.2.5	Supply, lay, bed and prove duct:				
		(a) uPVC Class 400KPa to SANS 1601 sleeve pipes using spigot and socket rubber rings joints laid in combined trench with bedding for flexible pipes of diameters stated:				
CAT7		(i) 110mm	m	50		
CAT8		(ii) 160mm	m	50		
		(b) Black HDPE ducting pipe, "Kabelflex" or relevant equivalent approved of diameters stated:				
CAT9		(i) 32mm	m	900		
CAT10		(ii) 110mm	m	350		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CAT11	8.2.6	Brought forward / ... (iii) 160mm	m	50		
CAT12		Provision of bedding material complying with SABS 1200LC 3.2: (a) From commercial or off site sources located by the Contractor				
CAT12	PSLC 8.2.7	Selected granular material	m ³	150		
CAT13		Manholes (a) Manholes complete as per detailed on drawing number 503081-WTW1-DRG-CC-0400 for depths up to 1.5m	No	10		
CAT14	8.2.8	(b) Extra over item 8.2.7(a) for manholes of depth exceeding 1.5m				
CAT14		Exceeding 1.5m up to 2.0m	No	5		
CAT15		Cable markers (a) All ducts:				
CAT16	8.2.12	(i) Route markers to detail on drawings	No	5		
CAT16		(ii) Kerb markers to detail on drawings	No	5		
CAT17		Imported backfill (source and quality stated): (i) Subbase quality material complying with subclause 3.5 of SABS 1200 DB and PSDB 3.5	m ³	70		
CAT18	8.2.13	Compaction in road crossings (95% of modified AASHTO maximum density)	m ³	10		
CAT19	8.2.14	Supply and installation of concrete protection slabs	No	5		
TOTAL OF SECTION CAT CARRIED TO SUMMARY					R	

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CBA				
		SITE CLEARANCE AND BULK EARTHWORKS				
	SANS 1200 C	SITE CLEARANCE				
	8.2.10	Remove topsoil, stockpile and maintain:				
CBA1		Remove topsoil to nominal depth of 150 mm and stockpile	m ³	300		
	SANS 1200 D	EARTHWORKS				
		Bulk excavation				
CBA2	8.3.2	a) Excavate in all materials and use for embankment or backfill, as ordered	m ³	700		
CBA3		b) Excavate in all materials and dispose of at a licensed landfill facility	m ³	5 500		
		d) Extra over subitems 8.3.2(a) and 8.3.2(b) for:				
		2) Hard rock excavation				
CBA4		(i) By means of explosives	m ³	350		
CBA5		(ii) Without explosives	m ³	350		
		3) Boulder Excavation, Class A				
CBA6		(i) By means of explosives	m ³	200		
CBA7		(ii) Without explosives	m ³	500		
		4) Boulder Excavation, Class B				
CBA8		(i) By means of explosives	m ³	200		
CBA9		(ii) Without explosives (hand methods e.g. pneumatic hammers)	m ³	500		
	8.3.4	Importing of materials				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CBA10		Brought forward / ... G7 fill material compacted in layers of 200 mm to 95% MOD AASHTO Density (100% for sand)	m ³	630		
CBA11		G8 fill material compacted in layers of 200 mm to 93% MOD AASHTO Density (100% for sand) - varying depths	m ³	5 220		
CBA12	8.3.11	Survey and protection of surrounding structures before blasting	Sum	-		
	8.3.14	Extra over items 8.3.2(a) and for temporary stockpiling				
CBA13		Selected fill material compacted to 93% MOD AASTHO Density (100% for sand) in layers of 200 mm - varyng depths	m ³	5 220		
TOTAL OF SECTION CBA CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CBB				
		ROADS				
	SANS 1200DM	EARTHWORKS (ROADS, SUBGRADE)				
	8.3.3.3	Treatment of roadbed:				
		(a) Roadbed preparation and compaction of material to:				
CBB1		(i) Minimum 90% of modified AASHTO maximum density	m ³	100		
		(b) In-place treatment of roadbed in hard rock material by:				
CBB2		(i) Ripping	m ³	10		
CBB3	8.3.11	Extra over items 8.3.7 for temporary stockpiling of material	m ³	10		
	SABS 1200ME	SUBBASE				
CBB4	8.3.2	Construct the subbase course/shoulders/gravel wearing course with material from designated excavations	m ³	5		
	8.3.3	Construct the subbase course/shoulders/gravel wearing course with material from commercial sources:				
CBB5		150mm natural gravel sub-base, crushed (G5) compacted to 95% of modified AASHTO maximum density	m ³	200		
CBB6		150mm cemented natural gravel sub-base, crushed (G5), Subbase compacted to 97% of modified AASHTO maximum density (C4)	m ³	100		
	8.3.5	Process subbase material by the following processes, as relevant, and use in the subbase:				
CBB7		Stabilization	m ³	100		
	8.3.8	Stabilizing agent:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CBB8		Brought forward / ...				
		Portland cement (CEM II -32.5)	t	20		
	SABS 1200MJ	SEGMENTED PAVING				
	8.2.2	Construction of paving complete:				
CBB9		(b) 80mm Natural grey interlocking concrete paving units, class 40/2.6 (Type S-A), laid in herringbone pattern, with header course	m ²	650		
	8.2.3	Cutting units to fit edge restraints:				
CBB10		(a) Circular cutting	m	250		
CBB11		(b) Straight cutting	m	250		
CBB12	8.2.4	Rolling to locked up condition as specified in 5.6.2	m ²	650		
	SABS 1200MK	KERBING AND CHANNELLING				
	8.2.1	Concrete kerbing:				
		(a) Precast barrier kerbing (Type BK2) as detailed on drawings for curvatures indicated:				
CBB13		Radius up to 1m	m	5		
CBB14		Radius exceeding 1m up to 4m	m	5		
CBB15		Radius exceeding 4m up to 20m	m	5		
CBB16		Radius exceeding 20m	m	30		
		(b) Cast in-situ edging strips using class 20/19 concrete as detailed on drawings for curvatures indicated:				
CBB17		(i) 300x250mm	m	5		
	8.2.2	Concrete kerbing and Channelling combined:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		(a) Precast barrier kerbing as detailed on drawing and 300mm wide cast in-situ class 20/19 concrete channelling for curvatures indicated:				
CBB18		(i) Radius up to 1m	m	5		
CBB19		(ii) Radius exceeding 1m up to 4m	m	5		
CBB20		(iii) Radius exceeding 4m up to 20m	m	5		
CBB21		(iii) Radius exceeding 20m	m	30		
	8.2.3	Tests on cast in-situ or extruded kerbing and channelling:				
CBB22		(a) Core strength test	No	2		
CBB23		(b) Set of three cubes	No	2		
TOTAL OF SECTION CBB CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CBC				
		PRESSURE PIPELINES				
	SANS 1200 A	GENERAL				
	8.5	Sum stated provisionally by the Engineer				
	8.5 (a)	For work to be executed (including plant, materials or services to be supplied) by the Contractor, and valued in terms of the variation procedure in the Conditions of Conditions				
CBC1		Potable water supply to Abstraction Works	Prov Sum	1	20 000	20 000.00
	SANS 1200 DB	EARTHWORKS (PIPE TRENCHES)				
	8.3.1	Site clearance and removal of topsoil				
CBC2	8.3.1 (c)	Remove topsoil to a minimum depth of 150 mm	m	900		
	8.3.2	Excavation				
	8.3.2 (a)	Excavate in all materials, for trenches, backfill, compact and dispose of surplus material (including lateral support as necessary or required in terms of safety regulations)				
		Fibre Optic Conduits				
		Pipes up to DN50 for depths:				
CBC3		Up to 1,5 m	m	700		
CBC4		Over 1,5 m and up to 2,5 m	m	100		
		Pipes up to DN355 for depths:				
CBC5		Up to 1,5 m	m	100		
CBC6		Over 1,5 m and up to 2,5 m	m	170		
		Trench as per detail in drawing number 503081-WTW1-DRG-CC-1925:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CBC7		Up to 1,5 m	m	50		
CBC8		Over 1,5 m and up to 2,5 m	m	530		
CBC9		Over 2,5 m and up to 3,5 m	m	50		
	8.3.2.(b)	Extra over to 8.3.2 (a) for items above for:				
		2) Hard rock excavation				
CBC10		(i) By means of explosives	m ³	150		
CBC11		(ii) Without explosives	m ³	150		
		3) Hand excavation and backfill where ordered by the Employer's Agent				
CBC12		a) Soft and intermediate material	m ³	50		
CBC13		b) Hard rock material	m ³	10		
CBC14		4) Stabilizing backfill with 5% cement where directed by the Employer's Agent	m ³	2 000		
		5) Working within a restricted working area				
		a) Over 5 m and up to 10 m				
CBC15		i) Up to 1.5 m depths	m	15		
CBC16		ii) Over 1.5 m and up to 2.5 m depths	m	10		
CBC17		iii) Over 2.5 m and up to 3.5 m depths	m	5		
		b) Over 10 m and up to 15 m				
CBC18		i) Up to 1.5 m depths	m	20		
CBC19		ii) Over 1.5 m and up to 2.5 m depths	m	20		
CBC20		iii) Over 2.5 m and up to 3.5 m depths	m	10		
		c) Over 15 m and up to 27 m				
CBC21		i) Up to 1.5 m depths	m	20		
CBC22		ii) Over 1.5 m and up to 2.5 m depths	m	20		
CBC23		iii) Over 2.5 m and up to 3.5 m depths	m	10		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		8) Boulder Excavation, Class A				
CBC24		(i) By means of explosives	m ³	35		
CBC25		(ii) Without explosives	m ³	35		
		9) Boulder Excavation, Class B				
CBC26		(i) By means of explosives	m ³	35		
CBC27		(ii) Without explosives	m ³	35		
CBC28	8.3.2 (c)	Excavate and dispose of unsuitable material from trench bottom (only where ordered in writing by Employer's Agent)	m ³	150		
	8.3.3	Excavation ancillaries				
	8.3.3.1	Make up deficiency in backfill material				
CBC29		a) from other necessary excavations on site	m ³	100		
CBC30		b) by importation from designated borrow pits	m ³	100		
CBC31		c) by importation from commercial or off-site sources selected by the Contractor	m ³	2 000		
	SANS 1200 H	STRUCTURAL STEELWORK				
	8.3.1	Structural Steel				
	8.3.14	Miscellaneous steel items				
CBC32		Supply and install steel pipe brackets and supports to donga crossing as per drawing number 503081-WTW1-DRG-CC-1934	t	0.15		
	SANS 1200 LB	BEDDING (PIPES)				
	8.2.1	Provision of bedding from trench excavation				
CBC33		i) Without the need for screening	m ³	100		
CBC34		ii) Including for screening	m ³	100		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.2.2	Supply only of bedding by importation				
	8.2.2.3	From commercial sources (Provisional)				
CBC35		a) Selected granular material	m ³	410		
CBC36		b) Selected fill material	m ³	150		
		Supply and place the following where directed by the Employer's Agent to form sound foundation to pipework for unstable trench conditions:				
CBC37		a) 19 mm crushed stone	m ³	50		
CBC38		b) Geofabric filter blanket (Bidim A4 or equivalent approved)	m ²	200		
	SANS 1200 LC	CABLE DUCTS				
	8.2.5	Supply, lay, bed and prove duct				
CBC39		DN32 HDPE fibre optic conduit	m	800		
	SANS 1200 L	MEDIUM PRESSURE PIPELINES				
	8.2.1	Supply, lay and bed pipes complete with couplings				
		HDPE PE100 PN12.5, ISO 4427, butt welded				
CBC40		DN250	m	710		
CBC41		DN315	m	685		
		Pipes, mild steel grade X52, fully flanged, 4.5 mm minimum wall thickness, painted internally and externally with two pack epoxy for immersed steel fabrications (D5.5.1), drilled to SANS 1123 Table 1600/3				
CBC42		DN50	m	20		
CBC43		DN250	m	20		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CBC44	8.2.2	Brought forward / ... DN300	m	20		
		Extra-over 8.2.1 for the supplying, laying and bedding of specials complete with couplings				
		HDPE PE100 PN16, ISO 4427, compression fittings				
		Bends				
CBC45		DN250 x 90° bend	No	2		
CBC46		DN315 x 45° bend	No	1		
CBC47		DN315 x 90° bend	No	1		
		Mild steel grade X52, fully flanged, 4.5 mm minimum wall thickness, painted internally and externally with two pack epoxy for immersed steel fabrications (D5.5.1), drilled to SANS 1123 Table 1600/3 (refer drawing number 503081-WTW1-DRG-CC-1934)				
CBC48		DN50 x 90° bend	No	4		
CBC49		DN250 x 90° bend	No	8		
CBC50		DN300 x 90° bend	No	8		
CBC51		DN250 x DN250 tee	No	1		
CBC52		DN300 x DN300 tee	No	1		
CBC53		DN250 Stub flange and stainless steel (SS304L) backing ring	No	8		
CBC54		DN315 Stub flange and stainless steel (SS304L) backing ring	No	8		
		Anchor / thrust blocks and pedestals				
CBC55	8.2.11	Concrete (Grade 25 MPa/19 mm)	m ³	5		
TOTAL OF SECTION CBC CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CBD				
		CONCRETE AND BUILDING WORK				
	SANS 1200 D	EARTHWORKS				
	8.3.3	Restricted excavation:				
		a) Excavate for restricted foundations, footings and pipe trenches in all materials and dispose of, and backfill with material from commercial sources (clean sand unless otherwise indicated)				
CBD1		Total depth up to 2,0 m	m ³	220		
CBD2		Total depth up to 4,0 m	m ³	64		
		(b) Extra-over item 8.3.3 (a) for:				
CBD3		Hard rock excavation (without explosives)	m ³	284		
CBD4		(e) Extra-over item 8.3.3 (a) for hand excavation	m ³	55		
CBD5	8.3.5	Extra excavation to provide working space	m ²	630		
	8.3.4	Importing of materials				
		Extra-over for importation of materials from commercial sources or from borrow pits:				
CBD6		G7 compacted to 95% Modified AASHTO (unless otherwise stated) in 150mm thick layers (unless otherwise stated)	m ³	327		
	SANS 1200 DM	EARTHWORKS (ROADS, SUBGRADE)				
	8.3.3	Treatment of road-bed				
		Roadbed preparation and compaction of material to:				
CBD7		Minimum of 93% of modified AASHTO maximum density	m ³	3 200		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled formwork items:				
	8.2.1	Rough:				
		Plane vertical to:				
CBD8		Sides of strip footings	m ²	46		
CBD9		Sides of bases	m ²	260		
CBD10		Sides of columns in foundations	m ²	12		
CBD11		Sides of raft foundations	m ²	16		
	8.2.2	Smooth:				
		Plane vertical to:				
CBD12		Sides of upstand beams and slabs	m ²	170		
CBD13		Sides of downstand beams	m ²	30		
CBD14		Sides of columns	m ²	80		
CBD15		Sides of retaining walls	m ²	2 834		
CBD16		Sides of door surrounds	m ²	30		
CBD17		Sides of valve chamber walls	m ²	100		
CBD18		Sides of plinths	m ²	65		
CBD19		Stepped sides of stairs 360mm high	m ²	28		
		Plane sloping to:				
		Soffits of stairs for prop heights of:				
CBD20		over 2.0 m and up to and including 3.0 m	m ²	5		
CBD21		over 3.0 m and up to and including 4.0 m	m ²	10		
		top of benching, back shuttered:				
CBD22		35° and up to 80° to the horizontal	m ²	64		
		Plane horizontal to:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Soffits of landings for prop heights of:				
CBD23		up to 3.0 m	m ²	25		
CBD24		over 3.0 m and up to and including 5.0 m	m ²	125		
CBD25		over 5.0 m and up to and including 7.0 m	m ²	12		
CBD26		over 7.0 m and up to and including 9.0 m	m ²	6		
CBD27		over 9.0 m and up to and including 11.0 m	m ²	20		
CBD28		over 11 m and up to and including 13.0 m	m ²	10		
CBD29		over 13.0 m and up to and including 15.0 m	m ²	75		
		Soffits of slabs for prop heights of:				
CBD30		up to 3.0 m	m ²	5		
CBD31		over 3.0 m and up to and including 5.0 m	m ²	5		
CBD32		over 5.0 m and up to and including 7.0 m	m ²	7		
CBD33		over 7.0 m and up to and including 9.0 m	m ²	9		
CBD34		over 9.0 m and up to and including 11.0 m	m ²	5		
CBD35		over 11 m and up to and including 13.0 m	m ²	12		
		Soffits of beams for prop heights of:				
CBD36		over 9.0 m and up to and including 11.0 m	m ²	25		
CBD37		over 11 m and up to and including 13.0 m	m ²	50		
		Circular vertical/battered to:				
CBD38		Sides of walls	m ²	182		
	8.2.5	Narrow widths:				
		Rough:				
CBD39		Up to 200 mm wide	m	50		
CBD40		Over 200 mm and up to and including 300 mm wide	m	25		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CBD41		Brought forward / ... Over 300 mm and up to and including 400 mm wide	m	60		
CBD42		Smooth: Up to 200 mm wide	m	50		
CBD43		Over 200 mm and up to and including 300 mm wide	m	25		
CBD44		Over 300 mm and up to and including 400 mm wide	m	60		
	8.3	Scheduled reinforcement items:				
	8.3.1	Steel bars: Mild steel bars:				
CBD45		8mm	t	2		
CBD46		10mm	t	5		
		High-tensile steel bars:				
CBD47		10mm	t	10		
CBD48		12mm	t	30		
CBD49		16mm	t	50		
CBD50		20mm	t	85		
CBD51		25mm	t	55		
CBD52		32mm	t	45		
	8.3.2	High-tensile welded mesh:				
CBD53		Ref No 395 in surface beds	m ²	500		
CBD54		Ref No 617 in surface beds	m ²	250		
	8.4	Scheduled concrete items:				
	8.4.2	Blinding layer in grade 15 MPa/19 mm concrete of:				
CBD55		75 mm thickness	m ²	735		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.4.3	Strength concrete:				
		Grade 25 MPa/19 mm concrete to:				
CBD56		Strip footings	m ³	5		
		Grade 35 MPa/19 mm concrete watertight to:				
CBD57		Column bases	m ³	5		
CBD58		Surface beds & Raft	m ³	35		
CBD59		Retaining wall foundations	m ³	560		
CBD60		Plinths	m ³	2		
CBD61		Sump floors	m ³	2		
CBD62		Trench floors	m ³	10		
CBD63		Chamber floors	m ³	16		
CBD64		Abstraction chamber floor	m ³	195		
CBD65		Walls	m ³	790		
CBD66		Roof slabs	m ³	48		
CBD67		Upstand beams	m ³	25		
CBD68		Downstand beams	m ³	5		
CBD69		Columns	m ³	20		
CBD70		Stairs and landings	m ³	7.50		
CBD71		Door surrounds	m ³	5		
	8.4.4	Unformed surface finishes:				
		(a) Wood-floated finishes to:				
CBD72		Horizontal surfaces	m ²	400		
CBD73		Narrow surfaces up to 350 mm wide	m ²	50		
		(b) Steel-floated finishes to:				
CBD74		Horizontal surfaces	m ²	66		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CBD75	8.5	Narrow surfaces up to 350 mm wide	m²	25		
		(c) Power-floated finishes to:				
CBD76		Horizontal surfaces	m²	110		
		Joints:				
		Designated joints, complete, as detailed on drawing 503081-GENR-DRG-CC-0301:				
CBD77		Joint Type A2	m	600		
CBD78		Joint Type F	m	50		
CBD79		Joint Type H	m	80		
CBD80		Joint Type R	m	25		
CBD81		Joint Type E2	m	100		
CBD82		Joint Type T	m	3 000		
CBD83		Joint Type V	m	75		
CBD84		Joint Type W	m	125		
		Designated joints, complete, as detailed on drawing 503081-GENR-DRG-CC-0309:				
CBD85		Sawcut Joint in 200mm thick concrete slabs	m	305		
		Isolation joints:				
CBD86	10 mm Jointex between concrete surfaces, 200 mm high	m	50			
CBD87	20 mm Jointex between concrete surfaces, 200 mm high	m	375			
	8.12	Granolithic Screeding:				
CBD88	80 mm thick average granolithic screed, sloped.	m²	150			
	8.23	Concrete protection and proprietary floor finishes:				
		As per Room Finishes Schedule:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Epoxy Finish:				
CBD89		Type 3	m²	150		
	8.13	Casting items in concrete				
CBD90		DN150 spool piece (Item 5 on drawing 503081-WTW1-DRG-CC-1296)	No.	2		
CBD91		DN200 spool piece (Item 3 and 4 on drawing 503081-WTW1-DRG-CC-1296)	No.	3		
CBD92		DN250 spool piece (Item 1 and 2 on drawing 503081-WTW1-DRG-CC-1296)	No.	4		
	8.28	Miscellaneous work				
CBD93		Supply and install Type 2A (SANS 50124) heavy duty hinged double seal manhole cover and frame	No.	1		
CBD94		Precast cover panels as per details on drawing 503081-WTW1-DRG-CC-1289	No.	13		
	SANS 1200 H	STRUCTURAL STEELWORK				
	8.3	Scheduled items				
	8.3.1	Structural Steel				
CBD95		Crawl beam ex 254x146x31 UB	t	1		
CBD96		Columns ex 203x133x30 UB	t	2		
CBD97		Beams ex 254x146x31 UB	t	0.50		
CBD98		Bracing ex 80x80x6L	t	0.29		
	8.3.7	Handrails (refer to typical handrailing details drawing):				
CBD99		a) Horizontal top mounted	m	22		
CBD100		b) Sloping top mounted	m	4		
	8.3.8	Ladders, complete and installed (refer to Steel Ladder Details drawings):				
		Ladder Type 1 with cage, of height:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CBD101		over 2m up to 3m	No.	1		
CBD102		over 3m up to 4m	No.	1		
CBD103		over 4m up to 5m	No.	1		
CBD104		over 5m up to 6m	No.	1		
	8.3.9	Flooring, complete and installed with frames (refer to Typical Flooring Details drawing):				
CBD105		Floor detail 2, flooring type 4;	m ²	23		
CBD106		Floor detail 2, flooring type 1;	m ²	2		
CBD107		Floor detail 2, flooring type 19;	m ²	18		
	8.3.14	Miscellaneous steel items:				
		(a) Items measured by number:				
CBD108	8.3.14	Bollards as per detail on drawing 503081-WTW1-DRG-CC-1288.	No.	6		
	SPEC PD	SPECIFICATION PD: BUILDING WORK				
	10.1	Brickwork:				
CBD109		280 mm thick cavity brick wall, outside skin in unplastered FBS solid engineering bricks (Corobrik Amber Satin or similar approved) and inside skin in plastered (steel-floated) and painted NFX solid engineering bricks. Refer to drawings 503081-GENR-DRG-CC-0326 & 503081-GENR-DRG-CC-0330	m ²	187		
		in NFX solid engineering bricks, plastered and painted both sides (steel-floated):				
CBD110		230mm thick wall	m ²	50		
	10.3	Roof finishes:				
		Roof screed				
CBD111		Average 75 mm thick screed to roof slabs	m ²	150		
		Crushed stone to roof slab				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount	
		Brought forward / ...					
CBD112	10.4	Average 80mm Crushed sone on roof slabs	m³	15			
		Torch-on Waterproofing					
CBD113		To roofs, including sides and tops of upstand beams	m²	150			
		Doors and Windows:					
		Doors as per schedule drawing 503081-GENR-DRG-CC-0329:					
CBD114		DA1	No	1			
CBD115		DA3	No	1			
CBD116		DA4	No	2			
		10.7	Miscellaneous work				
			Fullbore Rainwater Outlets:				
CBD117	Roof outlet type 3 as per drawing 503081-GENR-DRG-CC-0400 cast in concrete with clamped Derbigum laps to manufacturer's specification including connecting to uPVC pipes		No.	8			
CBD118	80mm Diameter uPVC overflow pipe cast into concrete slabs, beams and columns		No.	16			
	Damp- and waterproofing:						
CBD119	375 micron medium density polyethylene damp proof sheeting under floors		m²	150			
CBD120	375 micron green medium density polyethylene damp proof course in walls		m²	20			
	Ant poison, aldrin emulsifiable concentrates solution to SANS 618 spread at a rate recommended by the manufacturer:						
CBD121	Bottoms of foundations, footings and column bases		m²	20			
CBD122	Under floors		m²	150			
	SANS 1200 L	MEDIUM PRESSURE PIPELINES					
Carried forward / ...							

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.2.5	Supply and place pipes, valves, and specials (short pipe runs) Stainless steel grade 304, flanged, 4.5 mm minimum wall thickness, drilled to SANS 1123 Table 1600/3 Spool pieces (refer drawing number 503081-WTW1-DRG-CC-1296)				
CBD123		Item 1: DN250 spool piece with puddle flange, fully flanged, 1000 mm F/F, PN16	No	3		
CBD124		Item 2: DN250 spool piece with puddle flange, fully flanged, 1100 mm F/F, PN16	No	1		
CBD125		Item 3: DN200 spool piece with puddle flange, fully flanged, 1100 mm F/F, PN16	No	2		
CBD126		Item 4: DN200 spool piece with puddle flange, fully flanged, 850 mm F/F, PN16	No	1		
CBD127		Item 5: DN150 spool piece with puddle flange, fully flanged, 1100 mm F/F, PN16	No	2		
	SANS 1200 LE	STORMWATER DRAINAGE Supply and install subsurface drains complete:				
CBD128	8.2.14	19mm crushed stone subsurface drains as per detail Drawing No 503081-GENR-DRG-CC-0310	m	150		
TOTAL OF SECTION CBD CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CBE				
		CHAMBERS				
	SANS 1200 DB	EARTHWORKS (PIPE TRENCHES)				
	8.3.2	Excavation:				
CBE1		d) Excavate in all materials for stormwater inlet and outlet structures and for manholes, catchpits, valve chambers and the like, irrespective of depth, and backfill around these structures	m ³	90		
		f) Extra over items (d) for excavating in:				
CBE2		1) Hard rock material	m ³	30		
	SANS 1200 G	CONCRETE (STRUCTURAL)				
	8.2	Scheduled Formwork Items				
	8.2.1	Rough:				
		Plane vertical to:				
CBE3		Sides of bases	m ²	5		
	8.2.2	Smooth:				
		Plane vertical to:				
CBE4		Sides of walls	m ²	115		
CBE5		Sides of slabs	m ²	5		
		Plane horizontal to:				
CBE6		Precast Slabs	m ²	15		
	8.3	Scheduled reinforcement items:				
	8.3.1	Steel bars:				
		Mild steel bars:				
CBE7		8 mm dia	t	0.10		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CBE8		Brought forward / ... 10 mm dia	t	0.10		
		High-tensile steel bars:				
CBE9		10 mm dia	t	0.40		
CBE10		12 mm dia	t	0.60		
CBE11		16 mm dia	t	0.80		
CBE12		20 mm dia	t	0.70		
CBE13		25 mm dia	t	0.50		
CBE14		32 mm dia	t	0.30		
	8.4	Scheduled concrete items: Blinding layer in grade 15 MPa/19 mm concrete of:				
CBE15	8.4.2	75 mm thickness	m ²	15		
	8.4.3	Strength concrete: Grade 25 MPa/19 mm concrete to:				
CBE16		Benching	m ³	1		
		Grade 35 MPa/19 mm concrete (watertight) to:				
CBE17		Bases	m ³	5		
CBE18		Walls	m ³	15		
CBE19		Slabs	m ³	5		
	8.4.4	Unformed surface finishes: a) Wood-floated finishes to:				
CBE20		Horizontal surfaces	m ²	15		
	8.5	Joints: Designated joints, complete as per drawings:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CBE21		Brought forward / ...				
		Type: Joint CJ	m	20		
	8.13	Casting items in concrete:				
CBE22		DN100 (Items 3, 6 & 9 on drawing number 503081-WTW1-DRG-CC-1932)	No.	4		
	8.24	Preparation of base concrete to receive benching				
CBE23		Chamber Floors	m ²	8		
	8.28	Miscellaneous work				
CBE24		Supply and install manhole cover as per drawing number 503081-PIPE-DRG-CC-2038 and 503081-PIPE-DRG-CC-2039	No	2		
CBE25		Supply and install chamber roof inlet air vent as per drawing number 503081-PIPE-DRG-CC-2042 and 503081-PIPE-DRG-CC-2043	No	2		
CBE26		Supply and install chamber roof outlet air vent as per drawing number 503081-PIPE-DRG-CC-2042 and 503081-PIPE-DRG-CC-2043	No	2		
CBE27		Supply and Install 2 layers of 250 mm Wide ABE Malthoid 3 Ply (or similar approved) between chamber walls and precast top slabs	m	20		
CBE28		Supply and install lifting hooks as per drawing 503081-PIPE-DRG-CC-2036	No	8		
	SANS 1200 H	STRUCTURAL STEELWORK				
	8.3.1	Structural Steel				
	8.3.8	Ladders, complete and installed (all ladders to be hot-dip galvanized mild steel)				
		Ladder Type 1 (refer drawing number 503081-GENR-DRG-CC-0315), of height:				
CBE29		Over 2 m up to 4 m	No.	2		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	SANS	MEDIUM PRESSURE PIPELINES				
	8.2.5	Supply and place pipes, valves, and specials (short pipe runs)				
		Mild steel grade X52, flanged, 4.5 mm minimum wall thickness, painted internally and externally with two pack epoxy for immersed steel fabrications (D5.5.1), drilled to SANS 1123 Table 1600/3				
		Scour Valve Chamber (refer drawing number 503081-WTW1-DRG-CC-1932)				
CBE30		Item 1: DN300 x DN100, fully flanged tee, 890 mm long with 90° flanged branch, 500 mm C/F	No	1		
CBE31		Item 2: DN80 Restrained flange adaptor	No	4		
CBE32		Item 3: DN80 pipe, flanged one end with restraining flange at other end, 1500 mm F/F with puddle flange in centre of wall	No	1		
CBE33		Item 4: DN80, wedge gate valve, fully flanged, PN16	No	2		
CBE34		Item 5: DN80 Pipe, flanged one end, 800 mm long	No	2		
CBE35		Item 6: DN80 Pipe, flanged one end, 1100 mm long	No	2		
CBE36		Item 7: DN80 fully flanged orifice plate with 42 mm diameter orifice opening, PN16	No	2		
CBE37		Item 8: DN250 x DN80 fully flanged tee, barrel 890 mm F/F, with 90° flanged branch 500 mm C/F	No	1		
CBE38		Item 9: DN80 Pipe, flanged one end with restraining flange at other end, 900 mm F/F with collar flange in centre of wall	No	1		
	SPEC GF	GRP GRID FLOORING				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CBE39	8.1	<p>Brought forward / ...</p> <p>GRP flooring, complete and installed with frames (as per drawing number 503081-WTW1-DRG-CC-0304 and 503081-WTW1-DRG-CC-0305):</p> <p>Flooring Detail 2, Flooring type 9, 600 mm x 600 mm over chamber sump</p>	No	1		
TOTAL OF SECTION CBE CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
	503081-ZUT-SPEC-FI-ABSTR	SECTION CBF FIRE AND SAFETY - ABSTRACTION WORKS Regulatory Fire Safety Signage (refer drawing number 503081-WTW1-DRG-FI-1315-T0) Photoluminescent fire and directional signage, complete with all require fittings, mountings, hangers, brackets etc. Signage to be affixed using screws, no adhesive or double sided tape allowed. 190 mm height signage complete with aluminium black frames TRANSFORMER ROOM (190 mm signage)				
CBF1		1-2 sized	Sum	1		
CBF2		Illuminated Exit Sign	Sum	1		
		TRANSFORMER ROOM External Signage (white backing, non-photoluminescent)				
CBF3		1-2 sized	Sum	1		
		MCC ROOM (190 mm signage)				
CBF4		1-2 sized	Sum	1		
CBF5		Illuminated Exit Sign	Sum	1		
		MCC ROOM External Signage (white backing, non-photoluminescent)				
CBF6		1-2 sized	Sum	1		
		Supply and Install Portable Fire Extinguishers c/w mounting brackets fixed inside cabinets, signage and surface mounted where required mounted inside cabinets for the following types and capacities:				
CBF7		5kg CO2 Fire Extinguisher	No.	2		
TOTAL OF SECTION CBF CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CBG				
		DUCTS				
	SANS 1200LC	CABLE DUCTS				
	8.2.5	Supply, lay, bed and prove duct:				
		a) Black HDPE ducting pipe, "Kabelflex" or relevant equivalent approved of diameters stated:				
CBG1		1) 110 mm	m	40		
	8.2.6	Imported bedding material, where ordered				
		a) From commercial or off site sources located by the Contractor				
CBG2		Selected granular material	m ³	10		
	8.2.7	Draw pits/manholes				
CBG3		a) Manholes complete as per details on drawing number 503081-GENR-DRG-CC-0400-T0 for depths up to 1.5 m	No	2		
TOTAL OF SECTION CBG CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CBH				
		ABSTRACTION WORKS ANCILLARIES				
	SPEC AW	ANCILLARIES				
CBH1	6.1	Trash rack (refer drawing 503081-WTW1-DRG-CC-1299)	No.	2		
CBH2	6.2	Vertical sluice gate (refer drawing 503081-WTW1-DRG-CC-1299)	No.	2		
TOTAL OF SECTION CBH CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CBI				
		GEOTECHNICAL INVESTIGATION				
	SPEC GI	ROTARY CORE DRILLING				
CBI1	7.3.1	Establishment on site	Sum	-		
	7.3.2	Setting up of core drill rig at drill position (incl. access and reinstatement)				
CBI2		a) Normal skid setup	No	1		
CBI3		b) Very difficult skid setup (Barge)	No	1		
	7.3.3	Drilling				
CBI4		a) In category A materials	m	20		
CBI5		b) In category B materials	m	20		
CBI6		c) In category C materials	m	20		
CBI7		d) In category D materials (extra over Item CBI5) by different rock types	m	10		
CBI8		e) In very closely fractured material (extra over Item CBI5)	m	10		
CBI9		f) Drilling in gravel	m	20		
CBI10		g) Drilling in cobbles and boulders	m	20		
		h) Extra over for drilling inclined holes in all categories:				
CBI11		i) Inclination > 60° and < 85°	m	50		
	7.3.4	Core and soil material recovery				
CBI12		a) Soil material recovery in all material types	m	20		
CBI13		b) Core recovery in category A materials	m	20		
CBI14		c) Core recovery in category B materials	m	20		
CBI15		d) Core recovery in category C materials	m	20		
CBI16		e) Core recovery in category D materials	m	10		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		f) Extra-over Item CBI in different rock types:				
CBI17		i) In very closely fractured material	m	10		
	7.3.5	Casing				
CBI18		a) Casing left in the hole (by size)	m	50		
		b) Extra-over Item CBI17 for casing:				
CBI19		i) In material of Category B or harder	m	30		
CBI20		ii) In boulders and gravel	m	20		
CBI21		iii) In inclined holes	m	25		
CBI22	7.3.6	SPT tests (incl. energy testing as per ISO 22476-3:2005)	No	30		
CBI23	7.3.7	Supply aluminium core boxes	No	10		
CBI24	7.3.8	Marking of hole by concrete block	No	2		
	7.3.9	Standing time				
CBI25		a) Drill rig	hours	16		
	7.3.10	Laboratory testing				
CBI26		Uniaxial Compressive Strength Test (UCS)	No	4		
CBI27		BRE/DIN tests	No	2		
CBI28		Shear box tests	No	2		
CBI29		Slake durability tests	No	2		
TOTAL OF SECTION CBI CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CCA				
		HIGH-LIFT PUMPING MAIN				
		CHAINAGE 0m To 580m				
	SANS 1200 C	SITE CLEARANCE				
	8.2.1	Clear and Grub				
CCA1		Clear and grub vegetation and trees including tree stumps up to 15m wide strip (Max. tree girth 1m)	m ²	8 700		
	8.2.8	Demolish and remove structures/buildings and dismantle steelwork, etc.				
CCA2		a) Pit latrine and top structure of any size and construction.	No	2		
CCA3		b) Animal Holding Pen of any size and construction.	No	1		
CCA4		c) Rondavel of any size and construction.	No	1		
CCA5		d) Single-storey Brick structure up to 25m ² floor area	No	1		
	8.2.11	Take down and re-erect existing fences				
CCA6		a) All Types and materials up to 0 to 1.0m high	m	116		
CCA7		b) All Types and materials over 1.0 to 1.5m high	m	290		
CCA8		c) All Types and materials over 1.5 to 2.0m high	m	29		
CCA9	SANS 1200 A 8.9.1	Temporary fencing where existing fencing has been taken down	m	435		
	SANS 1200 D	EARTHWORKS				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.3.3	Restricted Excavation a) Excavate for restricted foundations, footings and pipe trenches in all materials and use for backfill or embankment or dispose				
CCA10		Pipeline AC Mitigation Chambers	m ³	20		
CCA11		e) Extra over sub-item 8.3.3 (a) for hand excavation where ordered	m ³	6		
CCA12	8.3.10	Topsoiling	m ³	522		
	SANS 1200 DB	EARTHWORKS (PIPE TRENCHES)				
	8.3.1	Site clearance and removal of topsoil				
CCA13		c) Remove topsoil to a minimum depth of 150mm	m ²	6 960		
	8.3.2	Excavation a) Excavate in all materials, for trenches, backfill, compact and dispose of surplus material				
		Fibre Optic Conduits				
		Pipes up to 50 mm dia for depths:				
		Over and Up to				
CCA14		0,5 m 1,5 m	m	522		
CCA15		1,5 m 2,5 m	m	58		
		High-Lift Pumping Main				
		Pipes over 315 mm dia and up to 400 mm dia for depths:				
		Over and Up to				
CCA16		0,5 m 1,5 m	m	522		
CCA17		1,5 m 2,5 m	m	29		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CCA18		Brought forward / ... 2,5 m 3,5 m b) Extra-over for items under payment reference 8.3.2(a) (SANS 1200 DB) for: 2) Hard rock excavation	m	29		
CCA19		(i) By means of explosives	m ³	210		
CCA20		(ii) Without explosives	m ³	200		
		3) Hand excavation and backfill by hand where ordered by the Engineer				
CCA21		a) Soft and intermediate material	m ³	59		
CCA22		b) Hard rock material	m ³	12		
CCA23		4) Stabilizing backfill with 5% cement where directed by the Engineer	m ³	52		
		5) Working within a restricted working area				
		a) 5 - 10m				
CCA24		i. Up to 1.5 m depths	m	139		
CCA25		ii. Over 1.5 m and up to 2.5 m depths	m	17		
CCA26		iii. Over 2.5 m and up to 3.5 m depths	m	17		
		b) 10 - 15m				
CCA27		i. Up to 1.5 m depths	m	186		
CCA28		ii. Over 1.5 m and up to 2.5 m depths	m	23		
CCA29		iii. Over 2.5 m and up to 3.5 m depths	m	23		
		7) Steep Slopes				
CCA30		a) Pipe trench slopes > 10% to 15%	m	6		
CCA31		b) Pipe trench slopes > 15% to 20%	m	6		
CCA32		c) Pipe trench slopes > 20%	m	3		
		8) Boulder Excavation, Class A				
CCA33		(i) By means of explosives	m ³	30		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CCA34		Brought forward / ... (ii) Without explosives	m ³	30		
CCA35		9) Boulder Excavation, Class B (i) By means of explosives	m ³	30		
CCA36		(ii) Without explosives	m ³	30		
CCA37		c) Excavate and dispose/stockpile of unsuitable material from trench bottom (Provisional)	m ³	65		
CCA38		d) Excavate in all materials for stormwater inlet and outlet structures and for manholes, catchpits, valve chambers and the like, irrespective of depth, and backfill around these structures	m ³	60		
CCA39		e) Excavate open drains in all materials	m ³	7		
CCA40		f) Extra over to items (d) and (e) above for excavating in: 1) Hard rock material	m ³	7		
	8.3.3	Excavation ancillaries:				
	8.3.3.1	Make up deficiency in backfill material (Provisional):				
CCA41		b) From other necessary excavations on site	m ³	26		
CCA42		c) By importation from commercial or off-site sources selected by the Contractor	m ³	309		
CCA43	8.3.3.3	Compaction in Road Crossings	m ³	23		
	8.3.4	Particular items (Where Ordered): a) Shoring:				
CCA44		Over 0m Deep to 1m Deep	m	1		
CCA45		Over 1m Deep to 2m Deep	m	6		
CCA46		Over 2m Deep to 3m Deep	m	3		
	8.3.5	Existing services that intersect or adjoin a pipe trench:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		a) Services the intersect a trench:				
CCA47		O/H Electrical or Communication lines of all kinds	No	3		
CCA48		Buried water or sewer pipes up to DN350mm	No	2		
CCA49		Buried electrical or communication cables of all kinds	No	2		
CCA50		Fences or boundary walls of all kinds	No	2		
CCA51		Stormwater pipes up to DN600mm	No	2		
CCA52		Stormwater Channels	No	2		
		b) Services that adjoin a trench:				
CCA53		O/H Electrical or Communication lines of all kinds	m	174		
CCA54		Buried water or sewer pipes up to DN350mm	m	29		
CCA55		Buried electrical or communication cables of all kinds	m	29		
CCA56		Fences or boundary walls of all kinds	m	174		
CCA57		Stormwater pipes up to DN600mm	m	29		
CCA58		Stormwater Channels	m	29		
	8.3.6	Finishing:				
	8.3.6.1	Reinstate road surfaces complete with all courses:				
CCA59		a) Gravel on shoulders	m ²	9		
CCA60		b) Subbase - 150mm G5 Material 95% of modified AASHTO	m ²	18		
CCA61		c) Base layer - 150mm G4 Material 98% of modified AASHTO	m ²	18		
CCA62		d) 150mm Gravel Wearing Course	m ²	18		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CCA63	8.3.8	Temporary stockpiling of wet material	m ³	26		
	8.3.9	Reinstatement of existing stormwater infrastructure				
CCA64		a) Open Earth Channels up to 600mm wide	m	5		
CCA65		b) Concrete lined Open Channels up to 600mm wide	m	5		
CCA66		c) Concrete and Brick Inlet / Outlet Headwall Structures for storm culverts up to 600mm dia.	No	2		
CCA67		d) Stormwater pipes of all materials up to 400mm Dia	m	5		
CCA68		e) Stormwater pipes of all materials 450mm Dia up 700mm Dia	m	2		
	8.3.10	Stone bedding layer and geotextile filter blanket				
CCA69		19mm Stone bedding layer	m ³	17		
CCA70		Geotextile filter blanket - Grade A4 Bidim or Similar Approved	m ²	151		
CCA71	8.3.11	Survey and protection of surrounding structures before blasting	Sum	-		
	SANS 1200 DK	GABIONS AND PITCHING				
CCA72	8.2.9	Rip-rap	m ³	8		
CCA73	8.2.10	Geotextile beneath rip-rap - A4 Bidim or Similar Approved	m ²	56		
	SANS 1200 LB	BEDDING (PIPES)				
	8.2.1	Provision of bedding from trench excavation				
		a) Selected granular material				
CCA74		i) Without the need for screening	m ³	46		
CCA75		ii) Including for screening	m ³	368		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.2.2	Supply only of bedding by importation				
	8.2.2.3	From commercial sources (Provisional)				
CCA76		a) Selected granular material	m ³	18		
CCA77		b) Selected fill material	m ³	18		
	8.2.2.4	From other sources on site:				
CCA78		a) Selected granular material	m ³	5		
CCA79		b) Selected fill material	m ³	5		
	8.2.4	Encasing of pipes in Concrete:				
		20 MPa/19 mm concrete for pipes:				
CCA80		over DN 300 up to DN 500	m ³	13		
CCA81	8.2.6	Extra-over to 8.2.2 for bedding stabilised with 5% cement	m ³	23		
	SANS 1200 LC	CABLE DUCTS				
	8.2.5	Supply, lay, bed and test duct				
CCA82		50mm HdPE Fibre Optic Conduit	m	580		
	SPE-CC-7003	LAYING & JOINTING OF MEDIUM PRESSURE STEEL PIPES & SPECIALS				
	8.2.1	Supply, lay and bed steel pipes and specials complete with couplings				
CCA83		5.0mm WT, Bell & Spigot, Externally Welded, DN350mm. Refer SPE-JJ-0003 for; - Lining PL1 : Cement-Mortar Lining - Coating PC2 : FBMDPE	m	580		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CCA84		Brought forward / ... 6.0mm WT, Bell & Spigot, Externally Welded, DN350mm. Refer SPE-JJ-0003 for; - Lining PL1 : Cement-Mortar Lining - Coating PC2 : FBMDPE	m	Rate Only		Rate Only
	SPE-JJ-0003	GENERAL CORROSION PROTECTION				
CCA85	12.2.1	Quality Control Plan (QCP) and Documentation	Sum	-		
	SPE-CC-7003	Supply, lay and bed steel pipes and specials complete with couplings Specials : Unless specified otherwise elsewhere are manufactured from Steel Grade X52. Including lining and coating to match main pipeline and any field repairs as specified if required.				
	8.2.1	Bends to Suit Bell & Spigot - 5.0mm Wall Thickness				
CCA86		DN350 x 5° up to 22.5° bend	No	5		
CCA87		DN350 x over 22.5° up to 45° bend	No	5		
CCA88		DN350 x over 45° up to 90° bend	No	5		
CCA89		Bolt Flange, PN40. Welded On-Site. Including all necessary repairs to pipe coating / lining as specified.	No	6		
CCA90		Collar Flange, PN40. Welded to pipe On-Site. Including all necessary repairs to pipe coating / lining as specified.	No	2		
	8.2.1	Fittings, PN40				
CCA91		DN350 Restrained Flange Adaptor	No	8		
CCA92		DN200 Restrained Flange Adaptor	No	1		
CCA93		DN100 Restrained Flange Adaptor	No	2		
		Air Valve Chamber: Drawing No. 503081-PIPE-DRG-CC-2021				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.2.1	Pipe Specials, SS Grade 304L, WT 5.0mm				
CCA94		Item 2. DN350, 1200mm Long, Flanged, with Collar Flange 450mm from one end.	No	2		
CCA95		Item 3. DN350 Flanged Equal Tee	No	2		
CCA96		Item 3A. DN350 blank flange with 300mm long, DN50 stub riser. 4 No. 50mm x 50mm x 5mm web plates to be welded equi-distant around stub to blank flange and stub. Riser flanged DN50 other end end.	No	2		
CCA97		Item 4. DN350, 1200mm Long, Flanged one end with Collar Flange 450mm from one end.	No	2		
	8.2.3	Valves				
CCA98		Item 3B. DN50, Wedge Gate Valve, Flanged, PN40	No	2		
CCA99		Item 3C. DN50, Flanged Air Valve, Two-Stage, PN40	No	2		
		Scour Valve Chamber "TYPE 1": Drawing No. 503081-PIPE-DRG-CC-2022				
	8.2.1	Pipe Specials, SS Grade 304L, WT 5.0mm				
CCA100		Item 1. DN350 x DN100, Flanged Scour Tee, 890mm Long With 90 Degree Flanged Branch, 500mm CF	No	1		
CCA101		Item 3. DN100 Pipe, Flanged One End, 1000mm Long with Restraining Flange at othe end.	No	1		
CCA102		Item 5. DN100 Pipe, Flanged One End, 600mm Long with Restraining Flange at other end	No	1		
CCA103		Item 6. DN100 Pipe, Flanged one End, 1000mm Long	No	1		
	8.2.3	Valves				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CCA104		Brought forward / ... Item 4. DN100, Wedge Gate Valve, Flanged, PN40 Scour Valve Chamber "TYPE 2": Drawing No. 503081-PIPE-DRG-CC-2023	No	2		
	8.2.1	Pipe Specials, SS Grade 304L, WT 5.0mm (Unless Specified Otherwise)				
CCA105		Item 1. DN350 x DN100, Flanged Scour Tee, 890mm Long With 90 Degree Flanged Branch, 500mm CF	No	1		
CCA106		Item 2. DN100 Pipe, Flanged One End, 1000mm Long with Restraining Collar Flange at other end.	No	1		
CCA107	SANS 1200 L 8.2.1	Item 3. DN100 Pipe, HdPE, PN16. Custom Fabricated to-suite chosen site alignment. Flanged both ends, including S/S flange stub backing ring connection complete.	m	10		
	8.2.2	Extra-Over "Item 3" above, for supply and butt-welding of plain-ended bends				
CCA108		a) DN100, PN16, 11.25 Deg Bend	No	2		
CCA109		b) DN100, PN16, 12.5 Deg Bend	No	2		
CCA110		c) DN100, PN16, 45 Deg Bend	No	2		
CCA111		Item 5. DN100 Pipe, Flanged one End, 500mm Long with collar flange 200mm from flanged end	No	1		
	SPE-CC-7003 8.2.3	Valves				
CCA112		Item 6. DN100, Wedge Gate Valve, Flanged, PN40	No	1		
	8.2.6	Anchor / thrust blocks and pedestals				
CCA113		a). Construct Complete with concrete (Grade 25MPa/19 mm)	m ³	15		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CCA114	8.2.8	Brought forward / ... b). Formwork	m²	64		
CCA115		c). High and Medium Tensile Steel Reinforcement	ton	1.20		
		Valve chambers Construct the chamber complete, as per the relevant drawings. Air Valve Chamber: Drawing No. 503081-PIPE-DRG-CC-2021 For depths to pipe invert in the range of:				
CCA116		Over 1,0 m and up to 2,0 m	No	1		
CCA117		Over 2.0 m and up to 3.0 m	No	1		
		Scour Valve Chamber "Type 1": Drawing No. 503081-PIPE-DRG-CC-2021 For depths to pipe invert in the range of:				
CCA118		Over 1,0 m and up to 2,0 m	No	1		
		Scour Valve Chamber "Type 2": Drawing No. 503081-PIPE-DRG-CC-2023 For depths to pipe invert in the range of:				
CCA119		Over 1,0 m and up to 2,0 m	No	1		
		Items Cast or Built into Concrete				
CCA120	8.2.11	Up to DN100mm pipe or Special through up to 400mm thick mass	No	2		
CCA121		From DN100mm to DN350mm pipe or Special through up to 400mm thick mass	No	6		
CCA122	8.2.12	Pipe lining integrity testing	m	580		
CCA123	8.2.16	Pipeline Marker-Posts as per drawing 503081-PIPE-DRG-CC-2032	No	5		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.2.18	Miscellaneous				
		Erosion Protection Measures. Refer to DRG-CC-2034				
CCA124		Cross Embankments	m ³	54		
CCA125		Cross Walls	m ³	5		
CCA126		Anchor Blocks	m ³	5		
CCA127		Grassing by means of Hydroseeding	m ²	120		
	SANS	CHAMBER DRAINAGE PIPEWORK				
	1200 L					
	8.2.16					
CCA128		Drainage outlet pipes for Chambers : DN50mm, HdPE, PN16. Flexible Bedding, including all necessary Couplings and excavations	m	20		
CCA129		Supply and Install Headwall structure as detailed on Dwg No 503081-PIPE-DRG-CC- 2044 at all daylight points for chamber drainage outlet pipes.	No	2		
	SANS 1200 A	GENERAL				
	8.5	Sum stated provisionally by the Engineer				
	SANS 1200A 8.5	b) For work to be executed by a subcontractor, and/or for goods, materials, plant and/or services to be supplied to the Site				
CCA130		Pipeline Corrosion Protection (cathodic protection and AC Mitigation)	Prov Sum	-	1 100 000	1 100 000.00
CCA131		Overheads, charges and profit on item above	%	1 100 000		
TOTAL OF SECTION CCA CARRIED TO SUMMARY					R	

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CEA				
		ACCESS ROAD 1: WTW TO ABSTRACTION WORKS				
	SANS 1200C	SITE CLEARANCE				
CEA1	8.2.1	Clear and grub	ha	1		
CEA2	8.2.2	Remove topsoil to nominal depth of 150 mm and stockpile/spoil	m³	1 620		
	SANS 1200DB	EARTHWORKS (PIPE TRENCHES)				
	8.3.2	Excavation				
		(a) Excavation in all materials for trenches backfill, compact, and dispose of surplus/unsuitable material, for all pipe diameters, for total trench depth:				
		depth ranges below the surface level:				
CEA3		0 m up to 1 m	m³	5		
CEA4		1 m up to 2 m	m³	200		
CEA5		2 m up to 3 m	m³	560		
CEA6		exceeding 3 m and up to 4 m	m³	230		
		(b) Extra over item (a) above for:				
		2) Hard Rock Excavation				
CEA7		(i) By means of explosives	m³	250		
CEA8		(ii) Without explosives	m³	250		
CEA9		(c) Excavate and dispose of unsuitable material from trench bottom	m³	100		
	8.3.4	Particular items				
CEA10		(a) Shore trench opposite structures or services	m	10		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		(b) Temporary Works: Control Water Inflows				
CEA11		1) Provide Equipment	sum	1		
CEA12		2) Operate and Maintain	Days	20		
CEA13		3) Remove Equipment	sum	1		
	8.3.5	Existing services that intersect or adjoin a pipe trench				
		(a) Services that intersect a trench a pipe trench				
CEA14		i) ESKOM cables	No.	1		
CEA15		ii) Telecommunication cables	No.	1		
CEA16		iii) Watermains up to 300 mm dia	No.	1		
CEA17		iv) Watermains over 300 mm dia	No.	1		
CEA18		v) Sewers up 300 mm dia	No.	1		
CEA19		vi) Stormwater up to 700 mm dia	No.	1		
		(b) Services that adjoin a trench a pipe trench				
CEA20		i) ESKOM cables	No.	1		
CEA21		ii) Telecommunication cables	No.	1		
CEA22		iii) Watermains up to 300 mm dia	No.	1		
CEA23		iv) Watermains over 300 mm dia	No.	1		
CEA24		v) Sewers up 300 mm dia	No.	1		
CEA25		vi) Stormwater up to 700 mm dia	No.	1		
	SANS 1200D	EARTHWORKS				
	8.2.2	Bulk excavation				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		(a) Excavate in all materials and use for embankment or backfill, as ordered				
		depth ranges below the surface level:				
CEA26		0 m up to 1 m	m ³	1 510		
CEA27		1 m up to 2 m	m ³	120		
CEA28		2 m up to 3 m	m ³	620		
CEA29		3 m and up to 4 m	m ³	10		
CEA30		exceeding 4 m and up to 5 m	m ³	1 930		
		(b) Excavate in all materials and dispose of:				
		2) Hard Rock Excavation				
CEA31		(i) By means of explosives	m ³	420		
CEA32		(ii) Without explosives	m ³	420		
CEA33		(c) Excavate in all materials and dispose of, and backfill with material from commercial sources (clean sand unless otherwise indicated)	m ³	420		
	SANS 1200DK	GABIONS AND PITCHING				
CEA34	8.2.1	Surface preparation for bedding of gabions.	m ³	740		
	8.2.2	Construct gabions and Reno Mattresses using double twisted hexagonal mesh type specified below with 3.4mm OD frame wire and 2.7mm OD mesh wire to SANS 1480:2005: 503081-ROAD-DRG-CC- 5300				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Supply and install the following rock filled gabion baskets complete :				
CEA35		a) 2 x 1 x 1m with 80 x 100mm galv. mesh	m ³	560		
CEA36		b) 1,5 x 1 x 1m with 80 x 100mm galv. mesh	m ³	630		
CEA37		c) 1 x 1 x 1m with 80 x 100mm galv. mesh	m ³	1 061		
CEA38		d) 3 x 1 x 0,3m with 60 x 80mm galv. mesh (Reno Mattress)	m ³	1 090		
CEA39		f) 2 x 1 x 0,3m with 80 x 100mm galv. mesh (Reno Mattress)	m ³	510		
CEA40		Rip-Rap	m ³	3 860		
CEA41	8.2.3	Extra Over 8.2.2 for packing selected stone for exposed face.	m ²	240		
CEA42	8.2.4	Geotextile beneath rip-rap	m ²	6 980		
CEA43		Sand layer on top of geotextile layer	m ²	5 290		
CEA44		Filter layers beneath rip-rap	m ²	5 290		
CEA45	8.2.5	Pitching	m ³	20		
CEA46	8.2.5	Excavation and concrete backfill of footing trenches for pitching	m ³	20		
	SANS 1200DM	EARTHWORKS (ROADS, SUBGRADE)				
	8.3.3	Treatment of roadbed:				
		(a) Roadbed preparation and compaction of material to:				
CEA47		(i) Minimum 90% of modified AASHTO maximum density	m ³	650		
CEA48		(ii) Minimum 93% of modified AASHTO maximum density	m ³	80		
		(b) In-place treatment of roadbed in hard rock material by:				
CEA49		(i) Ripping	m ³	40		
CEA50		(i) Blasting	m ³	220		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.3.4	Cut to fill, borrow to fill:				
CEA51		(a) Cut to fill compacted to 93% of modified AASHTO maximum density	m ³	135		
CEA52		(b) Borrow to fill from commercial or off site sources located by the Contractor compacted to 93% of modified AASHTO maximum density	m ³	1 220		
	8.3.5	Selected layer compacted to 93% of modified AASHTO maximum density				
		(a) Selected layers using material cut from the site and compacted to: excavation:				
CEA53		(i) 150mm selected subgrade (SSG), G9 lower selected layer compacted to 93% of modified AASHTO maximum density	m ³	5		
CEA54		(ii) 150mm selected subgrade (SSG), G7 upper selected layer compacted to 95% of modified AASHTO maximum density	m ³	5		
		(b) Selected layers using material from commercial or off site sources located by the Contractor, compacted to:				
CEA55		(i) 150mm selected subgrade (SSG), G9 lower selected layer compacted to 93% of modified AASHTO maximum density	m ³	5		
CEA56		(ii) 150mm selected subgrade (SSG), G7 upper selected layer compacted to 93% of modified AASHTO maximum density	m ³	3 130		
CEA57	8.3.6	Extra over items 8.3.4 (a) through to 8.3.5 (b) for excavating and breaking down material in hard excavation	m ³	3 130		
	8.3.7	Cut to spoil or stockpile from:				
CEA58		(a) Soft excavation	m ³	3 740		
CEA59		(c) Hard excavation	m ³	534		
CEA60		(d) Boulder Excavation Class A	m ³	540		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CEA61		Brought forward / ...				
CEA61		(e) Boulder Excavation Class B	m ³	534		
CEA62	8.3.8	Removal of oversize material	m ³	1 610		
	8.3.9	Overbreak of excavation in:				
CEA63		(c) Hard excavation	m ²	440		
CEA64	8.3.10	Materials bladed to windrow	m ³	670		
CEA65	8.2.7	Extra over items 8.3.4, 8.3.5 and 8.3.7 for temporary stockpiling of material	m ³	9 700		
	8.3.13	Surface finishes:				
CEA66		(a) Topsoiling (from stockpile)	m ²	6 180		
		(b) Grassing or other vegetation cover:				
CEA67		(1) Planting of Grass sods	m ²	2 480		
CEA68		(2) Hydroseeding	m ²	3 710		
CEA69		(3) Trim, shape and roll verge	m ²	6 190		
CEA70		(4) Fertilizer (2.3.2(22) at 400kg/ha)	t	0.25		
CEA71	8.3.15	Catchment mounds and channels and mitre banks and channels	m ³	270		
	SABS 1200LB	BEDDING (Pipes)				
	8.2.1	Provision of Bedding from Trench Excavation				
CEA72		(a) Selected granular material	m ³	5		
	8.2.2	Supply only of Bedding by Importation				
	8.2.2.3	From commercial source				
CEA73		(a) Selected granular material from commercial source	m ³	180		
CEA74		(b) Selected fill material from trench excavation commercial source	m ³	30		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.2.3	Concrete Bedding Cradle				
CEA75		a) 0 to 750 mm dia. Pipes in concrete (Class 15/19 concrete)	m ³	5		
CEA76		a) 0 to 750 mm dia. Pipes in soilcrete as per drawing (12% cement added per volume) vibrated as for concrete	m ³	180		
	8.2.4	Encasing of Pipes in Concrete				
CEA77		a) 0 to 750 mm dia. Pipes in concrete (Class 15/19 concrete)	m ³	30		
	SANS 1200LE	STORMWATER DRAINAGE				
	8.2.1	Supply and Lay Concrete Pipe Culverts				
		On Class C bedding:				
CEA78		(i) 350mm diameter Class 100D	m	5		
CEA79		(ii) 600mm diameter Class 100D	m	50		
CEA80		(iii) 750mm diameter Class 100D	m	5		
CEA81		(iv) 900mm diameter Class 100D	m	30		
CEA82		(v) 1500mm diameter Class 100D	m	20		
	8.2.8	Supply and installation of manholes, catch pits, and the like				
		(a) Manholes:				
		(i) Brickwork manholes including covers and frames (complete as per drawing):				
CEA83		Depth exceeding 1.0m to 1.5m	No	1		
CEA84		Depth exceeding 1.5m to 2.0m	No	1		
CEA85		Depth exceeding 2.0m to 2.5m	No	1		
CEA86		Depth exceeding 2.5m to 3.0m	No	1		
CEA87		Depth exceeding 3.0m to 3.5m	No	1		
CEA88		Depth exceeding 3.5m to 4.0m	No	1		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CEA89		Depth exceeding 4.0m to 4.5m	No	1		
CEA90		Depth exceeding 4.5m to 5.0m	No	1		
		(ii) Brickwork double grid inlets including covers and frames (complete as per drawing 503081-ROAD-DRG-CC-5400 to 5403):				
CEA91		Depth exceeding 1.0m up to 1.5m	No	1		
CEA92		Depth exceeding 1.5m up to 2.0m	No	2		
CEA93		Depth exceeding 2.0m up to 2.5m	No	1		
CEA94		Depth exceeding 2.5m up to 3.0m	No	1		
CEA95		Depth exceeding 3.0m up to 3.5m	No	1		
CEA96		Depth exceeding 3.5m up to 4.0m	No	2		
CEA97		Depth exceeding 4.0m up to 4.5m	No	2		
CEA98		Depth exceeding 4.5m up to 5.0m	No	1		
	8.2.14	Subsurface drains				
CEA99		Supply and lay subsurface drains at 2m depths complete with bidim filter jacket, flownet drainage core, DN 150mm perforated mesh-structured drainage pipe as per drawing 503081-ROAD-DRG-CC-5404	m	1 400		
	8.2.15	Headwall Outlet Structures (as per drawing 503081-ROAD-DRG-CC-5404)				
CEA100		Headwall for 600mm to 750mm diameter pipes	No	1		
CEA101		Headwall for 750 mm to 1500mm diameter pipes	No	1		
CEA102		Headwall for two 1500mm Diameter pipes	No	1		
	SANS 1200G	CONCRETE SMALL WORKS				
	8.1.1	Formwork				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.2.1	Rough formwork for surfaces to be covered up				
CEA103		Sides of foundations	m ²	65		
	8.2.2	Smooth formwork for exposed surfaces				
CEA104		Sides of walls	m ²	435		
CEA105		Sides of deck slab	m ²	20		
CEA106		Sides of columns	m ²	5		
CEA107		Soffits of the slab	m ²	90		
CEA108		Roof slab upstand	m ²	21		
CEA109		Concrete pavement	m ²	120		
	8.3	Reinforcement				
CEA110	8.3.1	Mild steel bars R12	t	0.50		
CEA111		High tensile steel bars Y10	t	1		
CEA112		High tensile steel bars Y12	t	6		
CEA113		High tensile steel bars Y16	t	13		
CEA114		High tensile steel bars Y20	t	19		
CEA115	8.3.2	Welded steel fabric (Ref 617)	m ²	975		
	8.4	Concrete				
CEA116	8.4.2	Blinding concrete Grade 10/19mm in 75mm blinding layer under foundations, footings and the like.	m ³	20		
	8.4.3	Reinforced concrete Grade 30/19 (30 MPa, 19mm stone) as follows:				
CEA117		a) No fines concrete	m ³	10		
CEA118		b) Culvert Foundations	m ³	150		
CEA119		c) Structural walls	m ³	100		
CEA120		d) Structural columns	m ³	5		
CEA121		e) Structural Deck slabs	m ³	50		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CEA122		Brought forward / ...				
	8.4.4	f) Concrete pavement	m ³	293		
		Unformed surface finishes				
CEA123		(a) Smooth wood float finish	m ²	580		
CEA124		(b) Power float finish on floor slab	m ²	100		
	8.5	JOINTS				
		(a) Construction joints				
CEA125		(i) Butt type construction joint for construction in base slab and deck slab	m	80		
CEA126		(ii) Butt type construction joint with dowel between base slab and wingwall as well as between deck slab and approach slab; complete with Ø25 PVCU TUBE END CLOSED WITH ANTI-CORROSION AND SEALING TAPE; 10mm COMPRESSIBLE BITUMEN-IMPREGNATED JOINT FILLER; R16 DOWEL BARS 1200mm LONG @ 600c/c (BARS TO BE SAWN NOT CUT)	m	70		
		(b) Expansion joints				
CEA127		(i) Install base and bridge deck expansion joint, EPDM rubber seal and ancillaries including all labour and materials	m	140		
	SANS 1200ME	ROAD SUB-BASE				
	8.3.1	Construct the subbase course/shoulders/gravel wearing course with material from commercial sources:				
CEA128		150mm cemented natural gravel sub-base, crushed (G5), Subbase compacted to 95% of modified AASHTO maximum density (C4)	m ³	570		
	8.3.5	Process subbase material by the following processes, as relevant, and use in the subbase:				
CEA129		(d) Stabilization	m ³	570		
	8.3.8	Stabilizing agent:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CEA130		Brought forward / ...				
		(b) Portland cement (CEM II -32.5)	t	10		
	SANS 1200MF	BASE				
CEA131	8.3.3	Construct 200mm base course with material from commercial sources and compact to 95% of modified AASHTO maximum density (G5)	m ³	520		
	SANS 1200MK	KERBING AND CHANNELING				
	8.2.7	Trimming and compaction to 90% of modified AASHTO maximum density of surface area of unlined open drains and areas to be concrete lined:				
CEA132		(a) Soft material	m ²	280		
CEA133		(b) Hard material	m ²	530		
	8.2.8	20MPa/19mm concrete lining				
CEA134		Channel - 150mm thick, 1m wide	m ²	425		
CEA135		Channel - 150mm thick, 2m wide	m ²	260		
CEA136		Channel - 150mm thick, 4m wide transition	m ²	280		
	8.2.10	Sealed joints in concrete lining				
CEA137		15mm wide expansion joint	m	70		
	SANS 1200MM	ANCILLARY ROADWORKS				
	8.2.1	(a) Guardrails :				
CEA138		Supply and install galvanized hand rails on both sides of the culvert crossing complete with 1m stanchions spaced at 1.5m lengths, 1.5m cross rails, 4 x D end terminations and 16 plastic end plugs as well as all the associated bolts and screws.	m	50		
CEA139	8.2.2	Extra over item 8.2.1	m	50		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		PERMANENT ROAD SIGNS:				
	8.3.1	Sign faces with painted / galvanized background with painted symbols, characters, legend, and borders in engineering grade retroreflective material with signboards constructed from:				
		(a) Aluminium sheet (2,0mm thick), of area:				
CEA140		(i) Up to 2m ²	m ²	12		
CEA141		(ii) 2m ² up to 10m ²	m ²	5		
	8.3.2	Provision and application of retro-reflective material				
CEA142		(a) Engineering grade retro-reflective background	m ²	17		
	8.3.3	Sign supports				
CEA143		(a) Steel tubing galvanized	No	16		
	8.1.1 & 8.3.4	Excavation and backfilling for sign supports:				
CEA144		(a) Backfill with grade 10 concrete	m ³	7		
	8.3.6	Statutory signs, street names, and the like, supplied and erected complete				
CEA145		(a) R1 – Stop sign	No	2		
CEA146		(b) W326 - Narrow Bridge	No	2		
CEA147		(c) W401 - Danger plate	No	7		
CEA148		(d) W402 - Danger plate	No	5		
		Provision of stock fence				
CEA149		Fencing by stockproof fencing complete with end and intermediate wooden posts, concrete footings and 4 strands of 3.125mm x 2.50mm fully galvanised barbed wire, as per drawing (incl. supply of fence)	m	1 000		
TOTAL OF SECTION CEA CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION CEB				
		ACCESS ROAD 2: EXISTING ROAD TO WTW				
	SANS 1200C	SITE CLEARANCE				
CEB1	8.2.1	Clear and grub	ha	0.50		
CEB2	8.2.2	Remove topsoil to nominal depth of 150 mm and stockpile/spoil	m³	860		
	SANS 1200DB	EARTHWORKS (PIPE TRENCHES)				
	8.3.2	Excavation				
		(a) Excavation in all materials for trenches backfill, compact, and dispose of surplus/unsuitable material, for all pipe diameters, for total trench depth:				
		Depth ranges below the surface level:				
CEB3		0 m up to 1 m	m³	5		
CEB4		1 m up to 2 m	m³	260		
CEB5		2 m up to 3 m	m³	5		
CEB6		exceeding 3 m and up to 4 m	m³	5		
		(b) Extra over item (a) above for:				
		2) Hard Rock Excavation				
CEB7		(i) By means of explosives	m³	110		
CEB8		(ii) Without explosives	m³	100		
CEB9		(c) Excavate and dispose of unsuitable material from trench bottom	m³	70		
	8.3.4	Particular items				
CEB10		(a) Shore trench opposite structures or services	m	5		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		(b) Temporary Works: Control Water Inflows				
CEB11		1) Provide Equipment	sum	1		
CEB12		2) Operate and Maintain	Days	15		
CEB13		3) Remove Equipment	sum	1		
	8.3.5	Existing services that intersect or adjoin a pipe trench				
		(a) Services that intersect a trench a pipe trench				
CEB14		i) ESKOM cables	No.	1		
CEB15		ii) Telecommunication cables	No.	1		
CEB16		iii) Watermains up to 300 mm dia	No.	1		
CEB17		iv) Watermains over 300 mm dia	No.	1		
CEB18		v) Sewers up 300 mm dia	No.	1		
CEB19		vi) Stormwater up to 700 mm dia	No.	1		
		(b) Services that adjoin a trench a pipe trench				
CEB20		i) ESKOM cables	No.	1		
CEB21		ii) Telecommunication cables	No.	1		
CEB22		iii) Watermains up to 300 mm dia	No.	1		
CEB23		iv) Watermains over 300 mm dia	No.	1		
CEB24		v) Sewers up 300 mm dia	No.	1		
CEB25		vi) Stormwater up to 700 mm dia	No.	1		
	SANS 1200D	EARTHWORKS				
	8.2.2	Bulk excavation				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		(a) Excavate in all materials and use for embankment or backfill, as ordered				
		Depth ranges below the surface level:				
CEB26		0 m up to 1 m	m ³	2 170		
CEB27		1 m up to 2 m	m ³	90		
CEB28		2 m up to 3 m	m ³	5		
CEB29		3 m and up to 4 m	m ³	5		
CEB30		exceeding 4 m and up to 5 m	m ³	5		
		(b) Excavate in all materials and dispose of:				
		2) Hard Rock Excavation				
CEB31		(i) By means of explosives	m ³	260		
CEB32		(ii) Without explosives	m ³	200		
CEB33		(c) Excavate in all materials and dispose of, and backfill with material from commercial sources (clean sand unless otherwise indicated)	m ³	230		
	SANS 1200DK	GABIONS AND PITCHING				
CEB34	8.2.1	Surface preparation for bedding of gabions.	m ³	130		
	8.2.2	Construct gabions and Reno Mattresses using double twisted hexagonal mesh type specified below with 3.4mm OD frame wire and 2.7mm OD mesh wire to SANS 1480:2005: Refer to drawing 503081-ROAD-DRG-CC- 5300				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Supply and install the following rock filled gabion baskets complete :				
CEB35		a) 2 x 1 x 1m with 80 x 100mm galv. mesh	m ³	10		
CEB36		b) 1,5 x 1 x 1m with 80 x 100mm galv. mesh	m ³	10		
CEB37		c) 1 x 1 x 1m with 80 x 100mm galv. mesh	m ³	50		
CEB38		d) 3 x 1 x 0,3m with 60 x 80mm galv. mesh (Reno Mattress)	m ³	10		
CEB39		f) 2 x 1 x 0,3m with 80 x 100mm galv. mesh (Reno Mattress)	m ³	40		
CEB40		Rip-Rap	m ³	120		
CEB41	8.2.3	Extra Over 8.2.2 for packing selected stone for exposed face.	m ²	240		
CEB42	8.2.4	Geotextile beneath rip-rap	m ²	180		
CEB43		Sand layer on top of geotextile layer	m ²	220		
CEB44		Filter layers beneath rip-rap	m ²	220		
CEB45	8.2.5	Pitching	m ³	10		
CEB46	8.2.5	Excavation and concrete backfill of footing trenches for pitching	m ³	10		
	SANS 1200DM	EARTHWORKS (ROADS, SUBGRADE)				
	8.3.3	Treatment of roadbed:				
		(a) Roadbed preparation and compaction of material to:				
CEB47		(i) Minimum 90% of modified AASHTO maximum density	m ³	640		
CEB48		(ii) Minimum 93% of modified AASHTO maximum density	m ³	20		
		(b) In-place treatment of roadbed in hard rock material by:				
CEB49		(i) Ripping	m ³	320		
CEB50		(i) Blasting	m ³	200		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.3.4	Cut to fill, borrow to fill:				
CEB51		(a) Cut to fill compacted to 93% of modified AASHTO maximum density	m ³	25		
CEB52		(b) Borrow to fill from commercial or off site sources located by the Contractor compacted to 93% of modified AASHTO maximum density	m ³	220		
	8.3.5	Selected layer compacted to 93% of modified AASHTO maximum density				
		(a) Selected layers using material cut from the site and compacted to: excavation:				
CEB53		(i) 150mm selected subgrade (SSG), G9 lower selected layer compacted to 93% of modified AASHTO maximum density	m ³	5		
CEB54		(ii) 150mm selected subgrade (SSG), G7 upper selected layer compacted to 93% of modified AASHTO maximum density	m ³	5		
		(b) Selected layers using material from commercial or off site sources located by the Contractor, compacted to:				
CEB55		(i) 150mm selected subgrade (SSG), G9 lower selected layer compacted to 93% of modified AASHTO maximum density	m ³	5		
CEB56		(ii) 150mm selected subgrade (SSG), G7 upper selected layer compacted to 95% of modified AASHTO maximum density	m ³	900		
CEB57	8.3.6	Extra over items 8.3.4 (a) through to 8.3.5 (b) for excavating and breaking down material in hard excavation	m ³	850		
	8.3.7	Cut to spoil or stockpile from:				
CEB58		(a) Soft excavation	m ³	640		
CEB59		(c) Hard excavation	m ³	1 055		
CEB60		(d) Boulder Excavation Class A	m ³	220		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CEB61		(e) Boulder Excavation Class B	m ³	211		
CEB62	8.3.8	Removal of oversize material	m ³	1 490		
	8.3.9	Overbreak of excavation in:				
CEB63		(c) Hard excavation	m ²	400		
CEB64	8.3.10	Materials bladed to windrow	m ³	600		
CEB65	8.2.7	Extra over items 8.3.4, 8.3.5 and 8.3.7 for temporary stockpiling of material	m ³	3 250		
	8.3.13	Surface finishes:				
CEB66		(a) Topsoiling (from stockpile)	m ²	2 420		
		(b) Grassing or other vegetation cover:				
CEB67		(1) Planting of Grass sods	m ²	970		
CEB68		(2) Hydroseeding	m ²	1 450		
CEB69		(3) Trim, shape and roll verge	m ²	2 420		
CEB70		(4) Fertilizer (2.3.2(22) at 400kg/ha)	t	0.10		
CEB71	8.3.15	Catchment mounds and channels and mitre banks and channels	m ³	227		
	SABS 1200LB	BEDDING (Pipes)				
	8.2.1	Provision of Bedding from Trench Excavation				
CEB72		(a) Selected granular material	m ³	10		
	8.2.2	Supply only of Bedding by Importation				
	8.2.2.3	From commercial source				
CEB73		(a) Selected granular material from commercial source	m ³	120		
CEB74		(b) Selected fill material from trench excavation commercial source	m ³	30		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	8.2.3	Concrete Bedding Cradle				
CEB75		a) 0 to 750 mm dia. Pipes in concrete (Class 15/19 concrete)	m³	10		
CEB76		a) 0 to 750 mm dia. Pipes in soilcrete as per drawing (12% cement added per volume) vibrated as for concrete	m³	120		
	8.2.4	Encasing of Pipes in Concrete				
CEB77		a) 0 to 750 mm dia. Pipes in concrete (Class 15/19 concrete)	m³	30		
	SANS 1200LE	STORMWATER DRAINAGE				
	8.2.1	Supply and Lay Concrete Pipe Culverts				
		On Class C bedding:				
CEB78		(i) 350mm diameter Class 100D	m	5		
CEB79		(ii) 600mm diameter Class 100D	m	110		
CEB80		(iii) 750mm diameter Class 100D	m	5		
CEB81		(iv) 900mm diameter Class 100D	m	5		
CEB82		(v) 1500mm diameter Class 100D	m	5		
	8.2.8	Supply and installation of manholes, catch pits, and the like				
		(a) Manholes:				
		(i) Brickwork manholes including covers and frames (complete as per drawing):				
CEB83		Depth exceeding 1.0m to 1.5m	No	1		
CEB84		Depth exceeding 1.5m to 2.0m	No	1		
CEB85		Depth exceeding 2.0m to 2.5m	No	1		
CEB86		Depth exceeding 2.5m to 3.0m	No	1		
CEB87		Depth exceeding 3.0m to 3.5m	No	1		
CEB88		Depth exceeding 3.5m to 4.0m	No	1		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
CEB89		Depth exceeding 4.0m to 4.5m	No	1		
CEB90		Depth exceeding 4.5m to 5.0m	No	1		
		(ii) Brickwork double grid inlets including covers and frames (complete as per drawing):				
CEB91		Depth exceeding 1.0m up to 1.5m	No	1		
CEB92		Depth exceeding 1.5m up to 2.0m	No	3		
CEB93		Depth exceeding 2.0m up to 2.5m	No	1		
CEB94		Depth exceeding 2.5m up to 3.0m	No	1		
CEB95		Depth exceeding 3.0m up to 3.5m	No	1		
CEB96		Depth exceeding 3.5m up to 4.0m	No	1		
CEB97		Depth exceeding 4.0m up to 4.5m	No	1		
CEB98		Depth exceeding 4.5m up to 5.0m	No	1		
	8.2.14	Subsurface drains				
CEB99		Supply and lay subsurface drains at 2m depths complete with bidim filter jacket, flownet drainage core, DN 150mm perforated mesh-structured drainage pipe as per drawing 503081-ROAD-DRG-CC-5404	m	400		
	8.2.15	Headwall Outlet Structures (as per drawing				
CEB100		Headwall for 600mm to 750mm diameter pipes	No	3		
CEB101		Headwall for 750 mm to 1500mm diameter pipes	No	1		
CEB102		Headwall for two 900mm Diameter pipes	No	1		
	SANS 1200ME	ROAD SUB-BASE				
	8.3.1	Construct the subbase course/shoulders/gravel wearing course with material from commercial sources:				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
CEB103		Brought forward / ... 150mm cemented natural gravel sub-base, crushed (G5), Subbase compacted to 95% of modified AASHTO maximum density (C4)	m ³	1		
	8.3.5	Process subbase material by the following processes, as relevant, and use in the subbase:				
CEB104		(d) Stabilization	m ³	1		
	8.3.8	Stabilizing agent:				
CEB105		(b) Portland cement (CEM II -32.5)	t	1		
	SANS 1200MF	BASE				
CEB106	8.3.3	Construct 200mm base course with material from commercial sources and compact to 95% of modified AASHTO maximum density (G5)	m ³	760		
	SANS 1200MK	KERBING AND CHANNELING				
	8.2.7	Trimming and compaction to 90% of modified AASHTO maximum density of surface area of unlined open drains and areas to be concrete lined:				
CEB107		(a) Soft material	m ²	500		
CEB108		(b) Hard material	m ²	600		
	8.2.8	20MPa/19mm concrete lining				
CEB109		Channel - 150mm thick, 1m wide	m ²	300		
CEB110		Channel - 150mm thick, 2m wide	m ²	260		
CEB111		Channel - 150mm thick, 4m wide transition	m ²	1		
	8.2.10	Sealed joints in concrete lining				
CEB112		15mm wide expansion joint	m	70		
	SANS 1200MM	ANCILLARY ROADWORKS				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		PERMANENT ROAD SIGNS:				
	8.3.1	Sign faces with painted / galvanized background with painted symbols, characters, legend, and borders in engineering grade retroreflective material with signboards constructed from:				
		(a) Aluminium sheet (2,0mm thick), of area:				
CEB113		(i) Up to 2m ²	m ²	12		
CEB114		(ii) 2m ² up to 10m ²	m ²	5		
	8.3.2	Provision and application of retro-reflective material				
CEB115		(a) Engineering grade retro-reflective background	m ²	17		
	8.3.3	Sign supports				
CEB116		(a) Steel tubing galvanized	No	9		
	8.1.1 & 8.3.4	Excavation and backfilling for sign supports:				
CEB117		(a) Backfill with grade 10 concrete	m ³	5		
	8.3.6	Statutory signs, street names, and the like, supplied and erected complete				
CEB118		(a) R1 – Stop sign	No	1		
CEB119		(b) W401 - Danger plate	No	5		
CEB120		(c) W402 - Danger plate	No	3		
TOTAL OF SECTION CEB CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION EAA				
		WTW BUILDING ELECTRICAL				
	Spec BE1	BUILDING ELECTRICAL				
		GENERAL				
EAA1		Provision of temporary power for testing and commissioning	Sum	-		
EAA2		Earthing and equipotential bonding of electrical installation	Sum	-		
EAA3	1.12.9.1	Liaison with M&E Contractor for permanent electrical supplies to distribution boards	Sum	-		
EAA4	1.12.9.2	Labelling of all equipment and conductors	Sum	-		
EAA5	1.12.9.3	Testing and Commissioning of Small Power and Lighting System	Sum	-		
EAA6	1.12.9.4	Certificates of Compliance	Sum	-		
EAA7	1.12.9.5	As-Built Drawings	Sum	-		
		Supply				
	1.12.1	DISTRIBUTION BOARDS				
EAA8		Staff House 1 (DB-H1) complete. Factory acceptance testing for 2 persons included.	Sum	-		
EAA9		Staff House 2 (DB-H2) complete. Factory acceptance testing for 2 persons included.	Sum	-		
EAA10		Staff House 3 (DB-H3) complete. Factory acceptance testing for 2 persons included.	Sum	-		
EAA11		Guard House (DB-GH) complete. Factory acceptance testing for 2 persons included.	Sum	-		
EAA12		Admin Building (DB-ADM) complete. Factory acceptance testing for 2 persons included.	Sum	-		
EAA13		Pump Station and Clearwell Complex (DB-PS)	Sum	-		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
EAA14	1.12.2	Eskom Transformer Room (DB-TRF) complete. Factory acceptance testing for 2 persons included.	Sum	-		
EAA15		Chemical Building (DB-CHM) complete. Factory acceptance testing for 2 persons included.	Sum	-		
EAA16		Area Lighting Kiosk 1 (EK-01) complete. Factory acceptance testing for 2 persons included.	Sum	-		
EAA17		Area Lighting Kiosk 2 (EK-02) complete. Factory acceptance testing for 2 persons included.	Sum	-		
		LIGHTING				
EAA18		Type A fitting (Standard)	No.	32		
EAA19		Type A fitting (Emergency)	No.	23		
EAA20		Type B fitting (Standard)	No.	28		
EAA21		Type B fitting (Emergency)	No.	5		
EAA22		Type C fitting (Standard)	No.	17		
EAA23		Type C fitting (Emergency)	No.	17		
EAA24		Type D fitting (Standard)	No.	25		
EAA25		Type D fitting (Emergency)	No.	5		
EAA26		Type L1 fitting (Standard)	No.	77		
EAA27		Type L1 fitting (Emergency)	No.	5		
EAA28		Type S fitting (Standard)	No.	30		
EAA29		Type S fitting (Emergency)	No.	5		
		POLES				
EAA30		7m Galvanized Steel Pole for 1 x LED Streetlight/Floodlight complete with bracket, etc	No.	17		
EAA31		7m Galvanized Steel Pole for 2 x LED Streetlight/Floodlight complete with bracket, etc	No.	3		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
EAA32	1.12.3	Brought forward / ... 7m Galvanized Steel Pole for 1 x LED Streetlight and Camera complete with bracket, etc	No.	3		
		LIGHT SWITCHES				
EAA33		1 lever 1-way, 20A, flush mounted switch	No.	26		
EAA34		1 lever 2-way, 20A, flush mounted switch	No.	20		
EAA35		3 lever 2-way, 20A, flush mounted switch	No.	Rate only		Rate Only
EAA36		1 lever 1-way, 20A, flush mounted switch, (weatherproof)	No.	5		
EAA37		Photocell	No.	9		
		SMALL POWER				
EAA38		Single normal 3-pin (SANS164-1 and SANS164-2) switched socket outlet (weatherproof)	No.	Rate only		Rate Only
EAA39		Single normal 3-pin (SANS164-1 and SANS164-2) switched socket outlet with USB attachment	No.	5		
EAA40		Single dedicated 3-pin (SANS164-1) switched socket outlet	No.	16		
EAA41		Single normal 3-pin (SANS164-1) and Double normal 3-pin (SANS164-2) switched socket outlet	No.	100		
EAA42		Single normal 3-pin (SANS164-1) and Double normal 3-pin (SANS164-2) switched socket outlet (weatherproof)	No.	5		
EAA43		Industrial 5-pin 400V socket outlet	No.	6		
EAA44		RJ45/RJ45 Combo Outlet	No.	18		
EAA45		Floorbox	No.	3		
EAA46		2 pole, 20A, 250V switch disconnecter	No.	17		
EAA47		2 pole, 20A, 250V switch disconnecter (weatherproof)	No.	9		
EAA48		3 pole, 20A, 400V switch disconnecter	No.	Rate only		Rate Only
EAA49	3 pole, 32A, 400V switch disconnecter	No.	Rate only		Rate Only	
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
EAA50	1.12.4	Brought forward / ...				
		3 pole, 40A, 400V switch disconnecter (weatherproof)	No.	6		
EAA51		4 pole, 32A, 400V switch disconnecter	No.	Rate only		Rate Only
		CONDUITS				
		Conduits surface mounted to brickwork, concrete, steel or ceiling voids or cast into concrete or built/chased into brickwork or concrete. Complete with bends, couplings, glue, round conduit boxes placed in position etc.				
EAA52		20mm Diameter, PVC	m	Rate only		Rate Only
EAA53		25mm Diameter, PVC	m	1 000		
EAA54		32mm Diameter, PVC	m	Rate only		Rate Only
EAA55		20mm Diameter, Stainless Steel	m	Rate only		Rate Only
EAA56		25mm Diameter, Stainless Steel	m	500		
EAA57		32mm Diameter, Stainless Steel	m	Rate only		Rate Only
		SLEEVES				
		Sleeves installed in cable trenches, under roads, paving, building entrances, etc. Complete with bends, couplings, draw wires and end caps				
EAA58		50mm Diameter, uPVC	m	80		
EAA59	75mm Diameter, uPVC	m	1 590			
EAA60	110mm Diameter, uPVC	m	Rate only		Rate Only	
EAA61	160mm Diameter, uPVC	m	Rate only		Rate Only	
	1.12.5	POWER SKIRTING				
EAA62		Double compartment power skirting outside dimensions (55 x 160mm minimum)	m	30		
EAA63		Double compartment: End caps	No.	6		
EAA64		Double compartment: Internal Bend	No.	6		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
	1.12.6	WIRE MESH				
		Welded Wire Mesh Cable Tray, 50 x 50mm Base Aperture, 25 x 50mm Side Aperture complete with splices, couplers, clamps, threaded rods, hangers, brackets, etc to fix to trusses, walls, etc				
EAA65		75 x 50mm (W x H), Ø 4mm Wire	m	-		
EAA66		100 x 50mm (W x H), Ø 4mm Wire	m	50		
	1.12.7	SINGLE CORE PVC INSULATED GENERAL PURPOSE HIGH CONDUCTIVITY STRANDED CONDUCTORS (RED, BLACK)				
		Single core PVC insulated house wire				
EAA67		1.5mm ²	m	Rate only		Rate Only
EAA68		2.5mm ²	m	5 000		
EAA69		4mm ²	m	5 000		
EAA70		6mm ²	m	100		
		Single core PVC insulated earth wire				
EAA71		1.5mm ²	m	Rate only		Rate Only
EAA72		2.5mm ²	m	2 500		
EAA73		4mm ²	m	2 500		
EAA74		6mm ²	m	50		
		Supply Twin and Earth PVC insulated wire				
EAA75		1.5mm ²	m	Rate only		Rate Only
EAA76		2.5mm ²	m	Rate only		Rate Only
EAA77		4mm ²	m	Rate only		Rate Only
EAA78		6mm ²	m	Rate only		Rate Only
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		LV CABLES				
		Cu/PVC Insulated/PVC Bedded/SWA/PVC Sheathed 600/1000V multicore cable with stranded conductors.				
EAA79		2.5mm ² x 4 core	m	Rate only		Rate Only
EAA80		4mm ² x 4 core	m	50		
EAA81		6mm ² x 4 core	m	50		
		Cable terminations for Cu/PVC Insulated/PVC Bedded/SWA/PVC Sheathed 600/1000V multicore cables, complete, including gland shroud, lugs, number tags, etc and connection.				
EAA82		2.5mm ² x 4 core	No.	Rate only		Rate Only
EAA83		4mm ² x 4 core	No.	8		
EAA84		6mm ² x 4 core	No.	8		
		Bare Copper Earth Cable with stranded conductors				
EAA85		6mm ²	m	50		
EAA86		16mm ²	m	Rate only		Rate Only
		Cable terminations for Bare Copper Earth Cable with stranded conductors				
EAA87		6mm ²	No.	4		
EAA88		16mm ²	No.	Rate only		Rate Only
		EARTHWORKS				
		Excavate and set excavated material aside for re-use as filling for cable or sleeve trench not exceeding 1m				
EAA89		In earth	m ³	500		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
EAA90		Brought forward / ... In soft rock	m ³	500		
EAA91		In hard rock	m ³	500		
EAA92		Selected and approved material for backfilling, bedding and cover	m ³	1 000		
EAA93		Surplus excavated material spread and levelled on site as directed	m ³	1 000		
EAA94		Danger tape - 400mm wide overlapping	m	1 000		
EAA95		Cable marker with engraved aluminium plate	No.	20		
		EARTHING				
EAA96	1.12.8.1	Earth Electrode (70mm² BCEC)	m	250		
EAA97	1.12.8.2	1500mm, 16mm diameter Cu earth rods	No.	10		
EAA98	1.12.8.3	Cu Earth Bar	No.	4		
	1.12.11	Delivery				
EAA99		All	Sum	-		
		Install				
	1.12.1	DISTRIBUTION BOARDS				
EAA100		Staff House 1 (DB-H1) complete	Sum	-		
EAA101		Staff House 2 (DB-H2) complete.	Sum	-		
EAA102		Staff House 3 (DB-H3) complete.	Sum	-		
EAA103		Guard House (DB-GH) complete.	Sum	-		
EAA104		Admin Building (DB-ADM) complete	Sum	-		
EAA105		Pump Station and Clearwell Complex (DB-PS) complete.	Sum	-		
EAA106		Eskom Transformer Room (DB-TRF) complete.	Sum	-		
EAA107		Chemical Building (DB-CHM) complete.	Sum	-		
EAA108		Area Lighting Kiosk 1 (EK-01) complete.	Sum	-		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount	
		Brought forward / ...					
EAA109	1.12.2	Area Lighting Kiosk 2 (EK-02) complete.	Sum	-			
		LIGHTING					
EAA110		Type A fitting (Standard)	No.	32			
EAA111		Type A fitting (Emergency)	No.	23			
EAA112		Type B fitting (Standard)	No.	28			
EAA113		Type B fitting (Emergency)	No.	5			
EAA114		Type C fitting (Standard)	No.	17			
EAA115		Type C fitting (Emergency)	No.	17			
EAA116		Type D fitting (Standard)	No.	25			
EAA117		Type D fitting (Emergency)	No.	5			
EAA118		Type L1 fitting (Standard)	No.	77			
EAA119		Type L1 fitting (Emergency)	No.	5			
EAA120		Type S fitting (Standard)	No.	30			
EAA121		Type S fitting (Emergency)	No.	5			
		POLES					
EAA122		7m Galvanized Steel Pole for 1 x LED Streetlight/Floodlight complete with bracket, etc	No.	17			
EAA123		7m Galvanized Steel Pole for 2 x LED Streetlight/Floodlight complete with bracket, etc	No.	3			
EAA124		7m Galvanized Steel Pole for 1 x LED Streetlight and Camera complete with bracket, etc	No.	3			
		LIGHT SWITCHES					
EAA125		1 lever 1-way, 20A, flush mounted switch	No.	26			
EAA126		1 lever 2-way, 20A, flush mounted switch	No.	20			
EAA127		3 lever 2-way, 20A, flush mounted switch	No.	Rate only			Rate Only
EAA128		1 lever 1-way, 20A, flush mounted switch, (weatherproof)	No.	5			
Carried forward / ...							

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
EAA129	1.12.3	Photocell	No.	9		
		SMALL POWER				
EAA130		Single normal 3-pin (SANS164-1 and SANS164-2) switched socket outlet (weatherproof)	No.	Rate only		Rate Only
EAA131		Single normal 3-pin (SANS164-1 and SANS164-2) switched socket outlet with USB attachment	No.	5		
EAA132		Single dedicated 3-pin (SANS164-1) switched socket outlet	No.	16		
EAA133		Single normal 3-pin (SANS164-1) and Double normal 3-pin (SANS164-2) switched socket outlet	No.	100		
EAA134		Single normal 3-pin (SANS164-1) and Double normal 3-pin (SANS164-2) switched socket outlet (weatherproof)	No.	5		
EAA135		Industrial 5-pin 400V socket outlet	No.	6		
EAA136		RJ45/RJ45 Combo Outlet	No.	18		
EAA137		Floorbox	No.	3		
EAA138		2 pole, 20A, 250V switch disconnecter	No.	17		
EAA139		2 pole, 20A, 250V switch disconnecter (weatherproof)	No.	9		
EAA140		3 pole, 20A, 400V switch disconnecter	No.	Rate only		Rate Only
EAA141		3 pole, 32A, 400V switch disconnecter	No.	Rate only		Rate Only
EAA142	3 pole, 40A, 400V switch disconnecter (weatherproof)	No.	6			
EAA143	1.12.4	4 pole, 32A, 400V switch disconnecter	No.	Rate only		Rate Only
		CONDUITS				
EAA144		20mm Diameter, PVC	m	Rate only		Rate Only
EAA145		25mm Diameter, PVC	m	1 000		
EAA146		32mm Diameter, PVC	m	Rate only		Rate Only
EAA147		20mm Diameter, Stainless Steel	m	Rate only		Rate Only
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
EAA148		Brought forward / ... 25mm Diameter, Stainless Steel	m	500		
EAA149		32mm Diameter, Stainless Steel	m	Rate only		Rate Only
		SLEEVES Sleeves installed in cable trenches, under roads, paving, building entrances, etc. Complete with bends, couplings, draw wires and end caps				
EAA150		50mm Diameter, uPVC	m	80		
EAA151		75mm Diameter, uPVC	m	1 590		
EAA152		110mm Diameter, uPVC	m	Rate only		Rate Only
EAA153		160mm Diameter, uPVC	m	Rate only		Rate Only
	1.12.5	POWER SKIRTING				
EAA154		Double compartment power skirting outside dimensions (55 x 160mm minimum)	m	30		
EAA155		Double compartment: End caps	No.	6		
EAA156		Double compartment: Internal Bend	No.	6		
	1.12.6	WIRE MESH Welded Wire Mesh Cable Tray, 50 x 50mm Base Aperture, 25 x 50mm Side Aperture complete with splices, couplers, clamps, threaded rods, hangers, brackets, etc to fix to trusses, walls, etc				
EAA157		75 x 50mm (W x H), Ø 4mm Wire	m	Rate only		Rate Only
EAA158		100 x 50mm (W x H), Ø 4mm Wire	m	50		
	1.12.7	SINGLE CORE PVC INSULATED GENERAL PURPOSE HIGH CONDUCTIVITY STRANDED CONDUCTORS (RED, BLACK) Single core PVC insulated house wire				
EAA159		1.5mm ²	m	Rate only		Rate Only
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
EAA160		Brought forward / ... 2.5mm ²	m	5 000		
EAA161		4mm ²	m	5 000		
EAA162		6mm ²	m	100		
		Single core PVC insulated earth wire				
EAA163		1.5mm ²	m	Rate only		Rate Only
EAA164		2.5mm ²	m	2 500		
EAA165		4mm ²	m	2 500		
EAA166		6mm ²	m	50		
		Supply Twin and Earth PVC insulated wire				
EAA167		1.5mm ²	m	Rate only		Rate Only
EAA168		2.5mm ²	m	Rate only		Rate Only
EAA169		4mm ²	m	Rate only		Rate Only
EAA170		6mm ²	m	Rate only		Rate Only
		LV CABLES				
		Cu/PVC Insulated/PVC Bedded/SWA/PVC Sheathed 600/1000V multicore cable with stranded conductors.				
EAA171		2.5mm ² x 4 core	m	Rate only		Rate Only
EAA172		4mm ² x 4 core	m	50		
EAA173		6mm ² x 4 core	m	50		
		Cable terminations for Cu/PVC Insulated/PVC Bedded/SWA/PVC Sheathed 600/1000V multicore cables, complete, including gland shroud, lugs, number tags, etc and connection.				
EAA174		2.5mm ² x 4 core	No.	Rate only		Rate Only
EAA175		4mm ² x 4 core	No.	8		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
EAA176		Brought forward / ... 6mm ² x 4 core	No.	8		
EAA177		Bare Copper Earth Cable with stranded conductors 6mm ²	m	50		
EAA178		16mm ² Cable terminations for Bare Copper Earth Cable with stranded conductors	m	Rate only		Rate Only
EAA179		6mm ²	No.	4		
EAA180		16mm ² EARTHWORKS	No.	Rate only		Rate Only
EAA181		Danger tape - 400mm wide overlapping	m	1 000		
EAA182		Cable marker with engraved aluminium plate EARTHING	No.	20		
EAA183	1.12.8.1	Earth Electrode (70mm² BCEC)	m	150		
EAA184	1.12.8.2	1500mm, 16mm diameter Cu earth rods	No.	8		
EAA185	1.12.8.3	Cu Earth Bar	No.	2		
	SANS 1200 A 8.5	Sums stated provisionally by the Engineer b) For work to be executed by a subcontractor, and/or for goods, materials, plant and/or services to be supplied to the Site				
EAA186		Additional lighting as directed by the Engineer	Prov Sum	-	100 000	100 000.00
EAA187		Overheads, charges and profit on item above	%	100 000		
EAA188		Additional small power as directed by the Engineer	Prov Sum	-	100 000	100 000.00
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
EAA189		Brought forward / ... Overheads, charges and profit on item above	%	100 000		
EAA190		Additional earthing or earth testing as directed by the Engineer	Prov Sum	-	100 000	100 000.00
EAA191		Overheads, charges and profit on item above	%	100 000		
TOTAL OF SECTION EAA CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION EAB				
		WTW BUILDING ELECTRONICS				
	Spec BE2	BUILDING ELECTRONICS				
	1.3	GENERAL				
EAB1		Point-to-point certification test report per ethernet cable	Sum	-		
EAB2	1.9.5.1	Design, liaison and coordination of all buildings CCTV systems by specialist sub-contractors with main and other sub-contractors	Sum	-		
EAB3	1.9.5.2	Labelling of all equipment and conductors	Sum	-		
EAB4	1.9.5.3	Complete site wide CCTV network configuration, testing and commissioning of Electronic System as per drawings and specification	Sum	-		
EAB5	1.9.5.4	Certificates of Compliance	Sum	-		
EAB6	1.9.5.5	As-built drawings per building	Sum	-		
EAB7	1.9.5.6	O&M manuals	Sum	-		
EAB8	1.9.5.7	Training	Sum	-		
		Supply				
EAB9		25mm HDG conduit c/w brackets & round boxes as required	m	50		
EAB10		32mm HDG conduit c/w brackets & round boxes as required	m	50		
EAB11		4C x 4 mm² PVC insulated, PVC bedded cable unarmoured 600/1000V cable	m	50		
EAB12		Terminations for 4C x 4 mm² PVC insulated, PVC bedded cable unarmoured 600/1000V cable	No	10		
	1.9.1	CCTV SYSTEM				
EAB13		Type A camera complete	No.	17		
EAB14		Type B camera complete	No.	10		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
EAB15		Type C camera complete	No.	1		
EAB16		CCTV Network Panel	No.	6		
EAB17		CCTV Utility box	No.	6		
EAB18		CCTV Small form-factor pluggable transceiver (SFP)	No.	8		
EAB19		CCTV Network Management Software	Sum	-		
EAB20		CCTV server C/W software	Sum	-		
EAB21		CCTV Operator computer workstation	No.	1		
EAB22		Display 32"	No.	2		
EAB23		Display 55"	No.	2		
EAB24		DC power supply	No.	4		
EAB25		CAT patch panel	No.	4		
	1.9.2	CAT CABLES				
EAB26		CAT6e cable	m	1 000		
EAB27		CAT6e cable terminations	No.	60		
	1.9.3	FIBRE OPTIC CABLES				
EAB28		8 core single-mode fibre optic cable	m	200		
EAB29		8 core single-mode fibre optic cable terminations	No.	10		
EAB30		Fibre Patch Panels	No.	5		
EAB31		Fibre Patch Cable	m	20		
EAB32		Fibre Splice	No.	20		
EAB33		Fibre-optic drawpit	No.	2		
	1.9.4	Wi-Fi ACCESS				
EAB34		Admin Building Wi-Fi	Sum	-		
	1.9.6	Delivery				
EAB35		All	Sum	-		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Installation				
EAB36		25mm HDG conduit c/w brackets & round boxes as required	m	50		
EAB37		32mm HDG conduit c/w brackets & round boxes as required	m	50		
EAB38		4C x 4 mm ² PVC insulated, PVC bedded cable unarmoured 600/1000V cable	m	50		
EAB39		Terminations for 4C x 4 mm ² PVC insulated, PVC bedded cable unarmoured 600/1000V cable	No	10		
	1.9.1	CCTV SYSTEM				
EAB40		Type A camera complete	No.	17		
EAB41		Type B camera complete	No.	10		
EAB42		CCTV Network Panel	No.	6		
EAB43		CCTV Utility box	No.	6		
EAB44		CCTV Small form-factor pluggable transceiver (SFP)	No.	8		
EAB45		CCTV Network Management Software	Sum	-		
EAB46		CCTV server C/W software	Sum	-		
EAB47		CCTV Operator computer workstation	No.	1		
EAB48		Display 32"	No.	2		
EAB49		Display 55"	No.	2		
EAB50		DC power supply	No.	4		
EAB51		CAT patch panel	No.	4		
	1.9.2	CAT CABLES				
EAB52		CAT6e cable	m	1 000		
EAB53		CAT6e cable terminations	No.	60		
	1.9.3	FIBRE OPTIC CABLES				
EAB54		8 core single-mode fibre optic cable	m	200		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
EAB55		Brought forward / ... 8 core single-mode fibre optic cable terminations	No.	10		
EAB56		Fibre Patch Panels	No.	5		
EAB57		Fibre Patch Cable	m	20		
EAB58		Fibre Splice	No.	20		
EAB59		Fibre-optic drawpit	No.	2		
	1.9.4	Wi-Fi ACCESS				
EAB60		Admin Building Wi-Fi	Sum	-		
	SANS 1200 A 8.5	Sums stated provisionally by the Engineer				
		b) For work to be executed by a subcontractor, and/or for goods, materials, plant and/or services to be supplied to the Site				
EAB61		Additional CCTV as directed by the Engineer	Prov Sum	-	100 000	100 000.00
EAB62		Overheads, charges and profit on item above	%	100 000		
TOTAL OF SECTION EAB CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION EBA				
		ABSTRACTION WORKS BUILDING ELECTRICAL				
	Spec BE1	BUILDING ELECTRICAL				
		GENERAL				
EBA1		Provision of temporary power for testing and commissioning	Sum	-		
EBA2		Earthing and equipotential bonding of electrical installation	Sum	-		
EBA3	1.12.9.1	Liaison with M&E Contractor for permanent electrical supplies to distribution boards	Sum	-		
EBA4	1.12.9.2	Labelling of all equipment and conductors	Sum	-		
EBA5	1.12.9.3	Testing and Commissioning of Small Power and Lighting System	Sum	-		
EBA6	1.12.9.4	Certificates of Compliance	Sum	-		
EBA7	1.12.9.5	As-Built Drawings	Sum	-		
		Supply				
	1.12.1	DISTRIBUTION BOARDS				
EBA8		Abstraction Works DB (DB-ABS-01) complete. Factory acceptance testing for 2 persons included.	Sum	-		
EBA9		Transformer room DB (DB-ABS-02) complete. Factory acceptance testing for 2 persons included.	Sum	-		
	1.12.2	LIGHTING				
EBA10		Type A fitting (Standard)	No.	13		
EBA11		Type A fitting (Emergency)	No.	14		
EBA12		Type B fitting (Standard)	No.	8		
EBA13		Type B fitting (Emergency)	No.	3		
EBA14		Type S fitting (Standard)	No.	7		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
EBA15	1.12.3	Brought forward / ...				
		Type S fitting (Emergency)	No.	4		
		POLES				
EBA16		7m Galvanized Steel Pole for 1 x LED Streetlight and Camera complete with bracket, etc	No.	3		
		LIGHT SWITCHES				
EBA17		1 lever, 1-way, 20A, IP65 pedestal mounted outdoor switch complete	No.	2		
EBA18		1 lever 1-way, 20A, flush mounted switch	No.	2		
EBA19		1 lever 2-way, 20A, flush mounted switch	No.	4		
EBA20		3 lever 2-way, 20A, flush mounted switch	No.	4		
		SMALL POWER				
EBA21		Single normal 3-pin (SANS164-1 and SANS164-2) switched socket outlet	No.	4		
EBA22		Single normal 3-pin (SANS164-1 and SANS164-2) switched socket outlet (weatherproof)	No.	2		
EBA23		Double normal 3-pin (SANS164-2) switched socket outlet	No.	Rate only		Rate Only
EBA24		Industrial 5-pin 400V socket outlet	No.	1		
EBA25		RJ45/RJ45 Combo Outlet	No.	Rate only		Rate Only
EBA26	2 pole, 20A switch disconnecter	No.	3			
EBA27	3 pole, 20A switch disconnecter	No.	Rate only		Rate Only	
	1.12.4	CONDUITS				
EBA28		20mm Diameter, PVC	m	Rate only		Rate Only
EBA29		25mm Diameter, PVC	m	100		
EBA30		32mm Diameter, PVC	m	Rate only		Rate Only
EBA31		20mm Diameter, Stainless Steel	m	Rate only		Rate Only
EBA32		25mm Diameter, Stainless Steel	m	80		
EBA33		32mm Diameter, Stainless Steel	m	Rate only		Rate Only
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		SLEEVES				
		Sleeves installed in cable trenches, under roads, paving, building entrances, etc. Complete with bends, couplings, draw wires and end caps				
EBA34		50mm Diameter, uPVC	m	50		
EBA35		75mm Diameter, uPVC	m	Rate only		Rate Only
EBA36		110mm Diameter, uPVC	m	Rate only		Rate Only
EBA37		160mm Diameter, uPVC	m	Rate only		Rate Only
	1.12.6	WIRE MESH				
		Welded Wire Mesh Cable Tray, 50 x 50mm Base Aperture, 25 x 50mm Side Aperture complete with splices, couplers, clamps, threaded rods, hangers, brackets, etc to fix to trusses, walls, etc				
EBA38		75 x 50mm (W x H), Ø 4mm Wire	m	Rate only		Rate Only
EBA39		100 x 50mm (W x H), Ø 4mm Wire	m	Rate only		Rate Only
	1.12.7	SINGLE CORE PVC INSULATED GENERAL PURPOSE HIGH CONDUCTIVITY STRANDED CONDUCTORS (RED, BLACK)				
		Single core PVC insulated house wire				
EBA40		1.5mm ²	m	-		
EBA41		2.5mm ²	m	300		
EBA42		4mm ²	m	100		
EBA43		6mm ²	m	20		
		Single core PVC insulated earth wire				
EBA44		1.5mm ²	m	Rate only		Rate Only
EBA45		2.5mm ²	m	150		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
EBA46		Brought forward / ... 4mm ²	m	50		
EBA47		6mm ²	m	10		
		Supply Twin and Earth PVC insulated wire				
EBA48		1.5mm ²	m	Rate only		Rate Only
EBA49		2.5mm ²	m	Rate only		Rate Only
EBA50		4mm ²	m	Rate only		Rate Only
EBA51		6mm ²	m	Rate only		Rate Only
		LV CABLES				
		Cu/PVC Insulated/PVC Bedded/SWA/PVC Sheathed 600/1000V multicore cable with stranded conductors.				
EBA52		2.5mm ² x 3 core	m	Rate only		Rate Only
EBA53		4mm ² x 3 core	m	50		
EBA54		6mm ² x 3 core	m	Rate only		Rate Only
		Cable terminations for Cu/PVC Insulated/PVC Bedded/SWA/PVC Sheathed 600/1000V multicore cables, complete, including gland shroud, lugs, number tags, etc and connection.				
EBA55		2.5mm ² x 3 core	No.	Rate only		Rate Only
EBA56		4mm ² x 3 core	No.	6		
EBA57		6mm ² x 3 core	No.	Rate only		Rate Only
		Bare Copper Earth Cable with Stranded Conductors				
EBA58		6mm ²	m	Rate only		Rate Only
EBA59		16mm ²	m	Rate only		Rate Only
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Cable terminations for Bare Copper Earth Cable with Stranded Conductors				
EBA60		6mm ²	No.	Rate only		Rate Only
EBA61		16mm ²	No.	Rate only		Rate Only
		EARTHWORKS				
		Excavate and set excavated material aside for re-use as filling for cable or sleeve trench not exceeding 1m				
EBA62		In earth	m ³	7		
EBA63		In soft rock	m ³	7		
EBA64		In hard rock	m ³	1		
EBA65		Selected and approved material for backfilling, bedding and cover	m ³	7		
EBA66		Surplus excavated material spread and levelled on site as directed	m ³	1		
EBA67		Danger tape - 400mm wide overlapping	m	40		
EBA68		Cable marker with engraved aluminium plate	No.	3		
		EARTHING				
EBA69	1.12.8.1	Earth Electrode (70mm² BCEC)	m	60		
EBA70	1.12.8.2	1500mm, 16mm diameter Cu earth rods	No.	6		
EBA71	1.12.8.3	Cu Earth Bar	No.	3		
	1.12.11	Delivery				
EBA72		All	Sum	-		
		Install				
	1.12.1	DISTRIBUTION BOARDS				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
EBA73	1.12.2	Brought forward / ...				
EBA74		Abstraction Works DB (DB-ABS-01)	Sum	-		
EBA74		Transformer room DB (DB-ABS-02) complete. Factory acceptance testing for 2 persons included.	Sum	-		
EBA75		LIGHTING				
EBA75		Type A fitting (Standard)	No.	13		
EBA76		Type A fitting (Emergency)	No.	14		
EBA77		Type B fitting (Standard)	No.	8		
EBA78		Type B fitting (Emergency)	No.	3		
EBA79		Type S fitting (Standard)	No.	7		
EBA80		Type S fitting (Emergency)	No.	4		
EBA81	1.12.3	POLES				
EBA81		7m Galvanized Steel Pole for 1 x LED Streetlight and Camera complete with bracket, etc	No.	3		
EBA82		LIGHT SWITCHES				
EBA82		1 lever, 1-way, 20A, IP65 pedestal mounted outdoor switch	No.	2		
EBA83		1 lever 1-way, 20A, flush mounted switch	No.	2		
EBA84		1 lever 2-way, 20A, flush mounted switch	No.	4		
EBA85		3 lever 2-way, 20A, flush mounted switch	No.	4		
EBA86		SMALL POWER				
EBA86		Single normal 3-pin (SANS164-1 and SANS164-2) switched socket outlet	No.	4		
EBA87		Single normal 3-pin (SANS164-1 and SANS164-2) switched socket outlet (weatherproof)	No.	2		
EBA88		Double normal 3-pin (SANS164-2) switched socket outlet	No.	-		
EBA89		Industrial 5-pin 400V socket outlet	No.	1		
EBA90		RJ45/RJ45 Combo Outlet	No.	-		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
EBA91	1.12.4	Brought forward / ... 2 pole, 20A switch disconnecter	No.	3		
EBA92		3 pole, 20A switch disconnecter	No.	Rate only		Rate Only
		CONDUITS				
EBA93		20mm Diameter, PVC	m	Rate only		Rate Only
EBA94		25mm Diameter, PVC	m	100		
EBA95		32mm Diameter, PVC	m	Rate only		Rate Only
EBA96		20mm Diameter, Stainless Steel	m	Rate only		Rate Only
EBA97		25mm Diameter, Stainless Steel	m	80		
EBA98		32mm Diameter, Stainless Steel	m	Rate only		Rate Only
		SLEEVES Sleeves installed in cable trenches, under roads, paving, building entrances, etc. Complete with bends, couplings, draw wires and end caps				
EBA99	1.12.6	50mm Diameter, uPVC	m	50		
EBA100		75mm Diameter, uPVC	m	Rate only		Rate Only
EBA101		110mm Diameter, uPVC	m	Rate only		Rate Only
EBA102		160mm Diameter, uPVC	m	Rate only		Rate Only
		WIRE MESH Welded Wire Mesh Cable Tray, 50 x 50mm Base Aperture, 25 x 50mm Side Aperture complete with splices, couplers, clamps, threaded rods, hangers, brackets, etc to fix to trusses, walls, etc				
EBA103		75 x 50mm (W x H), Ø 4mm Wire	m	Rate only		Rate Only
EBA104		100 x 50mm (W x H), Ø 4mm Wire	m	Rate only		Rate Only
		SINGLE CORE PVC INSULATED GENERAL				
	1.12.7					
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Single core PVC insulated house wire				
EBA105		1.5mm ²	m	Rate only		Rate Only
EBA106		2.5mm ²	m	300		
EBA107		4mm ²	m	100		
EBA108		6mm ²	m	20		
		Single core PVC insulated earth wire				
EBA109		1.5mm ²	m	Rate only		Rate Only
EBA110		2.5mm ²	m	150		
EBA111		4mm ²	m	50		
EBA112		6mm ²	m	10		
		Supply Twin and Earth PVC insulated wire				
EBA113		1.5mm ²	m	Rate only		Rate Only
EBA114		2.5mm ²	m	Rate only		Rate Only
EBA115		4mm ²	m	Rate only		Rate Only
EBA116		6mm ²	m	Rate only		Rate Only
		LV CABLES				
		Cu/PVC Insulated/PVC Bedded/SWA/PVC Sheathed 600/1000V multicore cable with stranded conductors.				
EBA117		2.5mm ² x 3 core	m	Rate only		Rate Only
EBA118		4mm ² x 3 core	m	50		
EBA119		6mm ² x 3 core	m	Rate only		Rate Only
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		Cable terminations for Cu/PVC Insulated/PVC Bedded/SWA/PVC Sheathed 600/1000V multicore cables, complete, including gland shroud, lugs, number tags, etc and connection.				
EBA120		2.5mm ² x 3 core	No.	Rate only		Rate Only
EBA121		4mm ² x 3 core	No.	6		
EBA122		6mm ² x 3 core	No.	Rate only		Rate Only
		Bare Copper Earth Cable with Stranded Conductors				
EBA123		6mm ²	m	Rate only		Rate Only
EBA124		16mm ²	m	50		
		Cable terminations for Bare Copper Earth Cable with Stranded Conductors				
EBA125		6mm ²	No.	Rate only		Rate Only
EBA126		16mm ²	No.	50		
		EARTHWORKS				
EBA127		Danger tape - 400mm wide overlapping	m	40		
EBA128		Cable marker with engraved aluminium plate	No.	3		
		EARTHING				
EBA129	1.12.8.1	Earth Electrode (70mm² BCEC)	m	60		
EBA130	1.12.8.2	1500mm, 16mm diameter Cu earth rods	No.	6		
EBA131	1.12.8.3	Cu Earth Bar	No.	3		
	SANS 1200 A 8.5	Sums stated provisionally by the Engineer				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
		b) For work to be executed by a subcontractor, and/or for goods, materials, plant and/or services to be supplied to the Site				
EBA132		Additional lighting as directed by the Engineer	Prov Sum	-	50 000	50 000.00
EBA133		Overheads, charges and profit on item above	%	50 000		
EBA134		Additional small power as directed by the Engineer	Prov Sum	-	50 000	50 000.00
EBA135		Overheads, charges and profit on item above	%	50 000		
EBA136		Additional earthing or earth testing as directed by the Engineer	Prov Sum	-	50 000	50 000.00
EBA137		Overheads, charges and profit on item above	%	50 000		
TOTAL OF SECTION EBA CARRIED TO SUMMARY						R

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		SECTION EBB				
		ABSTRACTION WORKS BUILDING ELECTRONICS				
	Spec BE2	BUILDING ELECTRONICS				
		GENERAL				
EBB1		Point-to-point certification test report per ethernet cable	Sum	-		
EBB2	1.9.5.1	Design, liaison and coordination of all buildings CCTV systems by specialist sub-contractors with main and other sub-contractors	Sum	-		
EBB3	1.9.5.2	Labelling of all equipment and conductors	Sum	-		
EBB4	1.9.5.3	Complete site wide CCTV network configuration, testing and commissioning of Electronic System as per drawings and specification	Sum	-		
EBB5	1.9.5.4	Certificates of Compliance	Sum	-		
EBB6	1.9.5.5	As-built drawings per building	Sum	-		
EBB7	1.9.5.6	O&M manuals	Sum	-		
EBB8	1.9.5.7	Training	Sum	-		
		Supply				
EBB9		25mm HDG conduit c/w brackets & round boxes as required	m	10		
EBB10		32mm HDG conduit c/w brackets & round boxes as required	m	10		
EBB11		4C x 4 mm ² PVC insulated, PVC bedded cable unarmoured 600/1000V cable	m	10		
EBB12		Terminations for 4C x 4 mm ² PVC insulated, PVC bedded cable unarmoured 600/1000V cable	No	4		
	1.9.1	CCTV SYSTEM				
EBB13		Type A camera complete	No.	5		
EBB14		Type B camera complete	No.	2		
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
EBB15		CCTV Network Panel	No.	1		
EBB16		CCTV Utility box	No.	2		
EBB17		CCTV Small form-factor pluggable transceiver (SFP)	No.	4		
EBB18		CCTV Network Management Software	Sum	-		
EBB19		DC power supply	No.	3		
EBB20		CAT patch panel	No.	1		
	1.9.2	CAT CABLES				
EBB21		CAT6e cable	m	80		
EBB22		CAT6e cable terminations	No.	14		
	1.9.3	FIBRE OPTIC CABLES				
EBB23		8 core single-mode fibre optic cable	m	1 000		
EBB24		8 core single-mode fibre optic cable terminations	No.	32		
EBB25		Fibre Patch Panels	No.	3		
EBB26		Fibre Patch Cable	m	10		
EBB27		Fibre Splice	No.	36		
EBB28		Fibre-optic drawpit	No.	4		
	1.9.5	Delivery				
EBB29		All	Sum	-		
		Installation				
EBB30		25mm HDG conduit c/w brackets & round boxes as required	m	10		
EBB31		32mm HDG conduit c/w brackets & round boxes as required	m	10		
EBB32		4C x 4 mm ² PVC insulated, PVC bedded cable unarmoured 600/1000V cable	m	10		
EBB33		Terminations for 4C x 4 mm ² PVC insulated, PVC bedded cable unarmoured 600/1000V cable	No	4		
	1.9.1	CCTV SYSTEM				
Carried forward / ...						

Item No	Chief Reference	Short Description	Unit	Quantity	Rate	Amount
		Brought forward / ...				
EBB34		Type A camera complete	No.	5		
EBB35		Type B camera complete	No.	2		
EBB36		Camera Licensing	Sum	-		
EBB37		CCTV Network Panel	No.	1		
EBB38		CCTV Utility box	No.	2		
EBB39		CCTV Small form-factor pluggable transceiver (SFP)	No.	5		
EBB40		CCTV Network Management Software	Sum	-		
EBB41		DC power supply	No.	3		
EBB42		CAT patch panel	No.	1		
	1.9.2	CAT CABLES				
EBB43		CAT6e cable	m	80		
EBB44		CAT6e cable terminations	No.	14		
	1.9.3	FIBRE OPTIC CABLES				
EBB45		8 core single-mode fibre optic cable	m	1 000		
EBB46		8 core single-mode fibre optic cable terminations	No.	32		
EBB47		Fibre Patch Panels	No.	3		
EBB48		Fibre Patch Cable	No.	3		
EBB49		Fibre Splice	No.	36		
EBB50		Fibre-optic drawpit	No.	4		
	SANS 1200 A 8.5	Sums stated provisionally by the Engineer				
		b) For work to be executed by a subcontractor, and/or for goods, materials, plant and/or services to be supplied to the Site				
EBB51		Additional CCTV as directed by the Engineer	Prov Sum	-	100 000	100 000.00
EBB52		Overheads, charges and profit on item above	%	100 000		
TOTAL OF SECTION EBB CARRIED TO SUMMARY						

SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B – CONSTRUCTION OF ABSTRACTION WORKS AND MALEPELEPE WATER TREATMENT WORKS - CONTRACT 1		
SUMMARY OF SCHEDULE OF QUANTITIES		
		AMOUNT
<u>GENERAL</u>		
SECTION AAA	PRELIMINARY AND GENERAL	
SECTION ABA	OCCUPATIONAL HEALTH AND SAFETY	
SECTION ASM	SMME MANAGEMENT	
<u>WATER TREATMENT WORKS</u>		
SECTION CAA	SITE CLEARANCE AND BULK EARTHWORKS	
SECTION CAB	FLOCCULATION AND SEDIMENTATION COMPLEX	
SECTION CAC	CHEMICAL BUILDING	
SECTION CAD	FILTER FOUNDATIONS AND BACKWASH SUMPS (3 No.)	
SECTION CAE	PUMP AND CLEARWELL COMPLEX	
SECTION CAF	ADMINISTRATION BUILDING	
SECTION CAG	STAFF HOUSING	
SECTION CAH	GUARD HOUSE	
SECTION CAI	LAGOONS (4 No.)	
SECTION CAJ	RESIDUE HOLDING TANK	
SECTION CAL	ROADS	
SECTION CAM	FENCING	
SECTION CAN	FIRE AND SAFETY - WTW	
SECTION CAO	INTERCONNECTING PIPEWORK	
SECTION CAP	HYDROCYCLONE PLATFORM	
SECTION CAQ	STORMWATER	
SECTION CAR	SEWERS	
SECTION CAS	WATER RETICULATION	
SECTION CAT	DUCTS	
Carried forward to SUMMARY PAGE 2 of 2		

Brought forward from SUMMARY PAGE 1 of 2		
<u>ABSTRACTION WORKS</u>		
SECTION CBA	SITE CLEARANCE AND BULK EARTHWORKS	
SECTION CBB	ROADS	
SECTION CBC	PRESSURE PIPELINES	
SECTION CBD	CONCRETE AND BUILDING WORK	
SECTION CBE	CHAMBERS	
SECTION CBF	FIRE AND SAFETY - ABSTRACTION WORKS	
SECTION CBG	DUCTS	
SECTION CBH	ABSTRACTION WORKS ANCILLARIES	
SECTION CBI	GEOTECHNICAL INVESTIGATION	
<u>HIGH-LIFT PUMPING MAIN</u>		
SECTION CCA	HIGH-LIFT PUMPING MAIN	
<u>ACCESS ROAD</u>		
SECTION CEA	ACCESS ROAD 1: WTW TO ABSTRACTION WORKS	
SECTION CEB	ACCESS ROAD 2: EXISTING ROAD TO WTW	
<u>ELECTRICAL BUILDING SERVICES</u>		
SECTION EAA	WTW BUILDING ELECTRICAL	
SECTION EAB	WTW BUILDING ELECTRONICS	
SECTION EBA	ABSTRACTION WORKS BUILDING ELECTRICAL	
SECTION EBB	ABSTRACTION WORKS BUILDING ELECTRONICS	
	TOTAL OF SCHEDULE OF QUANTITIES	
ADD 10% FOR CONTINGENCIES		
	SUBTOTAL 1	
PROVISION FOR CONTRACT PRICE ADJUSTMENT (10%)		
	SUBTOTAL 2	
ADD 15% FOR VALUE-ADDED TAX		
	GROSS TOTAL OF TENDER (Carried to Tender Form)	

O.R. TAMBO DISTRICT MUNICIPALITY
CONTRACT NO.: MIS 478 793 A
SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B – CONSTRUCTION OF
ABSTRACTION WORKS AND MALEPELEPE WATER TREATMENT WORKS - CONTRACT 1

SIGNED BY/ON BEHALF OF TENDERER

NAME

SIGNATURE

DATE

COMPANY STAMP

Declaration

(In respect of completeness of Tender)

O. R. TAMBO DISTRICT MUNICIPALITY

Nelson Mandela Drive

Myezo Park

Mthatha

I/we, the undersigned, do hereby declare that these are the properly priced Bill of Quantities forming Part C2 of this Contract Document in consecutive order upon which my/our tender for the **CONTRACT NUMBER: MIS 478 793 A - SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B – CONSTRUCTION OF ABSTRACTION WORKS AND MALEPELEPE WATER TREATMENT WORKS - CONTRACT 1** has been based.

By signing this page, I confirm that I have received and taken into account in my offer being submitted, all of the following documents provided by the Employer, acknowledging that some of these may have been issued separately:

	TENDER INDEX
Tender	T1.1 Tender Notice and Invitation to Tender.
	T1.2 Tender Data
	T1.3 Standard Conditions of Tender
	T2.1 List of Returnable Documents
	T2.2 Returnable Documents for Tender Evaluation Purposes
	T2.3 Returnable Documents to be Incorporated into the Contract

O.R. TAMBO DISTRICT MUNICIPALITY
 CONTRACT NO.: MIS 478 793 A
 SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B – CONSTRUCTION OF
 ABSTRACTION WORKS AND MALEPELEPE WATER TREATMENT WORKS - CONTRACT 1

	TENDER INDEX
Contract Part C1: Agreements and Contract data	C1.1 Forms of Offer and Acceptance C1.2 Contract Data C1.3 Tenderer's Direct Participation of Targeted Labour C1.4 Specification for SMME Sub-contractor Employment C1.5 Performance Guarantee (Pro forma) C1.6 Adjudication C1.7 Agreement in Terms of the Occupational Health and Safety Act 1993 (Act 85 of 1993)
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SIGNED BY/ON BEHALF OF TENDERER

NAME

SIGNATURE

DATE

Part C3: SCOPE OF WORK

OR TAMBO DISTRICT MUNICIPALITY

CONTRACT NO: MIS 478 793 A

**SIDWADWENI REGIONAL WATER SUPPLY SCHEME
PHASE 5B – CONSTRUCTION OF ABSTRACTION WORKS AND
MALEPELEPE WATER TREATMENT WORKS - CONTRACT 1**

- C3.1 Description of the Works
- C3.2 Engineering
- C3.3 Procurement
- C3.4 Construction
- C3.5 Management
- C3.6 Health and Safety
- C3.7 Project Specification

C3.1. DESCRIPTION OF THE WORKS

STATUS

In the event of any discrepancy between the Scope of Work and any part of the SANS 1200 Standardised Specifications, the Bill of Quantities or the Drawings, the Scope of Work shall take precedence and prevail in the Contract.

C3.1.1 Employer's Objectives

The objective of the Employer (O. R. Tambo District Municipality) is to augment the bulk water supply to the existing Sidwadweni Regional Water Supply Scheme with treated water from the Tsitsa River, in order to provide an assured water supply to the existing water users within the area.

Based on the specific goals, the Employer is aiming to promote enterprises located in Eastern Cape Province and in O. R. Tambo District in particular.

C3.1.2 Overview of the Works

This contract (referred to as "Contract 1") forms part of a series of construction contracts to be implemented by ORTDM in order to augment the bulk water supply to the Sidwadweni Regional Water Supply Scheme. The existing scheme will be augmented with water abstracted from the Tsitsa River and then treated to drinking water standards, prior to distribution.

The proposed scheme will augment the supply of treated water to the existing Sidwadweni RWSS, and the entire scheme will consist of the following components and contract phases:

Contract	Discipline	Component
Contract 1 (this contract)	Civil and structural	1. Abstraction works on the Tsitsa River.
		2. Malepelele water treatment works (WTW) on the bank of the Tsitsa River.
		3. Low-lift pressurised water conveyance pipelines between abstraction works and WTW.
		4. Access road to WTW and abstraction works, including the bridge to be constructed across the donga erosion channel.
		5. High-lift pump station
		6. New electrical overhead line to supply power to abstraction works and WTW.
		7. Steel pumping main pipeline from Chainage 0 at High-lift pumpstation to Chainage 580

This Contract 1 entails the construction of the civil and structural elements (only) of the abstraction works, water treatment works, low-lift pipelines, access road and bridge across the donga erosion line, a portion of the steel rising main pipeline, as well as the bulk electrical 22kV overhead line as an Eskom self-build subcontract within Contract 1.

In other words, this Contract is for the construction of the civil and structural elements of above items 1 - 7.

The following should be noted:

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- The bulk electrical 22 kV overhead line will be constructed as a subcontract using an Eskom-approved contractor as part of the Eskom self-build application process. (For more detail regarding the procurement process, refer C3.3.4.2.)
- Only the first approximately 580m of the steel rising main pipeline from the Malepelepe WTW will be constructed, up to the first air valve chamber and as indicated in the tender drawings and BOQ. The remainder of the steel rising main pipeline will be constructed as part of a separate future civil construction contract, “Contract 2,” along with above items 8) Nduku Command Reservoir and 9) Access roads and 10) Connection of command reservoir to existing water network.
- The mechanical and electrical equipping of the civil and structural infrastructure constructed as part of “Contract 1” and “Contract 2” will be done as part of a separate future mechanical and electrical construction contract, “Contract 3.”
- A separate future “Contract 4,” split into smaller contract packages, will include the items 10) and 11).
- The Works will be divided into two distinct Portions as described in Section C3.5.2.1, with separate practical completion dates. The objective of the milestone practical completion of Portion A of the Works is to align this Contract 1 above listed Contract 2 and Contract 3 (future projects planned by the Employer), and manage critical schedule interfaces between these various construction contracts. The intended purpose/use of Portion A is for the civil and structural works to be fit/ready for a mechanical and electrical contractor to be able to safely access, install and test equipment.

C3.1.3 Extent of the Works

The Works to be carried out by the Contractor under this Contract comprise mainly the following:

- Geotechnical investigation to verify the founding conditions for the proposed abstraction works.
- Relocation (exhumation and reburial) of existing graves in close vicinity to the proposed abstraction works location, in consultation with and based on the requirements of the Employer’s Agent, ISD facilitator and Environmental Control Officer.
- Construction of abstraction works (requiring temporary diversion of the Tsitsa River)
- Construction of total 1400 m HDPE pipelines (2 no. of pipelines with approximate lengths of 700 m each) between the abstraction works and WTW.
- Construction of 800 m access road to WTW and abstraction works, including a reinforced concrete structure across an existing donga erosion channel
- Construction of 6 Mℓ/day Malepelepe WTW.
- Construction of approximately 580m of rising main steel pipeline from the WTW along the proposed access road.
- Bulk electrical 22kV overhead line as a subcontract using an Eskom-approved contractor as part of the Eskom self-build application process.
- Water tightness testing, cleaning and disinfections of water retaining structures and pipelines.
- Pressure testing of pipelines and fittings.
- Subcontracting a minimum of 20% of the value of work (excluding specialist supply items, contingencies, CPA and provisional sums) to SMMEs as per the project specification.

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- Dealing with community participation with regards to the construction
- Environmental compliance and management of the area during and after the completion of construction.
- Compliance with the requirements of the Occupational Health and Safety Act of 1993, Construction Regulations 2014 and COVID-19 requirements.
- Correct defects in the Works in accordance with the requirements of the Contract.

This description of the Works is not necessarily complete and shall not limit the work to be carried out by the Contractor under this Contract. Approximate quantities of each type of work are given in the Bill of Quantities.

C3.1.4 Location of the Works

ORTDM is one of six district municipalities in the Eastern Cape Province. ORTDM consists of five local municipalities (LM's), namely King Sabata Dalindyebo (KSD), Nyandeni, Port St Johns, Ingquza Hill, and Mhlontlo LM, where this project is located.

Sidwadweni RWSS is located approximately (31°12'33.52"S; 8°43'18.64"E) 24km north of Mthatha and adjacent to the N2 to Kokstad within the Mhlontlo LM area. It covers the area south of the Tsitsa River both east and west of the town of Tsolo. In the east it extends up to the Nyandeni LM boundary and in the west, it extends up to the Joe Gqabi DM boundary.

Mhlontlo LM is classified as a B4 rural Municipality and incorporates Qumbu and Tsolo rural towns. It is located near the north-eastern side of the Eastern Cape Provincial border. Major transport routes which traverse the area include the N2 between Mthatha and Mount Frere and the R396 between Tsolo and Maclear. The location of the site is indicated on the locality plan bound as **Appendix A**.

C3.1.5 Temporary Works

The Contractor will be responsible for determining the extent of temporary works required to execute the contract, and the cost thereof shall be included in the rates for the respective items of work. Nonetheless, it is envisaged that temporary work may be required for the following activities:

- River diversion and dewatering.
- Formwork and falsework for reinforced concrete.
- Pipeline trenches requiring shoring due to space and depth constraints.
- Dealing with water in excavations and trenches.
- Construction of pipelines near existing fences, which must be temporarily removed, will require the erection and maintenance of temporary fencing until restoration of the original fences.
- Construction of pipe trenches near existing properties or through existing accesses may require the provision of temporary access for pedestrians, livestock or vehicles.
- Traffic control measures where construction takes place at or close to existing roads.
- Safety measures deemed necessary by the Health and Safety specification or the Contractor's own risk assessment (e.g. pedestrian barriers).

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C3.1.6 Construction Programme

The programme of construction shall be submitted to the Employer's Agent within the time stipulated in these documents. The programme shall clearly show all activities related to the works and shall indicate which activities are on the critical path.

In compiling the programme, the Contractor shall consider the following:

- The requirements and effects of employing labour-intensive construction methods.
- The lead-time for training of local labour.
- The accommodation and safeguarding of public access and traffic.
- Establishment and de-establishment times.
- Time to obtain all permits and wayleaves.
- Appointment of Community Liaison Officer (CLO).
- All public and Contractor close down periods.
- All other activities required in terms of this document.

If during the contract, the execution of the work deviates in any manner from the programme, the Contractor shall, on instruction by the Employer's Agent, within one week of such instruction submit a revised programme. Should such a revision be because of the Contractor falling behind with his work, the programme shall clearly show the steps to be taken to rectify the situation so as to enable the contract to be completed within the stipulated contract period. Positive steps to increase production through increased resources, or the more efficient usage of existing resources shall accompany such a programme. The tender programme shall however be used.

The Contractor will be required to provide the required information to the Employer to allow for the successful integration and management of programme and construction interfaces between the various construction contracts listed in Section C3.1. It is anticipated that Contracts 1, Subcontract 1 (Bulk electrical), Contract 2 and Contract 3 will be implemented in parallel over a 36 month period.

The stated contract duration of 36 months has been prescribed to allow sufficient time for the mechanical and electrical contractor to perform and complete their work in parallel to Contract 1 (this Contract) to install the mechanical and electrical equipment required for the successful completion and commissioning of the scheme.

C3.2. ENGINEERING

C3.2.1 Design Services and Activity Matrix

Responsibilities for design and related documentation are as follows:

- | | |
|--|---------------------|
| • Concept, feasibility and overall process | Employer |
| • Basic engineering and detail layouts to tender stage | Employer |
| • Final design to approved construction stage | Employer |
| • Temporary works | Contractor |
| • Preparation of record drawings and GIS information | Contractor/Employer |

C3.2.2 Employer's Design

The Employer's design encompasses the permanent Works described in C.3.1.3 and what is included on the drawings.

C3.2.3 Design Brief

The design of the permanent Works is the responsibility of the Employer's Agent.

The Contractor is responsible for the design of the temporary Works required for the construction and execution of the permanent Works.

Where the Contractor is to supply the design of designated parts of the permanent Works or temporary Works, he shall supply full working drawings supported by a professional Employer's Agent's design certificate.

C3.2.4 Drawings

The Contractor shall use only the dimensions stated in figures on the Drawings in setting out the Works and dimensions shall not be scaled from the Drawings, unless required by the Employer's Agent.

The Employer's Agent will, on the request of the Contractor, and in accordance with the provisions of the Conditions of Contract, provide such dimensions as may have been omitted from the Drawings.

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 provided.

A marked-up set of Drawings shall be kept and updated by the Contractor on a day-to-day basis. This information shall be supplied to the Employer's Agent Representative on a regular basis.

All information in possession of the Contractor where required by the Employer's Agent and/or the Employer's Agent Representative to complete the As Built/Record Drawings, must be submitted to the Employer's Agent Representative before the Certificate of Completion may be issued.

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The Drawings prepared by the Employer for the permanent Works are listed and bound under **Appendix G**. The Employer reserves the right to issue amended and/or additional Drawings during the Contract.

C3.2.5 Design Procedures

The Contractor is responsible for the design of all the temporary works required for the construction and execution of the Permanent Works. This includes, inter alia, temporary roads, access control, accommodation of traffic, formwork and falsework, shoring of trenches and excavations, dewatering, all health and safety measures, environmental management as well as temporary support systems, until the completion of the Contract.

C3.3. PROCUREMENT

C3.3.1 Preferential Procurement Procedures

All works to be completed in this contract shall be executed in accordance with the O.R. Tambo District Municipality's preferential procurement policies and procedures.

C3.3.2 Subcontracting

C3.3.3 Scope of Mandatory Subcontract Works

Where possible, work that can be subcontracted to EMEs and QSEs is identified and detailed in Part C1, Section C1.4 and in Part C1, Section C1.3, the requirements for the procurement and employment of local labour are specified. It is noted that the work identified in this document is not exhaustive and it shall be required from the Contractor to ensure that a minimum of 20% of the Works (excluding specialist supply items, contingencies, CPA and provisional sums) is done by local EMEs and QSEs.

No work may be sub-contracted to another party unless approval is given by the ORTDM in writing. The Contractor is to submit to the ORTDM in writing a request for appointment of a particular sub-contractor. Accompanying this request is to be the full detail of the sub-contractor, including:

- Previous experience.
- Work which will be sub-contracted to him/her.
- Approximate value of the work to be sub-contracted.

The bulk electrical 22kV overhead line will be constructed as a subcontract using an Eskom-approved contractor as part of the Eskom self-build application process.

C3.3.4 Preferred Subcontractors / Suppliers

The Contractor will be required to liaise with the Employer, Employer's Agent and local community structures to finalise the list of local EMEs and QSEs to be employed as part of the project.

c3.3.4.1 Subcontracting Procedures

A formal tender process will be followed to appoint the Subcontractor which will be facilitated by the Employer, Employer's Agent and Main Contractor.

All subcontractors appointed under **C3.3.2.1** above shall be:

- Registered with the CIDB
- Allocated work within the category and value limits designated by their CIDB grading
- Be in good standing with the Department of Labour
- Registered on the Central Supplier Database.

Proof of the above is to be provided to the Employer's Agent before appointment of the subcontractor.

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c3.3.4.2 Subcontracting Procedure Specific to the Eskom-Overhead Line Subcontract

The bulk electrical 22kV overhead line will be constructed as a subcontract to Contract 1 using an Eskom-approved contractor as part of the Eskom self-build application process. An open tender process will not be followed; Eskom will provide a shortlist of between three (3) to five (5) Eskom-approved contractors for the Contractor to approach to submit tenders.

The Contractor (with support where required from the Employer's Agent) shall compile the tender documents for the subcontract in such a manner that it will meet Eskom's requirements.

All tenders received shall be evaluated by the Contractor and the Employer's Agent in terms of an evaluation process determined by the Employer's Agent. The Contractor will then award the subcontract to the successful tenderer.

A Sub-Contract Agreement in accordance with the General Conditions of Subcontract for Construction Works, SAICE, First Edition 2018 including all amendments, will be compiled by the Contractor with the assistance of the Employer's Agent.

All costs associated with the tender process including the conclusion of the agreement are for the Contractor's account, to be included in the mark-up provision allowed for this work package.

C3.3.5 Attendance on subcontractors

The Contractor shall guide, assist, advise and mentor the local EME and QSE subcontractor/s and guidance on how to establish and determine rates.

The Contractor shall be responsible for ensuring that the prospective local EME and QSE subcontractor/s fully comprehends the:

- Implications of the liabilities and responsibilities inherent in the contract into which the tenderer entered.
- Implications of the tendered rates.
- Scope and extent of the Works.
- Proper procedures for the submission of a tender.
- Procedures and basis on which tenders will be evaluated and awarded.

The Contractor shall closely manage, mentor, supervise, guide and assist the EEs in all aspects of management, planning, execution and the completion of work.

The above shall include inter alia, but is not limited to, the following:

- (i) Planning and programming of the Works.
- (ii) The sourcing, ordering, purchasing, hiring all the necessary Construction Equipment, Materials, tools and incidentals necessary and required for the successful execution and completion of the Permanent as well as the Temporary Works.
- (iii) Labour relations and employment.
- (iv) Monthly measurements, costing and invoicing.
- (v) General safety, occupational health and safety matters.

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- (vi) Functions of civil engineering infrastructure, structures, services and systems.
- (vii) Interpreting and understanding the contract.
- (viii) Construction and maintenance methods and procedures.
- (ix) Communication.
- (x) Cash-flow control, submitting invoices and payment certificates.
- (xi) Planning, programming, scheduling, critical path control and acceleration.
- (xii) Maintenance planning.
- (xiii) Material procurement and control.
- (xiv) Risk limitation and management.
- (xv) Quality assurance and procedures.
- (xvi) Compliances with all applicable laws, regulations, statutory provisions and agreements.
- (xvii) General Conditions of Contract and Contract Data.
- (xviii) Contractual claims, if situations arise that entitle a contractor to claims in terms of the Conditions of Contract.
- (xix) Profit and loss.
- (xx) Replacement and running costs of Construction Equipment.

The extent and level of management, mentorship, supervision, guidance and assistance to be provided by the Contractor shall be in commensuration with the expertise of the relevant EME and QSE and should be so directed as to enable the EME and QSE to achieve the successful execution and completion of the respective works.

C3.4. CONSTRUCTION

C3.4.1 WORKS SPECIFICATIONS

C3.4.1.1 Applicable SANS 1200 Standardised Specifications

The SANS 1200 Standardised Specifications for civil engineering construction that are applicable are listed in C3.7.1.

C3.4.1.2 Particular Specifications

The Particular Specifications for work not covered by the SANS 1200 Standardised Specifications are listed in C3.7.2.

C3.4.1.4 Variations and Additions to the SANS 1200 Standardised Specifications

Variations and additions to the SANS 1200 Standardised Specifications listed in C3.7.1 are given in section C3.7.3.

C3.4.2 SITE ESTABLISHMENT

C3.4.2.1 Services and facilities provided by the Employer

(a) Water Sources

The Contractor shall make his own arrangements regarding the supply of water.

The Contractor shall, in accordance with the provisions of subclause C3.4.2.2(b), and at his own expense, make all arrangements necessary for the supply and distribution of water as may be required for the purposes of executing the Contract, including water for both construction purposes and domestic use as well as for making all arrangements in connection therewith.

The Contractor shall further, at his own expense, be responsible for providing all necessities for procuring, storing, transporting and applying water required for the execution of the Contract, including but not limited to all piping, valves, tanks, pumps, meters and other plant and equipment, as well as for all work and superintendence associated therewith. Payment for the aforementioned shall be deemed to be covered by the rates and prices tendered and paid for the various items of work included under the Contract.

The Contractor shall make himself thoroughly acquainted with the regulations relating to the use of water and shall take adequate measures to prevent the wastage of water.

The sources of all water utilised for the purposes of the Contract shall be subject to the prior approval of the Employer's Agent, which approval shall not be unreasonably withheld. The Contractor shall comply with all prevailing legislation in respect of drawing water from natural and other sources and shall, when required by the Employer's Agent, produce proof of such compliance.

The distribution of water shall be carried out by the Contractor strictly in accordance with the applicable laws and regulations. All water provided by the Contractor for construction purposes shall be clean, free from undesirable concentrations of deleterious salts and other materials and shall

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comply with any further relevant specifications of the Contract.

The Contractor shall, whenever reasonably required by the Employer's Agent, produce test results demonstrating such compliance. Water provided by the Contractor for human consumption shall be healthy and potable to the satisfaction of the health authorities in the area of the Site.

The Employer accepts no responsibility for the shortage of water due to any cause whatsoever or for the additional costs incurred by the Contractor as a result of such shortage.

(b) Power / Electricity Supply

The Contractor shall make his own arrangements with the Electricity Department for a supply of electricity if required and shall pay establishment and consumption costs at the tariffs ruling at the time.

The Contractor shall, in accordance with the provisions of subclause C3.4.2.2(c), and at his own cost, make all arrangements necessary for the supply and distribution of electrical power required for construction purposes as well as for use in and about his site establishment.

The Contractor shall comply with all prevailing legislation in respect of the generation and distribution of electricity and shall, when required by the Employer's Agent, produce proof of such compliance.

No separate payment will be made to the Contractor for the obtainment, distribution and consumption of electricity, the costs of which will be deemed to be in the Contractor's tendered rates and prices.

(c) Excrement Disposal / Sanitary Facilities

The Contractor shall, in complying with his obligations in terms of subclause C3.4.2.2(d), at his own cost, be responsible for safely and hygienically dealing with and disposing of all human excrement and similar matter generated on the Site during the course of the Contract, all to the satisfaction of the responsible health authorities in the area of the Site.

All such excrement shall be removed from the Site and shall not be disposed of by the Contractor on the Site. The Contractor shall further comply with any other requirements in this regard as may be stated in the Contract.

The Contractor shall further, as a minimum, supply and maintain chemical toilets for use by his workmen. The number of toilets shall be based on one toilet per fifteen personnel on site.

Under no circumstances will the Contractor's staff be allowed to use any other toilet facilities in and around the Site.

(d) Disposal Site

All material cleared on the site, rubble, spoil and refuse shall be disposed of at one of the municipal solid waste sites. Hazardous material shall only be disposed of at the waste site with Waste license issued by the Department of Environmental Affairs.

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These are dedicated disposal sites and therefore no separate overhaul shall be paid. The Contractor shall pay all charges levied at the waste site and must make allowance in his rates to cover these charges as no separate payment will be made in this regard.

(e) Area for Contractor's site establishment

The Employer has no suitable areas available where the Contractor may erect offices, workshops, stores and other facilities that he requires for the purposes of the Contract. The Contractor shall, at his own cost, be responsible for locating and making all arrangements necessary for securing an area suitable to meet his needs in respect of the erection of the Contractor's offices, stores and other facilities, including the facilities to be provided for the Employer's Agent in accordance with the Contract.

Any potential area proposed by the Contractor shall be within reasonable proximity to the Site of the Works and its location shall be subject to the approval of the Employer's Agent, which approval shall not be unreasonably withheld.

The Contractor shall be responsible for arranging, at his own cost, for the provision of all services he may require in the area, as well as elsewhere on the Site.

(f) Accommodation of employees

The Contractor shall make his own arrangements for the accommodation of his employees. Where field accommodation is required, the Contractor shall comply fully with the wishes of the various landowners, as in their agreement with the Employer, to the satisfaction of both landowner and Employer.

C3.4.2.2 Facilities provided by the Contractor

(a) Facilities for the Employer's Agent

The Contractor shall provide on the Site, for the duration of the Contract and for the exclusive use of the Employer's Agent and/or his Employer's Agent's Representative (as applicable), the various facilities described in SANS 1200 AB as amended.

(b) Water

The Contractor shall, at his own expense, be responsible for obtaining and distributing all water as may be required for the purposes of executing the Contract, including water for both construction purposes and domestic use, as well as for making all arrangements in connection therewith.

The Contractor shall further, at his own expense, be responsible for providing all necessities for procuring, storing, transporting and applying water required for the execution of the Contract, including but not limited to all piping, valves, tanks, pumps, meters and other plant and equipment, as well as for all work and superintendence associated therewith.

The sources of all water utilised for the purposes of the Contract shall be subject to the prior approval of the Employer's Agent, which approval shall not be unreasonably withheld.

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The Contractor shall comply with all prevailing legislation in respect of drawing water from natural and other sources and shall, when required by the Employer's Agent, produce proof of such compliance. The distribution of water shall be carried out by the Contractor strictly in accordance with the applicable laws and regulations.

All water provided by the Contractor for construction purposes shall be clean, free from undesirable concentrations of deleterious salts and other materials and shall comply with any further relevant specifications of the Contract. The Contractor shall, whenever reasonably required by the Employer's Agent, produce test results demonstrating such compliance. Water provided by the Contractor for human consumption shall be healthy and potable to the satisfaction of the health authorities in the area of the Site.

No separate payment will be made to the Contractor for the obtainment, distribution and consumption of water, the costs of which will be deemed to be included in the Contractor's tendered rates.

(c) Electricity

The Contractor shall, at his own expense, be responsible for obtaining and distributing all electricity as he may require for the purposes of executing the Contract, including electricity for both construction purposes and domestic use, as well as for making all arrangements in connection therewith.

The distribution of electricity shall be carried out by the Contractor strictly in accordance with the applicable laws and regulations.

No separate payment will be made to the Contractor for the procurement, distribution and consumption of electricity, the costs of which will be deemed to be in the Contractor's tendered rates and prices.

(d) Excrement disposal

The Contractor shall, at his own expense, be responsible for safely and hygienically dealing with and disposing of all human excrement and similar matter generated on the Site during the course of the Contract, to the satisfaction of the responsible health authorities in the area of the Site and the Employer's Agent. All such excrement shall be removed from the Site and shall not be disposed of by the Contractor on the Site.

The Contractor shall further comply with any other requirements in this regard as may be stated in the Contract.

No latrines are available and therefore the Contractor shall supply portable chemical toilets for use by his workmen. The number of toilets shall be based on one toilet per fifteen personnel on site. Under no circumstances will the Contractor's staff be allowed to use private or public toilet facilities.

The Contractor shall provide water and soap for his staff to be able to wash with at each site of the Works. The wastewater shall be disposed of off-site.

No separate payment will be made to the Contractor in respect of discharging his obligations in terms of this subclause and the costs thereof shall be deemed to be included within the Contractor's tendered Preliminary and General Items.

C3.4.2.3 Site Usage and Security on site

The Contractor shall be responsible to control unauthorised entry to the site and shall inform the Employer's Agent of any breach of such rules. The site shall be managed and used for its intended purpose. The Contractor is required to keep a visitors log and ensure full compliance with site safety standards.

The Contractor shall make provision for security on site against theft and robbery, as his sole responsibility. The cost for providing adequate security, as and when required, must be borne by the Contractor.

However, the access and possession of Site shall not be exclusive to the Contractor. The Contractor will be required to interface with and accommodate other contractors appointed by the Employer for other components of the larger project included in separate construction contracts. The relevant payment items for costs associated with compliance to these requirements are included and described in the BOQ and SANS 1200A and its amendments.

C3.4.2.4 Permits and Wayleaves

The Contractor shall be responsible for obtaining all the necessary wayleaves, permissions or permits applicable to working near any existing services or other infrastructure on Site, and shall ensure that any wayleaves, permissions or permits obtained by the Employer's Agent prior to the award of the contract are transferred into the Contractor's name.

Required wayleaves include, but are not limited to, those from Eskom (construction in proximity to existing overhead line), the Department of Public Works (construction in proximity to cattle dip structure) and various ORTDM departments (roads, water, electrical).

The Contractor shall abide by any conditions imposed by such wayleaves, permissions or permits.

The Contractor shall ensure that all wayleaves, permissions and permits are kept on site and are available for inspection by the relevant service authorities on demand.

The Contractor shall also ensure that any wayleaves in respect of electricity services are renewed timeously every three months.

C3.4.2.5 Features requiring special attention

(a) Site maintenance

During progress of the work and upon completion thereof, the Site of the Works shall be kept and left in a clean and orderly condition. The Contractor shall store materials and equipment for which he is responsible in an orderly manner and shall keep the Site free from debris and obstructions.

The general neatness and tidiness of the Site is to be maintained and therefore the Contractor shall on a day-to-day basis, keep the area of the Works in a condition acceptable to the Employer's Agent, the Employer's Health and Safety Agent and the Environmental Control Officer.

(b) Testing and Quality Control

(i) Contractor to engage services of an independent laboratory

Notwithstanding the requirements of the Specifications pertaining to testing and quality control, the Contractor shall engage the services of an approved independent laboratory to undertake all testing of materials, the results of which are specified in, or may reasonably be inferred from, the Contract.

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These results will be taken into consideration by the Employer's Agent in deciding whether the quality of materials utilised, and workmanship achieved by the Contractor comply with the requirements of the Specifications. The foregoing shall apply irrespective of whether the specifications indicate that the said testing is to be carried out by the Employer's Agent or by the Contractor.

The Contractor shall be responsible for arranging with the independent testing laboratory for the timeous carrying out of all such testing specified in the Contract, at not less than the frequencies and in the manner specified. The Contractor shall promptly provide the Employer's Agent with copies of the results of all such testing carried out by the independent laboratory.

For the purposes of this clause, an "independent laboratory" shall mean an "approved laboratory" (as defined in subclause PSA 7.2) which is not under the management or control of the Contractor and in which the Contractor has no financial interest, nor which has any control or financial interest in the Contractor.

(ii) Additional testing required by the Employer's Agent

In addition to the provisions of subclause C3.4.2.5(b)(i): Contractor to engage services of an independent laboratory, the Employer's Agent shall be entitled at times during the Contract to require that the Contractor arrange with the independent laboratory to carry out any such tests, additional to those described in subclause C3.4.2.5(b)(i), at such times and at such locations in the Works as the Employer's Agent shall prescribe. The Contractor shall promptly and without delay arrange with the independent laboratory for carrying out all such additional testing as required by the Employer's Agent, and copies of the test results shall be promptly submitted to the Employer's Agent.

(iii) Cost of Testing

a) Testing in term of subclause C3.4.2.5(b)(i)

The costs of all testing carried out by the independent laboratory in accordance with the requirements of subclause C3.4.2.5(b)(i), above shall be borne by the Contractor and shall be deemed to be included in the tendered rates and prices for the respective items of work as listed in the Bill of Quantities and which require testing in terms of the Specifications. No separate payments will be made by the Employer to the Contractor in respect of any testing carried out in terms of subclause C3.4.2.5(b)(i).

Where, as a result of the consistency of the materials varying or as a result of failure to meet the required specifications for the work, it becomes necessary to carry out additional tests (e.g. re-tests on rectified work and/or replacement materials), the costs of such additional testing shall be for the Contractor's account.

b) Additional tests required by the Employer's Agent

The costs of any additional tests required by the Employer's Agent in terms of subclause C3.4.2.5(b)(ii): Additional testing required by the Employer's Agent, shall be reimbursed to the Contractor against substitution of the Provisional Sum allowed therefore in the Bill of Quantities; provided always that the costs of any such additional tests ordered by the Employer's Agent, the results of which indicate that the quality of the materials utilised and/or the standard of workmanship achieved are/is not in accordance with the specifications, shall not be reimbursable to the Contractor.

(c) Contractor supplied equipment

The Contractor shall when required to supply any testing, measuring and/or survey equipment for the Employer's Agent's use provide calibration certificates or verification certificates (as appropriate) for all equipment. This shall apply for both shared equipment as well as for equipment specified to be provided for the Employer's Agent's use on site.

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Calibration or verification, by certified authorities shall be subject to the Employer's Agent's approval prior to the delivery of any equipment to the Employer's Agent; and thereafter at intervals as prescribed for the relevant equipment but not less than every twelve (12) months.

The calibration or verification certificate for each item of equipment shall be submitted to the Employer's Agent for approval prior to its use or within seven (7) days of subsequent re-calibration/verification.

Unless otherwise provided for in the bill of quantities the cost of providing the above specified equipment shall be deemed to be included in the tendered rates and prices for the respective items of work as listed in the Bill of Quantities.

Failure to submit certificates shall result in payment for the equipment being withheld.

(d) Opening up and closing down of designated borrow pits

Measurement and payment for opening up and closing down designated borrow pits, including removing and stockpiling overburden and restoring the Site, shall be made under item 8.3.4 of SANS 1200 D. This item applies to all borrow material required under this Contract.

The requirements of subclause 5.2.2.2 of SANS 1200 D regarding the opening up, maintenance and closing down of borrow pits shall be adhered to.

(e) Access to properties

The Contractor shall organise the work to cause the least possible inconvenience to the public and to the property owners adjacent to or affected by the work, and except as hereunder provided, shall at all times provide and allow pedestrian and vehicular access to properties within or adjoining or affected by the area in which he is working. In this respect the Contractor's attention is drawn to Clause 8.1.2 of the Conditions of Contract.

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

Notwithstanding the afore-going, the Contractor may, with the prior approval of the Employer's Agent (which approval shall not be unreasonably withheld), make arrangements with and obtain the acceptance of the occupiers of erven and properties to close off part of a street, road, footpath or entrance temporarily, provided that the Contractor duly notifies the occupiers of the intended closure and its probable duration, and reopens the route as punctually as possible. Where possible, such streets, roads, footpaths and entrances shall be made safe and reopened to traffic overnight. Such closure shall not absolve the Contractor from his obligations under the Contract to provide access at all times. Barricades, traffic signs, drums and other safety measures appropriate to the circumstances shall be provided by the Contractor to suit the specific conditions.

(f) Access to public facilities (cattle dip tank)

There is an existing cattle dipping tank in the immediate vicinity of the site. This tank will need to remain in operation for occasional (estimated monthly) usage by the community. The Contractor will be responsible for protection of this structure against any damage caused by construction activity in the vicinity for the duration of the contract. Defining the preferred access route will be the responsibility of the Contractor. The Contractor will also be responsible for erecting a sufficient barricade and all other

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temporary works and measures required to allow safe access by the public and livestock to the tank for the entire duration of the project.

(g) Monthly statements and payment certificates

The Employer's Agent payment certificate template will be used as the only format for submission to the Employer.

The statement (measured quantities) to be submitted by the Contractor in terms of Clause 6.10 of the Conditions of Contract shall be prepared by the Contractor at his own cost, strictly in accordance with the standard payment certificate prescribed by the Employer's Agent, in digital electronic computer format. The Contractor shall, together with a copy of the digital electronic computer file of the statement, submit two (2) A4 size paper copies of the statement.

For the purposes of the Employer's Agent payment certificate, the Contractor shall subsequently be responsible, at his own cost, for making such adjustments to his statement as may be required by the Employer's Agent for the purposes of accurately reflecting the actual quantities and amounts which the Employer's Agent deems to be due and payable to the Contractor in the payment certificate.

The Contractor shall, at his own cost, make the said adjustments to the statement and return it to the Employer's Agent within three (3) normal workings days from the date on which the Employer's Agent communicated to the Contractor the adjustments required. The Contractor shall submit to the Employer's Agent five (5) sets of A4 size paper copies of such adjusted statement, together with a copy of the electronic digital computer file thereof.

Any delay by the Contractor in making the said adjustments and submitting to the Employer's Agent the requisite copies of the adjusted statement for the purposes of the Employer's Agent payment certificate will be added to the times allowed to the Employer's Agent in terms of Clause 6.10.4 of the Conditions of Contract to submit the signed payment certificate to the Employer and the Contractor. Any such delay will also be added to the period in which the Employer is required to make payment to the Contractor.

The Contractor is further required to complete the monthly reporting template forms, refer to PSA 8.1.2.2 and **Appendix B** at least 48 hours prior to each Site meeting. These reports shall also be submitted together with the Contractor's monthly payment certificates. Payment of the Contractor is conditional on this information being accurate and timeously provided.

The monthly statements accompanying the payment certificates shall include:

- i. Contractor's Invoice;
- ii. Interim Payment Certificate;
- iii. Proof of Delivery and Invoices of all materials Claimed as Materials on Site;
- iv. Construction Progress Report, including:
 - a. Detailed report on monthly and cumulative Contract Participation Goals achieved, as per Item C1.4 Item 4.2 Monthly Returns.
 - b. Plant and Labour report, including all forms required by the Employer attached as Appendix B and proof of job creation / signed labour returns;
 - c. An "Information required" schedule indicating any information or drawings required.
 - d. A report on any delays encountered or anticipated;
 - e. Programme update, complying to the requirements of Section C3.5.2;
 - f. Updated cashflow vs Expenditure to date report, including all items as per C1.4 Item 4.2 Monthly Returns.

(i) Construction in restricted areas

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Working space is sometimes restricted. The construction method used in these restricted areas largely depends on the Contractor's Plant. Notwithstanding, measurement and payment will be strictly according to the specified cross-sections and dimensions irrespective of the method used, and the rates and prices tendered will be deemed to include full compensation for any difficulties encountered by the Contractor while working in restricted areas. No extra payment nor any claim for payment due to these difficulties will be considered.

(j) Notices, signs, barricades and advertisements

All notices, signs and barricades, as well as advertisements, may be used only if approved by the Employer's Agent. The Contractor shall be responsible for their supply, erection, maintenance and ultimate removal and shall make provision for this in his tendered rates.

The Employer's Agent shall have the right to instruct the Contractor to move any sign, notice or advertisement to another position, or to remove it from the Site of the Works if in his opinion it is unsatisfactory, inconvenient or dangerous.

(j) Workmanship and quality control

The onus to produce work that conforms in quality and accuracy of detail to the requirements of the Specifications and Drawings rests with the Contractor, and the Contractor shall, at his own expense, institute a quality control system and provide suitably qualified and experienced Employer's Agents, foremen, surveyors, materials technicians, other technicians and technical staff, together with all transport, instruments and equipment to ensure adequate supervision and positive control of the Works at all times.

The cost of supervision and process control, including testing and mix designs carried out by the Contractor, will be deemed to be included in the rates tendered for the related items of work.

The Contractor's attention is drawn to the provisions of the various Standardised Specifications regarding the minimum frequency of testing required. The Contractor shall, at his own discretion, increase this frequency where necessary to ensure adequate control.

On completion and submission of every part of the work to the Employer's Agent for examination and measurement, the Contractor shall furnish the Employer's Agent with the results of the relevant tests, mix designs, measurements and levels to demonstrate the achievement of compliance with the Specifications.

C3.4.2.6 Extension of time due to abnormal rainfall

- a) Extension of time in respect of delays resulting from wet climatic conditions on the Site will only be considered in respect of abnormally wet climatic conditions and shall be determined for each calendar month or part thereof, in accordance with the formula given below:

$$V = (Nw - Nn) + \frac{(Rw - Rn)}{X}$$

Where:

V = Extension of time in calendar days in respect of the calendar month under consideration:

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If V is negative and its absolute value exceeds Nn, then V shall be taken as equal to minus Nn.

When the value of V for any month exceeds the number of days in the particular month, V will be the number of days in the month.

Nw = Actual number of days during the calendar month on which a rainfall of 10 mm or more has been recorded.

Nn = Average number of days in the relevant calendar month, as derived from existing rainfall records, on which a rainfall of 20mm or more has been recorded for the calendar month.

Rw = Actual average rainfall in mm recorded for the calendar month under consideration.

Rn = Average rainfall in mm for the calendar month as derived from existing rainfall records as stated in the Site Information.

The factor $(Rw - Rn)/X$ shall be deemed to be a fair allowance for variations from the average number of days during which the rainfall did not exceed Y mm but wet conditions prevented or disrupted work.

- b) The rainfall records for Mthatha for the period 2000 to 2020 from South African Weather Service (see **Appendix F**) are reproduced in the accompanying table, and the monthly averages (Rn and Nn) for this period shall, for the purposes of this Contract be taken as normal and as the values to be substituted for Rn and Nn. The values of X and Y shall be 20 and 10 respectively.
- c) The potential extension of time V has been calculated for each month and year of the period concerned to indicate the possible effect of the rainfall formula. The values of V were obtained by applying the rainfall formula and using the actual rainfall figures and the calculated values of Rn and Nn indicated in the table.
- d) The Contractor shall, at his own cost, provide and erect on the Site at a location approved by the Employer's Agent, an approved rain gauge, which shall be fenced off in a manner which will prevent any undue interference by workmen and others. The Contractor shall, at his own cost, arrange for the reading of the rain gauge on a daily basis for the duration of the Contract. The gauge readings, as well as the date and time at which the reading was taken shall be recorded in a separate record book provided by the Contractor for this purpose. All entries in the rainfall record books shall be signed by the person taking the reading and the gauge shall be properly emptied immediately after each reading has been taken. If required by the Employer's Agent, the Employer's Agent shall be entitled to witness the reading of the gauge.
- e) The Contractor's claims in terms of Clause 5.12 of the Conditions of Contract for extension of time in respect of delays resulting from wet climatic conditions on the Site during each month, shall be submitted in writing to the Employer's Agent monthly; provided always that:
 - (i) the period allowed to the Contractor in terms of Clause 10 of the Conditions of Contract in which to submit his claim for each month shall be reduced to seven (7) days, calculated from the last day of the month to which the claim applies; and

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(ii) the 28-day period allowed to the Employer's Agent in terms of Clause 10.1.2 of the Conditions of Contract in which to give his ruling on the claim, shall be reduced to fourteen (14) days.

The Contractor's monthly claim shall be accompanied by a copy of the signed daily rainfall readings for the applicable month.

- f) The extent of any extension of time which may be granted to the Contractor in respect of wet climatic conditions (whether normal or abnormal) shall be determined as the algebraic sum of the "V" values for each month between the Commencement Date and the Due Completion Date of the Contract, calculated using the formula above; provided always that:
- (i) rainfall occurring within the period of the Contractor's Christmas shut-down period (referred to in the Conditions of Contract) shall not be taken into account in the calculation of the monthly "V" values;
 - (ii) rainfall occurring during any period during which the Contractor was delayed due to reasons other than wet climatic conditions on the Site, and for which delay an extension of time is granted by the Employer's Agent, shall not be taken into account in the calculation of the monthly "V" values;
 - (iii) if the algebraic sum of the "V" values for each month is negative, the time for completion will not be reduced on account of subnormal rainfall, and
 - (iv) where rainfall is recorded only for part of a month, the "V" value shall be calculated for that part of the month using pro rata values for N_n and R_n .
- g) The Employer's Agent shall, simultaneous with granting any extension of time in terms of this clause, revise the Due Completion Date of the Contract to reflect an extension of time having been granted in respect of wet climatic conditions, to the extent of the algebraic sum of all the "V" values for all the preceding months of the Contract, less the aggregate of the " N_n " values for the remaining (unexpired) months of the Contract (viz less aggregate of the potential maximum negative "V" values for the remaining Contract Period). Thus, provided that where such period is negative, the Due Completion Date shall not be revised.
- h) Any extension of time in respect of wet climatic conditions granted in terms of this clause shall not be deemed to take into account delays experienced by the Contractor in repairing or reinstating damage to or physical loss of the Works arising from the occurrence of abnormal climatic conditions. Extension of time in respect of any such repairs or reinstatement regarding damage shall be the subject of a separate application for extension of time in accordance with the provisions of Clause 5.12 and Clause 10 of the Conditions of Contract.

C3.4.3 PLANT AND MATERIALS

C3.4.3.1 Plant and materials supplied by the Employer

The Employer will not provide any plant or materials. The Contractor shall provide all plant and materials of whatever nature necessary to enable him to undertake the works as specified.

C3.4.3.2 Materials, Samples and Shop Drawings

Materials or work, which does not conform to the approved samples submitted in terms of Clause 7.4.1 (GCC 2015) of the Conditions of Contract, will be rejected. The Employer's Agent reserves the right to

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submit samples to tests to ensure that the material represented by the sample meets the specification requirements.

The costs of any such test conducted by or on behalf of the Employer's Agent, the results of which indicate that the samples provided by the Contractor do not conform to the requirements of the Contract, shall, in accordance with the provisions of Clause 7 of the Conditions of Contract, be for the Contractor's account.

C3.4.4 CONSTRUCTION EQUIPMENT

C3.4.4.1 Requirements for equipment

All construction plant and equipment used on this contract shall be in good working order, well maintained, of adequate size and fit for purpose. No plant or equipment that leaks oil, fuel or hydraulic fluids may be used on site.

Equipment must be such that work can be executed in an efficient manner.

Any plant or equipment that, in the opinion of the Employer's Agent, is not of adequate size or fit for use shall be removed from the site and replaced with acceptable plant and equipment, all at the Contractor's cost.

All equipment must comply with the requirements as stipulated in the Environmental regulations and specifications and contained in the OHS Act.

C3.4.4.2 Equipment provided by the Employer

The Employer shall not provide any equipment.

C3.4.5 EXISTING SERVICES

C3.4.5.1 Known services

The Contractor shall familiarise himself with all existing services and liaise with all relevant authorities for the location and detection of existing services.

No guarantee can be given that all affected services are indicated on the drawings, or that, if they are shown, they are shown exactly in the correct location. Once located, the exact location, level and nature of the service shall be recorded and given to the Employer's Agent's Representative in writing.

The Contractor shall, subject to the provisions of PSA 5.4, expose all services by hand in advance of his trenching operation in order to reduce the risk of damage to existing services.

The Contractor shall take special care not to damage any existing services and shall comply with all the requirements of the relevant authorities during construction. The Contractor will be held solely responsible for the protection of all known services and for any claims for damages arising from damage to any such service. (See also PSA 5.4).

C3.4.5.2 Treatment of existing services

The Contractor to ensure that existing services supply are not interrupted. All existing services have to remain operational, either through protection or re-routing. Temporary re-routing of existing services is allowed, with the approval of the owner of the service.

C3.4.5.3 Use of detection equipment for the location of underground services

The Contractor to make use of the necessary detection equipment to determine the location of an existing service, before excavation commences to expose the service.

C3.4.5.4 Damage to services

The Contractor shall take special care not to damage any existing services and shall comply with all the requirements of the relevant authorities during construction. The Contractor will be held solely responsible for the protection of all known services and for any claims for damages arising from damage to any such service. (See also PSA 5.4).

Damage that occurs to unknown services during construction will be paid by the Employer.

C3.4.5.5 Reinstatement of services and structures damaged during construction

The Contractor will be responsible for the repair and reinstatement of damaged services in compliance with the service owner's specifications.

C3.5. MANAGEMENT OF THE WORKS

C3.5.1 SPECIFICATIONS

The following Specifications are applicable:

- (i) The SANS 1200 Standardised Specifications listed in C3.7.1;
- (ii) The Particular Specifications given in C3.7.2; and
- (iii) The Variations and Additions to the SANS 1200 Standardised Specifications given in C3.7. 3.

C3.5.2 PLANNING AND PROGRAMME

C3.5.2.1 General

The Contractor's Programme to be submitted in terms of Clause 5.6.1 of the Conditions of Contract shall take all matters that may impact the Contractor's sequence of executing the various components of the Works and the requisite rate of progress of the Works, as may be specified in or reasonably inferred from the Contract.

The Contract is divided into two portions with associated Contractual Periods which are defined in Clause 1.1.1.14 of C1.2 Contract Data. The portions have been defined as Portion A and Portion B.

- Portion A includes specific works which need to be completed such that those works will be ready for safe access to others for the purpose of installing and testing plant and equipment.
- Portion B is the balance of work not identified by Portion A.

Table 1 describes how programming restrictions apply to different parts of the works. Some structures/systems can be classified under both Portion A and B.

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Description of work	Portion A	Portion B
Earthworks	X (sufficient to provide access to all structures required by M&E contractor)	X (All other work not required for Portion A Milestone)
Geotechnical investigation	X	
Abstraction works intake structure	X (all work necessary to successfully pass water tightness testing of the structures)	X (All other work not required for Portion A Milestone)
Abstraction works transformer and MCC rooms	X	X (All other work not required for Portion A Milestone)
Low-lift and motive pumping pipelines, including chambers	X (all work necessary to successfully pass pipeline pressure testing)	X (All other work not necessary for the pipeline pressure testing)
Hydrocyclone platform	X	X (All other work not required for Portion A Milestone)
Flocculation and sedimentation complex	X (all work necessary to successfully pass water tightness testing of the structures)	X (All other work not necessary for the water tightness testing of the structure)
Filter foundations and backwash sumps	X (all work necessary to successfully pass water tightness testing of the structures)	X (All other work not necessary for the water tightness testing of the structure)
Chemical building	X (sufficient to provide access to all structures required by M&E contractor)	X
Pump and clearwell complex	X (sufficient to provide access to all structures required by M&E contractor)	X (All other work not required for Portion A Milestone)
Machine room, substation and transformer room	X (sufficient to provide access to all structures required by M&E contractor)	X (All other work not required for Portion A Milestone)
Bulk electrical	X (sufficient to power supply required by M&E contractor)	X (All other work not required for Portion A Milestone)
Building electrical		X
Residue holding tank		X
Water reticulation	X (all work necessary to successfully pass pipeline pressure testing)	X (All other work not necessary for the pipeline pressure testing)
Ducts	X (sufficient to provide access to all structures required by M&E contractor)	X (All other work not required for Portion A Milestone)
Fire and safety		X
Administration building	X (sufficient to support installation and testing of M&E contractor)	X
Staff housing and guard house		X
Lagoons		X
Interconnecting pipework	X (sufficient to support installation and testing of M&E contractor)	X

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Description of work	Portion A	Portion B
Roads and stormwater	X (sufficient to provide access to all structures required by M&E contractor)	X
Sewers		X
Fencing		X

C3.5.2.2 Requirements of Submitted Programme

It is essential that the construction programme, which shall conform in all respects to Clause 5.6 of the General Conditions of Contract 2015, be furnished within the time stated in the Contract Data. The preliminary programme to be submitted with the tender shall be used as basis for this programme.

The Contractor shall indicate on the programme all critical path activities. In this regard, the Contractor's attention is drawn to Clause 5.12 of the General Conditions of Contract, where consideration will only be given to claims for extension of time associated with critical path activities.

The Contractor's planning, programme and method statements are to comply with the following:

- a) The programme shall be prepared in bar (Gantt) chart form, using a project management software tool such as Microsoft Project and shall be issued to the Engineer in both hard copy and electronic format.
- b) The programme shall be structured to cover all items of work conceivable including all work to be done by Sub-Contractors.
- c) Clearly indicate start and end dates, the durations of all construction activities, all dependencies and shall clearly indicate the critical path.
- d) The Contractor must plan and schedule his works and order of work to allow for the practical completion of Portion A and Portion B as per the requirements of the Contract.
- e) Take full cognisance of the Contractor's risks and obligations in terms of the Contract.
- f) The programme must clearly show the intermediate milestone dates to be achieved taking the indicative construction sequences into account.
- g) Indicate key dates in respect of works to be carried out by others (E.g. Contract 2 and Contract 3 as defined in Section C3.1).
- h) Indicate key dates in respect of information to be provided by the Employer's Agent and/or others
- i) Irrespective of any constraints, the Contractor shall be responsible for the construction management, timing and sequence of the works, so as to avoid the repair or reinstatement (or both) of completed works or damage to existing works.
- j) Regular meetings must be held with the Engineer.
- k) Method statements shall be prepared in accordance with the requirements of the project specifications.
- l) The period of notice shall be a minimum of one working day whenever any material or work which is subject to inspection is to be covered up or concealed in any way, and the Contractor shall expose and later make good such material or work where such notice was not so provided.
- m) Where the scope of work is not complete in all respects at the commencement of the contract, the Contractor and the Employer shall work together to identify the outstanding scope of work and agree upon reasonable dates for the Contractor to be furnished with such information.

In addition to the requirements of Clause 5.6.1 of the General Conditions of Contract 2015, the Contractors' programme shall show:

- a) the various activities, related to a time scale, for each element of the Works, in sufficient

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- b) detail to be able to assess construction progress,
- c) critical path activities and their dependencies,
- d) key dates in respect of work to be carried out by others, and
- d) key dates in respect of information to be provided by the Engineer and/or others.

If any change to the critical path occurs, the Contractor shall as soon as practicable notify the Engineer in writing.

C3.5.2.3 General allowances

The following (but not limited to) programming information shall be incorporated into the Contractor's initial programme and all subsequently adjusted programmes. The Contractor's programme shall also take full account of the matters described in the sub-clauses hereunder. No additional payments will be made to the Contractor in respect of any additional costs as it may incur in consequence of arranging or adjusting its programme to accommodate the said matters and the Contractor's various tendered rates and prices shall be deemed to fully inclusive of such costs.

- (a) Time related items, in respect of the following:
 - (i) Time to submit documentation before commencing to carry out the Works – refer to Clause 5.3.1 C1.2 of Contract Data
 - (ii) Construction Regulations, 2014 requirements:
 - Regulation 3, Construction work permit process period
 - Regulation 4, notification of construction works period
 - (iii) Due Completion Date
- (b) All special non-working days defined in the Contract Data.
- (c) Contractor's annual shutdown period between December and January
- (d) Meeting the requirements of the Environmental Management Plan
- (e) The time needed for preparation and approval of the various mix designs specified in the relevant construction sections of the Scope of Works.
- (f) Expected inclement weather conditions and their effects
- (g) Known physical conditions or artificial obstructions
- (h) Searching for, dealing with and carrying out alterations to the existing services
- (i) The accommodation and safeguarding of public access and traffic
- (j) The design, testing and approval of the concrete mixes
- (k) The times allowed for "W", "X", "YA" and "YB" in Clause 1.1.1.14 in the Contract Data

C3.5.2.4 Review of progress

The Contractor shall review his progress each month and should progress lag behind the latest approved programme, by more than 2 weeks, he shall submit a method statement of how he proposes to make up the lost time. If, in the opinion of the Engineer, such methods proposed will not make up the lost time, the Engineer shall have the right to request the Contractor to reorganize his work in a manner which will ensure an acceptable programme. Claims for additional payment to meet any costs incurred due to such reorganisation will not be accepted.

C3.5.2.5 Programme as a basis for claims

The Contractor's programme and method statement will not be accepted as the basis for claims for extension of time and/or additional compensation without due reference to all relevant associated

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factors, and without demonstrating that a delay to the critical path activities has occurred due to circumstances beyond his control.

C3.5.2.6 Additional Programming Information

There are various project-specific matters that the Contractor is required to make allowance for in his initial (and subsequently updated) programme:

a) Grave relocation

In his programme, the Contractor will be required to prioritise and complete as soon as possible, the relocation (exhumation and reburial) of the existing graves in the vicinity of the abstraction works, prior to any construction work being performed in this area.

b) Geotechnical Investigation

In his programme, the Contractor will be required to prioritise and complete as soon as possible the geotechnical investigation as per the Contract. The Contractor will be required to provide this information to the Employer as soon as possible to allow the Employer to confirm the design assumptions of the abstraction intake structure foundation prior to the start of any construction work on the abstraction works intake structure.

c) River Diversion Works

It is required that the construction phase of the abstraction works be programmed to allow temporary works in the Tsitsa river to be constructed (in accordance with the Contract and Specification RD) during the historic low flow season which typically stretches from July to October of each year.

d) Attendance to Other Contractors

The Contractor will be required to provide the required information to the Employer to allow for the successful integration and management of programme and construction interfaces between the various construction contracts listed in Section C3.1. It is anticipated that Contracts 1, Subcontract 1 (Bulk electrical), Contract 2 and Contract 3 will be implemented in parallel over a 36-month period.

The stated contract duration of 36 months has been prescribed to allow sufficient time for the mechanical and electrical contractor to perform and complete their work in parallel to Contract 1 (this Contract) to install the mechanical and electrical equipment required for the successful completion and commissioning of the scheme.

e) Community Access to Livestock Dipping Tank

There is an existing cattle dipping tank in the immediate vicinity of the site. This tank will need to remain in operation for occasional (estimated monthly) usage by the community. The Contractor will be required to provide safe access by the public and livestock to the tank for the entire duration of the project. In the event that such access requires the Contractor to stop working in a specific area, his programme should make allowance for such. No additional extensions of time will be allowed for delays to Contractor's programme by accommodating community access to the dipping tank.

C3.5.3 QUALITY PLANS AND CONTROL

Refer the various and applicable SANS specifications, the general health and safety specifications and subsequent health and safety plan, the Conditions of Contract as well as the various clauses within the Scope of Work.

The Contractor to submit the Quality Management Plan for the approval by the Employer's Agent before commencing any work.

C3.5.4 ENVIRONMENTAL MANAGEMENT

The Contractor will be responsible for managing his activities so that damage to the environment is minimised, as per the approved Environmental Management Plan contained in **Appendix C**. A payment item is included in the Bill of Quantities to cover the Contractor's cost for compliance and provision of the Method Statement.

C3.5.5 FORMAT OF COMMUNICATIONS

All contractual communication shall be in writing.

The Contractor shall, for the full duration of the Contract Period, supply and maintain the following documentation:

- (a) Site Communication and Request Book.
- (b) Safety File containing all relevant safety data.
- (c) Daily register of all labour, plant and equipment.
- (d) Quality Control file containing all quality control/assurance forms and records.
- (e) One full set of Contract Drawings and documents.
- (f) Latest revision of the Construction Programme.

The above-mentioned shall be kept on Site and be accessible to the Employer's Agent at all times.

C3.6. HEALTH AND SAFETY

The Contractor will be responsible for managing his health and safety activities as per the approved Health and Safety Plan, as indicated in Health and Safety Specification included in **Appendix D**. Payment items are included in the Bill of Quantities to cover the Contractor's cost for compliance.

Refer to the Occupational Health and Safety Act, 1993 and the Construction Regulations, 2014

C3.6.1 HEALTH AND SAFETY REQUIREMENTS AND PROCEDURES

(a) Construction Regulations, 2014

The Contractor shall be required to comply with the Occupational Health and Safety Act, 1993: Construction Regulations, 2014 (the regulations) as promulgated in Government Gazette No 37305 and Regulation Gazette No 10113 of 7 February 2014 including COVID-19 requirements. Non-compliance with these regulations, in any way whatsoever, will be adequate reason for suspending the Works.

The proposed type of work, materials to be used and potential hazards likely to be encountered on this Contract are detailed in the Project Specifications, Bill of Quantities and Drawings, as well as in the Employers' health and safety specifications (regulation 5(1)(b)) of the Construction Regulations 2014, which are bound in the Contract document.

The Contractor shall in terms of regulation 7(1)(a) provide a comprehensive Health and Safety Plan detailing his proposed compliance with the regulations, for approval by the Employer.

The Contractor shall at all times be responsible for full compliance with the approved plan as well as the Construction Regulations and no extension of time will be considered for delays due to non-compliance with the abovementioned plan or regulations.

A payment item is included in the Bill of Quantities to cover the Contractor's cost for compliance with the OHS Act and the abovementioned regulations.

C3.6.2 PROTECTION OF THE PUBLIC

The Contractor to ensure the sufficient screening and barricading of the site of works is done to prevent unauthorised public access. If screening/barricading will impact on the movement of the public, the Contractor is to ensure that safe detour routes are allowed and clearly indicated.

Refer to the Occupational Health and Safety Act, 1993 and the Construction Regulations, 2014.

C3.6.3 BARRICADES AND LIGHTING

Refer to the Occupational Health and Safety Act, 1993 and the Construction Regulations, 2014.

C3.6.4 TRAFFIC CONTROL ON ROADS

The Contractor shall carry out, erect and maintain such temporary works and provide all temporary road signs, pipes, deviations, warning boards, barricades, signs, lighting and demarcations and the

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like, as are necessary to maintain and safeguard the normal flow of public and private vehicular and pedestrian traffic.

Refer to the Occupational Health and Safety Act, 1993 and the Construction Regulations, 2014.

C3.6.5 MEASURES AGAINST DISEASE AND EPIDEMICS

Refer to the Occupational Health and Safety Act, 1993 and the Construction Regulations, 2014. The Contractor also needs to refer to the Health and Safety Specification included as **Appendix D** to this document for measures to be deployed on site.

C3.6.6 AIDS AWARENESS

The Contractor is required to refer to SANS 1921 – 6 as further amended below. Payment items have been included in the Schedule of Quantities to ensure compliance.

SANS 1921-6	
Variations	
Clause	Specification Data
1 e)	Appointment of an HIV / AIDS Awareness Champion.
4.1 f)	<p>Appointing an HIV/ AIDS Awareness Champion within 14 days of site handover from amongst the workers (which could include the Community Liaison Officer).</p> <p>The champion should be able to speak, read and write English, speak and understand the local languages spoken by the Workers and shall be on site at all stages of the construction period.</p> <p>The Contractor shall ensure that the Awareness Champion has been trained by the Service Provider on basic HIV/AIDS information, the support services available and has the necessary skills to handle questions regarding the HIV/AIDS programme in a sensitive and confidential manner.</p> <p>The Awareness Champion shall be responsible for:</p> <ul style="list-style-type: none"> • Liaising with the Service Provider to assist in organising awareness workshops; • Filling condom dispensers and monitoring condom distribution; • Handing out information booklets; • Placing and maintaining posters
4.1 g)	Provide information about the names of the closest service providers to be displayed on a poster of size not smaller than A2.
4.2.3 c)	Understand and communicate the purpose of voluntary HIV/AIDS testing and counselling.
4.2.3 d)	Recognise the importance of caring for people living with HIV/AIDS and be familiar with the various treatments available, including treatment of opportunistic infections.
4.2.3 e)	Understand and communicate the rights and responsibilities of those living with HIV/AIDS in the workplace and the importance of non-discrimination.
4.3.2	The HIV/AIDS Awareness Champion and the Employer's representative shall certify the report and schedule described in 4.3.1 whenever a claim for payment is issued to the Employer.
5	Sanctions

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SANS 1921-6	
Variations	
Clause	Specification Data
	In the event that the Contractor fails to satisfy the requirements of this specification, the Employer may apply sanctions which include the rejection of claims for payment as being incomplete or the withholding of completion certificates (interim or final).

C3.7. PROJECT SPECIFICATIONS

C3.7.1 APPLICABLE SANS 1200 STANDARDISED SPECIFICATIONS

The below SANS 1200 Standardized Specifications for civil engineering construction are applicable to this Contract and shall be read in conjunction with any amendments to them. Any references to these specifications shall refer to them as amended (if applicable).

• SANS 1200 A	:	General
• SANS 1200 AB	:	Engineer's office
• SANS 1200 C	:	Site clearance
• SANS 1200 D	:	Earthworks
• SANS 1200 DB	:	Earthworks (pipe trenches)
• SANS 1200 DK	:	Gabions and pitching
• SANS 1200 DM	:	Earthworks (roads, subgrade)
• SANS 1200 G	:	Concrete (structural)
• SANS 1200 H	:	Structural steelwork
• SANS 1200 HB	:	Cladding and sheeting
• SANS 1200 HC	:	Corrosion protection of structural steelwork
• SANS 1200 L	:	Medium-pressure pipelines
• SANS 1200 LB	:	Bedding (pipes)
• SANS 1200 LC	:	Cable ducts
• SANS 1200 LD	:	Sewers
• SANS 1200 LE	:	Stormwater drainage
• SANS 1200 LF	:	Erf connection (water)
• SANS 1200 M	:	Roads (general)
• SANS 1200 ME	:	Subbase
• SANS 1200 MF	:	Base
• SANS 1200 MH	:	Asphalt base and surfacing
• SANS 1200 MJ	:	Segmented paving
• SANS 1200 MK	:	Kerbing and channelling
• SANS 1200 MM	:	Ancillary Roadworks

The contents of the SANS 1200 Specifications, the drawings and other specifications may indicate further applicable specifications which are not bound into the tender/contract documents.

Many of the SANS 1200 Specifications contain appendices, which in turn list and reference further applicable specifications, which are also not bound into the tender/contract documents.

All the above specifications shall apply to the Contract to the same extent as if each of these had been bound into the tender/contract documents.

Except for references to the Bureau itself or to the (official) SABS mark, the term 'SABS' has been

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changed to 'SANS', without change to the contents of the specifications.

The terms "Engineer", when referring to the Employer's appointee, and "Employer's Agent" shall be synonymous wherever they appear in the specifications.

The terms "Schedule of Quantities", "Bill of Quantities" and "Schedules of Rates and/or Prices" shall be synonymous wherever they appear in the specifications.

The terms "specification" and "specified" shall be taken to mean/include as specified in the Conditions of Contract, Scope of Work (if applicable), Employer's Requirements (if applicable), Specification (if applicable), Schedule of Quantities, or on the Drawings, and in any other document included in the Contract.

The phrase "in Portion 2 of the project specification" must be replaced with "elsewhere in the specification" wherever it appears in the specifications.

The term "project specification" shall generally be taken to mean any specification with the exception of the Standardized Specifications but includes any variations and additions to them.

The SANS 1200 Specifications are not bound into the tender/contract documents but are available at the Tenderer's/Contractor's expense from the South African Bureau of Standards in Pretoria, Private Bag X191, PRETORIA, 0001.

C3.7.2 PARTICULAR SPECIFICATIONS

In addition to the SANS 1200 Specifications listed above, the following specifications shall also apply to this Contract:

- | | |
|----------------------|---|
| • Specification AW : | Ancillary Works |
| • Specification GC : | Geo-cell Waterproof Trafficable Liner |
| • Specification GF : | GRP Grid Flooring |
| • Specification GI : | Geotechnical Investigation |
| • Specification PD : | Building Work |
| • Specification RD : | River Diversion |
| • Specification RW : | Dry Laid Concrete Block Retaining Wall |
| • Specification WA : | Fencing |
| • SPE-JJ-0003 : | General Corrosion Protection |
| • SPE-MM-4009 : | Hand-Raked Screen |
| • SPE-MP-7001 : | Design and Manufacture of Medium Pressure Steel Specials |
| • SPE-MP-7002 : | Manufacture of Medium Pressure Steel Pipes |
| • SPE-CC-7003 : | Laying and Jointing of Medium Pressure Steel Pipes and Specials |
| • SPE-MM-7007 : | Sluice Gates |
| • SPE-MM-7015 : | Metal Seated Wedge Gate Valves |
| • SPE-MM-7016 : | Resilient Seal Gate Valves |

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- SPE-MM-7017 : Single Door Check Valves
 - SPE-MM-7022 : Air Valves
 - SPE-MP-7023 : Pipe Couplings
 - SPE-MP-7024 : Pipework Anchors
 - SPE-EE-0013 : Wiring and outlets.pdf
 - SPE-EE-0014 : Lighting.pdf
 - SPE-EE-0020 : MV & LV Earthing.pdf
 - SPE-II-0001 : General Electronic Installations.pdf
 - SPE-II-0008 : Video Surveillance.pdf
 - Spec BE01 : Building Electrical
 - Spec BE02 : Building Electronic
-
- 503081-ZUT-SPEC-FI-WTW: Abstraction Works Fire Safety Specifications
 - 503081-ZUT-SPEC-FI-ABSTR: Abstraction Works Fire Safety Specifications
 - Sidwadweni Bulk Water Supply Scheme – CP and AC Mitigation Technical Specification for Tender Purposes – Contract 1
 - Zutari-2212-AE-04 Environmental Management Programme: Proposed Sidwadweni Regional Bulk Water Supply Scheme (**Appendix C**)
 - Project Health and Safety Specification in terms of CR 2014 dated 14 April 2025 (**Appendix D**)

C3.7.3 VARIATIONS AND ADDITIONS TO SANS 1200 STANDARDISED SPECIFICATIONS

Aside for general amendments already made to the Standard Specifications, the bulk of the amendments (and additions) to the Standard Specifications required for this particular Contract are included in this part of the specifications.

In certain clauses, the Standard Specifications allow for additional details to be provided and/or choices to be specified between alternative materials or methods of construction etc. to suit a particular contract. These additional details and choices are contained in these amendments, as are further amendments necessary for this particular Contract.

The Amendments to the Standard Specifications are included as stand-alone sections, each with table of contents or index pages that reference the relevant Standard Specification being amended. Each amendment consists of sequentially numbered clauses and subclauses containing the heading and clause or subclause number (in brackets) of the relevant Standard Specification clause or subclause being amended.

Where new clauses and subclauses are being added to the Standard Specifications, they can generally be identified as a heading followed by the words “New Clause” with the new clause number (in brackets) or “New Subclause” with the new subclause number (in brackets). The contents of this new clause or new subclause will follow.

Any general amendments to the Standard Specifications shall also apply to their specific amendments.

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1 SCOPE

This specification covers the general requirements for the ancillary work items related to the abstraction works and high-lift pump station.

2 GENERAL

The Contractor shall provide the following equipment for the abstraction works and high-lift pump station (where applicable) which shall include, but not be limited to, the following:

- Trash rack (2 off)
- Vertical sluice gate (2 off)

3 CORROSION PROTECTION

3.1 SPECIFICATION

Corrosion protection shall comply with SPE-JJ-0003.

The amendments and additions to SPE-JJ-0003 and the detailed requirements applicable to the ancillary works are contained hereunder.

3.2 AMENDMENTS, ADDITIONS, AND DETAILED REQUIREMENTS

3.2.1 REQUIREMENTS (CLAUSE 4)

Individual equipment corrosion protection is specified in the equipment clauses.

3.2.2 INSPECTION OF EQUIPMENT (CLAUSE 6.5)

The Contractor shall propose an independent inspectorate for approval by the Engineer, who will inspect the various items at all the necessary stages of fabrication when the Engineer is not available.

4 TRASH RACK

4.1 SPECIFICATION

The trash rack shall comply with SPE-MM-4009.

The amendments and additions to SPE-MM-4009 and the detailed requirements applicable to this contract are contained hereunder.

4.2 AMENDMENTS, ADDITIONS, AND DETAILED REQUIREMENTS

4.2.1 Scope of works (Clause 2)

A trash rack screen shall be manufactured, supplied, and installed at the inlet of the abstraction works. It shall be fixed to the inside of the intakes to ensure that the trash racks fit flush with the concrete face of the wing wall.

4.2.2 Design and construction (Clause 5)

The inlet grating shall be constructed from EN Grade 1.4401 (316) stainless steel.

The screen at the inlet works shall be manufactured from 10 mm x 50 mm flat bar with a square bar spacing of 30 mm. The vertical sections shall be inclined at an angle of inclination to the vertical of 45° with the flow

of the river. The screening field shall span the full width of the opening and shall be secured in place with 316 S/S anchors. The opening width is 1800 mm, and the depth is 300 mm.

5 VERTICAL SLUICE GATES

5.1 SPECIFICATION

The sluice gates shall comply with SPE-MM-7007.

The amendments and additions to SPE-MM-7007 and the detailed requirements applicable to this contract are contained hereunder.

5.2 AMENDMENTS, ADDITIONS, AND DETAILED REQUIREMENTS

5.2.1 Scope of works (Clause 2)

The Contractor shall provide all items specified, including the following:

- Sluice gates, including frame, gate seals, spindle, headstock, thrust nut and handwheel (2 off)
- Spindle sleeves for the sluice gates
- Grouting

The installation shall be as shown on the Drawings.

5.2.2 Design and construction (Clause 7)

The sluice gates shall be designed and constructed to isolate the abstraction works wet well from the river i.e., prevent water ingress through the abstraction works inlets to the wet well.

The sluice gates shall be designed according to a maximum differential pressure of 12.0 m in an off-seated application with a box-out size of 1000 mm high x 2000 mm wide.

The headstocks shall be designed such that the handwheels are at a level approximately 1000 mm above the top of the access floor.

The sluice gates shall be wall mounted to the inside of abstraction works wet well.

5.2.3 Materials and coatings – General (Clause 9)

Support frames and headstock shall be of EN Grade 1.4401 (316) stainless steel.

5.2.4 Civils and building (Clause 11)

In the last paragraph, delete “constructed by others”.

5.2.5 Inspections (Clause 13)

The Contractor shall additionally include for all costs of one person from the Employer to inspect equipment and fabrications in the workshop.

6 MEASUREMENT & PAYMENT

6.1 TRASH RACK Unit: No

The tendered sum shall include all costs and expenses associated with the design, manufacture, handling, inspecting, transporting, installing, and testing of trash racks shown on the Drawings in terms of the project specification.

6.2 VERTICAL SLUICE GATE Unit: No

The tendered sum shall include all costs and expenses associated with the design, manufacture, handling, inspecting, transporting, installing, and testing of vertical sluice gates shown on the Drawings in terms of the project specification.

SPECIFICATION: GC

GEO-CELL WATERPROOF TRAFFICABLE LINER

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1 SCOPE OF WORK

This section covers the Specification for the design, manufacture, supply, installation and testing of a waterproof articulated double-layered cast insitu paving liner, which may be trafficked for the mechanical removal of silt. The outer layer of paving incorporates permanent flexible smooth pre-deformed polyethylene formwork mats complete with double rigging strings together with a sandwiched layer of bitumen.

2 MATERIALS

2.1 Hollow-Cell Liner System

The hollow-cell liner system shall be a polymeric homogenous sheet bonded so as to form a four-sided cell in a diamond-shaped lattice. Cell walls may be specified as regular (plane cell walls) or keyed (blow moulded key in each of the 4 walls) for superior mechanical interlock.

Furthermore, the hollow-cell liner system shall have the following properties:

	Cell Sizes			
Weld-to-weld (view collapsed)	300 mm	400 mm	600 mm	800 mm
Cell diagonal when opened	210 mm	280 mm	420 mm	560 mm
Cell sides	150 mm	200 mm	300 mm	400 mm
Regular cells available depths: (Mechanical interlock formed by deformation of cell wall during installation)	75 mm, 100 mm, 150 mm, 200 mm, 250 mm, 500 mm, 1 000 mm, 2 000 mm			
Keyed cells available depths:	75mm, 100 mm, 150 mm, 200 mm			
Weight of bale containing 100 m ² if cell depth is 100 mm	37.5 kg	25 kg	18.8 kg	12.5 kg

The Contractor shall supply to the Engineer for his approval samples of the aggregates (and, if so ordered, of the water) that he proposes to use for the concrete 28 days before he intends to start with work and shall provide evidence that the water and aggregate comply with the requirements of the drawings and relevant sections.

Evidence shall be in the form of either:

- A statement from an approved laboratory of the results of tests; or
- An authoritative report or record of previous experience.

2.2 Cement

(i) Applicable Specifications

Cement and blends of Portland cement and milled granulated blast-furnace slag or fly ash are the types scheduled or stated on the drawings or in the project specification and shall comply

with the relevant requirements of BS 1370 (Low-heat Portland cement) and SANS 50197-1/EN 197-1.

(ii) Alternative Types of Cement

Any type of cement other than those referred to above shall be used only when specifically authorised by the Engineer.

(iii) Storage of Cement

Separate storage facilities shall be provided on the Site for each type of cement used. Cement that is stored on site shall be kept under cover that provides proper protection against moisture and other factors that may promote deterioration.

The storage of cement in bulk weatherproof silos or similar containers shall be permitted, provided that the cement drawn for use is measured by mass and not by volume.

2.3 Water

Water shall be clean and free from injurious amounts of acids, alkalis, organic matter and other substances that may impair the strength or durability of concrete.

2.4 Aggregates

Both the coarse aggregate (stone) and the fine aggregate (sand) shall comply with the relevant requirements of SABS 1083.

Coarse stone and sand shall comply with the relevant requirements of SANS 1083:2006.

The use of natural river sand is recommended as opposed to sand produced by mechanical crushing or milling of rock due to easier workability. Sand shall not contain more than 5% clay.

The grout shall be pumpable with a slump of between 120mm and 135mm, measured in accordance with SABS Method 862.

Crusher dust or crusher run, soil cement and grouted stone concrete shall not be used.

Aggregates of different nominal sizes shall be stored separately to minimise segregation. The intermixing of different materials and contamination by foreign matter shall be avoided.

2.5 Reinforcement

Steel reinforcement of the grout blocks cast by the hollow-cell liner formwork is **NOT** required. However, steel reinforcing bars are used as rigging pegs to:

- (a) Allow the formwork to be rigged taut for filling; and
- (b) Secure the cast structure to the underlying material.

Reinforcing bars for rigging pegs shall be ribbed 10 mm diameter high-tensile reinforcement that complies with the relevant requirements of SANS 920:2005. Unless otherwise specified on the Drawings or in the project specification, the bars shall be plain and not hot-dip galvanised.

The length of the rigging peg is determined by the hardness of the underlying material. Pegs shall be cut on site their lengths will vary over the site, depending on the specific conditions encountered.

For rigging in hard rock, 12 mm holes shall be drilled and the pegs shall be grouted into the drilled holes.

2.6 Additives

Suitable super plasticisers and retarders that comply with ASTM C-494 or AASHTO M-154 or BS 5075 shall be used to prevent segregation and ensure suitable workability.

2.7 Bitumen Waterproofing

An anionic bitumen emulsion Grade 60 primer that complies with the requirements of SANS 309:2004 shall be used as the waterproofing layer between the two hollow-cell liners, unless specified otherwise in the project specification.

2.8 Storage Capacity

The storage capacity and quantity of materials provided shall be sufficient to ensure that there are no interruptions to the progress of the work.

2.9 Deteriorated Materials

Deteriorated, damaged or contaminated material shall not be used, but removed from the Site immediately.

3 CONSTRUCTION

Manufacture and Installation of Hollow-Cell Liner System

3.1 Plant

(i) General

All plant shall be maintained in good working order.

(ii) Mixing Plant

The type and capacity of mixing machines shall be such that the rate of output of concrete is suitable for the rate of output of concrete is sufficient for the rate of filling the hollow-cell mats. Each machine shall be capable of producing a uniform distribution of the ingredients throughout the batch and shall comply with the specification to which the manufacturer claims it has been manufactured. Worn or bent blades and paddles shall be replaced. The inner surfaces of the mixer shall be clean and free from hardened concrete.

(iii) Ready-Mix Concrete Vehicles

Long discharge chutes are required to place premixed concrete over a large arc over the area to be filled. If the vehicles do not have chutes of an adequate length, an extension chute of lightweight material shall be made available on site.

A long pipe with a funnel or a channel shall be provided on site to enable plasticisers and retarders to be placed evenly throughout the length of the mixer drum when such additives are added to the premixed concrete on site shortly before discharging the grout. Alternatively, the concrete shall be pumped to its destination.

(iv) Labour-Based Alternative

The hand-mixing of grout in wheelbarrows that incorporates various quality and quantity controls suited to labour-based tasks may be used as an alternative to ready-mix, if approved by the Engineer.

(v) Vibrators

Vibrators shall be capable of fully compacting each layer of concrete where compaction by vibration is specified. At least one standby vibrator shall be available for every three (or smaller number of) vibrators necessary to maintain the rate of placing.

3.2 Compaction of Supporting Surface

Compaction of the foundation surface on steep slopes of newly constructed embankments with compacted fill shall be constructed 200 mm wider than intended and the 200 mm excess width trimmed off prior to placing the first layer of the lining. The banks and all other surfaces, except trimmed excavated sloping faces, shall be compacted in accordance with SANS 1200 D or as otherwise specified on the Drawings.

3.3 Placing Of Concrete

A floating vibrating screed comprising an aluminium ladder fitted with high-speed pneumatic vibrators may be employed to speed up the process of striking off the surface of large horizontal areas. The vibrating screed shall be light enough so that it can be supported by the hollow-cell liner before the concrete is placed without causing the liner to collapse.

3.4 Preparatory Work

(i) General

Before the hollow-cell liner is rigged into position, trenches for the edge beams shall be excavated after the foundation surface has been graded to an even surface and compacted and the sub-surface drainage, if specified, has been installed.

(ii) Training of Workers

Workers shall be trained by an experienced trainer who has been approved by the supplier to ensure good quality workmanship at efficient production rates.

(iii) Reference Test Sample

Reference test samples shall be constructed under the guidance of the approved trainer. If the trainer or the Engineer is not satisfied with the quality of the work or the thickness of the grouted

cell, the work shall be rejected, removed and re-constructed until an acceptable sample has been produced. The accepted sample shall be used as a quality reference for the remainder of the work.

(iv) Support Surface Finish

The finished surface of the grouted cells will reflect the accuracy of the foundation surface. The foundation surface shall be laid to the tolerances specified and after compaction and finishing it shall not be damaged during subsequent operations. If a friable sandy support surface is used, it shall be kept damp continuously until the grout filling has been placed. The sand blinding layer may be mixed with 1% bitumen to prevent the wind erosion of blinding sand where any overbreak has occurred. In rock cuts, the surface shall be levelled using a soil cement mortar mix incorporating 10% of ordinary Portland cement by volume. The soil shall not have more than 5% of clay or silt.

(v) Abrupt Changes

Unless specifically excluded on the Drawings or in the project specifications, all changes of slope or grade, except at the edge beams, shall be rounded with a radius of not less than 0.6 m to avoid the localised reduction of the grouted cell thickness.

(vi) Dealing with Water

Hollow-cell liners shall not be placed or installed on a saturated foundation surface. Where necessary, the water table below the foundation shall be lowered by pumping from sumps. The trenches excavated for the cut-off beams may serve as temporary sumps. To minimise impact on the installation production schedule in the event of rain, the cell mats may be rigged over the top of the temporary sump(s) and the sump(s) filled later by placing sand before the cells are placed or through the open cells in the mat with grout. Such sumps shall be restored before the grout can be placed in the cell mat.

Pumping shall be continued until 48 hours after the completion of the grout filling operation.

(vii) Edges and Beams

The edges of the lower hollow-cell liners shall be deflected into the trenches of the edge beams. The local deformation of the cell walls is not important and continuous layers of grout will form above and below the cells. The square joint pattern of the blocks will terminate at the edge beam and normal shrinkage cracking at the usual spacing of mass concrete will appear in the edge beams. The purpose of the edge beam is to secure the edge blocks and prevent undermining and wind erosion.

(viii) Fitting Hollow-Cell Liners to Pipes

(a) Pipework to be Installed Prior to Hollow-Cell Liner

Where pipework is to be accommodated by the hollow-cell liners or similar, the pipework shall be installed and supported in the underlying material before the liner is installed.

(b) Bitumen-Impregnated Bandage

A series of seals shall be installed at the interface between the pipe and the liner. All seals shall be approved by the Engineer.

(ix) Fitting Hollow-Cell Liners to Sumps or Other Concrete Structures

When a sump or other concrete structure, such as an inlet structure, spillway or outlet structure, is cast, it shall be fitted with 10 mm diameter stainless steel anchor bolts (or 10 mm diameter stainless steel bars with hooks) at 1 m centres horizontally, to which the liner rigging strings can be attached. The anchor bolts shall be positioned vertically at the midpoint of each of the two liner layers. The Contractor may propose an alternative or equivalent anchorage system to anchor bolts or bars with hooks for approval by the Engineer. There shall be no additional payment to the tendered rate (or rates) to cover the cost of the design, manufacture, supply, setting out and installation of an alternative or equivalent anchorage system to anchor bolts (or bars with hooks) as described above.

The joint between the sump or other concrete structure and the lining armouring layers shall be fitted with a bitumen-impregnated bandage or equivalent to that shown on the Drawings before the liner formwork is filled with grout.

(x) Ramps and Trafficable Crests for Subsequent Dam Cleaning

Silt shall be removed from reservoirs or dams by scraping the silt with front-end loaders and transporting the solids away to waste with trucks.

Hollow-cell liners of 200 mm thick shall be used on suitably designed underlying layer works or as indicated on the relevant Drawings.

(xi) Rigging of Hollow-Cell Liners**(a) Rigging Pegs**

Ribbed 10 mm high-tensile reinforcing steel pegs or bars (Y10s) shall be cut on site to accommodate the likely variation in the hardness of the support surface. The pegs shall be cut with 45° sloping cuts to form sharp points.

(b) Length of Pegs

Unless otherwise specified in the project specification the pegs, shall be long enough to ensure that they project between half and three quarters of the thickness of the upper layer above the lower layer after the bitumen has been applied.

(c) Location and Support

Steel pegs shall be used to anchor and support the rigging strings that hold the cell walls up as well as secure them onto the surface and prevent them from floating in wet grout.

Where the edge of the mat is to be deflected into an edge beam trench, there shall be a rigging string in the last row of cells.

Pegs driven into the trench and wired to the rigging strings shall be spaced no more than 1 m apart.

In the remaining area, pegs shall be placed approximately 1 m apart in two directions along the rigging lines and preferably at the intersection of 2 sets of rigging.

The cells shall be equipped with drilled holes so that the rigging strings that are laced in the factory may be moved to new locations, if required.

For slopes steeper than 1:1 the 1 m separation shall be reduced to approximately 0.6 m. The separation will also need to be reduced if the underlying surface is not level so as to achieve the required bonding with the underlying surface as specified.

When paving is to be laid over a rock cut, it may be necessary to drill holes to accommodate the anchor pegs at the required spacing, if suitable fissures in the rock cannot be utilised.

(d) Slope of Pegs

Pegs shall be driven at an angle of between 10 and 15 degrees off the perpendicular to the lower surface to ensure that the upper layer of the lining is locked to the lower layer in order to confine the bitumen when the projecting pegs are bitumen-coated.

Pegs in any row shall lean to the left and the right alternately.

The pegs may be driven perpendicular to the lower surface if the excess bitumen is removed to ensure that the ribs of the steel peg can engage properly in the upper blocks of grout to create a mechanical bond.

(xii) Tensioning of the Rigging Strings and Cell Walls

The rigging strings shall be tensioned and anchored with a tensile force of between 400 and 600 N per string. The strings shall be spaced and secured in such a manner that the cell walls are taut and form nearly square voids.

(a) Cutting and Joining Cell Packs

At the corners of rectangular ponds, the mats shall be cut and shaped. All the cast blocks shall be approximately the same size and shape. Corresponding cells of separate mats shall be joined by threading joining pins so as to form a new row of cells at the boundaries of the cell mat. It is not permitted to simply butt the mats or to join the mats at the corners only.

(b) Lacing with Additional Strings

A rigging string is required through all the cells that are to be deflected into edge beams. A new string shall be laced in cut cells where no string is present to ensure proper rigging. New strings shall be threaded through the pre-punched holes.

Additional strings shall also be laced where the cell mat bridges a concavity so that the cell mat may be brought into close contact with the underlying material instead of bridging it.

(c) Wiring of the Rigging Strings to the Pegs

The rigging strings shall be wired to all the support pegs with 0.6 mm soft binding wire.

(d) Contact with the Support Surface

The rigging strings shall be wired to the support pegs in such a manner that close contact between the underside of each cell wall and the support surface is ensured.

3.5 Filling With Concrete

(i) Construction Joints

Construction joints may be placed at any convenient selection of cell walls. Any spillage of concrete into cells adjacent to a construction joint shall be cleaned out of those cells prior to the following cast.

(ii) Concrete fill

The concrete shall be pumpable so that it can flow from cell to cell while it is being spread initially, thus a slump ranging from 120mm to 135mm is required.

The concrete mix design is as per geo-cell supplier specification, and must be prepared in an approved laboratory and the results of actual test mixes must be submitted for approval together with 7-day and 28-day strength test results. Special attention is drawn to the fact that the concrete mix must provide a very dense and impervious concrete.

No concrete shall be cast until the mix designs have been approved by the Engineer. The Engineer may call for revised mix designs at any stage during the Contract.

In order to facilitate increasing the workability of concrete in the fresh/plastic state, to ensure watertightness without increasing the water/cement ratio, the Engineer may approve the use of an additive.

Unless otherwise directed on the drawing or by the supplier specification (and approved by the Engineer), the strength of the concrete for the lower layer of cells is to be 20MPa at 28 days, and 30MPa at 28 days for the upper layer.

(iii) Consistency and Workability

The concrete shall be of such workability that it can be readily placed into the hollow-cell mat without segregation of the materials or excessive bleeding of free water at the surface, with a slump of between 120mm and 135mm.

(iv) Working on Slopes

On slopes, the concrete shall be delivered from the head of the slope and shall then be allowed to flow down the slope and overfill the cells. Excess concrete shall be worked off to the sides working up the slope. As the concrete stiffens, it must be worked and topped up with small quantities and evened to the top of the cell boundaries.

(v) Surface Finish

(a) General

The upper exposed surfaces of concrete shall be brought up to a plane, uniform surface with suitable screed boards.

If the finish of any concrete surface is unsatisfactory and does not conform to that specified, the Contractor shall, at his own expense, replace the paving, unless the Engineer allows him to rub down the surface while it is still green, grind it down with carborundum or other suitable material when it has hardened, or to take other approved measures.

(b) Brush Finishes

Unless otherwise indicated on the Drawings, the exposed surfaces shall be worked to a smooth finish by brushing the surface. Only sufficient additional mortar shall be used to fill slight depressions, if necessary, to bring the surface up to the level of the top of the cell walls but no higher. When the work is completed, the pattern of the cells shall be clearly evident. Areas shall not be trafficked until sufficient strength has been achieved to prevent damage.

(c) Wood Floated Finish

If specified in the project specification or indicated on the Drawings, finishing by means of wood float shall be permitted, provided that when the work is completed the pattern of the cells shall be clearly evident and the finish is to the satisfaction of the Engineer.

(d) Steel Floated Finish

If so indicated on the Drawings, finishing by means of steel trowel shall be permitted, provided that when the work is completed the pattern of the cells shall be clearly evident and the finish is to the satisfaction of the Engineer.

Cement powder shall not be used to dust the surface during this operation.

(e) Removal of Projecting Cell Boundaries

Projecting cell boundaries shall be removed to prevent the damming of bitumen layers, which may cause slow curing.

3.6 Application of Bituminous Waterproofing Layer

The thickness of the bitumen layer shall be achieved by marking out an area to receive a predetermined number of drums and stacking the drums in lots adjacent to the area to be covered.

- 4 litres of 60% emulsion per m² gives 3 mm layer;
- 6 litres of 60% emulsion per m² gives 4 mm layer.

Approximately 15 layers of various dilutions of bitumen are applied, sluiced from a 10-litre bucket and then spread evenly by brushing. Each layer must be allowed to cure or 'break' (whereby the bitumen changes colour) before the succeeding layer is applied. This typically takes approx. 10min in warmer climates for heavy dilutions and approx. 30min for lighter dilutions.

(i) Primer Layers

A primer layer of bitumen shall be applied as soon as the brush finish of the bottom layer has been completed. The priming layer of bitumen shall be applied while the concrete is still wet.

The bitumen emulsion is to be diluted with water by adding 9 litres of water to every 1 litre of 60% emulsion to prepare a primer mix.

Eight applications of the primer mix shall be applied, with each application having cured before the next is applied. The priming layers shall be applied during the course of one day.

(ii) Waterproofing

The waterproof layer shall be applied on the day after the primer has been applied. Four layers shall be applied of a mix of 1 litre of 60% emulsion to 3 litres of water. Between 20 and 30 minutes shall be allowed between applications (depending on the ambient temperature) to allow the preceding layer to settle.

This shall be followed by two layers of 1 litre of 60% emulsion to 1 litre of water, which shall then be followed by the application of a final layer of neat 60% emulsion.

The total finished dry thickness of the bitumen shall not be less than 4 mm. The total application shall be about 6 litres of 60% emulsion per square metre of surface. Where a 3mm layer of bitumen is specified (4 litres of 60% emulsion per square meter of surface), the final neat layer of bitumen emulsion may be omitted if the 3mm thickness has already been achieved.

Overnight curing shall be allowed.

(iii) Protective Application

If indicated on the Drawings, a protective layer of bitumen shall be applied by the same methods specified in sub-clauses (i) and (ii) above.

(iv) Access and Protection

The sprinkling of fine sand onto the bitumen or to adhere a layer of high-density polyethylene onto the bitumen surface shall be allowed to enable access to install the next layer of cells during hot weather conditions.

(v) Supports for Scaffold Board

Bridging support structures shall be used to support scaffold boards. Where the Engineer has allowed that supports may rest onto the lower layer of the lining, the bitumen layer shall be properly installed before the upper layer of the lining is installed in that region.

4 TESTING**4.1 Facilities**

The Engineer shall have free access to the work for taking grout cube samples and core samples and for carrying out other tests he may request. The Contractor shall render any assistance necessary. The Contractor shall provide storage and protection for such samples on the Site.

The Contractor shall provide slump cones and the moulds required for compressive strength testing in accordance with SANS 5861 through 5863 in sufficient quantities to enable the frequency of sampling and testing required in terms of 17.4.1.2 and 17.4.1.3.

4.2 Frequency of Sampling

Cubes for strength tests of concrete shall be taken in sufficient quantity while concrete of a particular grade is being placed under the same conditions. Sets of samples shall be taken in accordance with SANS 5861 through 5863, each sample being sufficient for 3 cubes.

If ordered by the Engineer, cores shall be taken to verify the thickness and consolidation of the grout.

Unless otherwise specified in the project specification, a sample shall be taken from each cast every day for the first three days and then one sample for every 500 m² of paving for both cube and core tests.

A sample for the thickness of the bitumen layer shall be taken from each 10 m².

4.3 Testing

(i) General

All testing shall be carried out in accordance with the methods referred to in the specification or in accordance with such other methods as are specified in the project specification.

(ii) Laboratory Testing

Laboratory testing shall be carried out by a recognised testing institution, an approved laboratory or a firm approved by the Engineer.

(iii) Early-Strength Testing

Concrete strength shall be based on samples tested at the age of 28 days only. However, any plan for early-strength testing shall be as agreed between the Contractor and the Engineer. Early-strength test results shall be used for early remedial measures, such as the changing of the mix design, if necessary, but shall not be used for the assessment of strength in terms of 4.24.2.

(iv) Acceptance Criteria for Strength Grout

If any valid test result for a specific grade of grout is more than 15% below the specified strength, the grout that yields such a result shall be deemed not to comply with the requirements of the specification. If an examination satisfies the Engineer that the integrity and durability of the part of the lining in which the grout has been used is not significantly impaired, the grout shall be accepted and the mix design and other factors that influence the quality reviewed to ensure that further grout cast are of acceptable quality.

5 MEASUREMENT AND PAYMENT

The rates tendered for this section shall not include for the general obligations and work deemed to be covered by other rates.

The provision of a field, laboratory shall be held to have been included in the sums tendered for the items below as applicable.

The tendered sums shall be held to include for the cost of the provision, establishment, maintenance, and staffing with approved and qualified personnel of a field laboratory for the duration of the works.

The Contractor shall be responsible for all on-site routine testing called for in this specification and all costs related to these tests shall be included in the rate for the supply and installation of the liner.

In addition, the Contractor shall provide free of charge to the Engineer samples required for testing at a recognised laboratory. Should these samples show positive results, the laboratory costs shall be borne by the Engineer. In the case of negative results, the Contractor shall pay all laboratory costs.

5.1 Training of workers Unit: sum

The rate shall cover the costs of transport, accommodation and the daily cost for providing specialised training for the correct and efficient installation of hollow-cell liners to ensure a properly articulated concrete watertight lining.

5.2 Reference test sample..... Unit: number (No)

If a reference test sample is to be incorporated in the final paving, it shall be paid for as part of the completed Works. If the reference test sample is to be constructed elsewhere, it shall be paid for at the tendered rates over and above the main pavement. No payment shall be made for any test sample that is not satisfactory. If no permission is granted to abandon it, the Contractor shall be responsible for the cost of its removal.

5.3 Preparation of support surface Unit: square metre (m²)

The rate shall cover the cost of scraping and levelling the surface and evening it out with a layer sandy material.

5.4 Preparation of support surface with backfill for overbreak. Unit: square metre (m²)

The rate shall include for the provision of the infill material and its finishing when the nature of the support surface is such that a hard, rough broken surface remains after excavation that cannot be shaped with hand tools. The surface shall be evened out with soil cement mortar.

5.5 Edge beam excavation Unit: metre (m)

The edge beams shall be measured per linear metre. The rates for edge beams shall cover the cost of the excavation of the trench and disposal of the spoil.

5.6 Blinding layer Unit: square metre (m²)

The supply, spreading and suitable levelling of a layer of sand over the supporting surface shall be measured as the net area actually covered, excluding the areas occupied by trenches for edges beams, if applicable. Unless otherwise directed on the drawing or by the supplier specification (and approved by the Engineer), the average sand layer thickness will be 10mm, with a minimum of 2mm and maximum of 20mm, to provide a level working surface and for the geo-cells to 'bite' into, preventing the concrete fill from flowing underneath the cell walls.

5.7 Y10 high-tensile steel bars for rigging pegs Unit: metre (m)

The supply, cutting and installation of high-tensile steel bars for rigging pegs shall be measured in linear metre for plain or hot-dip galvanised pegs.

5.8 Hollow-cell liners, 150mm total thickness when excluding the thickness of bitumen Unit: square metre (m²)

The supply and rigging of the hollow-cell liner shall be measured as the net completed paved area, which combines bottom and top cell layers (not as individual layers), whether horizontal or sloped. The rates shall cover the cost of the supply, setting out, cutting, jointing, and rigging of both layers of the liner and the removal of projecting cell boundaries of the lower layer of the hollow-cells.

The rate shall also cover the cost of the design, manufacture, supply, setting out and installation of 10 mm diameter stainless steel anchor bolts (or 10 mm diameter stainless steel anchor bars with hooks) at 1 m centres horizontally, to which the rigging strings for each layer of the liner can be attached at a sump or other concrete structure.

The rate shall also cover the cost of the design, supply, setting out, cutting, jointing, and rigging of each layer of the liner, the removal of projecting cell boundaries of the lower layer of the hollow-cells and all other related work.

5.9 Concrete filling Unit: square metre (m²)

The work shall be measured per the square metre of the paved area for each thickness of paving and specific type of concrete.

The rate will cover the cost of the design of the mix, the provision of the concrete (made with ordinary Portland cement unless otherwise scheduled), mixing, testing, placing, placing, compacting, the forming of unforeseen construction joints, striking-off or levelling as applicable, and curing and repairing where necessary. Further finishing until the cell boundaries are clearly visible shall be measured separately.

5.10 Edge beam concrete Unit: cubic metre (m³)

The concrete to fill the edge beams shall be measured in cubic meters. No allowance will be made for concrete required to make up overbreak. The rate will cover the cost of the design of the mix, the provision of the concrete (made with ordinary Portland cement unless otherwise scheduled), mixing, testing, placing, placing, compacting, the forming of unforeseen construction joints, striking-off or levelling as applicable, and curing and repairing where necessary.

5.11 Surface finishes Unit: square metre (m²)

The surface shall be measured net in the square metre for each type of finish specified.

5.12 Bituminous waterproofing layer Unit: square metre (m²)

The rate shall cover the cost of supplying all necessary materials for and installing the specified bituminous waterproofing layer. This includes mixing and placing all layers as specified on top of a curing geocell layer and against abutting structures, and is further inclusive of testing and verifying the bitumen thickness and protecting the bitumen layer until the top layer of geocells has been cast. The rate shall be measured net per square metre of area.

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1 SCOPE

This specification covers the general requirements for open grid floors of glass fibre reinforced plastic (GRP), their supports and items ancillary to them. Open grid floors of steel are covered elsewhere.

2 INTERPRETATIONS

2.1 DEFINITIONS

In this Specification, the following shall have the meaning given:

“Grating” shall be synonymous with “grid flooring”.

“Glass fibre” shall be synonymous with fibreglass”

“Covered open grid flooring” and “covered grating” shall be taken to mean open grid flooring with a permanently attached solid top GRP cover of the same material and finish as the grid flooring. Figure 2.1a illustrates covered open grid flooring (unbanded).

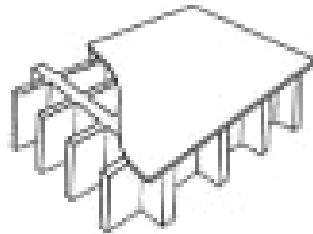


Figure 2.1a: An example of covered open grid flooring (unbanded), cover partially removed for illustration.

“Open grid flooring” shall include open grid flooring with an attached solid top cover of the same material (i.e. covered grating is also open grid flooring).

“Angle support” shall be synonymous with “frame” and refers to any cast-in or bolt-on type flooring panel support (whether of steel or GRP) with an L or Y profile, and which support may additionally include lugs, ribs or fasteners for anchoring. For GRP, this includes Fibergrate ‘Ez Angle’ (or similar) supports. For steel and GRP, this includes any support constructed from equal or unequal angle profiles.

“Additional support” shall mean any support, whether of steel or GRP, other than an angle support or top hat section (i.e., beams, channels, etc. are additional supports)

“Pitch” shall mean the centre-to-centre distance of bearer bars.

“Mini-mesh” shall be synonymous with “micro-mesh” and shall refer to a type of grid flooring panel which, additional the full-depth bearer bars, includes shallower bars at the top of the panel, midway between the full-depth bars. This halves the aperture size of the top half of the grid flooring (i.e. grid flooring with a 38x38 mesh pattern on the bottom and a 19x19mm mesh pattern on the top is a mini-mesh grid flooring). Figure 2.1b illustrates mini-mesh grid flooring (unbanded).

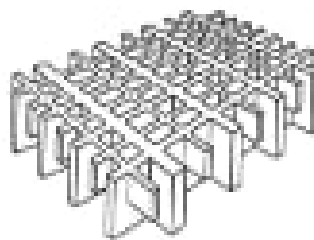


Figure 2.1b: An example of mini-mesh (unbanded)

2.2 ABBREVIATIONS

The following abbreviations shall have the meaning given assigned to them:

GRP	: Glass fibre reinforced plastic/polymer
HDG	: Hot dip galvanised
UV	: Ultraviolet
SS304	: Stainless steel grade 304
SS316	: Stainless steel grade 316

3 MATERIALS

3.1 GRATING AND SUPPORTS

Unless otherwise indicated, open grid flooring shall be of the moulded type (not the pultruded type) and supports shall be of the pultruded type. Both shall comprise of continuous glass fibre roving and a grey resin system (unless another colour is specified). The resin system shall consist of:

- a) isophthalic polyester resin, unless otherwise indicated (vinyl ester resin is also acceptable),
- b) UV inhibitors sufficient to enable the open grid flooring for use in outdoor application without showing any deleterious effects after ten years of external weathering in full sun exposure, and
- c) flame retardants necessary to achieve a flame spread of 25 or less (ASTM E84 rating).

For the moulded grid flooring, the glass fibre content shall be 35% and the resin system content 65%, unless otherwise approved by the Engineer.

All GRP grating and supports shall be supplied with a certificate from the manufacture indicating that they comply with the above requirements.

Where additional supports of GRP are required, their end connections shall be of stainless steel grade 316, unless otherwise specified.

In some cases, steel supports may be indicated on the drawings, in which case they shall comply with the requirements of SANS 1200 H and shall be HDG unless they are of stainless steel or unless otherwise indicated.

Where top hat sections are shown on the drawings (i.e., for use with trench covers), they shall, unless otherwise indicated be of HDG mild steel and shall meet the requirements of SANS 1200 H.

3.2 FIXING CLIPS AND FASTENERS

All fasteners and fixing clip sets shall be of stainless steel grade 316, unless otherwise specified. Anchor fasteners shall be chemically anchored into concrete or brickwork using Sika Anchorfix-2+ or Hilti HIT-RE 500 (or equivalent approved).

4 PLANT

Plant and equipment used in handling, fabrication and erection shall comply with the applicable regulations of the Occupational Health and Safety Act, 1983 (Act 85 of 1993). Handling and lifting plant shall have enough capacity to ensure that grating and supports are placed in their final position without distortion or undue stressing of members. The use of cranes, lifting devices, safety belts, harnesses, nets and barricades shall comply with the recommendations given in BS 5531.

5 CONSTRUCTION

5.1 FABRICATION AND ASSEMBLY

5.1.1 General

Open grid flooring, supports and ancillaries shall be manufactured by an approved firm specializing in such work. The Contractor shall provide the Engineer with written confirmation from the suppliers indicating that the components comply with the requirements of this specification.

Before commencing with any manufacturing or construction, the Contractor shall confirm and accommodate the actual dimensions and details measured on site which may differ from those provided on drawings.

For all GRP items, any areas which are abraded, cut or drilled during or after the moulding or pultruding process (as applicable), shall be permanently sealed with a catalysed resin (with added UV inhibitors) compatible with the resin from which the item was manufactured. Alternatively, two coats of an aliphatic acrylic polyurethane topcoat suitable for use on GRP items in outdoor environments (such as Carboline 134 or similar approved) may be used as a sealant. The colour of the sealant shall either be clear or match the item being coated. Sealants shall be applied in accordance with the manufacturer's instructions in addition to the substrate being thoroughly cleaned and degreased, then wiped with acetone prior to applying the sealant.

5.1.2 Grating

Grid flooring shall be of the moulded type and bearer bars shall run in both directions (panels constructed of pultruded members or panels with bearer bars in one direction and transversals in the other are not acceptable). The grid flooring panel depth as well as the bearer bar thickness and pitch (spacing) shall be as specified on the drawings. The depth of bearer bars shall be equal to the panel depth.

Cut-outs made to accommodate equipment shall be neat and as small as practical. Gaps between equipment and grid flooring shall not exceed 100mm in extreme cases. Unless otherwise specified, cuts made in grating with top covers shall create shapes to suit the equipment. For grating without top covers, cuts shall generally be parallel to bearer bars, except for cut-outs made to accommodate a circular object or pipe larger than 300 ND. In this instance, cut-outs shall be octagonal in shape to prevent excessive gaps and facilitate banding.

Where top covers are specified, they shall cover the entire top of the grid flooring panel with the edges of the cover flush with the edges of the flooring panel. The top cover shall be fully adhered to the grid flooring panel with a suitable epoxy adhesive approved by the grid flooring manufacturer and the Engineer, leaving no crevices at the joints. Mechanically fastening covers to panels is not acceptable.

Aside from grid flooring with solid top covers, the perimeter of any individual flooring panel, not limited to the outside perimeter, perimeter of cut-outs and perimeter of removable sections, shall be banded (with bands of equal thickness to the bearer bars) and without short bearer bar stubs protruding, to create a continuous perimeter surface of depth equal to the panel depth. If grid flooring is cut in such a way that edge bands are to be added, they shall be done so by fully and securely adhering bands (matching bearer bar dimensions) to the stubs with a suitable epoxy adhesive approved by the grid flooring manufacturer and the Engineer, leaving no crevices at the joints. Mechanically fastening bands to panels is not acceptable.

For mini-mesh grid flooring, the shallower bars included at the top of the panel will be acceptable as edge banding provided these bars have not been added, are of thickness equal to the bearer bars and have no bearer bar stubs protruding past them. However, if edge bands are to be added, they shall match the bearer bar dimensions (adding shallower bars is not acceptable).

Protrusions along the perimeter of grid flooring with solid top covers (where the full perimeter is not banded) and mini-mesh grid flooring (where edge banding is not full height) shall be neatly rounded to a radius of 2mm.

Edge bands added to grid flooring shall have the same top surface finish as the panel it is affixed to.

Where grid flooring is used as stair treads, their leading edges shall be fitted with a solid, gritted nosing of a colour approved by the Engineer. The nosing shall be fully adhered to the grid flooring panel with a suitable epoxy adhesive approved by the grid flooring manufacturer and the Engineer, leaving no crevices at the

joints. Mechanically fastening nosing to panels is not acceptable.

5.1.3 Supports

Supports shall be as specified on the drawings and shall consist of angle supports and additional supports (see definitions in 2.1).

Where angle supports are specified, they shall be installed along the full perimeters of openings which are to be covered with flooring panels. In addition, where a structural member is to pass through a flooring panel, adequately sized bolt-on angle supports shall be installed around the circumference of the structural member to support the flooring panel, unless otherwise directed by the Engineer. No angle supports will be paid for separately but shall be included in the rate tendered for the relevant flooring panels.

Additional supports may be required and shall be as indicated on the drawings. Where an additional support consists of combining multiple structural profiles (i.e., two back-to-back channel sections with a flat plate or bar to create a single support), all members of the support shall be fully joined together using an epoxy or other suitable-for-purpose adhesive. The adhesive and joining method must be approved by both the GRP profile manufacturer and the Engineer.

Each additional support type, complete with end plates, flat plates/bars, fasteners, etc. will be scheduled and paid for separately to the flooring panels with angle supports.

5.1.4 Fixing clips and fasteners

Anchor fastener lengths and sizes shall be as shown on the drawings. Fasteners shall be delivered to site in the correct lengths and already deburred, pickled and passivated (as no cutting of these fasteners will be permitted on site).

Clip sets shall make use of fasteners no smaller than M8. The fixing clip sets shall be delivered to site already pickled and passivated and shall not be modified on site. Countersunk fasteners used to secure panels with solid top covers shall also be no smaller than M8.

5.2 SETTING OUT AND ERECTION

Actual dimensions and details measured on site may differ from those provided on drawings, and shall be accommodated.

Grid flooring shall be mounted firm and level, orientated uniformly and shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order. Adjacent floor panels shall have vertical edge alignment of within 2 mm of each other. Unless otherwise specified, no less than four fixing clip sets for panels smaller than 1.5m² and six fixing clip sets for larger panels shall be used to secure each panel to the supports and to adjacent panels. No perceptible movement or rocking will be acceptable.

The gap between the edge of grid flooring and the support frame or abutting structure (as applicable) shall be at least 2 mm and no greater than 10 mm on each side (or no greater than 20mm on one side when the panel is shifted up against the support frame/abutting structure on the opposite side). No gaps shall be left between adjacent panels.

Unless otherwise approved, individual flooring panels which are not supported along their entire perimeter shall be no less than 1m wide (where the width is measured perpendicular to the shorter span). Where narrower widths are unavoidable, the narrower panel shall be fastened along the unsupported edges to the adjacent flooring panel with fixing clips at 250mm (or smaller) centres.

Where additional supports are installed, the gap between additional support ends and the substrates to which they are fixed shall be no greater than 10mm, and the gap shall be neatly filled with flowable non-shrink cementitious grout after the supports have been secured in place and prior to final tightening of nuts.

The Contractor shall submit for approval all relevant details for additional cut-outs and supports to flooring which are not specified but are required by him to accommodate his equipment. These flooring modifications

and supports shall ensure that, while under design load conditions, the deflection does not exceed 1/200th of the clear span, or 5 mm, whichever is the lesser. Cut-outs and supports required by the Contractor will not be measured or paid for separately but shall be included in the rate tendered for the relevant flooring panels.

Anchor holes required for supports shall be drilled to correct depths and cleaned in accordance with the anchor adhesive manufacturer's instructions. The Contractor shall have all holes inspected by the Engineer after completing preparations but before installing the adhesive or fastener. SS316 washers shall be provided under both bolt head (where applicable) and nut. Unless otherwise approved, fastener threads shall project no less than 1 thread and no more than 8 threads from the head of the nuts when fixed.

Countersunk fasteners shall be used with fixing clip sets to secure flooring panels which are covered with solid tops covers to supports and to adjacent panels. The countersunk fastener head shall not protrude above the flooring panel cover by more than 1.5mm.

In cases where the motor control centre (MCC) or variable frequency controllers (VFC) cover parts of the trench, supports and top hat sections shall continue under the MCC/VFC, however the GRP flooring panels shall not. Where flooring is supplied with top hats, 40x5mm neoprene strips shall be placed under all flooring edges not supported by a top hat section and adhered with contact adhesive to the angle support.

6 TOLERANCES

Grid flooring shall comply with the tolerances given in DIN 24537-3. GRP supports shall comply with the tolerances given in EN 13706-2. Steel supports shall comply with the tolerances given in SANS 1200 H. Adjacent floor panels shall have vertical edge alignment within 2 mm of each other.

Notwithstanding the above, supports shall be mounted or cast in (as applicable) such that the finished flooring panels, once installed, are flush with (or within 2mm of) the top of the abutting finished concrete or brick wall or floor (as applicable). The tolerance on spacing between parallel angle supports shall be $\pm 3\text{mm}$ regardless of the substrate tolerance to which they are affixed or cast into. As such, the substrate tolerances shall be amended to ensure the angle support spacing tolerance is achieved.

7 TESTING

During installation, the Contractor shall satisfy the Engineer that, for all GRP items, any areas which have been abraded, cut or drilled during or after the moulding or pultruding process (as applicable), have been permanently sealed as specified.

The Contractor shall further demonstrate, after placing the panels but before securing them with clips, that when shifted to any side, the panels overlap the supports as specified.

After installation and once fixed in position, the Contractor shall demonstrate, to the satisfaction of the Engineer, that there is no perceptible movement or rocking of the flooring panels.

During the defects notification period, any fibre prominence on GRP items or delamination of top covers from the grid flooring panels will result in rejection of the applicable item.

8 MEASUREMENT AND PAYMENT

8.1 GRP FLOORING, COMPLETE AND INSTALLED WITH FRAMES (Drawing number and type stated)..... Unit: No, m² or sum

The rate shall cover the cost of supplying the specified or scheduled type of flooring complete with angle supports/frames and top hat sections as indicated on the drawings (irrespective of whether the angle supports/frames or top hat sections are of steel or GRP). The rate shall further cover the cost of all fixings, installing, fixing and grouting/casting in, the production of shop drawings/details (where required), all

procurement costs, supply, fabrication, cutting, cut-outs, joining, banding, sealing, transportation and erection, all plant, labour and materials (including fasteners) necessary for proper completion of the flooring and support frames.

Any additional supports and cut-outs not specified but which are required by the Contractor to accommodate his equipment layout shall not be paid for separately, but shall be included for in the above rate for flooring.

Additional support systems will be scheduled and paid for separately (under 8.2 if primarily of GRP and under Subclause 8.3.1 of SANS 1200 H if primarily of steel), which rate shall also include for the required end connections, flat bars/plates, fasteners, etc. Additional support systems exclude angle supports/frames and top hat sections, which are already included for under the rate for grid flooring.

8.2 ADDITIONAL SUPPORTS OF GRP (Drawing number and details stated).....Unit: No, sum or m

The rate shall cover the cost of supplying the specified or scheduled GRP additional support system, complete as indicated on the drawings, and the cost of all fixings, installing, fixing, grouting/casting in, etc. The rate shall further include for the production of shop drawings/details (where required), all procurement costs, fabrication, cutting, joining, sealing, transportation and erection, all plant, labour and materials (including end plates and fasteners) necessary for proper completion of the additional supports.

Any additional supports and cut-outs not specified but which are required by the Contractor to accommodate his equipment layout shall not be paid for separately, but shall be included for in the rate for grid flooring.

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1 SCOPE OF SERVICES

This Specification establishes the requirements for the geotechnical investigative works to be conducted for the abstraction works.

The Contractor will be required to conduct a geotechnical investigation which entails rotary core drilling and laboratory testing of the sampled bedrock to confirm founding conditions.

The scope of works will entail the following services:

- Undertake the geotechnical fieldwork which includes rotary core drilling.
- In situ testing.
- Transport the representative core samples for laboratory testing at a SANAS accredited laboratory.
- Laboratory testing in accordance to acceptable testing standards.

2 ROTARY CORE DRILLING

Based on the expected loads associated with the abstraction works, rotary core drilling (triple tube, N size core) is proposed to confirm the deeper ground profile. Standard Penetration Tests (SPT's) are also proposed at 1.5 m intervals within the soil horizons. Refusal of the SPT shall be considered if the blow count exceeds 50 blows. SPT values must be recorded and presented against drill run in logs.

The core recovered from the boreholes must be stored in appropriate core boxes. Once all the necessary marking and information have been put on the cores and all cores are in the correct position, the core boxes shall be photographed. Photographs of the core box before rock and Shelby are taken.

The core boxes shall be marked as follows:

- Project name
- Location (i.e., appropriate name and number for intake, water treatment plant and reservoirs)
- Borehole number
- Depth range
- Dates of drilling

The core drilled shall be placed in the core boxes in order and clearly marked to define the start and end of each drill run. Depth marker blocks indicating the down-hole depth from the borehole collar level shall be inserted in the core box at the end of each drill run. These depth marker blocks shall be fitted between the partitions or fixed to the partitions to prevent any movement of the core during handling and transport of the core boxes. Any point at which a known core loss occurred shall be similarly marked by means of a wooden block approximating the length of the core loss. Core placed in core boxes shall be securely checked to prevent movement using wooden spacers if it is liable to move around in the core box during transport.

Friable material, material liable to disintegrate (slaking mudstone, etc.) or soft or loose material, must, at all times, be placed in a plastic sleeve, before being placed in the core box.

Profiling of the borehole core by suitably experienced geotechnical engineer or engineering geologist according to accepted standards. Thin-walled Shelby tube samples (of typical internal diameter 75 mm) to be taken within softer clayey layers at appropriate depths within the boreholes.

Positions of boreholes must be submitted and confirmed by Zutari prior to drilling on site using the layout drawings provided.

Final borehole positions shall be recorded with a hand-held GPS device and the coordinates made available in the geotechnical report (using WGS84 coordinate system).

The Contractor shall supply the necessary construction plant on the site for drilling under the above conditions. The plant and techniques used shall be suitable for ensuring maximum core recovery.

All drilling shall be in compliance with COTO (2010) Standard Specifications for Subsurface Investigations.

The Contractor shall arrange for the testing of borehole core samples. Testing of cores for compressive strength shall be done in accordance with SANS 3001-C03-5.

2.1 UNDISTURBED SAMPLES (SHELBY'S TUBE SAMPLES)

Undisturbed (Shelby) samples (sample size = size of drilling hole) must be taken in the soil profiles (clayey material) in boreholes where shear box or triaxial tests are to be done. The location of undisturbed samples will be indicated by the supervising engineering geologist.

3 DRILLING COORDINATES

The exact coordinates of the rotary core drilling locations are illustrated in Figure 1. Reference benchmark coordinates are summarized in Table 1.

Table 1: Reference benchmark information

Benchmark	X	Y
BH1	-31.207688°	28.717188°
BH2	-31.207527°	28.717328°



Figure 1: Location of rotary core drilling

4 GROUNDWATER LEVEL MEASUREMENTS

The water rest levels must be recorded at the start of the first drill shift during drilling in all boreholes as well as 24 hours after completion of a borehole.

5 LABORATORY TESTING

All laboratory tests shall be carried out on representative samples of materials obtained from the boreholes. Every effort shall be made to obtain undisturbed samples (including Shelby tubes). The following laboratory tests are envisaged as given in Table 2:

No	Type of Test	Number	Relevant Standard
1	Uniaxial Compressive Strength Test (UCS) (rock cores)	4	
2	BRE/DIN suites	2	
3	Shear box testing on soil samples	2	(BS 1377)
4	Slake durability tests	2	

6 CORE STORAGE

Core obtained through the rotary drilling process should be stored as follows:

- The core drilled shall be placed in the core boxes in order and shall be clearly marked to define the start and end of each drill run.
- Core boxes shall be of sound robust construction able to support the weight of core and any full boxes which may subsequently be stacked upon them.
- Core boxes shall be sufficiently watertight to protect the core from rain on site and in transit.
- Depth marker blocks indicating the down-hole depth from the borehole collar level shall be inserted in the core box at the end of each drill run. These depth marker blocks shall be fitted between the partitions or fixed to the partitions to prevent any movement of the core during handling and transport of the core boxes.
- Any point at which a known core loss occurred shall be similarly marked by means of a wooden block approximating the length of the core loss.
- Core placed in core boxes shall be securely checked to prevent movement using wooden spacers if it is liable to move around in the core box during transport.
- The core recovered as well as filled core boxes at the drilling rig must be sufficiently protected against possible loss or damage (wilful or accidental).

7 CORE PHOTOGRAPHY

On completion of the logging (before samples are taken for testing) a colour photograph shall be taken of the core in each core box. The Contractor shall provide an appropriate digital camera and photographs taken shall comply with the following:

- No shadows shall be permitted on the core.
- The core box shall be parallel to all four sides of the photograph.

- All written data shown on the photograph shall be neatly written in the same type and shall be clearly legible.
- All photographs shall be clear, in focus, and not over- or underexposed as a result of the flashlight used, poor lighting on site, etc.
- The core shall be orientated so that the core reads like a book in increasing depth from the top left.

The core box shall be positioned relative to the photographer so that photographs are taken at right angles to the plane of the box. This will necessitate the manufacturing of an appropriate setup as well as the use of a camera tripod to ensure consistency. Photographs taken obliquely to the core box will not be accepted.

Naming of photographs of core boxes shall be catalogued electronically to reflect the borehole number, core box number as well as the 'from' and 'to' depth of core contained in the core box.

The following information shall be displayed on a photo board above the core box:

- Project name and site
- Borehole number
- Box number and total number of boxes, e.g., Box 3 of 7
- Start and end depth of the core in the box.
- Date drilled.
- Standard scale and colour charts (just below the core box)

7.1 MEASUREMENT & PAYMENT

7.2 BASIC PRINCIPLES

7.3 SCHEDULED ITEMS

7.3.1 Establishment on site..... Unit: Sum

A drilling rig or equipment unit shall be regarded as established once it has been properly erected and commissioned and is in full working order, together with all equipment, tools, accessories and crew required to execute the particular work.

The tendered rate shall include full compensation for providing the plant, transporting it to site, erecting, commissioning, finally dismantling it, loading and transporting it away from site as well as standard Health & Safety obligations and Environmental Management.

No drilling rig, plant or other equipment shall be brought onto, or removed from the site, without the written authority of the Engineer.

7.3.2 Setting up of core drill rig at drill site Unit: No

The setting up of the core drill rig on site shall commence in accordance with Section 5 of COTO (2010) Standard Specifications for Subsurface Investigations. The setups shall be measured by number for the method of setup employed.

Movement of rigs between boreholes: The first kilometre shall be deemed to be included in the rates for setting up. For boreholes more than 1 km apart the unit of measurement for the distance moved (by the shortest practicable route, as approved by the Engineer) shall be per kilometre (measured to the nearest 0.1 km) by which the distance exceeds 1 km and shall be extra over the setup rate.

7.3.3 Drilling

- In category A materials Unit :m
- In category B materials Unit :m

- c) In category C materials Unit :m
- d) Extra-over item (c) above in category D materials by different rock types Unit :m
- e) Extra-over item (c) above in very closely fractured material Unit :pull
- f) Drilling in gravel Unit :m
- g) Drilling in cobbles and boulders Unit :m
- h) Extra-over for drilling inclined holes in all categories:
 - i. Inclination > 60° and < 85° Unit :m

Drilling shall be performed, and materials shall be defined in accordance with Section 10 of COTO (2010) Standard Specifications for Subsurface Investigations. The quantity to be paid for shall be the linear metre actually drilled to the satisfaction of the Engineer. All measurements of depths drilled shall be measured from the point at which physical drilling commences. When drilling in material classified as very closely fractured, the unit of measurement shall be the number of pulls of the core barrel necessary to achieve optimum core recovery.

7.3.4 Core and soil material recovery

- a) Soil material recovery in all material types Unit :m
- b) Core recovery in Category A material Unit :m
- c) Core recovery in Category B material Unit :m
- d) Core recovery in Category C material Unit :m
- e) Core recovery in Category D material Unit :m
- f) Extra-over (d) in different rock types:
 - i. In very closely fractured material Unit :m

Core and soil material recovery shall be performed in accordance with Section 12 of COTO (2010) Standard Specifications for Subsurface Investigations. The quantity to be paid for shall be the linear metre of core or soil material actually recovered and packed into the core box to the satisfaction of the Engineer. Measurement shall be made for individual drill runs in accordance with the minimum percentages given. The core recovery for each drill run shall be measured in place on the split inner tube before transfer to the core box.

No distinction shall be made for the depths or inclination of holes from which the core is recovered.

The rates for core recovery shall not be less than 50% of the rates for rotary core drilling, unless the contractor can prove that this ratio is not applicable. If necessary, tendered rates shall be adjusted accordingly prior to the award to the contract.

7.3.5 Casing

- a) Casing left in the hole by size Unit :m
- b) Extra-over (a) for casing:
 - i. In material of category B or harder Unit :m
 - ii. In boulders or gravel Unit :m
 - iii. In inclined holes Unit :m

Casings shall be installed in accordance with Section 13 of COTO (2010) Standard Specifications for Subsurface Investigations. The quantity to be paid for shall be the linear metre of casing actually installed

and/or subsequently removed or on instruction of the Engineer, left permanently in the hole, or casing irrecoverably jammed in the hole (for which the Engineer has agreed to pay), measured from the casing reference height. Unless depth increments are detailed in the Bill of Quantities, payment shall be irrespective of depth.

For the purposes of measurement, the length of casing installed shall be measured relative to a casing reference level as follows:

- For dry holes: From the mean adjacent ground level.
- For wet holes: From 0.5m above the highest normal water level or such height necessary to protrude through the drilling barge or platform.

Casing in category B or harder material, in boulders or gravel shall be measured per linear metre and paid extra over the rate for removable casing.

Where casing has already been installed and a reduction in the size of the casing is required for further advance, no payment shall be made for the portion(s) of the smaller diameter casing(s) contained within the larger diameter casing.

No extra payment shall be made for the use of drilling fluids or muds for the installation of casing unless agreed to and approved by the Engineer.

Casing in inclined holes shall be an extra over payment per metre of casing installed, regardless of size.

7.3.6 Standard Penetration Tests..... Unit: No

SPTs shall be performed in accordance with Section 23 of COTO (2010) Standard Specifications for Subsurface Investigations. The quantity to be paid for shall be each SPT as ordered by the Engineer and carried out to his satisfaction. Where the depth at which the test is required exceeds 50 m, depth increments (if any) as detailed in the Project Specifications and the Bill of Quantities, shall apply.

7.3.7 Supply aluminium core boxes..... Unit: No

The quality of-, the marking of-, and the temporary storage of the aluminium core boxes are to comply with Section 31 of COTO (2010) Standard Specifications for Subsurface Investigations. The measurement for the supply of core boxes will be the number of core boxes actually used for the storage of core or samples to the satisfaction of the Engineer. No separate measurement or payment will be made for the temporary storage of core.

7.3.8 Marking of hole by concrete block..... Unit: No

Marking of holes shall be conducted in accordance with Section 35 of COTO (2010) Standard Specifications for Subsurface Investigations. The quantity to be paid for shall be the number of holes actually marked to the satisfaction of the Engineer.

7.3.9 Standing time

- a) Drill rig..... Unit :hours

Section 37 of COTO (2010) Standard Specifications for Subsurface Investigations apply to this payment item. Standing time shall only be measured for payment for periods in excess of one hour. The actual measurement will be made for the full period during which standing time was agreed for any specific unit of plant measured to the nearest 0.25 hour.

7.3.10 Laboratory testing

The following laboratory tests will be conducted at the abstraction works and rates shall be deemed to include all cost associated with reporting the results into a comprehensive complete report as detailed in section .:

- (a) 4 No. UCM tests

- (b) 2 No. BRE/DIN tests
- (c) 2 No. shearbox tests
- (d) 2 No. Slake durability tests

SPECIFICATION: PD

BUILDING WORK

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1. SCOPE

This Particular Specification covers the various construction activities associated with the erection of buildings which form part of this Contract.

Building work shall be carried out in accordance with the National Building Regulations, SANS 10400, the applicable clauses of the SABS Standardised Specifications and the information contained in this Specification.

Work appurtenant to the erection of buildings such as earthworks, concrete work, structural steelwork, etc shall be carried out as specified in the appropriate Standardised Specifications and will be measured and paid for under those Specifications.

2. BRICKWORK, PLASTERWORK AND ROOF FINISHES**2.1 MATERIALS****2.1.1 Bricks**

Burnt clay bricks shall comply with SABS 227 and shall be of the class and strength scheduled or shown on the Drawings. Unless otherwise specified, brickwork below ground shall be 14 MPa NFX solid engineering units in class I mortar (mortar with minimum 10 MPa compressive strength) and brickwork in superstructures shall be 7 MPa NFX solid engineering units in class II mortar (mortar with minimum 5 MPa compressive strength).

Face bricks shall, unless otherwise specified, be FBS solid engineering units in class II mortar. Face bricks shall be in the style and colour as specified on the drawings.

All load bearing bricks shall be at least 14 MPa bricks.

Concrete bricks, where specified or approved by the Engineer, shall comply with SANS 1215, and shall meet the same compressive strength and mortar class requirements as indicated above for burnt clay bricks.

Satisfactory proof of the load-bearing capacity of the bricks offered shall be submitted before deliveries are made to the Site.

Unless otherwise specified or approved, bricks shall measure 222mm long x 106mm wide x 73mm high (South African Imperial brick size).

Brick lintels shall be of the 'special solid' type that are solid on all sides (i.e. has no core holes).

Air bricks shall be well-burnt terracotta (or concrete for concrete brickwork) and shall be free from cracks and blemishes and lined with a durable, non-corrosive, non-degrading insect gauze.

Three samples of each type of brick shall be submitted to the Engineer for approval. All subsequent deliveries shall be of a standard equal to or better than that of the approved samples.

2.1.2 Cement

Cement shall comply with the requirements of SABS 471 and shall be stored under cover. The use of Portland blast-furnace cement (PBFC) which complies with the requirements of SABS 626 will only be allowed if approved by the Engineer.

2.1.3 Aggregate

Fine aggregate shall consist of natural sand, or crushed rock or gravel, and shall be hard, clean and free from adherent coatings or other deleterious matter. Sand for plaster and mortar shall comply with the requirements of SABS 1090.

2.1.4 Water

Water shall be clean and free from clay, silt, oil, acid, alkali, organic or other matter which would impair the required strength and durability of the mortar, plaster or screed.

2.1.5 Wall ties and brickwork reinforcement

Wire ties shall be of galvanized steel of the single wire type for solid walls and either the "Butterfly" or Modified PWD type for hollow walls. Ties shall be of sufficient length to allow not less than 75 mm of each end to be built into brickwork or embedded in concrete. Vertical twist ties shall be used where specified on the drawings.

Brickwork reinforcement shall be manufactured from hard drawn steel wire conforming to BS 785 and shall consist of two 2,8 mm diameter main wires with 2,5 mm diameter cross wires at 300 mm centres welded at intersections.

Brickwork reinforcement shall be lapped not less than 300 mm at end joints and for a length equal to the width of the widest reinforcement at intersections.

2.1.6 Damp-proof sheeting

Damp-proof sheeting shall comply with SABS 248, type FV for fibre felt, or SABS 952, type B for embossed polyethylene sheeting.

2.1.7 Expansion/control joints

Expansion joints, masonry-to-concrete joints and the like shall be constructed as indicated on the drawings. Unless otherwise specified, the following shall apply:

- a) All hoop-irons/straps/concertina ties shall consist of 750mm long by 30mm wide by 1.2mm thick galvanized steel strips.
- b) For vertical masonry-to-concrete joints, each hoop-iron/strap shall be built 500mm deep into the brickwork after fixing one end to the concrete using 2x Fischer Hammerfix N6x40 anchors (or similar approved anchors, installed as per manufacturer's instructions). Each brick leaf abutting concrete shall have hoop-irons/straps built into the brickwork at approximately 255mm vertical centres (every third course).
- c) For vertical masonry-to-masonry joints, each brick leaf shall have a concertina tie built into the brickwork at every fourth course.
- d) All expansion/control joints shall be 10mm wide and consist of 10mm thick Jointex (or similar approved) compressible membrane, sealed (after being thoroughly cleaned) along the perimeter with a suitably approved polyurethane or polysulphide joint sealer of colour matching the wall finish. The sealant shall be applied against a full backing to ensure it is forced against the sides of the joint to obtain good adhesion, and the finished profile shall be no less than 12mm deep across the 10mm joint width, with the completed joint sealant face recessed 15mm for face brick or flush with brickwork/concrete to still receive plaster.

2.2 CONSTRUCTION OF BRICKWORK

2.2.1 Cement mortar

Cement mortar shall, unless otherwise specified, consist of one part Portland cement to four parts sand (1:4) by volume for foundation brickwork and one part Portland cement to six parts sand (1:6) by volume for superstructure brickwork. The ingredients for cement mortar shall be measured in proper gauge boxes on a boarded platform and thoroughly mixed. Alternatively, mixing may be by means of an approved mechanical batch mixer. Only when the dry ingredients have been thoroughly mixed and a mixture of uniform colour has been obtained may the water be added in sufficient quantity to obtain mortar with the required consistency. The Engineer shall be present when the first batch of mortar is mixed and used.

Cement mortar shall be used within two hours of adding water to the mix and shall not be used after two hours or if it has begun to set. Mortar shall be turned over frequently to prevent it from setting until it is used.

2.2.2 Brickwork

Dimensions of all the brickwork shall be set out and built as shown on the Drawings and shall, unless otherwise indicated, not include plaster thickness. Wall thicknesses indicated in the BOQ and dimensioned on the drawings shall also, unless otherwise stated, exclude the thickness of the plaster (plaster not included for in the thickness given).

Bricks shall be kept wet before laying and the top of brickwork shall be wetted before any further bricks are laid. Bricks shall be well buttered with mortar before being laid and all joints shall be thoroughly flushed up as the work proceeds. All joints to face brickwork shall be neatly made and key-drawn with a 6 mm key.

Face brick units shall be 'blended' by properly sorting and mixing the masonry units to ensure even distribution of colour, shape and texture across the entire finished wall. Clustering of variations will not be accepted.

Brickwork shall be carried up in a uniform manner with no portion being raised more than 1 m above an adjacent portion. Advanced work shall be raked back and toothing-in of masonry units shall not be permitted. All perpendics, quoins, etc, shall be kept strictly true and square and the whole properly bonded together.

Brickwork shall be built in stretcher bond, unless otherwise specified, and bats shall not be used except where required for the bond. All joints shall be 10 mm wide and four courses shall measure 340 mm.

All brickwork shall be constructed with galvanized brickwork reinforcement build-in at every fourth course in superstructure brickwork and every second course in foundation brickwork.

Brickwork for cavity walls and solid walls built in stretcher bond shall be tied with wall ties at 255 mm vertical and 690 mm horizontal centres in foundations and at 340 mm vertical and 690 mm horizontal centres in superstructure brickwork, and shall be staggered vertically. At openings, the ties shall be positioned not more than 300 mm apart along the periphery of the opening and 150 mm from the opening.

Face brickwork shall be kept perfectly clean and rubbing down of the brickwork shall not be allowed. Scaffold boards shall be turned back during heavy rain to avoid splashing.

Soiled brickwork shall be cleaned at the Contractor's expense, and the cleaning method shall be approved by the Engineer.

2.2.3 Reinforced brickwork

Unless otherwise shown on the drawings, brickwork over door and window openings shall be reinforced with steel rods, welded or expanded mesh, etc. Reinforcement shall be placed in each course of brickwork for a minimum of five (5) courses unless specified otherwise on the Drawings. Reinforced brickwork shall continue at least 600 mm on each side of the openings.

2.2.4 Lintels

Brick lintels (lintols) shall be built upon rigid temporary supports left in position for not less than seven (7) days after brick-laying. Brick lintels shall be of the 'special solid' type that are solid on all sides (has no core holes).

Pre-stressed concrete lintels be used where approved by the Engineer.

2.2.5 Key for plaster

Joints of all brickwork receiving plaster shall be raked out, or the brick surfaces shall otherwise be prepared with an acrylic slurry or any other approved bonding agent.

2.2.6 Damp-proofing

A damp-proof course/membrane shall be bedded in mortar (dry laying is not acceptable), laid over the full width of all the walls at a minimum height of 150 mm above the final ground level or wherever else it may be required, and it shall be lapped for at least 150 mm at angles and joints. A damp-proof course shall also be laid and stepped up under all external sills, and above all doors and windows that are not protected within 750mm above by a roof with overhang of at least 750mm.

In some cases, torch-on waterproofing may, instead of damp proof course, be specified on the drawings. Torch-on shall comply with the "Torch-on Waterproofing" clause of this specification.

2.2.7 General

Rough and fair cutting shall be performed as required, and the brickwork shall be fitted around any steel work. Face brickwork shall be carefully cut and fitted to suit fittings.

Chases shall be left or formed for edges of concrete floors, staircases, etc. Chases shall also be provided wherever they may be required for pipes, conduits, switch boxes, distribution boards, and the like. Joints shall be raked out for flashings

2.2.8 Expansion/control joints

Unless otherwise specified, expansion joints shall be made, with prior approval of the Engineer, at all masonry-to-concrete interfaces. In addition, where vertical expansion/control joints shown on the drawings exceed 9m centres for 220mm or thicker collar-jointed walls, 7m centres for cavity walls, 4m centres for external 110mm single-leaf walls or 5.5m for internal 110mm single-leaf brick walls, additional joints shall be constructed (with the prior approval of the Engineer) such that the centre-to-centre distances do not exceed those indicated above.

Expansion/control joints shall not be plastered over, with the plaster neatly finished on either side of the joint.

2.2.9 Face brick reference panel

Prior to commencing with face brick masonry work, a 1.2 m long by 1 m high by 280 mm thick (or similar approved) cavity reference panel (mock-up) shall be constructed in the presence of the Engineer using the proposed materials and tooling required for the final work.

The reference panel shall be constructed on a firm concrete base in a readily accessible area where it can be viewed in good natural light, and it shall be protected against moisture ingress. The panel shall match:

- a) the proposed size, colour and texture of the masonry units,
- b) the joint profile and the colour of the mortar,
- c) the agreed bond pattern,
- d) any special features.

The panel shall also incorporate:

- e) the required reinforcing,
- f) a damp proof course with weep hole,
- g) a control joint (expansion joint) through the centre.

Face brick masonry work shall only commence after the panel has been accepted by the Engineer. The panel shall be the standard of workmanship to which the Contractor will be held, but shall not supersede the requirements indicated on drawings or specified.

The brick panel shall not be altered, damaged or moved until the masonry work is complete and has been accepted by the Engineer.

2.3 PLASTERWORK

2.3.1 General

Plasterwork shall meet the requirements of SANS 2001-EM1, unless otherwise indicated. Prior to commencing with plasterwork, the Contractor shall submit, for approval by the Engineer, a plasterwork method statement.

2.3.2 Substrate Preparation

In addition to preparing surfaces in accordance with SANS 2001-EM1:

- substrates shall be at least as rough as coarse sandpaper or rough-sawn timber,
- and masonry joints shall be raked to a depth of 10mm to provide a good mechanical key for plastering.

The Engineer shall be called to inspect all prepared surfaces prior to receiving plaster.

2.3.3 Plaster Coats

The Engineer shall be notified and witness the mixing and use of the first batch of mortar. A plastered finish shall consist of a single coat comprising one application of a 1:6 cement sand mixture with a wood or steel-float finish, except where otherwise indicated.

Plaster shall be dampened by means of a light spray for a period of not less than 3 days after being applied to the substrate. Successive coats of plaster shall only be applied after the substrate coat has hardened sufficiently to bear a new layer or to enable a new layer to adhere to it and limit drying shrinkage crazing and cracking.

2.3.4 Thickness

The total thickness of the plaster finish shall be 13 mm minimum and 20 mm maximum, except where otherwise indicated. Plaster thickness is, unless otherwise stated, not incorporated in brick wall dimensions shown on the drawings or indicated in the BOQ.

2.3.5 Workmanship

All plasterwork shall be finished smooth and ready to receive paint. Plaster shall be flush with the faces of all switch and plug boxes, the interiors of which shall be kept free from plaster. Plastered surfaces shall be plumb and jambs and reveals shall be formed square.

Plaster shall be discontinuous across the line of a damp-proof course, a butt joint, a movement joint or at the interface between masonry and concrete elements. Unless otherwise indicated, the plaster at such interfaces shall be cut back to the substrate with a steel trowel to form a V-joint in accordance with SANS 2001-EM1.

The plasterer shall cut out and make good all cracks, blisters and other defects, ensuring that the plasterwork remains in a state which is acceptable to the Engineer. Delaminating plasterwork shall not be accepted.

2.4 ROOF FINISHES

2.4.1 Roof Screeds

This screed specification is only applicable to screeds applied to roofs, unless otherwise indicated. Granolithic screeds are specified in SANS 1200 G.

Where the type of screed required is not stated, the screed shall comply with:

- a) this roof screed specification if applied to roof tops, or
- b) the granolithic screed specification in SANS 1200 G if applied anywhere else.

2.4.1.1 Mix Design

Roof screeds shall have a mix proportion by mass consisting of one (1) part Portland cement and three (3) parts fine aggregate (1:3). A minimum amount of water is to be used, but it shall be sufficient to allow adequate compaction.

2.4.1.2 Preparation of base concrete

Preparation of base concrete shall be as specified for granolithic screeds/floor screeds in SANS 1200 G.

2.4.1.3 Placing

Placing shall be as specified for granolithic screeds/floor screeds in SANS 1200 G, but with the following two amended requirements:

- a) The falls specified shall be increased to 1:80.
- b) Instead of finishing the screed to Degree of Accuracy I, Degree of Accuracy II shall apply.

2.4.1.4 Curing

Curing shall be as specified for granolithic screeds/floor screeds in SANS 1200 G.

2.4.1.5 Joints

Joints shall be as specified for granolithic screeds/floor screeds in SANS 1200 G, but with the following two amended requirements:

- a) Additional joints are only to be made in the screed if, when matching the base concrete joints, the screed panel size will exceed 14m². These additional joints shall be construction joints as defined for concrete in 1200G.
- b) Additional joints shall be made such that joints are no more than 4.5m apart. These additional joints shall also be construction joints as defined for concrete in 1200G.

2.4.1.6 General

Screeds found to be delaminating shall not be accepted. No moisture-sensitive roof finishes or waterproofing shall be laid on screeds unless a reliable moisture test shows that the screed is sufficiently dry to receive the covering.

2.4.2 Crushed Stone on Roof Slabs

Where required, crushed stone shall be placed on roofs in thicknesses indicated on the Drawings (or 50mm where not indicated). The crushed stone shall be 19mm nominal stone complying with SANS 1083 grading criteria (including passing through a 25mm mesh sieve and retained on a 12mm mesh sieve). The crushed stone shall further be hard wearing and resistant to degradation and fouling.

The crushed stone shall be delivered to site clean and washed and shall not be placed without the permission of the Engineer and not until the concrete of the roof slab has reached the design strength. The Contractor shall, prior to placing, submit for approval a method statement indicating how the roof will be protected from damage during placing and spreading. During placing, the stone shall be immediately spread into position on the roof and no heaping-up of the stone will be allowed. Repairs to any damages caused by placing and spreading of the crushed stone shall be for the Contractor's cost.

If applicable, watertightness testing of roofs shall be done after the crushed stone has been placed and spread into position. The Contractor may, to satisfy themselves and at their own cost, conduct preliminary water tightness testing prior to crushed stone placement.

2.4.3 Torch-on Waterproofing

Unless otherwise indicated, torch-on waterproofing membranes shall be applied in accordance with manufactures instructions. A trial panel consisting of at least two overlapping membranes and covering what is considered by the Engineer as the most complex section of the roof or wall (as applicable) shall be prepared in advance by the Contractor for the Engineer's approval.

The Engineer shall be called to inspect all prepared surfaces prior to applying the waterproofing.

3. DOORS, WINDOWS, LOUVRES, ETC.**3.1 MATERIALS****3.1.1 General**

All steel and iron work shall be delivered clean and free from rust, pitting or other defects. Shop primers shall be applied before delivery and shall consist of a coat of red oxide paint, or any other approved anti-rust paint on all surfaces.

Unless otherwise specified, all materials shall conform at least to the appropriate SABS or BS standards where such standards apply to ironmongery, or steel, cast iron and any other related materials.

3.1.2 Pressed-steel door frames

Pressed-steel door frames shall comply with SABS 1129 and shall be manufactured from 1,6 mm thick mild-steel sheeting, pressed to the required shapes, properly mitred, welded and reinforced, with all welding neatly cleaned off.

Frames shall be of the widths required to suit the thickness of the walls into which they are built and shall be fitted with suitable tie bars and braces at the bottom. Three lugs to be built into the brickwork shall be provided on each jamb.

Rebates in frames and transoms for doors shall be of the widths required to suit the thicknesses of the doors and shall be fitted with a pair of approved steel butt hinges set flush into recesses in the frames. 4,5 mm thick reinforcing plates shall be welded to the backs of the frames at hinge positions.

Heads of frames over double doors shall be drilled where required to form keeps for bolts and shall be fitted with one rubber buffer for each leaf of the door.

Frames for single doors shall be fitted with approved chromium striking plates and an adjustable striking-plate keeper boxed in at the back of the frame by a welded-on sheet-metal box. The frames shall be fitted with a minimum of two rubber buffers.

Frames shall be protected against twisting and damage during transit and erection.

3.1.3 Pressed-steel doors

Pressed-steel doors shall be manufactured from 1,6 mm thick steel plate. The doors shall be of standard design, pressed to shape with 40 mm reveals all round. The doors shall be strengthened with full-length vertical V-shaped or other approved sectional strengthening ribs projecting to the outer face. Two horizontal stiffening rails shall also be welded to the inner face of the doors.

A door shall be hung on a pair of 100 mm long steel butt hinges with loose pins. The leaves of the hinges shall be welded to both the door and the door frame, and a 1,6 mm thick steel plate shall be welded to the inner face of the door to protect the lock.

One leaf of double doors shall be fitted at the top and bottom with approved 150 mm cast brass barrel bolts in an approved manner and the other leaf shall be fitted with a lock, the striking plate of which shall be fixed to the first leaf.

Where indicated on the drawings, doors shall be fitted with louvred ventilation grills of approved design, backed with insect and vermin-proof gauze screening.

3.1.4 Wooden doors

External wooden doors shall, unless otherwise specified, be 44mm thick hardwood, face-boarded, framed, ledged and braced tongue-in-groove batten doors with 3mm tempered hardboard (high-density fibreboard) on the inside.

Internal wooden doors shall, unless otherwise specified, be 44mm semi-solid doors with 3mm tempered hardboard (high-density fibreboard) both sides and a core consisting of chipboard strips.

3.1.5 Steel window frames

All steel window frames shall comply with SABS 727 and shall be of the types and sizes shown on the Drawings.

Standard industrial types of steel window frame shall be constructed from rolled mild-steel industrial sections, 35 mm wide by 3 mm thick, with opening sections constructed from standard residential sections, 25 mm wide by 3 mm thick, welded at angles and properly jointed at intersections.

3.1.6 Aluminium doors, windows, louvres, etc.

The Contractor for the manufacturing and installations of the aluminium doors, windows, louvres, etc. is to submit proof of AAAMSA membership and doors, windows, louvres shall comply with AAAMSA design criteria.

The following certificates shall be provided prior to commencement of site work:

- a) A copy of the relevant AAAMSA Performance Test Certificate from the manufacturer/contractor supplying the architectural aluminium product.
- b) A Certificate of Conformance confirming that anodizing or powder coating has been processed in accordance with SANS 999 and SANS 1796 respectively.
- c) A Certificate of Conformance confirming that glazing has been installed in accordance with SANS 10137, ensuring that safety glazing materials have been installed in the mandatory areas and that each individual pane of safety glazing materials has been permanently marked.
- d) A warranty from the manufacturer of the laminated safety glass and/or hermetically sealed glazing units guaranteeing the products against delamination and colour degradation for a period of not less than five years.

The successful tenderer shall provide full shop drawings for the approval by the Engineer prior to the manufacturing of any work.

3.1.7 Roller Shutter doors

Roller shutter doors shall be suitable for external use in all weather including periodic extreme wind loading conditions. They shall include all components required for a fully operating door, including but not limited to the door curtain, channel guides, revolving spring-loaded shaft barrel with fully-enclosed canopy, lugs and fasteners, components for operating the doors and heavy-duty locks.

The curtain shall be manufactured from 1mm thick machine rolled galvanised interlocking solid slats with steel 'end locks' spot welded to alternate strips and 'wind locks' fitted at manufacturer approved intervals. The bottom slat shall be an aluminium T-bar (T-section) with integrated EPDM weather seal, unless the door is over 7m wide in which case a hot dip galvanised T-bar with manufacturer-approved weather seal will be accepted.

The vertical edges of the curtain shall glide in hot-dip galvanised channel guides formed of steel not less than 2.5mm thick. The channel guides shall be mounted securely to sides of the door opening with SS316 fasteners, with fixing details and spacing approved by the manufacturer. The channel guides shall be no less than 76mm deep for doors below 6m in width and no less than 120mm deep for doors 6m and wider.

The door shall either be manually operated with crank and gearbox system or automated, whichever is specified. The canopy covering the opening mechanism shall be manufactured from 0.8mm (minimum) thick galvanised mild steel in a continuous length.

The door shall be finished with a UV resistant polyester powder coating if painting, powder coating or a finished colour is specified.

3.1.8 Door locks and handles

Unless otherwise specified, locks shall comply with the following requirements:

All door locks shall comply with the requirements of SABS 4 and shall be of approved manufacture and pattern. All locks shall be supplied with two keys. Keys shall be distinctly numbered with consecutive numbers and each key shall be stamped with the same number as that of the lock which it controls. No two locks in any one building may have the same key.

External doors shall be fitted with master-keyed four-lever heavy duty mortice locks or cylinder locks as indicated.

All locks shall be properly installed and, after completion, striker plates shall be adjusted and the locks serviced.

Door handles shall be of cast zinc of approved manufacture and pattern.

3.1.9 Miscellaneous fittings

All retaining devices for doors and windows as well as fittings such as coat hooks, retaining hooks, etc shall be of solid brass unless otherwise indicated. All fittings shall be secured by screws or set screws of the same material and finish as the fitting.

Fittings to be fixed to plastered walls, masonry or floors shall be fixed direct by means of patent plastic or fibre plugs fitted into drilled holes.

Door stops shall be provided at every external door and shall generally be 40 mm diameter rubber stops.

Patented precast concrete window surrounds or blocks shall be as scheduled in the bill of quantities.

3.2 INSTALLATION OF DOORS AND WINDOWS

All built-in door and window frames shall be set straight, plumb and level, and shall operate to the satisfaction of the Engineer after fixing has been completed.

Fittings shall be either removed, or wrapped and protected from damage, until all rough trades have been completed

4. GLAZING**4.1 MATERIALS****4.1.1 Glass**

Glass shall comply with the requirements of SANS 1263-1, unless otherwise specified otherwise. The quality of all window glass shall be such that surface deterioration will not develop after glazing.

All glass shall be free from bubbles, waviness, scratches, stains or other imperfections.

Unless otherwise specified, sheet glass for glazing shall be flat-drawn clear glass of ordinary glazing quality and of the thicknesses indicated below:

For panes not exceeding 1,5 m² in area: 4 mm

4.1.2 Putty

All putty shall comply with the requirements of SABS 680.

Putty shall not be too hard or soft or caked when used and shall dry evenly without crazing or cracking.

Defective putty shall be cut out and replaced by the Contractor at his own expense, and any broken glass shall also be so replaced and putty so repainted.

4.2 GLAZING

Glass shall be cut in panes to suit all glazed openings with sufficient clearance all round to prevent cracking by expansion, contraction or vibration.

In all cases the glass shall be well bedded and back-puttied and installed as specified in SABS Code of Practice 0137.

All putty shall be carefully trimmed, cleaned off and neatly finished off straight with smooth surfaces and sharp mitres. A paint primer shall be applied as soon as the putty has dried out sufficiently to prevent shrinkage cracks from forming.

The entire glazing operation shall be cleaned before the premises are handed over for occupation.

5. CARPENTRY AND JOINERY**5.1 GENERAL****5.1.1 Materials**

All timber used for structural purposes shall be of merchantable grade and shall comply with the requirements of SABS 563 and SABS 1245. Structural timber shall be carefully selected and of the best quality, free from large or dead knots, shakes, waney edges or other defects. Purlins and bracing shall comply with the requirements of SABS 653. Finger-jointed structural timber shall comply with the requirements of SABS 096 and laminated timber with the requirements of SABS 1089.

Hardwoods and softwoods for joinery shall comply with SABS 1099 and SABS 1359 respectively and suitable species shall be used for the various purposes.

Unless otherwise specified, all materials shall conform to the appropriate SABS or BS Specification where such standards exist for nails, screws, bolts, adhesives, etc.

5.1.2 Preservative treatment

All structural timber shall be given a preservative treatment suitable for the duty for which the timber is intended in accordance with SABS 05, and no untreated timber shall be used. The preservative treatment shall not impair the final finish. The timber shall be impregnated throughout. When surface coating is specified, the compounds applied on the surfaces of the timber shall form an unbroken film.

5.1.3 Priming

The jointing surfaces of all joints exposed to the weather and built-in portions of frames shall be thickly primed except where adhesives are specified.

Carpentry and joinery items which are prepared for painting by the manufacturer, shall be knotted and primed before being dispatched to the Site.

Primed surfaces shall be touched up where necessary during the progress of the work or where site adjustments have been made.

5.2 CARPENTRY WORK**5.2.1 Scope of work**

Carpentry work shall be carried out in a manner consistent with good workmanship and in compliance with the Drawings.

The carpenter shall perform all cutting away and making good in attendance upon all other trades and he shall provide and maintain temporary coverings required for the protection of any finished work that might be damaged if left unprotected during the progress of the work.

5.2.2 Dimensions

Unwrought timber shall be as sawn and shall be to the dimensions and within the tolerances specified in the relevant SABS Standard Specifications mentioned in subclause 5.1 (1).

5.2.3 Jointing

Unless otherwise specified, all joints shall be secured by means of a suitable type and a sufficient number of approved connectors. All joints shall be carefully made in such a way that they will not impair the strength and stiffness of the beams or members.

5.2.4 Timber roof construction

The plates, joists, rafters, purlins, brandering and other pieces used for the construction of the roof and trusses shall be of the dimensions, spacing and construction as shown on the Drawings.

All the joints in the framework shall be of the most appropriate type, accurately formed and adequately secured with fasteners as specified.

5.3 JOINERY WORK**5.3.1 Scope of work**

Joinery work shall consist of the manufacture, delivery to the Site, and fixing in the buildings, of all joinery shown on the Drawings.

Except where a special finish is specified, the Contractor shall have all stairs, landings, doors, shelves and other joinery work cleaned and scrubbed down and shall leave all his work in a good order to the satisfaction of the Engineer.

5.3.2 Dimensions

All wrought timber shall be sawn, planed, drilled or otherwise machined or worked to the correct sizes and shapes shown on the Drawings.

Reasonable tolerances shall be provided at all connections between joinery works and the building structure to compensate adequately for any irregularities, settlements or any other movements.

5.3.3 Manufacture

The joiner shall perform all the necessary mortising, tenoning, grooving, matching, tonguing, housing, rebating and all the other works necessary for correct jointing. He shall also provide all metal plates, screws, nails and other fixings that may be necessary for doing the specified joinery work properly.

5.3.4 Joints

Where joints are not specifically indicated, they shall be the recognised forms of joints for each position. The joints shall be so made as to comply with Part 2 of BS 1186.

5.3.5 Doors and frames

Door frames, linings, panel doors, framed, ledged and braced doors, flush doors, sliding doors, etc shall be supplied or made by the joiner and shall be installed, fitted or hung as detailed on the Drawings.

All timber shall be wrought and prepared for oiling, staining, varnishing or painting.

5.3.6 Skirtings, cornices, etc

Skirtings, cornices, etc shall not be installed until after the wall coverings have been applied, the flooring laid and ceilings installed, unless otherwise specified.

5.3.7 In-situ joinery

In-situ joinery work shall not be executed until after all floor, wall and ceiling surfaces have been formed or constructed, unless otherwise instructed.

5.3.8 Ceilings

Ceilings shall unless otherwise specified of scheduled consist of plaster board or fibre-cement panels as shown on the Drawings and shall be nailed to the bracing or suspended from the roof structure. The panels shall be separated by exposed tees and insulated with a 50 mm thick fibreglass wool blanket where shown on the Drawings.

The maximum permissible deviations for ceilings shall be as follows, with no abrupt changes accepted:

flatness of the ceiling soffit	:	5 mm measured over a 2 m distance
level of soffit	:	+/-10mm

5.3.9 Timber flooring panels for trench covers

Timber flooring panels (for trench covers) shall consist of meranti planks or laminated meranti panels (as specified) and shall be supplied and installed complete with the steel top hat sections, neoprene strips and support frames indicated on the drawings. Work shall be carried out in a manner consistent with good workmanship and in compliance with the Drawings. The actual dimensions and details measured on site shall be accommodated, and all dimensions to be verified before commencing with any manufacturing or construction.

Steel support frames and top hat sections shall, unless otherwise indicated, be of HDG mild steel and shall meet the requirements of SANS 1200 H. All steel joints (aside from top hat sections which are to remain unfixed) are to be fully welded with no crevices (continuous welding on all sides of any joint).

The gap between the edge of timber flooring and the support frame, top hat section or abutting structure (as applicable) shall be at least 1mm and no greater than 5mm on each side. No gaps shall be left between adjacent panels.

Timber shall meet the semi-clear grade requirements of SANS 1783-3, unless otherwise approved. All timber to be sanded smooth (>240 grit) and sealed all round with Woodoc deck or similar approved sealer (applied in accordance with the manufacturer's instructions). Corners of loose timber planks and complete panels shall be rounded (r≈5mm).

Laminating (gluing) timber planks together to create panels (as applicable) shall be done in accordance with the relevant clauses of SANS 1460. Timber panels are to be machine planed and sanded after laminating to achieve a smooth finish and uniform and correct panel thickness.

Flooring panels shall be mounted firm and level, orientated uniformly and shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order. Panel/plank depth shall be within 1mm of the specified depth and adjacent panels/planks shall have vertical edge alignment of within 2 mm of each other.

In cases where the motor control centre (MCC) or variable frequency controllers (VFC) cover parts of the trench, supports and top hat sections shall continue under the MCC/VFC, however the timber flooring panels shall not. Where flooring is supplied with top hats, 40x5mm neoprene strips shall be placed under all flooring edges not supported by a top hat section and adhered with contact adhesive to the angle support.

The tendered rate for timber flooring shall be for the timber flooring, complete and installed with sealer, supports, top hat sections, neoprene strips, etc.

6. ROOF SHEETING AND ACCESSORIES

Roof sheeting and accessories shall comply with and will be measured and paid for under SABS 1200 HB.

7. ELECTRICAL WORK

Electrical work shall be as specified and scheduled by the Electrical Engineer.

The electrical Contractor shall work in close co-operation with the building Contractor to ensure that all conduits, switchboards, plug boxes and switch boxes are installed in their correct position.

8. PLUMBING**8.1 MATERIALS****8.1.1 General**

All materials shall be of the best quality and shall be approved by the Engineer before installation. Cracked, chipped, dented or faulty items or materials shall be replaced at the Contractor's expense. Glazed ceramic sanitary ware shall comply with the requirements of SABS 497 and all other materials shall comply with the standards as specified, scheduled or shown on the Drawings.

8.1.2 Water closet (WC) suites

WC suites shall unless otherwise specified or scheduled consist of a glazed vitreous china closet with an S or P trap and seat lugs, a 14 litre low-level matching flat-bottomed flushing cistern placed and fixed on the closet, or a suspended enamelled cast-iron cistern with the flush pipe connected to the flushing rim of the closet with rubber cone joints, and a solid heavy-duty plastic seat with cover, hinges and buffers.

8.1.3 Urinals

Urinals shall be of the type specified or scheduled, of glazed vitreous china, wall mounted, with an automatic or a manual flushing system, and chromium-plated fittings.

8.1.4 Wash-hand-basins

Wash-hand-basins shall unless otherwise specified or scheduled be of glazed vitreous china or enamelled cast iron, wall mounted on a pair of cast-iron brackets, and fitted with chromium-plated fittings consisting of two taps, outlet and chain, and supplied with a plug and an anti-siphon trap.

8.1.5 Sinks

Sinks shall comply with the requirements of SABS 242 and shall be complete with cabinet, chromium-plated outlet, anti-siphon trap, plug, chain and two bib taps or one mixer tap, all as detailed or as scheduled.

8.1.6 Pipes and tubing

Cast-iron and steel pipes used in plumbing work shall comply with the requirements of SABS 746 and SABS 62 respectively. Copper tubing shall comply with the requirements of SABS 460 and malleable cast-iron fittings with SABS 509.

8.2 CONSTRUCTION

Plumbing shall be carried out strictly in accordance with the Drawings and with the National Building Regulations, with specific reference to Government Notice R1875 dated 31 August 1979.

Steel pipes and their malleable cast-iron fittings shall be joined with red lead and hemp, lead pipes shall have wiped soldered joints, and cast-iron pipes shall be joined by caulking with hemp and metallic lead.

Soil pipes from WC's shall have an internal diameter of at least 100 mm and shall be fitted with a pan connector and an access bend (or an access junction where a vent pipe is

used), and carried through walls and into the ground for connection to the sewer. Vent pipes shall be fitted with approved balloon gratings.

Waste pipes from basins and sinks shall have an internal diameter of at least 32 mm and shall discharge into gulleys. Bends for waste pipes shall incorporate cleaning eyes.

Cisterns, basins and sinks shall be connected to the pipe system with 12 mm diameter copper service pipes, and chromium-plated stopcocks shall be installed for isolation and maintenance purposes.

9. PAINTING

9.1 GENERAL

No paint shall be applied to any surface containing traces of dust, grit, grease, oil, loose rust, millscale or corrosion products of any kind or to any surface that is not free from moisture. Where necessary, surfaces shall be thoroughly washed to remove all traces of soluble salts and/or corrosive air-borne contaminants prior to painting, and the surfaces shall be dried and painted immediately thereafter.

Welding shall be completed in so far as it is possible before painting commences, but in cases where welding can be done only at a later stage, no paint shall be applied to within 75 mm of the proposed weld position unless otherwise specified. Welds and adjacent parent metal shall be abrasive blasted and/or ground and all contaminants such as flux shall be removed prior to painting.

Surfaces of members which are to rest on concrete or other floors or which will be otherwise inaccessible after erection shall receive the full paint system prior to erection.

Damaged paint areas on metal surfaces shall be cleaned, rust spots removed where applicable and the surrounding paint which is still intact shall be feathered for a distance of 20 mm beyond the damaged area. Spot priming and repair shall consist of all the coats previously applied and shall overlap the damaged area.

Damaged galvanised areas shall be cleaned and any rust spots and any flakes of the coating surrounding the damaged area removed. The coating shall then be restored by zinc spraying or soldering, or painting with a zinc-rich epoxy primer, as may be approved by the Engineer.

Where the shop coat is allowed to age for a few months before the final painting is done, light sanding or rubbing with steel wool or scrubbing with clean water using a bristle brush shall be carried out.

Steel to be embedded in concrete shall not be painted below 50 mm from the final level of the concrete.

Each priming coat and each undercoat of paint shall be inspected and approved by the Engineer before any subsequent undercoat or finishing coat is applied.

All finishing colours shall be as shown on the Drawings, or as directed by the Engineer.

9.2 MATERIALS

Paints shall comply with the requirements of the appropriate Specifications below:

9.2.1 Primers

SABS 678 : For wood

SABS 679 :	Zinc chromate for steel
SABS 723 :	Etch-wash primer for metals
SABS 912 :	Calcium plumbate for galvanized iron
SABS 926 :	Zinc-rich epoxy for steel

9.2.2 Undercoats

SABS 681 :	For all undercoats
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9.2.3 Finishing coats

SABS 515 :	For interior use, flat and egg-shell finish
SABS 630 :	For interior and exterior use, high-gloss enamel
SABS 631 :	For interior and exterior use, oil gloss paint
SABS 633 :	For interior use, emulsion paint
SABS 634 :	For exterior use, emulsion paint
SABS 684 :	For exterior use on structural steel
SABS 801 :	For interior and exterior use, epoxy-tar paint
SABS 802 :	For interior and exterior use, bituminous aluminium paint
SABS 887 :	For interior use, glossy and egg-shell varnish

The Contractor shall furnish the Engineer with the following information and details regarding the paints and decorative materials for the painting system he proposes to use, for written approval:

- a) The name of the manufacturer and trade name
- b) The brand, type or grade of paint and the appropriate SABS Specification
- c) Manufacturer's data sheets, colour references, instructions for use, including surface preparation, sealers, primers, undercoats, finishing coats, coat thicknesses and curing periods, which shall all be considered as being part of these Specifications if approved by the Engineer
- d) Safeguards to protect the applied paint from damage until the work is accepted by the Engineer
- e) The shelf or pot life of materials, if applicable
- f) An undertaking that the proposed paint system is suitable for its intended use and that the various coats of paint are compatible with one another

Where proprietary brands are used, the manufacturer's priming and all subsequent coats of paint suitable for that particular brand shall be employed in accordance with the manufacturer's instructions.

No other materials of a similar nature and quality or from another manufacturer may be used instead of those approved, unless written permission to do so has been obtained from the Engineer.

All materials shall be brought onto the Site in containers sealed by the manufacturer. Paints of a different quality, type, brand or colour shall not be mixed. Paint shall not be thinned

nor adulterated in any way, but shall be used as supplied by the manufacturer. Any mixing or tinting required shall be carried out by the manufacturer.

Tinting of paint on the Site by the Contractor will only be allowed with the written permission of the manufacturer and the Engineer.

9.3 INSPECTION AND PRELIMINARY WORK

Before commencing paintwork, the Contractor shall carefully inspect the surfaces to be painted to satisfy himself that the surfaces are in a satisfactory or acceptable condition to receive the paint system specified.

All metal fittings and fastenings shall be removed where applicable before the preparatory processes are commenced. On completion, the metal fittings and fastenings shall be cleaned and refitted in position.

9.4 WORKMANSHIP AND FINISHES

Paint may be applied by spray, brush or roller depending on the materials used, the surface to be painted, and the manufacturer's instructions.

Every coat of paint, irrespective of the method of application, shall be adequately and permanently keyed or bonded to the base material or previously applied coat, and shall be evenly distributed, continuous, free from sags, runs, brush marks, pin holes or other imperfections, and shall dry to a smooth finish.

An approved water trap and air-regulating valve shall be furnished and installed on all equipment used in spray painting.

Before painting the interiors of buildings they shall be cleaned and the floors shall be washed and kept free from dust during the progress of the interior work.

The Contractor shall protect all nearby surfaces against disfigurement by spatters, splashes and smirches of paint or paint materials. The Contractor shall be responsible for any damage by paint or dirt caused by his operations to vehicles or property or injury to persons and he will be required to provide protective measures to prevent any such damage or injury and make good, where required, at his own expense.

If passing traffic creates dust which may harm or spoil the appearance of external painted surfaces, the Contractor shall sprinkle the adjacent areas with water, at his own cost, for a sufficient distance on each side of the location where painting is being done.

Undercoats shall be tinted by the manufacturer to distinguish between successive coats.

The final coats or finishing coats of paint shall be applied after all the other work in the vicinity has been completed.

The painter shall keep some of the final paint in reserve in the event of his having to make good any patching which may be required as a result of damage or unforeseen circumstances.

Upon completion, the Contractor shall, in the case of buildings, clean all glass, remove all paint spots from walls, floors and fittings, and leave the premises clean and fit for occupation.

All inflammable materials, comprising solvents, thinners, wiping cloths, etc, shall be placed in tightly closed containers and properly disposed of.

9.5 PAINTING OF PLASTER, CONCRETE OR BRICK SURFACES**9.5.1 Surface preparation**

Surfaces for painting shall be prepared by sandpapering, scraping or wire-brushing to remove loose material, dust, laitance, scum or other deleterious materials or high spots. Defective areas shall be cut out where necessary and made good with an approved non-shrink filler. Cracks shall be cut out, suitably keyed, and given a coat of an approved bonding agent before the filler is applied. All patches shall be rubbed down to an even surface. Surfaces shall be washed and allowed to dry.

Surfaces shall be treated with neutralising liquid for walls, and if the surface is coarse or textured, either one full coat of pigmented wall sealer or one full filler coat shall be applied in addition to the neutralising liquid.

9.5.2 Paint application

Prior to the emulsion paint being applied, the surface shall be sealed with an approved clear sealer and primed with an undercoat diluted to 50%. Emulsion paint (PVA or acrylic) shall then be applied in two finishing coats.

Egg-shell finish (alkyd oil-based), oil gloss paint or enamel gloss paint shall be applied as follows: one coat of universal undercoat shall be applied and it shall be followed by one coat of a mixture comprising 50% of the undercoat and 50% of the paint to be used for the finishing coat. A finishing coat of semi-gloss egg-shell, or oil gloss paint or enamel gloss paint shall then be applied.

9.6 PAINTING OF WOODWORK**9.6.1 Surface preparation**

The surfaces shall be cleaned, sandpapered and rubbed down to a smooth, even face before painting. The moisture content of the timber shall not be more than 20% at the time when the first coat is applied. All cracks, shakes or scars shall be filled flush with a filler approved by the Engineer before painting. The surface shall then be washed with cleaner and allowed to dry.

9.6.2 Primer application

One coat of an approved wood primer shall be applied.

After timber has been prepared and primed, stopping and filling shall be done in accordance with SANS 10305-2, followed by sanding the stopped and filled areas with a fine-grit sandpaper to smooth the surface. Careful attention shall be paid to stopping and sealing rough, open-textured or coarse grained surfaces, and sealing joints, that may lead to water ingress, with a flexible sealer. Stopper/filler/sealer manufacturer's instructions should be strictly followed.

All new woodwork shall be properly primed on all surfaces and edges before being fixed in position. All woodwork not previously painted shall be given a prime coat, well brushed in.

9.6.3 Paint application

One coat of universal undercoat shall be applied followed by one coat of a mixture of 50% of the undercoat and 50% of the paint to be used for the finishing coat. A finishing coat of

oil gloss paint or enamel gloss paint or semi-gloss egg-shell (alkyd oil-based) paint shall then be applied.

9.6.4 Varnish finish

Two coats of gloss varnish or egg-shell varnish shall be prepared, stopped and applied.

9.7 PAINTING OF METAL SURFACES

9.7.1 General

Wherever possible, all painting shall be done at the manufacturer's works, but where this is not feasible, the Engineer may permit the application of the undercoat and finishing coats to be carried out on the Site, in which case a prime coat shall be applied at the manufacturer's works prior to the members being despatched to the Works.

9.7.2 Surface preparation

The preparation of metal surfaces shall comply with SABS Code of Practice 064 and shall receive the greatest care to ensure rust-free conditions prior to the paint system being applied.

All surfaces shall be prepared by removing loose paint, rust, plaster, scale, dust, dirt, grease, etc and by repairing or patching defective paint surfaces before painting or repainting. Damaged shop-primed surfaces shall be thoroughly cleaned of rust and patched with a prime coat.

9.7.3 Paint application

a) Iron and steel work

All iron and steel work shall be properly primed with a red-lead-based primer where steel work is likely to be exposed to the elements for longer than 30 days. Zinc-chromate primer may be used where overpainting will be completed within 30 days of priming. Metal-etch wash primers may be used under dry conditions where overpainting will be completed within 24 hours of priming. The dry-film thickness of the prime coat shall not be less than 0,300 mm.

After priming, one coat of universal undercoat shall be applied. If necessary, the undercoat shall be tinted to a shade just lighter than the desired finish with approved liquid stainers. The dry-film thickness shall not be less than 0,250 mm.

The two finishing coats shall either be of alkyd resin-based synthetic enamel, gloss or matt oil paint, or as specified elsewhere. The dry-film thickness shall not be less than 0,250 mm per coat.

When mating surfaces are brought together, both surfaces shall have been given the full treatment specified, but where this cannot be done, each surface shall be given a copious coating of primer and the surfaces drawn together while the paint is still wet.

The portion of structural steel members to be buried in soil, and all bases to a height of 500 mm shall be given two coats of an epoxy-tar primer instead of the zinc-chromate primer specified for other surfaces.

The surfaces of steel and cast-iron articles, such as floor gratings, grids and manhole covers, shall, after a thorough brushing to remove loose rust, be painted with two coats of epoxy-tar paint, each at least 0,230 mm thick.

b) Galvanized iron and steel

All traces of protective coating shall be removed with galvanized iron cleaner, and two coats of calcium plumbate primer shall be applied. One coat of tinted universal undercoat and two finishing coats of alkyd resin-based synthetic enamel gloss paint shall be applied.

c) Non-ferrous metals

Surfaces of aluminium, copper, etc shall be prepared and cleaned, and one coat of self-etch zinc-chromate wash primer shall be applied. One coat of universal tinted undercoat and two finishing coats of enamel gloss paint shall then be applied. Where non-ferrous metals are not to be painted, the surfaces shall be cleaned, polished and two coats of lacquer applied.

9.8 PAINTING OF FLOOR SCREEDS

Where chemicals could cause damage to floors or where specified, such floors shall, unless otherwise indicated, be painted with an approved epoxy paint. The type of paint to be used will be shown on the Drawings and will depend on the types of chemical that are used.

The preparation of such floor screeds for painting and the subsequent application of paints shall be carried out strictly in accordance with the manufacturer's instructions.

9.9 PAINT THICKNESS

Unless otherwise specified, all coats of paint, whether prime coat, undercoat or finishing coat, shall have a dry-film thickness of not less than 0,200 mm, irrespective of the method of application.

9.10 INSPECTION

The Contractor shall provide the necessary equipment to establish whether the primers, undercoats and finishing coats have been applied to the correct thickness according to the correct applications. The Engineer may take samples of the paints during painting operations for testing and quality control.

10. MEASUREMENT AND PAYMENT

10.1 BRICKWORK

- (1) (Indication of thickness, type, class, and if plastering and painting is required)..... Unit: m²
- (2) Etc for other thicknesses, types, classes and plastering, painting requirements.

The unit of measurement shall generally be the square metre of each type of brickwork built, calculated from the leading dimensions of the brickwork. Deductions will be made for doors, windows and other openings of similar dimensions. At corners and intersections common to more than one brick wall, the areas shall be measured only once.

The tendered rates shall include full compensation for the construction of the brickwork complete as specified, including pointing, lintels, weepholes, waterproofing to cavity walls (i.e. sloping infill adjacent weepholes with damp-proof course or torch-on etc.), expansion/control joints, masonry-to-concrete joints, wall ties, brickforce reinforcement, the raking-out of joints, etc., and, when scheduled, shall also include plasterwork, facings, paintwork, concrete infill, etc. The rates shall further include the building-in of pipework, conduits, sleeves, doors, windows, etc. The reference panel shall not be measured or paid for separately but shall be deemed to be included in the brickwork rates.

10.2 PLASTERWORK

- (1) (Thickness of plaster and finish indicated)..... Unit: m²
- (2) Etc for other thicknesses and finishes

The unit of measurement shall be the square metre of each type of coat completed as specified.

The tendered rates shall include full compensation for the construction of the plasterwork, including supplying all materials, mixing, applying, finishing, forming reveals, joints, narrow widths, rounded angles, V-joints, etc complete as specified.

Where brickwork is scheduled to include plasterwork (i.e. plasterwork is to be included in the brickwork rate, see 10.1), then plasterwork will not also be measured here.

Note: Where brickwork is scheduled to include plasterwork (i.e. plasterwork is to be included in the brickwork rate (see 10.1), then plasterwork will not also be measured here. Other rates may similarly also include plasterwork, in which case plasterwork will not also be measured here.

10.3 ROOF FINISHES

- (1) Roof screed (fall and avg. thickness if applicable)..... Unit: m²
- (2) Crushed stone to roof slab (avg. thickness if applicable). Unit: m²
- (3) Torch-on Waterproofing (description as applicable). Unit: m²
- (4) Etc Unit: m²

The unit of measurement shall be the square metre of roof finish applied, as specified, on areas shown on the Drawings or as designated by the Engineer.

Different roof finishes shall be scheduled separately. The tendered rates shall include full compensation for constructing and completing the roof finish, including supplying all materials, mixing, laying, placing finishing, curing and forming joints and edges, etc.

Floor screeds and finishes shall not be measured here but under the relevant Subclause of SANS 1200 G.

10.4 DOORS, WINDOWS, LOUVRES, ETC.

- (1) (Type and size indicated)..... Unit: number
- (2) Etc for other types and sizes

The unit of measurement shall be the number of doors, windows and louvres installed complete as specified.

The tendered rates shall include full compensation for manufacturing and installing the door, window and louvre, complete, whether of wood, steel, aluminium or other materials. The rate shall include the frames, hinges, handles, locks, keys, barrel bolts, door closers, retaining devices, door stops, stays and any other work or ironmongery necessary to complete the work as specified or as shown on the Drawings. The tendered rate for doors, windows, louvres, etc. shall further include full compensation for any coatings/finish required (oiling, staining, varnishing, painting, calking, sealing, etc.), corrosion protection, glazing, window sills (unless scheduled separately), thresholds as specified and all necessary subframes.

10.5 CEILINGS AND BULKHEADS

- (1) Plaster-board ceiling (type and thickness indicated):

- a) Fixed ceiling Unit: m²
- b) Suspended ceiling..... Unit: m²
- (2) Fibre-cement ceiling (thickness indicated):
 - a) Fixed ceiling Unit: m²
 - b) Suspended ceiling..... Unit: m²
- (3) Etc for other types of ceilings
- (4) Bulkheads (description of material and indication of vertical or horizontal)..... Unit: m²
- (5) Cornices (description)Unit: m

The unit of measurement shall be the square metre of fixed or suspended ceiling or bulkheads installed complete as scheduled. The unit of measurement for cornices shall be linear metre.

The tendered rates shall include full compensation for the construction of the ceilings, bulkheads and cornices as scheduled. The rate shall also include for, as applicable and not limited to, the exposed tees, grids, frameworks, hangers, trap doors, taping and filling joints, skimming, painting, insulation blanket and brandering as specified, as well as the suspension system where applicable.

10.6 CARPENTRY AND JOINERY

- (1) Cupboards and countertops (details indicated)
- (2) Skirtings (details indicated)
- (3) Timber flooring, complete with supports (details indicated)
- (4) Shower/toilet cubicles (details indicated)
- (5) Timber roof structure (details indicated)
- (6) Etc for other items

The unit of measurement shall be as scheduled.

The tendered rates shall include full compensation for supplying all materials, and manufacturing, cutting, wasting, applying the required finish (i.e. painting, varnishing, etc.), fixing, building-in and installing the items, and shall include all required fasteners, clips, tie-downs and straps, etc. Tendered rates shall also include for all ancillaries and accessories specified, such as specified ironmongery, granite tabletops, glass viewing panels in cupboard doors, etc.

Timber flooring shall be measured as the total area covered by the timber flooring panels (excluding areas covered by the MCC or VFCs). The rate for timber flooring shall further include the cost of supplying the specified or scheduled steel top hat sections (unfixed), angle support frames (including added flat bars where required) and neoprene strips as indicated on the drawings and the cost of all fixings, installing, fixing, grouting/casting in, etc. The rate shall further include for the production of shop drawings/details for the steel items (where required), all procurement costs, fabrication, cutting, welding, corrosion protection (such as galvanizing and painting) as specified, transportation and erection, all plant, labour and materials (including fasteners) necessary for proper completion of the flooring, support frames, top hat sections, etc.

10.7 MISCELLANEOUS

- (1) Plumbing
- (2) Etc

The unit of measurement shall be as scheduled.

The tendered sums or rates shall cover all costs required to complete the work and activities as scheduled and specified, and are to include for items and activities ancillary to the work. This shall, for example, include full compensation for the supply of all materials (including anchor fasteners and corrosion protection), manufacturing/providing, delivery to site, storage, all equipment and plant, labour, preparation, application, installation, applying finishes, testing, all temporary work and safety precautions, replacement of defective work, protection of completed work and clean-up after completion.

Note: Where brickwork is scheduled to include paintwork (i.e. paintwork is to be included in the brickwork rate (see 10.1), then paintwork will not also be measured here. Other rates such as ceilings and bulkheads may similarly also include paintwork, in which case paintwork will not also be measured here.

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1 SCOPE

In order to be able to construct the abstraction works in the dry, it will be necessary for the Contractor to provide temporary works to divert part of the river flow away from the abstraction works construction. The design, construction, maintenance and subsequent removal of these temporary works, are entirely the Contractor's responsibility, including any risk of failure or damage due to excessive flooding or weather conditions, or for any other reason. The temporary works may take the form of a cofferdam or similar type facility.

This specification provides information and certain requirements to guide the Contractor in meeting his obligations with respect to the river diversion works.

The hydrology and hydraulic information provided in the sections below are not in any way guaranteed and are only provided for the Contractor's guidance should he choose to use it. The Contractor shall satisfy himself as to the reliability of this information and accept any risks associated with any discrepancies or any data shown to be incorrect, as may occur.

2 HYDROLOGY

Data from a Department of Water and Sanitation (DWS) gauging station (T3H006), located approximately 33 km downstream of the abstraction works on the Tsitsa River, are illustrated graphically in Figure 1. The data extends from 1 June 2003 to 29 April 2023, and indicate larger river flows to generally occur during summer. Lower flows are historically expected between the months of July and October. Detailed data are available from DWS.

Determination of the likely occurrence of flood peaks at the river abstraction works site were based on the Unit Hydrograph method. The resultant estimated flood peaks for different annual exceedance probabilities (AEPs) are provided in Table 1.

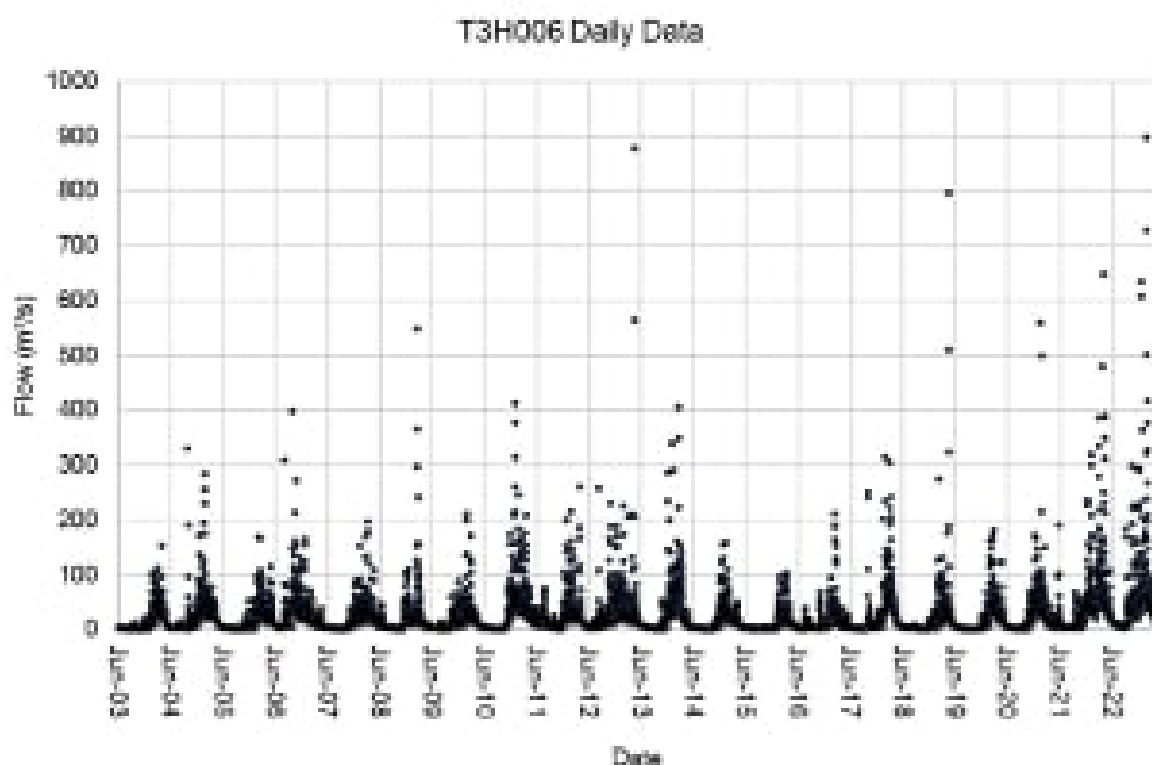


Figure 1: T3H006 flow measurement data

Table 1: Estimated Flood peaks in the river at the abstraction works site

Exceedance probability	Flood peak (m³/s)
20% (1 in 5-year flood)	1 044
10% (1 in 10-year flood)	1 372
5% (1 in 20-year flood)	1 758

3 HYDRAULICS

Preliminary river flow modelling was undertaken at the abstraction works site, to estimate river water levels for floods having different AEPs. These are shown in Figure 2 and are based on the survey undertaken in 2022. A typical cross section is shown in Figure 3.

While the provision of the river diversion temporary works is the Contractor's responsibility, one option could include the provision of a pioneer platform or cofferdam protruding into the river. In order to estimate the effect of this protrusion on river water levels, further modelling was undertaken. The results of this are shown in Figure 4, and a typical cross section in Figure 5. These levels would vary according to the extent of protrusion into the river, which in turn would depend on the Contractor's design.

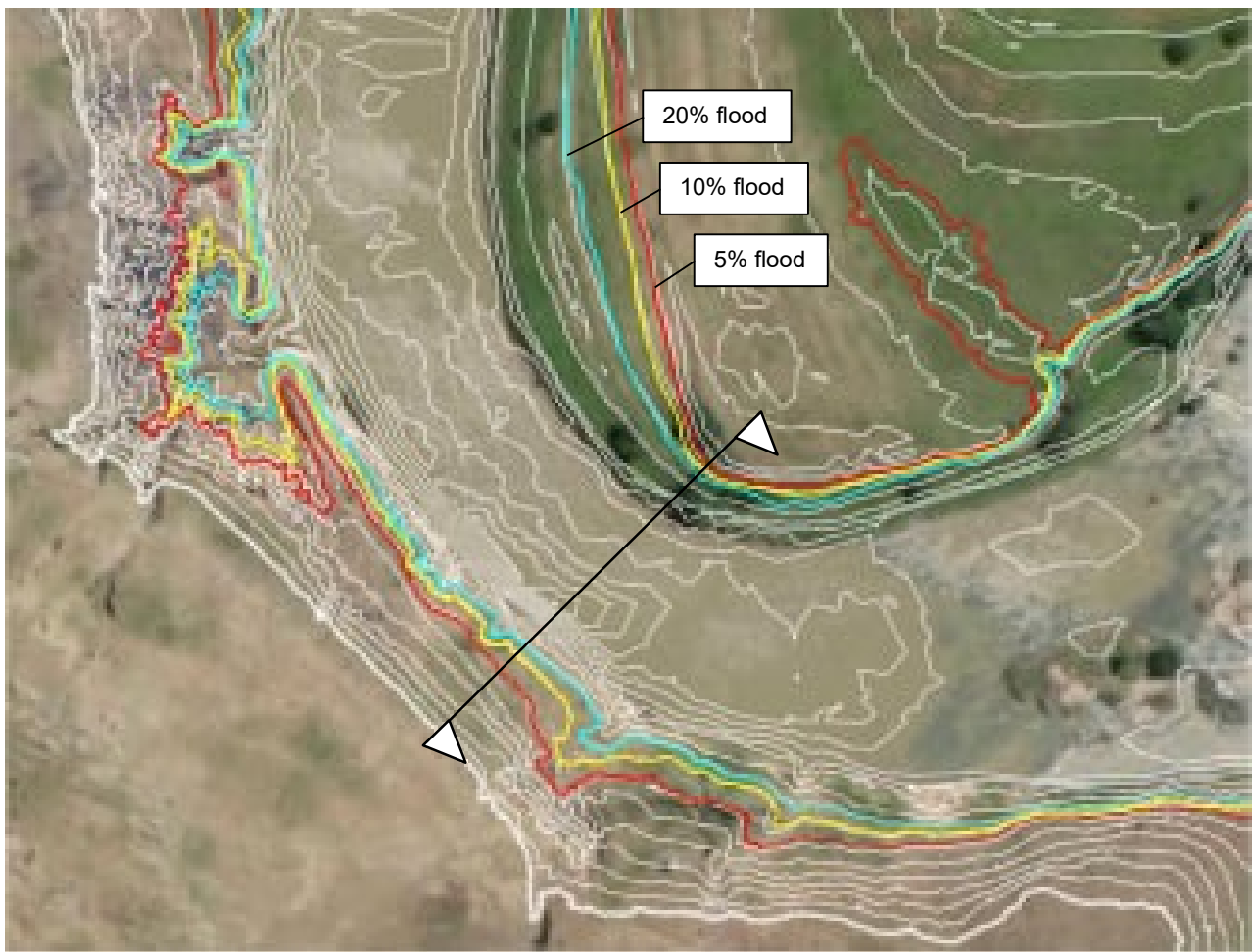


Figure 2: Flood line modelling without river diversion works

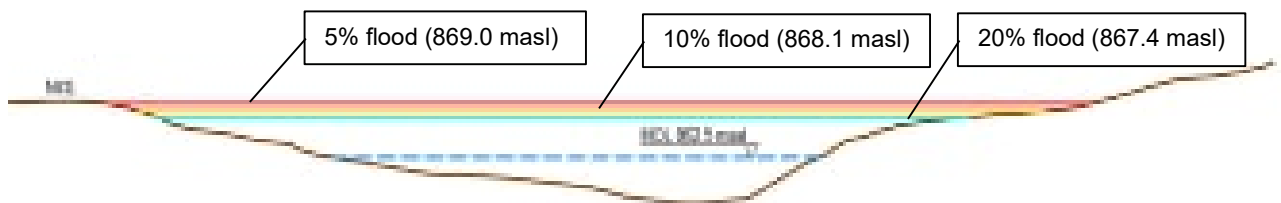


Figure 3: Flood line cross-section (refer Figure 2)

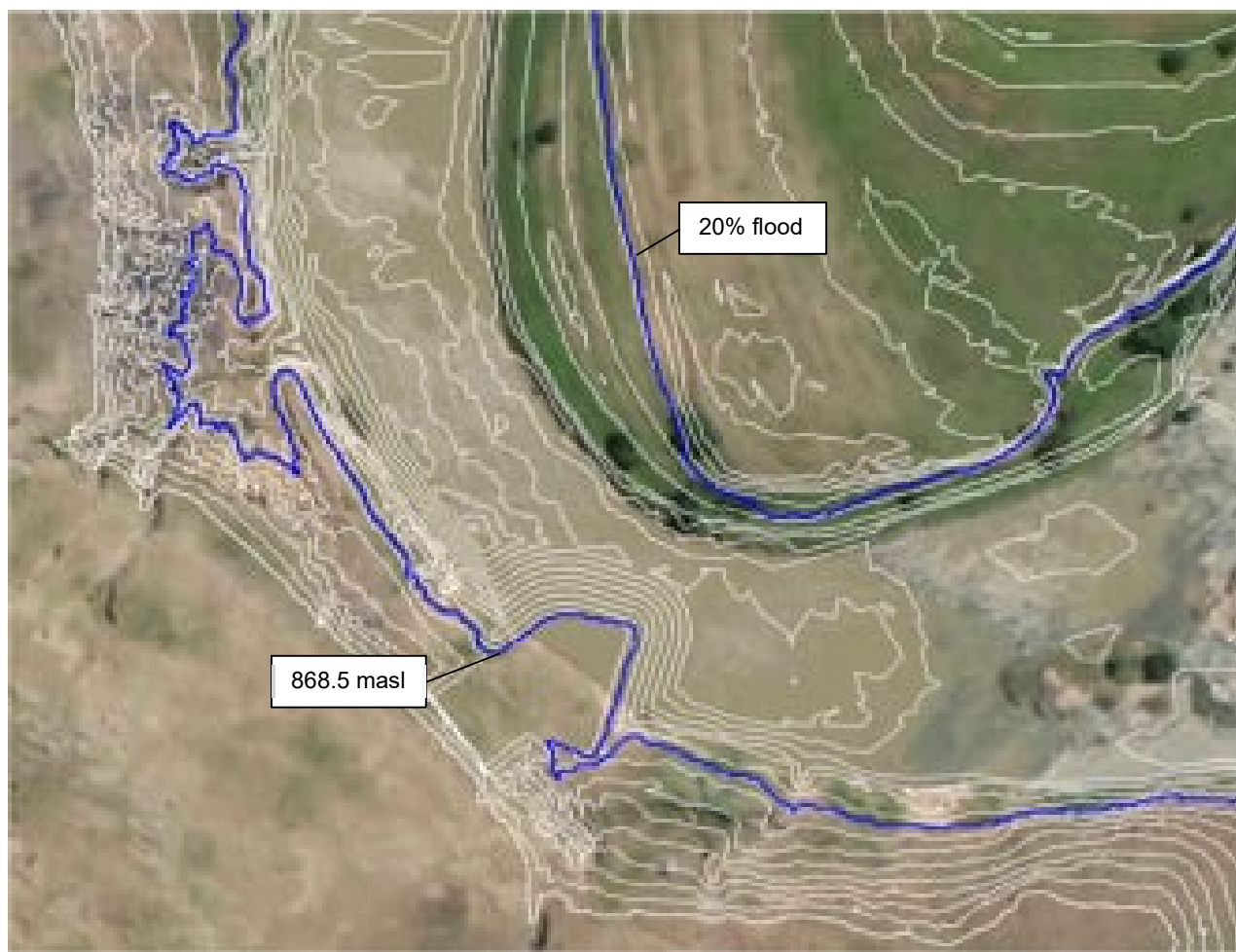


Figure 4: 20% AEP flood line modelling result with river diversion works

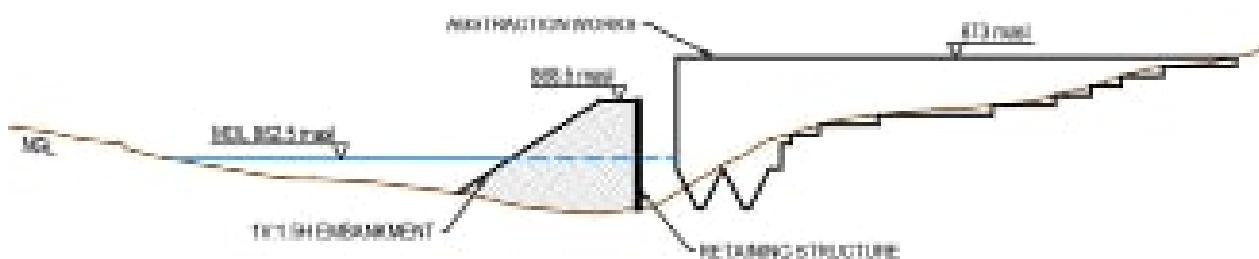


Figure 5: Section of possible temporary works

4 MATERIALS

All material to be used to divert the river should be of adequate quality to ensure that the temporary works remains in place, and suitably resistant against flooding and erosion. The earth or rock material to be used shall be sourced from other excavations on site or from a designated stockpile. At the completion of the abstraction works, all materials used, which is not suitable for any required backfilling, shall be removed and disposed of, earth and rock materials at a designated stockpile or dump site.

5 CONSTRUCTION

The temporary river diversion works shall be constructed in the Tsitsa River to facilitate construction of the permanent abstraction works in the dry, to ensure lateral stability of, or to retain surrounding material, and to protect the work under construction against flooding.

The Contractor shall have adequate pumping capacity to deal with all leakage through the river diversion works, and any other seepage, to ensure dry working conditions for the abstraction works construction.

At no time during the construction period shall the flow in the river be cut off.

The Contractor shall be responsible for the detailed design of the river diversion works, which shall be submitted for approval by the Employer's Agent. Such approval will not relieve the Contractor of his responsibility for the temporary works and all associated risks.

The construction of the river diversion works shall commence and be executed strictly in accordance with the Contractor's approved programme and upon obtaining written permission from the Employer's Agent to do so. The Contractor shall provide the method statement(s) to the Employer's Agent for approval at least 14 days prior to the planned commencement of this activity.

Where the river diversion works are not to be of earth- rockfill type, and rather of structural infrastructure, the diversion works shall be adequately braced, weighted, and anchored, and shall be as watertight as may be practicable.

No shoring of any part of the river diversion works against the permanent structure will be allowed until the concrete has reached a strength of 70% of the specified 28-day compressive strength and the method has been approved by the Employer's Agent.

The Contractor shall be responsible for preventing the ingress of water into the abstraction works foundation excavations. The preventative measures shall ensure that the foundation excavations are dewatered sufficiently to allow the necessary construction operations to be properly executed.

6 MEASUREMENT & PAYMENT

6.1 BASIC PRINCIPLES

Works designed by the Employer include the excavation for and the construction of the reinforced concrete foundation and wingwall, and the abstraction works structure itself, and backfilling as required, all which will form part of the permanent works. These items will be to the Employer's design, measured and paid for under the relevant sections.

Temporary works, designed, constructed, maintained and removed by the Contractor, shall be approved by the Employer's Agent and include the river diversion works and all necessary dewatering, and shall be paid for as indicated in Clause 6.2 below.

6.2 SCHEDULED ITEMS

The terms of SANS 1200 A shall apply, with the fixed-charge items scheduled under SANS 1200 A as Subclauses 8.3.10 and 8.3.11, and the time-related item scheduled under SANS 1200 A as Subclause 8.4.11.

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1 SCOPE

This is a Particular Specification and covers the construction of retaining structures by means of proprietary or custom-built precast concrete block retaining systems such as Löffelstein, Enviro-wall, Terraforce, etc.

2 INTERPRETATION

2.1 SUPPORTING DOCUMENTS

The following specifications, shall, inter alia, be applied together with this Specification:

- a) Project Specifications;
- b) SANS 1200 and applicable Amendments;

The construction details are presented on the Project Drawings.

3 DEFINITIONS AND ABBREVIATIONS

For the purposes of this Specifications the definitions and abbreviations given in the applicable Specifications listed in 2.1 shall apply.

4 REQUIREMENTS

4.1 MATERIALS

4.1.1 GENERAL

All materials used in constructing the retaining systems, as well as all precast units of proprietary or custom-built retaining systems shall be subject to the approval of the Employer's Agent.

When requested by the Employer's Agent, the contractor shall submit test certificates from an approved independent testing authority to show that the respective materials comply with the specified requirements, or certificates from the patent holders or licensees certifying that the manufactured items comply in all respects with the relevant product specifications.

4.1.2 CONCRETE BASES FOR EARTH RETAINING STRUCTURES

All materials for concrete bases for earth retaining systems shall comply with the relevant requirements of SABS 1200 G.

4.1.3 PRECAST CONCRETE BLOCKS

The precast concrete blocks shall be of the type shown on the drawings or specified in the project specifications, or it shall be an approved alternative type. The blocks shall be uniform of colour and durable and shall not react with soil. All materials for precast concrete blocks shall comply with the relevant requirements of SABS 1200 GE.

4.1.4 BACKFILL MATERIAL

The backfill material shall be approved granular material, unless otherwise specified in the project specifications or on the drawings.

4.2 CONSTRUCTION

4.2.1 EXCAVATIONS

All excavations for the bases of the earth retaining systems shall be done in accordance with the provisions of SABS 1200 D. The contractor shall not commence with the construction of the bases before the excavations have been properly cleaned by the contractor and inspected and approved by the Employer's Agent

4.2.2 BASES

The bases for the earth retaining systems shall be of the type or types shown on the drawings or specified in the project specifications.

The provisions of SABS 1200 G shall apply to the construction of concrete bases. The bases shall be constructed in accordance with the dimensions and levels shown on the drawings.

No precast concrete blocks shall be installed until the engineer has inspected and approved in writing the completed bases.

4.2.3 INSTALLING THE PRECAST CONCRETE BLOCKS

The precast concrete blocks shall be installed on the completed bases in accordance with the specifications of the patent holders or the licensees and in accordance with the lines, levels and angles of inclination shown on the drawings, or with the variations ordered in writing by the Employer's Agent.

5 TOLERANCES

5.1.1 PATENT RIGHTS

The contractor shall negotiate directly with the patent holders or licensees in connection with royalties payable for the use of the patented systems. The contractor shall arrange for technical assistance by the patent holders or licensees before and during construction.

6 MEASUREMENT AND PAYMENT

6.1 BILLED ITEMS

6.1.1 Patented earth retaining systems:

- | | |
|--|----------------------|
| (i) Löffelstein precast concrete blocks of type (State Type) | Unit: m ² |
| (ii) Enviro-wall precast concrete blocks of type (State Type) | Unit: m ² |
| (iii) Terraforce precast concrete blocks of type (State Type) | Unit: m ² |
| (iv) Etc. for other patented earth retaining systems and other types of blocks | Unit: m ² |

The unit of measurement shall be the square metre of the front vertical face of the earth retaining system placed in position as shown on the drawings. The front vertical face shall be measured from the top of the base to the top of the earth retaining system.

The tendered rate shall include full compensation for procuring, furnishing, transporting, handling, and placing all materials and precast concrete blocks, including the specified backfill material between the blocks, compacted fill and/or drainage material behind the blocks (20mm stone), Geotextile material as well as geogrids and any additional costs required for placing the blocks in position complete as specified.

6.1.2 Excavation for concrete bases for earth retaining systems:

- | | |
|--|----------------------|
| (i) In soft material | Unit: m ³ |
| (ii) Extra over subitem (a) above for excavation in hard material | Unit: No |
| (iii) Base preparation and compaction to minimum of 90% of modified AASHTO MDD | Unit: m ² |

6.1.3 Concrete bases for earth retaining systems:

- | | |
|---|----------------------|
| (i) Class 20MPa/20 concrete footings including formwork and 80 kg/m ³ of reinforcement,
to manufacture's detail | Unit: m ³ |
|---|----------------------|

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1 SCOPE

This is a Particular Specification and covers the erection of new fences.

Where specified on the drawings, the fence type will be installed as per typical details included in the drawings set. A similar product may be presented to the Employer's Agent for approval. The fence will be a proprietary product and shall be installed according to the manufacturer's specifications and drawings. The contractor shall provide details of the proposed proprietary product they intend to use for approval by the Employer's Agent and architect. Installation must be done by a contractor or subcontractor that is approved by the fence manufacturer.

Interpretations and variations of this Specification are set out in the Specification Data.

2 NORMATIVE REFERENCES

2.1 SUPPORTING SPECIFICATIONS

Where this specification is required for a project, the following specifications shall, inter alia, form part of the Contract Document:

- a) Specification Data;
- b) SANS 1200 Series of Standardized Specifications
 - a. SANS 1200 G or SANS 1200 GA, as applicable; and
- c) Standards listed in Appendix A .

3 DEFINITIONS AND ABBREVIATIONS

For the purposes of this Specifications the definitions and abbreviations given in the applicable Specifications listed in 2.1 shall apply.

4 REQUIREMENTS

4.1 MATERIALS

4.1.1 POSTS, STAYS AND STANDARDS

Posts, stays and standards shall be of the type and size indicated on the Drawings. Posts shall include gate posts, straining posts and corner posts.

Metal posts, stays and standards shall comply with the requirements of CKS 82 and SABS 280. "Acceptable" in CKS 82 means "acceptable to the Employer".

Tubular posts, standards and stays shall be galvanized in accordance with SABS ISO 1461:1999 Table 1 for type B articles. All rail and Y-sections shall be provided with a protective coating of tar or other approved material.

4.1.2 BOLTS FOR STAYS

Bolts shall be of mild steel and galvanized in accordance with SABS ISO 1461:1999 Table 1 for type C articles. The length and diameter of the bolts shall be as shown on the Drawings. All the necessary bolts, together with nuts and washers, shall be supplied with each post.

4.1.3 GATES

Gates shall comply with the requirements of CKS 146 and shall be manufactured to the dimensions shown on the Drawings or as per manufacturer's specifications where a proprietary product is used.

Gates shall be complete in every respect, and shall include hinges, washers, bolts, and the locking mechanism shown on the Drawings.

4.2 CLEARING FENCE LINE

Strip clearing for the fence shall be carried out in accordance with SABS 1200 C and will be measured and paid for under Section 1200 C of the Schedule of Quantities.

4.3 VOID

4.4 METHODS AND PROCEDURES

4.4.1 INSTALLING POSTS AND STANDARDS

Straining posts shall be erected at all ends, corners, and bends in the line of fencing and at all junctions with other fences. Straining posts shall not be spaced further apart than shown on the Drawings. The height of the posts above the ground shall be such that the correct clearance between the lowest wire and the ground can be obtained. Posts shall be accurately set in holes and, where indicated, shall be provided with concrete bases to the dimensions shown on the Drawings.

Holes shall be dug to the full specified depth. Where, due to the presence of rock, the holes cannot be excavated by hand or by pneumatic tools and the Contractor has to resort to the use of explosives, he will be paid separately for the drilling and blasting operations required.

Corner, gate, end, and straining posts shall be braced by means of stays or anchors, as shown on the Drawings. Pipe stays shall be bolted to the posts. Gate posts shall not be used as straining posts, but at each gate post a straining post shall be placed as shown on the Drawings and stayed by means of an anchor consisting of six strands of wire.

Standards shall be firmly planted in the ground at the spacing shown on the Drawings or as directed by the Employer's Agent. The spacing of standards between any two straining posts shall be uniform. In rock or hard material standards shall either be driven or set in holes drilled into the rock. The size of drilled holes shall be such that a tight fit is obtained. Care shall be taken not to buckle or damage the standards when driven. Where indicated, standards shall be provided with concrete bases to the dimensions shown on the Drawings.

All posts and standards shall be accurately aligned and set plumb and shall be planted with the overhang as shown on the Drawings and at right angles to the direction of the fence. After posts and standards have been firmly set in accordance with the foregoing requirements, the fencing wire shall be attached thereto as described below.

4.4.2 CLOSING OPENINGS UNDER FENCES

At ditches, streams, drainage channels or other hollows where the fence cannot follow the general ground contour, the Contractor shall close the opening under the fence by means of horizontal barbed wires 150 mm apart and stretched between additional straining posts as shown on the Drawings. The opening shall be covered with strips of diamond mesh, 1 000 mm wide, fixed to the barbed wires.

In the case of larger streams, the opening below the lower fencing wire shall be closed by means of loose-hanging wire nets as shown on the Drawings. These nets shall be erected at streams only on the instructions of the Employer's Agent.

4.4.3 INSTALLING GATES

Gates shall be installed at the positions indicated on the Drawings or pointed out on Site. The gates shall be hung on gate fittings in accordance with the details shown on the Drawings or as per manufacturer's specifications. Gates installed on existing fences shall match the existing fence and gates. Gates shall be so erected that they swing in a horizontal plane at right angles to the gate posts and clear of the ground in all positions. Double swing gates shall close to have a gap of not more than 25 mm between them, and other gates shall close to be no further than 25 mm from the gate post.

5 COMPLIANCE WITH REQUIREMENTS

5.1 GENERAL REQUIREMENTS AND TOLERANCES

The completed fences shall be plumb, taut, true to line and to the ground contour, and with all posts, standards and stays firmly set.

The height of the lower fencing wire above the ground at posts and standards shall not vary by more than 25 mm from that shown on the Drawings. Other fencing wires shall not vary by more than 10 mm from their prescribed relative vertical positions.

Anchoring of a fence to structures shall be done as shown on the Drawings. The Contractor shall, on completion of each section of fence, remove all cut-offs and other loose wire or mesh so as to leave the fence with a neat and finished appearance.

6 VOID

7 VOID

8 MEASUREMENT AND PAYMENT

8.1 BILLED ITEMS

- 8.1.1 Supply and install complete fencing panels to specification, including all required material, excavations, concrete, etc.:.....Unit: metre (m)**
- 8.1.2 Supply and install new gates.: Unit: No**

APPENDIX A : APPLICABLE STANDARDS

Reference is made to the latest issue of the following standards:

CKS 451	Anti-intruder fences
SANS 62	Steel pipes Part 1 Pipes suitable for threading and of nominal size not exceeding 150 mm Part 2 Screwed pieces and pipe fittings of nominal size not exceeding 150 mm.
SANS 675	Zinc-coated fencing wire (plain and barbed)
SANS 935	Hot-dip (galvanizrd) zinc coatings on steel wire
SANS 1024	Welded steel fabric for reinforcement of concrete
SANS 1373	Chain-link fencing and its wire accessories
SANS 1533	Padlocks
SANS 1700	Fasteners
SANS 3575	Continuous hot-dip zinc-coated carbon steel sheet of commercial, lock forming and drawing qualities
SANS 1200 A	Standardized Specification for Civil Engineering Construction: Section A: General
SANS 1200 AA	Standardized Specification for Civil Engineering Construction: Section AA: General (Small Works)
SANS 1200 G	Standardized Specification for Civil Engineering Construction: Section G: Concrete (Structural)
SANS 1200 GA	Standardized Specification for Civil Engineering Construction: Section GA: Concrete (Small Works)
AISI 304	
USA Military Specification MIL B 52489	

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1. SCOPE

This Specification covers the laying and jointing of electrically welded low carbon steel pipes and specials of diameter up to 2 280 mm, for transporting water and sewage under working pressures of up to 2,5 MPa.

This Specification shall be read in conjunction with Specifications ZUT 7001 and ZUT 7002.

This Specification contains clauses that are generally applicable to the laying and jointing of medium-pressure steel pipes and specials. Interpretations and variations of this specification are set out in the Amendments preceding this Specification.

2. NORMATIVE REFERENCES

2.1 SUPPORTING SPECIFICATIONS

Where this Specification is required for a project, the following specifications shall, inter alia, form part of the Contract Document:

- a) Amendments;
- b) Specification ZUT 7002 : Manufacture of medium-pressure steel pipes;
- c) Specification ZUT 7001 : Design and manufacture of medium-pressure steel specials;
- d) Valves specifications
- e) Flow meter specifications
- f) Specification ZUT 0003 : General corrosion protection for pipelines, water and wastewater works; and
- g) Standards listed in Appendix A.

3. DEFINITIONS AND ABBREVIATIONS

For the purposes of this Specification the definitions and abbreviations given in the specifications listed in 2.1 shall apply.

4. REQUIREMENTS

4.1 MATERIALS

4.1.1 General

Refer to Subclause 4.1.1 of ZUT 7001 and Subclause 4.1.1 of ZUT 7002.

Pipes and fittings shall be of the types specified in the Bill of Quantities or in the project specification and, unless otherwise required in terms of the project specification, they and their couplings shall be capable of withstanding the applicable test pressure specified in the Amendments. All pipes and fittings shall be supplied complete with couplings and jointing material.

Satisfactory temporary end covers shall be provided for the protection of threads, flanges, and prepared ends of plain-ended pipes and fittings, and to prevent damage to internal lining during transportation and during handling on Site.

4.1.2 Flanges

Refer to Subclauses 4.1.3 and 4.3.2 of ZUT 7001 and Subclauses 4.1.2 and 4.2.5 of ZUT 7002.

4.1.3 Insulating flanges

Refer to Subclause 4.3.3 of ZUT 7001.

4.1.4 Gaskets

Refer to Subclause 4.3.5 of ZUT 7001.

4.1.5 Bolts, nuts and washers

Refer to Subclause 4.3.6 of ZUT 7001.

4.1.6 Bricks

Bricks shall be obtained from an approved manufacturer and shall be either general purpose (special), burnt clay, or engineering bricks that comply with the applicable requirements of SANS 227, or Class S14 calcium silicate bricks that comply with the applicable requirements of SANS 285.

The Contractor shall submit to the Engineer samples of the bricks he intends using in the construction of the Works. The samples of bricks that are approved will be retained by the Engineer.

4.1.7 Precast cylinders

Precast cylinders may be of spun concrete, glass reinforced polyester, or PVC, except where particular materials are required in terms of the Bill of Quantities or the project specification. Precast concrete cylinders shall comply with the applicable requirements of SANS 1294. Sectional spun concrete cylinders shall comply with the requirements for pipes of SC type, Class A, of SANS 677. Jointing between cylinders shall be of the interlocking self-centring type suitable for sealing.

4.1.8 Concrete

Concrete shall comply with the requirements of SANS 1200 G or SANS 1200 GA, as applicable.

4.1.9 Welding rods

The Contractor shall supply all the necessary welding electrodes, which shall be of the shielded type. The chemical composition of weld metal and parent metal shall be similar. Electrodes that show signs of deterioration or damage shall be removed from Site and replaced at the Contractor's expense. Electrodes shall comply with the requirements of BS 639.

4.1.10 Corrosion protection

Refer to Specification ZUT 0003.

4.1.11 Records of materials on site

The Contractor shall keep and maintain a complete and comprehensive record of each pipe, special and fitting delivered to Site. The record shall at least denote the reference number, size, pressure class, location in the pipeline, date and condition of delivery and the location of delivery and the location of storage. Copies of the record shall be submitted to the Engineer at the end of each month or whenever requested by the Engineer.

Where pipes, specials and fittings are delivered without reference numbers, same shall be provided by stencilling, labelling or other methods approved by the Engineer.

4.2 PLANT

4.2.1 Packing

Goods shall be suitably packed in such a manner as will ensure safe and efficient transport by road or rail, and the Contractor shall include in his prices for whatever packing may be necessary in this respect. Small items particularly liable to damage or loss in transit should be crated. All crates and packing material shall, after use, become the property of the Employer, unless distinctly specified otherwise, or if returnable, shall be so at the Contractor's expense.

4.2.2 Handling and rigging

The plant and rigging equipment used by the Contractor for the handling and placing of pipes shall be such that no pipe shell is over-stressed during any operation covered by the specification.

4.2.3 Setting out

The Contractor may use any acceptable device, including one incorporating a laser beam, to control the alignment and laying of the pipeline.

4.2.4 Site equipment

The Contractor shall furnish all equipment, tools, and supplies, including the necessary welding electrodes. Welding machines shall be operated within the amperage and voltage ranges recommended for each size and type of electrode. Any equipment that does not meet these requirements shall be repaired or replaced upon request of the Engineer. (Refer also API 1104 Clause 1.3.)

4.2.5 Testing

The Contractor shall provide all equipment, materials, tools, and fittings required for the performance of the tests given in Clause 5.

4.3 METHODS AND PROCEDURES

4.3.1 Laying

4.3.1.1 General

The pipelines shall be laid and bedded to even grades and to the levels and alignments shown on the drawings or as directed. It shall be laid centrally in the trench in such a manner that the side allowance conforms to the applicable value specified in Clause 8 of SANS 1200 DB. For ease of inspection and testing the pipes shall be laid with the manufacturer's class and quality identification marks visible from the top of the trench, unless, in the case of large pipes, the position of lifting eyes render this impracticable.

Control of laying and bedding shall be by means of boning rods and sight rails or an acceptable laser beam device. Sight rails shall be painted black and white and shall be fixed securely and accurately.

4.3.1.2 Damage

Each pipe, pipe special and fitting shall be thoroughly cleaned and carefully examined for damage and defects prior to laying. Should any damaged or defective pipe, pipe special or fitting be laid, it shall be removed and replaced at the Contractor's expense and to the satisfaction of the Engineer.

During laying, the anti-corrosion lining of pipes being joined by butt welding shall be protected against damage by foot traffic or weld spatter, to the satisfaction of the Engineer and in the manner described in Clause 4.3.2.4.6.

4.3.1.3 Keeping pipelines clean

Every reasonable precaution shall be taken to prevent the entry of foreign matter and water into the pipe(s). At the close of each day's work, or at any time when work is suspended for a significant period, the last laid section of the pipeline shall be plugged, capped or otherwise tightly closed until laying is recommenced.

The interior of pipes shall be perfectly clean before being laid and the Engineer may instruct that the pipe interior be cleaned or washed before the pipes are lowered into the trench. All brushes, trowels, welding rod stumps, pieces of mortar, dust and all foreign matter shall be removed from pipes immediately before laying. Once a section of pipeline has been cleaned, it shall be sealed off and not be entered again unless permitted by the Engineer.

During laying and jointing of pipes and until the pipeline has passed the required acceptance tests and the trench has been backfilled, the trench shall be kept in a state which, in the opinion of the Engineer, is reasonably dry.

The Contractor shall at his own expense make good any damage to valves and fittings or clogging of off-takes or malfunctioning of fittings which result from his failure to keep the pipeline in a thoroughly clean condition.

4.3.1.4 Depths and cover

Unless otherwise specified in the Amendments, shown on the Drawings, or ordered by the Engineer, the minimum cover for pipelines shall be 1.0 m.

The minimum clearance between the outside of a pipeline being laid and the outside of any other pipe that it crosses shall be 300 mm. Where this requirement conflicts with the requirements for cover over the pipeline the Contractor shall ask the Engineer for written instructions and shall carry out the work in accordance with those instructions.

4.3.1.5 Cold stresses and deflection in pipe curvature

Pipes shall be laid free from cold stresses. No deflections shall be taken in curvature of pipes, but shall be taken with approved bends with exceptions as hereinafter specified. All deflections in pipes with flexible couplings shall not exceed those recommended by the manufacturer of the couplings after making allowance for ground movements.

4.3.1.6 Mitres to effect pipe deflections

All deflections in the axis of butt-welded steel pipelines of 10 degrees or less shall be made by mitring equally the ends of the two pipes to be joined so that the maximum mitre in any one pipe shall be 5 degrees. Where the total deflection is 3 degrees or less, the mitring may be made in one pipe end only. Ends to be mitred shall be carefully and accurately marked and then either machine cut or machine planed.

Hand planing will not be permitted. After mitring, the pipe ends shall be re-chamfered as described in Clause 5.1.5 of SANS 719. The minimum gap between pipe end root faces before welding shall be 1,5 mm and the maximum gap shall be 3,0 mm. After mitring all pipe ends shall be thoroughly cleaned before the field weld is carried out.

4.3.1.7 Cold bends

Where the Engineer gives written approval for cold bends on pipes with diameters of 450 mm and smaller, they shall be made by the cold stretch method in such a manner as to preserve the cross-sectional shape of the pipe. The minimum radius of any such bend shall be twenty five times the outside diameter of the pipe. Approved bending shoes shall be used for bending of the pipes.

4.3.1.8 Snaking

Snaking into the trench of butt-welded sections of steel pipeline which has been factory lined and/or coated will not be permitted without the written approval of the Engineer.

4.3.1.9 Stringing of pipes

The Contractor shall ensure that pipes are strung in accordance with a method statement to be approved by the Engineer. The method statement shall cover the proper placement by diameter, wall thickness and specifications. Any movement of pipes resulting from failure to comply with the approved method statement shall be rectified at the Contractor's expense.

4.3.1.10 Handling and transporting

Pipes and specials shall be handled as specified in Clause 4.8 of ZUT 7001 and Clause 4.7 of ZUT 7002.

Wrapped pipes shall be protected from grit and other sharp objects while the pipe is in the trench prior to bedding. Walking on wrapped pipes will not be allowed. The Engineer may reject any length of wrapping on which physical damage due to any cause whatsoever is visible.

Cement mortar lined pipes shall not be moved or transported for a period of 14 days after the date of lining.

4.3.1.11 Skids

Skids of sufficient number shall be supplied to support the pipe to proper height. If a pipe is supported over the trench, skids shall be of sufficient length to prevent collapsing of the trench and of sufficient strength to carry the pipe.

For coated pipe a sufficient number of skids shall be used to prevent damage to the coating.

4.3.2 Jointing methods

4.3.2.1 Flexible couplings

The joints of steel pipes by flexible couplings shall be made only in their final laid position. Before assembling the joint, care shall be taken to ensure that pipe ends and couplings are clean and free from burrs and ridges. Such burrs and ridges shall be removed if present. Pipe ends shall be mated carefully before joints are made. Pipe ends shall be concentric and perfectly lined up and the coupling shall not be relied upon to line up or to support the pipe.

Joints shall be made and couplings assembled to the manufacturer's instructions. Two-thirds of the number of coupling bolts, equally spaced, shall first be partially tightened up in a regular sequence, using a short spanner. The remaining bolts shall then be similarly tightened. After checking the coupling alignment, the bolts shall then be finally tightened evenly, using a torque wrench.

Where couplings without central registers are used, precautions shall be taken to ensure that the pipe ends are apart by the same distance as if a coupling with central register had been used and the coupling shall be carefully centred over the pipe ends.

Flexible couplings shall be provided with external protection as soon as the pipeline has been hydrostatically tested and electrically bonded, where applicable.

4.3.2.2 Flanged joints

All flanges shall be installed with bolt holes off-centre and symmetrically off-set from the vertical centre lines of the flanges. Flanges shall be installed truly square to the axis of the pipe.

In the jointing of steel pipes with flanges, special care shall be taken to align, grade and level the pipes, specials and valves to avoid straining of the flanges. All bitumen and paint shall be removed from the mating face of each flange immediately before jointing. Epoxy paints shall not be removed from flange faces. Insertion pieces that have accurately cut holes for bolts shall be placed to form a continuous one-piece ring between the flanges. Bolts shall be tightened up to ensure uniform bearing on the insertion. Care shall be taken to avoid damage to the internal surface of the pipes during assembly of the pipeline.

Wherever loose flanges are welded onto pipelines, the Contractor shall ensure that the inner lining is restored to the thickness specified for such lining and that the new repaired lining is soundly jointed to the existing lining.

In making the joint the Contractor shall ensure that the flanges are truly parallel with all bolts evenly firm before being finally drawn up with torque wrenches to watertightness. Taper gauges shall be used to check that there is a uniform gap before and after final tightening up of bolts. Bolts shall be tightened in an approved sequence with bolts equally spaced and tightened equally at opposite ends first. The Contractor shall ensure that the correct jointing materials, i.e. gaskets and bolts and nuts are available when required. The gaskets shall be in accordance with Subclause 4.3.5 of ZUT 7001. In the case of insulated joints the insulated materials shall be arranged as set out in Code of Practice No. SAECC/1.

Flanged fittings shall be so installed that there are no stresses induced into the pipework specials or fittings by forcing ill-fitting units into position or by bolting up flanges with faces not uniformly in contact with their gaskets over their whole faces.

4.3.2.3 Bolts and nuts

Bolts and nuts shall be in accordance with Subclause 4.3.6 of ZUT 7001.

Only correct diameters and lengths of bolts and studs shall be used. Flat washers shall be used under all nuts and bolt heads. The length of bolts and studs shall be such that approximately two threads protrude from the nut when fully tightened. The threads of bolts, studs and nuts shall be thoroughly cleaned and then coated with a graphite-grease compound immediately prior to assembly.

4.3.2.4 Field welding

4.3.2.4.1 General

Field welding of pipes which have been lined will only be permitted in pipes of DN 450 and larger where a man is able to enter the pipe to make good the lining after welding and testing in accordance with Clause 5.1 has been completed. Pipes of lesser diameter may be field welded where concrete linings will be made after the pipeline has been laid and all welds have been tested and approved.

At the discretion of the Engineer, roll welding will be permitted, provided an alignment is maintained by use of skids or of structural framework to accommodate two or more lengths of pipe with an adequate number of roller dollies to prevent sag in the pipe. The entire root bead, however, shall be made with the pipe in a stationary position.

All pipes welded in the trench shall be properly laid and aligned before welding commences. Joint holes shall be excavated at all field welds. The Contractor shall not lift the pipe to provide adequate access for the welders to enable them to weld the joint.

The alignment of abutting ends shall be such that the offset will not exceed 1.5 mm. Line up clamps shall be used for joint "fit-ups". The use of "bridges and wedges" or any method that may induce unnecessary stresses will not be permitted.

Both ends of coated and lined pipes shall be wrapped for a distance of at least 800 mm on either side of the weld by means of an asbestos mat or other approved material to ensure that weld spatter or other damage is not caused to the coating and lining during the welding process. The pipe trench shall be kept free of all dirt and water in the vicinity of the weld until after all corrosion protection measures have been completed and approved.

Destructive testing as specified in Clause 5.1.2.2 shall be carried out. The Contractor shall submit to the Engineer for approval a full procedure specification as detailed in API 1104 Clause 5.3 prior to any field welding being allowed.

4.3.2.4.2 Welding procedure and qualification of welders

Welding shall only be done by qualified welders who satisfy the requirements of API Std. 1104, Clause 6 and who have been tested at the Contractor's expense by an Independent Inspectorate.

Before any welding of pipeline materials commences, the qualification of welders shall have been approved, all detailed welding procedure specifications with weld diagrams required for their completion shall have been submitted for approval in a neat form and the welding procedure qualification tests shall have been successfully concluded all in accordance with the relevant standard specifications. Each welder shall mark the pipe adjacent to the weld with the figure assigned to him.

Sufficient records shall be kept by the Contractor to ensure that all field welds can be subsequently identified with the welder concerned.

As far as practicable all out of trench welding shall preferably be done by an automatic submerged process and the Contractor shall provide all necessary plant to carry out this process. Manual submerged electric arc process (MSEAP) welding may be used where in-trench welding is done.

Pre- and post-heat treatment for welding shall be in accordance with API Std. 1104 if required by same and the Contractor shall provide an approved shield to protect the pipe joint from wind and weather during heat treatment and welding.

4.3.2.4.3 Line up

Pipes shall be lined up in such a manner as to prevent damage thereto. If the pipe to be used has a longitudinal seam, these seams shall be staggered by not less than twenty degrees and welded sections, or single lengths, shall be assembled in such a manner that this seam shall remain in the top quadrant of the pipe during coating operations and after lowering into the trench.

4.3.2.4.4 Cleaning of pipe ends

Before welding, all foreign matter shall be removed from the bevelled ends. If any of the ends of the pipe joints are damaged to the extent that satisfactory welding contact cannot be obtained, the damaged pipe ends shall be cut and bevelled with an approved bevelling machine. These field bevels of pipe ends shall be made to the satisfaction of the Engineer. Should laminations, split ends, or other defects in the pipe be discovered, the joints of pipes containing such defects shall be cropped, repaired, or removed from the line as designated by the Engineer.

4.3.2.4.5 Weather conditions

No welding shall be carried out during rain or high wind unless the welder and joint are adequately protected and sheltered, to ensure that the welding is not impaired.

4.3.2.4.6 Protection of paintwork

Before welding commences, a suitable apron at least 800 mm wide shall be wrapped around both sides of the area to be welded to ensure that weld spatter or fallout from arc weld does not damage the paintwork.

During the welding of joints, the Contractor shall ensure that either rubber mats or other suitable material is laid in the pipe invert of epoxy lined steel pipes to protect the lining against damage by traffic or fall-out from arc welding at the joint. The mats shall be placed the full distance from the point of access up to the point of weld or weld inspection and shall be of sufficient width.

Workmen shall wear soft rubber soled shoes before entering lined pipes. Care shall be taken not to stroke arcs on the epoxy lined areas adjacent to the weld joint. Immediately before welding of joints, the protective tape between the ends of concrete or epoxy linings and coatings and pipe ends shall be removed.

4.3.2.4.7 Butt-welding

Pipes and specials to be joined by field welding shall be supplied with ends bevelled for welding. All welding of joints shall comply with API Std. 1104 and only approved type welding rods shall be used.

If backing rings are used, they shall be placed in position and wedged up or adjusted so that the pipe ends are completely circular and properly mated. The space between abutting pipe ends, when aligned for welding, shall be such as to ensure complete penetration without burn-through. For pipes having the same dimensions, the spacing shall be approximately 1,5 mm.

The alignment of the abutting pipe ends shall be such as to minimize the offset between pipe surfaces. For pipes of the same nominal wall thickness, the offset shall not exceed 1,5 mm. Internal line-up clamps shall be used wherever practicable and may be removed after the root bead is 50 % completed, provided that the completed part of the root bead is in segments of approximately equal lengths, spaced about the circumference of the pipe. If conditions make it difficult to prevent movement of the pipe, or if the weld will be unduly stressed, the root bead shall be completed before releasing clamp tension.

External line-up clamps shall be used where it is impracticable to use internal line-up clamps. Partial root beads made when using external clamps shall be uniformly spaced about the circumference of the pipe,

and shall have an accumulative length of not less than 50% of the pipe circumference before the clamps are removed.

Tack-welding shall be carried out to maintain the root gap and position of the pipe ends during the welding proper. The number of tack-welds shall be kept to a minimum but shall not be less than four around the circumference of the pipe.

After proper preparation and tack-welding, the root bead shall be carried out followed by successive filler passes, and capper finish pass in accordance with the approved welding procedure.

The filler and finish beads shall be deposited by an acceptable method and each filler bead shall be approximately 3 mm in thickness. Completed welds shall have a reinforcing of not less than 0,8 mm and not more than 1,5 mm above the pipe surface around the entire perimeter of the weld, and the width of the finish or cover shall be not more than 3 mm greater than the original groove.

The number of beads required shall be governed by the wall thickness of the pipe, so that the completed weld will have the reinforcement previously specified; provided, however, that each weld shall consist of at least three beads. No two beads shall be started at the same point. No mitre welds will be permitted, and all welds are to be at ninety degrees (± 5 degrees) to the axis of the pipe. All slag and scale shall be removed from each bead for visual inspection immediately after each bead is run.

In all field butt-welds where it is possible to work inside the pipe, the inside weld shall be done first. The chemical composition of weld metal and parent metal shall be similar and the inner weld metal or reinforcement shall not extend more than 1 mm above the inside metal surface of a pipe or special, and any excess shall be removed by grinding.

Defects caused by stray welding arc flashes shall be removed by grinding, provided that the pipe wall thickness is not reduced to less than the specified minimum thickness, otherwise the portion shall be cut out and repaired.

4.3.2.4.8 Fillet welding

Welding shall be as for butt-welding as applicable. All pipes of DN 600 and over shall be welded on both the outside and the inside.

4.3.2.4.9 Welding alongside the trench

The Contractor may butt-weld factory coated and/or lined steel pipes together alongside the edge of the trench to form continuous welded pipeline sections up to a maximum length of 45 m and to lower each section into the trench, provided the pipe, coating and/or lining are in no way damaged during these operations and provided furthermore that the deflection of the pipe barrel at any point during any stage of the operation does not exceed 2% of pipe outside diameter.

The linings and coatings of factory coated and/or lined pipes jointed together outside the trench shall be made good at these joints outside the trench.

4.3.2.5 Repair of welds

Rectification of defective welds shall be in accordance with API Std. 1104 and to the satisfaction of the Engineer. All costs related to the repair of defective welds shall be borne by the Contractor. Defective welds shall be repaired immediately once they are found to be defective. The Engineer has the right to stop the Contractor proceeding with further pipe laying in the event of the Contractor delaying the rectification of defective welds. Furthermore, no consideration will be given to any claims arising from delays in construction resulting from such action.

4.3.3 Installation of specials and fittings

4.3.3.1 General

Welding shall comply with API Std. 1104. All specials and other fittings shall be installed in accordance with the drawings and instructions of the Engineer. Where "slip-on" or sleeve couplings are to be fitted, all surfaces shall be thoroughly cleaned to a smooth finish, care being taken to remove as little of the protective coating as possible.

4.3.3.2 Bends

Bends shall be installed true to line, level and deflection and shall be anchored in concrete where required to counteract thrust. Bends shall normally be supplied with "centre planes" marked with two small punch marks close to both ends of the bends to facilitate correct positioning of the bends in laying.

4.3.3.3 Tees

Tees for air valves shall be installed with branch barrels pointing vertically upwards. Tees for scour valves shall be installed with branch barrels pointing vertically downwards or at the gradients indicated on the drawings. Tees for off-takes shall be installed as shown on the drawings.

Field installation of the off-takes from the pipelines for air and scour valve connections or any other form of off-take shall not be permitted. All tees for these off-takes and connections shall be factory manufactured.

4.3.3.4 Flanges

All flanges shall be installed with bolt holes off-centre and symmetrically off-set from the vertical centre lines of the flange. Flanges shall be installed truly square to the axis of the pipe.

4.3.3.5 Insulated flanged joints

Insulated flange joints shall be provided and installed by the Contractor where specified or instructed by the Engineer. The Contractor shall supply all materials, labour and plant required and shall complete and prove that each insulated joint after installation in the pipeline has a resistance well in excess of the resistance to earth of the pipeline on both sides of the insulating joint.

4.3.3.6 Temporary closure pipes

Temporary closure pieces shall be of the same standard, diameter and wall thickness as the pipeline, except where otherwise specified or instructed by the Engineer.

4.3.3.7 Permanent closure pipes

Permanent closure pipes shall be provided and installed as pipe laying proceeds. They shall be either butt welded to adjacent pipes, or jointed to access pipes, fittings or specials by means of slip-on couplings.

4.3.4 Temporary sealing of pipeline

4.3.4.1 Night-caps

Metal night-caps shall be used to close off all ends of each laid section of pipework when work is stopped at the end of each day or for longer periods and shall be left on the ends of sections of completed pipework until such sections are tied-in with the remainder of the completed pipeline. The night-caps shall consist of

a steel plate welded into a half slip-on coupling which shall be provided with a sufficient number of lugs to secure the ring and gasket and shall be strong enough to withstand external water and earth pressure in the event of flooding or collapse of earth. The joint shall be watertight.

The Contractor shall also, at his own expense, blank-off all air valve, scour valve and off-take tees with at least 6 mm thick blank flanges which shall be bolted with at least four bolts to tee flanges or shall be fixed to plain ended tee branches by using half couplings welded to the blank flanges. These shall be watertight and shall not be removed until the valves or other fittings are about to be fitted.

Notwithstanding the use of night-caps, the Contractor shall, at his own expense, make good all damage to pipe linings and fittings caused by the ingress of dirty water, silt, sand, debris, vermin, insects and other foreign matter. The Contractor shall, at his own expense and to the satisfaction of the Engineer, clean the interior of the pipeline of such contaminants.

4.3.5 Prevention of flotation

Pipes to be encased in concrete shall be prevented from flotation during concreting operations. Apart from this special case during concreting operations, the Contractor shall prevent the flotation of pipe work due to storm runoff or groundwater entering the trench before backfilling has been completed.

Methods adopted to prevent flotation shall not damage coatings or linings and shall be approved by the Engineer. Notwithstanding this the Contractor shall at his own expense repair all damage to pipework caused by flotation and/or by the methods adopted to prevent it.

4.3.6 Installation of valves and meters

Unless otherwise specified or directed, gate valves shall be set upright and butterfly valves shall be set with the main shafts horizontal. All valves and meters shall be correctly set, supported, and placed in position as the work proceeds, and shall be properly jointed to their respective pipes.

All valves and fittings shall be left in working order and shall be housed in chambers as shown on the Drawings.

Valves, meter bodies and fittings shall be supplied, painted externally and internally. The Contractor shall thoroughly clean damaged exterior painted surfaces of all valves, meter bodies and fittings of all dirt, rust, grease and other foreign matter by methods approved by the Engineer and shall make good all damaged surfaces in accordance with the requirements of ZUT 0003.

Valves requiring special adjustment after installation such as self-closing valves shall be commissioned by representatives of the valve manufacturers. Similarly, meters shall be commissioned by the respective suppliers after installation by the Contractor.

All valves and meters supplied under separate contracts, which are defective due to circumstances outside the Contractor's control shall be repaired, replaced or modified by the valve suppliers who will also be responsible for commissioning the valves.

The mass of valves or water meters shall at no time be carried by the pipe, the flange or the coupling. Support stools shall be constructed as soon as practicable after the installation of valves and meters, and shall generally be constructed of steel, concrete or masonry work. Where fabricated steel stools are approved or specified they shall comply with the requirements of SANS 10044-3 and shall be fabricated to the Engineer's approval. Supports shall be welded to the pipe only where specified and linings of pipes and specials shall be made good after welding.

Hydrostatic testing of individual sections of the pipeline shall only be carried out when all scour valves, air valves and control valves have been installed, except where otherwise instructed by the Engineer in writing.

Should line control valves or other equipment not be delivered timeously to enable the Contractor to lay continuously and to test the pipeline, the Engineer may order the Contractor to substitute specially made temporary flanged closure pieces. Such temporary closure pieces shall be supplied and installed by the Contractor to enable laying and testing to proceed. Subsequently after installation of the control valves, etc., they shall be removed and shall become the Contractor's property. These temporary closure pipes shall have the same face to face dimensions as the line control valves and shall be fitted with a suitably reinforced control diaphragm plate for sealing of the section of pipeline where it is fitted.

Wall thickness and diameter of the closure pipes shall be the same as the pipeline. A 100 mm nominal bore valve-controlled by-pass shall be fitted externally around the diaphragm plate.

4.3.7 Casings, anchor blocks and chambers

4.3.7.1 Concrete casing

Where the Engineer requires pipes to be encased in concrete, a strength 20 MPa/19 mm, or such other strength as is scheduled, shall be used. The work shall be done as follows:

- a) Concrete casing shall be discontinuous at flexible couplings in the pipeline.
- b) The pipe trench for the concrete encased pipeline shall be excavated to the depth below the bottom surface of the pipe, as ordered or shown on the drawings, and to sufficient width to allow for the concrete to be placed to the full specified width. The bottom of the trench shall be trimmed true to line and grade.
- c) The in situ concrete bed 150 mm thick shall be cast and the pipeline laid thereon true to line and level leaving a gap nowhere less than 50 mm between the pipe and the bed.
- d) After jointing the pipes shall be secured to steel loops left in the bed. Concrete shall then be punned under and around the pipes from one side only until the bottom quarter of circumference of the pipes is in contact with the concrete bed.
- e) The pipe shall be tested in accordance with the applicable tests given in Clause 5, care being taken to ensure that the pipe do not move during testing.
- f) After the pipeline has been tested, suitable formwork shall be erected and concrete carefully placed and vibrated in position up both sides of the pipe. The concrete level shall be raised equally on both sides of the pipe until encasement is complete and a cover over the surface of the pipe is provided that is nowhere less than that ordered or shown on the drawings.
- g) No earth filling over the concrete shall be commenced until at least 7 days after the concrete has been placed.

4.3.7.2 Anchor blocks

At tees, bends, terminal valves, end caps and where otherwise directed, anchor/thrust blocks shall be constructed to dimensions ordered or shown on the Drawings. Unless otherwise specified or indicated on the Drawings, anchor/thrust blocks and pedestals shall be constructed of 20 MPa/19 mm concrete or such other class as is scheduled.

The concrete shall be well punned round the pipe and, if in trenches, against the undisturbed faces and bottom of the trench. Backfilling behind or under thrust faces will not be permitted. Excess excavation shall be replaced with the prescribed mix concrete given above for anchor/thrust blocks at the Contractor's expense unless an item is scheduled to cover payment for overbreak. Care shall be taken to leave the

joints accessible. No anchor/thrust blocks and pedestals shall be concreted until the approval of the Engineer has been obtained.

4.3.7.3 Valve chambers

Valve chamber shall be constructed as indicated on the Drawings. Concrete chambers shall be constructed in accordance with the relevant clauses of SANS 1200 G or GA.

Lifting and relaying of existing pipes

4.3.8 Brickwork in chambers and manholes

Each chamber and manhole shall be built to the details shown on a particular drawing or as shown on the applicable type drawing. The walls shall be constructed in an approved bond comprising header and stretcher courses with the fair face on the inside. No false headers shall be built in and only whole bricks shall be used except where closures are required to form bond.

The bricks shall be well soaked in water immediately before being laid and the course of bricks last laid shall be well wetted before fresh bricks are laid upon it. All walls shall be carried up regularly so that no part of the walling is more than 1,3 m higher than any adjoining wall.

Joints shall be flushed up solid at every course throughout the whole width of each course, which shall be laid on a solid bed of mortar of thickness not exceeding 10 mm, and, when applicable, the joints shall be raked out as the works proceeds to form a key for plaster.

Mortar for brickwork and plasterwork shall be composed of one part of cement to three parts of sand. Sand shall be clean pit sand free from clay and other impurities and, if so directed, shall be properly screened and washed.

If required, step irons for a manhole shall be built into the straight of the wall at 300 mm intervals staggered right and left in vertical rows. Cast iron fittings shall be bitumen painted. Each cast iron cover and frame shall be grouted solidly onto the shaft. Concrete surrounds of each manhole shall be finished off to suit surrounding surfaces.

4.3.9 Lifting and relaying of existing pipes

Where shown on the drawings and where scheduled, existing pipes and fittings that are to be removed shall be lifted and the materials recovered as far as is practicable. The pipes and couplings shall be removed from the trench and placed in the Contractor's site store where they shall be cleaned, sorted, and listed. A copy of the list of undamaged material recovered shall be handed to the Engineer.

Unless, in terms of the contract, other pipes are to be laid in the same trench, each trench shall be backfilled as specified in SANS 1200 DB.

Where recovered pipes are scheduled to be relaid, rubber rings, insertion packings, damaged joints, and rusted bolts shall be replaced.

Before they are relaid, an acceptable number of pipes shall be tested for compliance with the requirements of the application specification for resistance to hydraulic pressure.

4.3.10 Disinfection of potable water pipelines

After completion of the laying and testing, each potable water pipeline shall be disinfected. The Contractor will be required to submit a detailed method statement for approval by the Engineer. A minimum requirement will be that the method statement deals with the method of dosing and how the dosing rate will

be controlled to ensure a uniform distribution throughout the pipeline to be disinfected, the chemicals to be used, the anticipated range of dosing rates and equipment to be used, and the name and qualification the Contractor's person supervising the disinfection.

Once a successful hydraulic test of the entire pipeline has been achieved and the connections have been completed, the pipeline shall be drained. The pipeline shall then be re-charged in accordance with Clause 5.1.3.5 "Initial Filling of the Pipeline". Whilst being charged, a sodium hypochlorite solution shall be introduced into the pipeline in such a manner as to ensure that a theoretical total chlorine concentration of at least 25 ppm (mg/l) is achieved throughout the pipeline.

Once the entire pipeline has been filled in this manner, it shall be left for a 24-hour period. Thereafter, total chlorine concentrations shall be measured at each scour and off-take point. A concentration of 20 ppm total chlorine will be considered acceptable. Should this concentration not be achieved at all scours and off-takes, the Contractor shall take all steps considered necessary by the Engineer to achieve satisfactory disinfection, at his/her own cost.

Once satisfactory disinfection has been achieved, the pipeline shall be drained via the scour valves (or by other means approved by the Engineer) and sufficient sodium thiosulphate (typically 1 part of total chlorine) shall be dosed into the scour-wet wells to fully neutralise the chlorine before discharging to watercourses.

The pipeline shall then be re-charged in accordance with the stated procedure and, after 24 hours, samples will be taken by the Engineer for analysis (at no cost to the Contractor). Should the following limits not be achieved, the Contractor shall carry out at his/her own cost, all steps deemed necessary by the Engineer to achieve satisfactory disinfection:

- a) E.coli: Count = 0
- b) Coliforms: Count = 0
- c) Faecal Streptococci: Count = 0
- d) In addition to a), b) and c), the water quality shall meet the requirements for potable water of the local authority or of the authority supplying such water to the area.

4.3.11 Corrosion protection

4.3.11.1 Final painting

After successful hydrostatic testing of the pipeline, and after completion of all construction work under this Contract, all external surfaces of uncoated steelwork and surfaces of all valves and fittings shall be prepared and painted as specified in the relevant clauses of Specification ZUT 0003. In addition, all surfaces of materials which had received first coats of paint in the course of the Contract in accordance with the specifications shall receive final coats of paint of the same colour or such other colours as may be specified or instructed by the Engineer.

All paint used shall be out of the original containers of the manufacturer and such containers are to be brought onto the site unopened. No adulteration will be permitted and paints shall be used strictly in accordance with the manufacturer's instructions.

Painting shall not be done in wet or humid weather.

4.3.11.2 Butt-welded steel pipes

As soon as practicable, but not more than 24 h after the welding of joints in the field has been approved and accepted by the Engineer, the internal lining of pipes and specials shall be made evenly continuous over the joints.

Materials for this work shall have the same properties as those used respectively for the adjacent lining or coating and shall be so applied that the finished work over the joint shall have the same quality as specified respectively for the adjacent lining or coating and shall be capable of passing the same tests as specified for adjacent lining or coating.

4.3.11.3 Metal couplings

In addition, all buried metal couplings and all metal couplings located inside chambers, shall be protected with "Denso" petrolatum as per the requirements of Specification ZUT 0003.

5. COMPLIANCE WITH REQUIREMENTS

5.1 TESTING

5.1.1 General

Testing shall be in accordance with this clause and Specifications ZUT 0003, 7001 and 7002, as relevant.

As the work proceeds, pipelines shall be hydrostatically tested by means of test equipment supplied by the Contractor.

Each test shall be carried out in the presence of the Engineer or his representative. The Contractor shall be responsible for carrying out all tests and for all expenses incurred.

When carrying out the hydrostatic tests, the Contractor shall ensure that all valves, tees, and bends are properly secured and shored to prevent movement of pipes and fittings and, should any such movement occur, the Contractor shall, at his own expense, reposition and, if necessary, repair the pipes and fittings and the securing means.

Until each section of the pipeline has been subjected to the hydrostatic test and has complied with the applicable requirement for leakage rate, the pipeline will not be accepted. The hydrostatic test shall be repeated until the Engineer is satisfied that the section under test complies with the said requirement.

5.1.2 Testing of field welds

5.1.2.1 Destruction tests

Tests as specified in API 1104 Clause 6.5 shall be carried out and approved prior to any field welding being done.

5.1.2.2 Radiographic testing

Radiographic tests and adjudication of test records shall be carried out by an Independent Inspectorate, appointed by the Engineer to act on his behalf. The Inspectorate shall be afforded every facility during the course of pipeline construction and testing to enable the inspection to be carried out effectively. 10% of the total length of all manual field butt welds and 2,5% of the total length of field welds done by an approved automatic process shall be examined radiographically with particular reference to weld intersections, using

equipment supplied and staffed by the Inspectorate. All welds on critical sections such as river, rail and road crossings shall be 100% radiographically tested.

The Engineer reserves the right to increase the length of welds to be radiographed if results obtained are not satisfactory or to reduce the length of welds radiographed to a minimum of 4% if the standard of welding is sufficiently high to warrant such a reduction.

The Inspectorate shall process and adjudicate radiographs on site. The standard of acceptability shall be in accordance with API 1104. All welds which are found to be unsatisfactory shall be repaired and 100% re-radiographed at the Contractor's expense. The additional radiography of repaired welds shall not be deemed to be included in the overall 10% or 2,5% radiography.

Field welds may be examined by radiographic inspection as stated in API 1104. Should two or more welders participate in making the weld, the welding foreman and the Engineer's Representative shall decide which welder is responsible for the defective work. The Engineer shall be privileged in the judgement of his inspector to cut out welds for further tests. The test welds (except the initial free test referred to in 5.1.2.1) that meet the Engineer's requirements and specifications when properly tested shall be replaced with a satisfactory tie-in at the Employer's expense. Should any test weld cut from the line prove unsatisfactory to the Engineer when properly tested, it shall be replaced at the Contractor's expense. Test welds shall be cut from the line as soon as practicable after completion to avoid unnecessary delay and expense, and shall consist of an annular ring not less than 230 mm long with the weld in the middle.

When welding the line together at places where the test welds have been cut out, one weld will be used if it is practicable to pull the line back into position; otherwise, two welds will be made by setting in a short length of pipe with a minimum length of 750 mm.

The Contractor shall furnish approved types of machines for testing. A record of the results of each test weld shall be made by the Engineer's inspector and jointly signed by the Engineer's Representative and Contractor's Representative. The Contractor will be reimbursed for extra welds at the rates tendered if scheduled in the Contract as a separate item. Extra welds shall be construed to mean those welds cut out at the Engineer's request which, after specified tests, are found to meet the Engineer's specifications, except those free initial test welds referred to herein.

Claims arising from delays in construction caused by justifiable additional radiography which may be ordered by the Engineer or re-radiography of repairs, will not be considered.

5.1.2.3 Dye-penetrant testings

A 100% dye penetrant test shall be carried out by the Contractor on all field welds except where radiographic testing is undertaken.

The dye-penetrant test shall be carried out in accordance with BS 4416 and as detailed below:

- a) The Contractor shall obtain the approval of the Engineer for the group of dye-penetrant and developer that he proposes to use for the test;
- b) As pipe laying progresses, field welds shall be subjected to the test soon after each weld is completed;
- c) In order to obtain a surface that is dry, clean and free from scale, dirt and grease, the Contractor may grind but he shall not grit blast the surface;
- d) The temperature of the surface to which the developer and the penetrant are applied shall not be below 16°C or above 52°C;
- e) Observations for indications shall be made not less than 15 minutes and not more than 60 minutes after the application of the penetrant;

- f) Any surfaces on which non-relevant indications are observed shall be explored by visual methods and, if considered necessary by the Engineer, such surfaces shall be cleaned and retested; and
- g) Welds that show no relevant trace of dye on the developer will be accepted.

5.1.2.4 Visual testing

All field welds shall be inspected visually throughout their entire length by the Contractor for signs of possible faults. Full records of the testing of each joint shall be kept by the Contractor and his findings reported to the Engineer. The Contractor shall allow the Engineer and/or the Inspectorate to also inspect up to 10% of the number of field welds visually.

5.1.2.5 Testing of fillet welds

In addition to the dye penetrant tests, each fillet weld on pipes of DN 600 and over shall be air and bubble tested by pumping air into the annular space between the welds to a pressure of at least double the specified working pressure. While this pressure is maintained, all welds and connections shall be tested with soap or primer. Defects found during testing shall be repaired by the Contractor, and testing continued all at the Contractor's expense until a satisfactory result is obtained.

The test tapping point shall then be plugged in an approved manner.

5.1.2.6 General

The pipeline shall be hydrostatically tested on completion of pipe laying and after installation of all valves and fittings. Test sections shall be blanked off by making use of end-caps. Installed isolating valves within the test section shall not be used as end-caps.

The Contractor shall submit to the Engineer a detailed method statement describing the timing, methodology and scheduling of each hydrostatic pressure test to be undertaken. No test shall proceed before approval of such method statement by the Engineer.

If sections of a pipeline are encased in concrete, or where concrete anchor blocks or other structural concrete structures had been provided, the Contractor shall allow for a minimum concrete setting period of 28 days prior to the hydrostatic test being executed.

The Contractor shall supply water from an approved source for hydraulic testing of the pipeline. Pipelines designed for potable use shall be hydraulically tested and disinfected using potable water. Water used for one filling of the pipeline for hydraulic testing, one filling for disinfection and one filling after draining the disinfection water will be provided by the Employer to the Contractor, free of charge, at the connection points stated in the project specifications. Items have been provided in the Bill of Quantities to cover the cost of receiving and conveying water from the supply point to the test section of pipeline. Additional water supplied by the Employer owing to unsuccessful disinfection and/or hydraulic testing will be charged to the Contractor.

5.1.2.7 Test pressure and time of test

After the pipe trench has been backfilled the pipeline shall be tested in sections between end caps, blank flanges, or other isolating devices, at the pressures appropriate to the pipeline section under test. The Engineer may require that blank flanges or "spades" be inserted and that the pipeline be tested in reduced lengths and, in addition, at the point of maximum pressure.

Unless otherwise specified, shown on the drawings, or approved by the Engineer, the average test pressure for field testing shall be 1,25 times the pressure rating of the pipe.

Where the pipeline is tested in sections, the Contractor will have the discretion to determine the sections in which the pipeline may be tested provided that:

- a) The test sections shall be determined, taking any differences in elevation along the pipeline into account, such that the:
 - i) maximum field test pressure at any point along the section is not higher than 1,5 times the pressure rating of the pipe or the maximum field test pressure permitted by the pipe manufacturer; and
 - ii) minimum field test pressure at any point along the section is not less than the greater of:
 - 1) the pressure rating of the pipe, or
 - 2) 1,25 times the maximum working pressure at these points.
- b) The first km (+200m,-100m) of pipeline laid is successfully tested before the subsequent section may proceed.
- c) The Contractor shall make due allowance in the construction programme and in the tendered rates for the entire testing operation including for the provision of temporary end stops (flanges or bullnoses) and any other costs associated with testing the pipeline in intermediate sections.

Once filled, the pipe shall be left for 24 hours to permit maximum saturation. The section to be tested shall then be pressurised to the specified pressure and left for a further 24 hours, during which period, the pressure drop (if any) and the quantity of water required to be pumped in to restore the test pressure shall be measured and recorded. In addition, all flexible and flanged joints shall be visually inspected and there shall be no sign of leakage.

At all times when there is water in the pipeline, and particularly during filling, testing and draining of the pipeline, all air valves shall be in operation and their individually isolating valves shall be open.

5.1.2.8 Visible leaks

- a) Except as allowed in b) the specified test pressure shall be maintained for a period of at least 24 hours (or such longer period as is necessary for inspection of the pipeline) during which period all pipes, pipe specials, joints, and fittings shall be carefully inspected for leaks. All visible leaks shall be made good and any pipe, pipe special, or fitting found to be defective shall be removed and replaced at the expense of the Contractor and such replacement material shall, after installation, be tested at the expense of the Contractor.
- b) In the case of pipes of DN 400 and under, the test period may be reduced proportionally to the nominal diameter of the pipe, provided that in no case shall the test period be less than 1 hour.

5.1.2.9 Permissible leakage rates

The test pressure shall be maintained for a further period of 1 hour after the completion of the test period specified in Clause 5.1.3.3, during which time the volume of water required to be pumped into the pipeline for maintenance of the pressure shall be measured.

The permissible leakage for welded and flanged steel pipelines is zero (0) litres.

5.1.2.10 Initial filling of pipeline

The entire process for filling the pipeline at any time during testing or disinfection shall be carried out under the supervision of the Engineer. Under no circumstances will the Contractor be allowed to carry out filling

of the pipeline without the supervision of the Engineer, neither shall the Contractor permit any other persons to carry out such filling without the written permission of the Engineer.

Unless otherwise specified or approved in writing by the Engineer, filling of the pipeline for hydraulic testing shall be carried out at a velocity in the main pipeline not exceeding 0.5 m/s.

Any damage to the pipeline caused by non-compliance with this clause shall be rectified at the Contractor's expense.

5.1.2.11 Connections after testing

The connections of the new pipework to the existing pipework shall only be carried out after the pipeline testing has been completed and accepted by the Engineer. For this reason, testing must be carried out against a blank flange or bullnose end cap at these locations.

5.1.2.12 Remedial measures

In the event that a pipe section fails a test, the Contractor shall carry out all remedial measures necessary to obtain a successful test of each individual section and the entire pipeline, at his/her own expense. Such remedial measures shall in no way compromise the requirements stipulated in the specifications.

5.1.2.13 Draining of the pipeline

The pipeline may have to be drained to carry out remedial measures and it must be drained before the disinfection process commences. The pipeline shall be drained via the scour valves in a manner that does not cause erosion of the streambeds or negatively impact on the environment in any way. All such drainage of the pipeline shall be carried out under the supervision of the Engineer.

5.1.3 Commissioning

The pipeline will be considered to have been commissioned and practically complete once all the associated structures are sufficiently complete to carry out their structural and hydraulic function and the hydraulic test and disinfection of the entire pipeline has been successfully completed.

5.1.4 Water tightness testing for chambers

Refer to the SANS 1200 G or 1200 GA, as applicable.

5.1.5 Tests on epoxy linings

Once all work in the pipeline has been completed bar the hydrostatic testing and backfilling, the pipeline shall be cleaned by sweeping with a soft broom and rinsing. Access to this section shall be restricted from this point forward and will only be allowed on the written consent of the Engineer.

Holiday detection testing is to be undertaken by the Contractor on the lining in order to ensure that it remained intact during the transport, handling, placing and backfilling processes. Holiday testing may also be undertaken by the Independent Inspectorate. The testing and repair procedures shall be in accordance with the requirements stipulated in Specification ZUT 0003.

5.1.6 Pipe coating integrity surveys

The Contractor shall perform the pipe coating integrity survey as defined in the cathodic protection specifications.

5.2 TOLERANCES**5.2.1 General**

No deviation will be permitted from the minimum pipe cover specified or shown on the Drawings.

5.2.2 Control points

For the purposes of this Clause, valves and pipe specials set on the centre line of the pipeline and designated changes in gradient shall be regarded as control points and shall be located with a permissible vertical deviation of ± 100 mm on the centre line. The same deviation will be permissible laterally except where the pipeline is laid at a designated distance from a fence line, kerb line, or boundary, in which case the permissible deviation shall be ± 20 mm.

Unless otherwise directed and subject to a permissible deviation (measured along the centre line) of ± 2 m, scour valves shall be located at the lowest points in pipelines and air valves at the highest points.

5.2.3 Alignment

PLAN (horizontal alignment): Unless otherwise directed, the permissible deviation from the defined alignment of the pipeline, when measured on the top centre of the pipeline, shall be ± 100 mm or $\pm 10\%$ of the nominal diameter of the pipe, whichever is the larger, and the permissible deviation per pipe length shall be ± 20 mm.

LEVEL (vertical alignment): The permissible deviation from the designated level at any point on the invert of the pipeline shall be ± 50 mm or $\pm 10\%$ of the nominal diameter of the pipe, whichever is the larger.

5.2.4 Manholes, valve chambers, etc.

Manholes, valve chambers and the like shall be constructed centrally on the control points and, with the exception of tolerances that affect access to bolts, nuts, etc., with a permissible deviation of ± 50 mm on all clearance dimensions. The clearance dimension between the outside of each nut and bolt-head and the inside face of the wall of a structure or any other fitting shall be at least the specified value.

6. TOLERANCES

Refer to Clauses 4 and 5.

7. TESTING

Refer to Clause 5.

8. MEASUREMENT AND PAYMENT**8.1 BASIC PRINCIPLES****8.1.1 General**

Excavation and backfilling of trenches, and laying of medium-pressure pipelines, will be measured separately under SANS 1200 DB and Clause 8.2 of this Specification.

8.1.2 Night-caps

No extra payment will be made for night-caps. The supply and use of night-caps will be held to be included in the unit rate tendered for pipe laying.

8.1.3 Permanent closure pipes

8.1.3.1 Butt welding

Where closures are butt welded to other pipes, the cost of cutting the pipe, preparing the end for welding and welding as specified in SANS 719, repairing the lining and coating as specified in Specification ZUT 0003 will be held to be included in the unit rate for laying of pipes.

8.1.3.2 Slip-on couplings

Where closures are jointed to either access pipes, fittings or specials by means of slip-on couplings, no additional payment will be made for extra cutting of the pipe, preparing the end for welding, welding on the loose collar (approved 150 x 20 mm mild steel, machined round to suit coupling) or making good the lining.

Unless separately billed, the supply, transport and handling of the collar and slip-on coupling will be held to be included in the unit rate for the supply of pipes, fittings and specials.

8.1.4 Extra welds

Payment for all extra welds shall be covered by variation orders showing the location of the welds according to stake value and other necessary details. Such variation orders shall be signed by the Engineer's Representative and the Contractor's Representative in the field on the day the work is done. No payment will be made for test welds not covered by variation orders as stated above.

8.2 BILLED ITEMS

8.2.1 Lay and bed steel pipes and specials complete with couplings

a) Pipes	Unit:	metre (m)
b) Specials	Unit:	number (No.)

Pipes will be measured linearly as laid in the trench. No deduction will be made for specials and valves. Separate payment will be made for each type, size and class of pipe laid.

Specials will be measured separately by number of each type.

The unit rates tendered in the Bill of Quantities for laying of pipes and specials shall cover the cost of the following:

- Inspecting, accepting, taking delivery, providing storage, taking delivery from storage on site, transporting, handling, inspecting, stringing alongside trench, forming joint ("fox") holes, laying, jointing, cutting, scarfing, cutting mitre deflections up to 10 degrees (5 degrees per side), bevelling, maintaining line and level, jacking for ovality if necessary, provision and use of shield for heat treatment and welding if required;
- maintenance of cleanliness including all night caps and temporary blank flanges, etc., necessary to keep the inside of the pipe dry;
- removal, where necessary, and making good of lining and coating over the joints;

- d) radiographic examination of field welds and holiday testing of the lining, visual and dye penetrant testing;
- e) testing of welders and issuing of the necessary certificates;
- f) making good all linings and coatings;
- g) hydrostatic testing, testing equipment and anything required to do this work, including temporary end caps and blank flanges;
- h) sterilizing the pipeline where used for potable water;
- i) bolts, nuts, washers, gaskets and insulating material;
- j) supply and installation of steel and or concrete pipe supports (not necessarily shown on drawings);
- k) building in of specials (Refer to Item 8.2.11)

No extra payment over and above the rates tendered in the Bill of Quantities will be made in respect of additional cutting and jointing of pipes required to locate valves, specials, etc., exactly.

No separate payment will be made for the supply and fitting, chipping of lining, cutting, trimming, bevelling and making good on Site of any additional couplings and jointing materials which may be required for the connection of shortened pipe closures, unless specific provision is made in the Bill of Quantities.

The unit rate tendered for laying of steel pipes and specials shall cover the cost of the laying, jointing, etc., as specified and, in addition, for final painting and surface preparation when applicable. No extra-over payment shall be made for protecting metal couplings with petrolatum wrappings as per Specification ZUT 0003.

Notwithstanding the use of night-caps the Contractor shall at his own expense make good all damage to pipe linings and fittings caused by the ingress of dirty water, silt, sand, debris, vermin, insects and other foreign matter. The Contractor shall at his own expense and to the satisfaction of the Engineer clean the interior of the pipeline of such contaminants.

A maximum payment of 85 % of the tendered rate may be made for the completed section of pipeline which has not yet been hydraulically pressure tested and disinfected. A further payment of 10% of the tendered rate will be made upon successful completion of the pressure testing for the relevant section of pipeline. The final 5% of the tendered rate will be made upon completion of disinfection of the pipeline.

8.2.2 Extra-over for mitre deflections

Unit: number (No.)

Where additional mitre deflections (up to 10 degrees) are ordered by the Engineer, these will be measured by number.

The rate shall cover the all the costs associated with mitre deflections detailed in Item 8.2.1 (a) to (f).

8.2.3 Installation of valves and meters

Unit: number (No.)

The unit rate for installation of valves and meters shall cover the cost of taking delivery of these items from storage on site, inspecting each item for visible signs of damage, transporting to the laying site, off-loading, installing and, except where separately billed, of testing and commissioning of the valves and meters in position in accordance with the manufacturer's instructions and to the satisfaction of the Engineer.

No extra payment over and above the rate will be made in respect of any additional cutting, turning and jointing of pipes required for the location of a valve, meter, etc. where a precise position is given on the drawings.

The tendered rate shall also cover all jointing materials and, except where separately billed, support pedestals. The rate tendered for installation of valves and meters shall also include the cost of necessary oiling and greasing of moving parts and for minor routine initial maintenance work such as tightening up leaking glands.

The unit rates shall include for the cost of making good and the repair of paintwork and final painting as specified.

8.2.4 Recover old pipeline

Unit: metre (m)

The total length of the pipeline ordered to be recovered will be measured by length for each stated depth range. No deductions will be made for valves, specials, and the like.

The rate shall cover the cost of the excavation and removal of pipes, valves, and fittings from the trench, the handling and transportation to the Contractor's store on site, the cleaning and listing of the salvaged recovered materials, and the backfilling of the trench.

8.2.5 Test and relay recovered pipe

8.2.5.1 Test recovered pipes on site before relaying

Unit: number (No.)

The rate shall cover the cost of the provision of suitable testing equipment and the carrying out of the specified test.

8.2.5.2 Relay pipeline

Unit: metre (m)

The rate shall cover the cost of transporting, handling, laying, and bedding, as well as the provision of new rubber rings or insertions, as the case may be. Couplings and bolts that have to be replaced will be paid for at daywork rates unless a suitable item such as 8.2.4.3 below has been provided in the Bill or, in the opinion of the Engineer, the need for their replacement arose from the fault or negligence of the Contractor.

8.2.5.3 Joints and couplings for recovered pipeline (Provisional)

Unit: number (No.)

The rate shall cover the provision of complete sets, each comprising a new rubber ring or insertion, as the case may be, as well as all elements of the coupling and bolts that need replacement.

8.2.6 Anchor/thrust blocks

a) Dimensions stated or given on drawing – Unit: No. or Sum

OR

b) Where, at the tender stage, no detailed drawings or dimensions are given or where only typical drawings are given:

Concrete – Unit: m³Formwork – Unit: m²

Reinforcement – Unit: ton

Except where measured by number or sum, anchor/thrust blocks will be measured as the volume of concrete, areas of formwork, and mass of reinforcement, as relevant, placed to dimensions ordered or given on the drawings and schedules of reinforcement. The relevant terms of Clause 8 of SANS 1200 G or SANS 1200 GA, as applicable, shall apply.

Where measured by number or sum, the rate or sum shall cover the cost of excavation and trimming, formwork, reinforcement (if any), and screeding of top surfaces.

8.2.7 Concrete casingUnit: m³

The concrete will be measured net by volume to the specified width and depth in excess of the external volume of the pipe (i.e. the volume of the pipe will be deducted).

The rate shall cover the cost of formwork (including stop ends at flexible joints), reinforcement (if any) and concrete.

8.2.8 Valve chambers

Unit: number (No.)

Valve chambers will be measured as complete units.

The rate shall cover additional excavation (see Subclauses 8.2.2 and 8.2.3 of SANS 1200 DB), materials, plant, and labour necessary for the complete construction including the installation of covers, ladders and ancillaries shown on the drawing.

8.2.9 Manholes

Unit: number (No.)

Manholes will be measured as complete units for which separate items will be scheduled for each type of manhole and depth categories.

The rate shall cover additional excavation, materials, plant, and labour necessary for the complete construction including the installation of the covers, ladders and ancillaries shown on the drawing.

8.2.10 Temporary closure pipes (Provisional)

Unit : number (No.)

Temporary closure pipes will be measured as provisional items by number only where ordered by the Engineer.

The unit rate shall cover the cost of the supply, installation, removal and making good of the pipe.

Excavation, backfilling and supply of bedding material will be measured and paid for separately as specified in SANS 1200 DB and SANS 1200 LB.

8.2.11 Items cast or built into concrete

Unit: number (No.)

The building in (or casting into concrete) of the pipes and pipe specials will be measured by the number of each item built in.

The unit rate shall cover the installation of the pipe or pipe special as well as all additional costs of formwork, concreting and fixing of pipes and specials which are not covered by the normal tendered rates for formwork and concrete.

8.2.12 Pipe lining integrity tests

Unit: lump sum (Sum) or metre (m)

Payment for tests on linings will include for all labour, the cost of supplying fuel and production related wearing parts (bucket teeth, cutters etc) for equipment utilised, and materials to perform all tests and repair work as defined in Specification ZUT 0003. Payment for the pipeline section tested and repaired will be certified for payment only on written acceptance of successful testing and repair work as defined in Clause 5.1.6.

8.2.13 Concrete/steel valve and pipe supports

Unit: number (No.)

Except where billed separately, payment for the supply and installation of concrete or steel supports to valves, meters, pipe specials, etc. shall be included in the rates tendered for the installation of these items.

Where billed separately, the rate for supports shall cover all material, plant and labour required for the supply and installation of the support, including all anchor bolts and jointing material. In the case of steel supports, the cost of the corrosion protection shall be included in the rate tendered for the support.

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Annexures

APPENDIX A : APPLICABLE STANDARDS

API 1104	:	Standard for welding of pipe lines and related facilities.
SANS 719	:	Electric welded low carbon steel pipes for aqueous fluids (Ordinary duty)
SANS 10044-3	:	The fusion welding of steel (including stainless steel): Tests for approval of welding procedures and production welds.
SANS 1200 G	:	Concrete (structural)
SANS 1200 GA	:	Concrete (small works)
SANS 1200 L	:	Medium-pressure pipelines
SAECC/1		
Specification ZUT 7002	:	Manufacture of medium-pressure steel pipes
Specification ZUT 7001	:	Design and manufacture of medium-pressure steel specials
Specification ZUT 0003	:	General corrosion protection for pipelines, water and wastewater works

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AMENDMENTS

The following amendments to this Specification apply to this Contract. The paragraph letters and numbers indicate the relevant clause number to which the amendments apply. Alternatively, the relevant clause number will be shown in brackets as part of the heading. New clauses added to this Specification are assigned with new numbers.

1. SCOPE (CLAUSE 1)

This specification shall be applicable to the steel pipeline component of the project included in the civil works.

In the first paragraph, replace “2 280mm” and “2.5 MPa” with “DN500 mm” and “PN 40”.

2. NORMATIVE REFERENCES (CLAUSE 2)

No amendments

3. DEFINITIONS AND ABBREVIATIONS (CLAUSE 3)

No amendments

4. REQUIREMENTS (CLAUSE 4)

4.1 MATERIALS (SUBCLAUSE 4.1)

4.1.1 General (Subclause 4.1.1)

Add the following at the end of this clause:

“Materials supplied and delivered under this specification shall comply with the relevant project specification including, but not limited to the following:

- **SPE-MP-7001** - Design and Manufacture of Medium Pressure Steel Specials
- **SPE-MP-7002** - Manufacture Of Medium Pressure Steel Pipes
- **SPE-MM-7015** – Metal Seated Wedge Gate Valves
- **SPE-MM-7016** – Resilient Seal Gate Valves
- **SPE-MM-7017** – Single Door Check Valves
- **SPE-MM-7022** – Air Valves
- **SPE-MP-7023** - Pipe Couplings
- **SPE-MP-7024** - Pipework Anchors

Where no specifications are provided, valves shall comply with the requirements of SANS 1200 L.”

4.2 PLANT (SUBCLAUSE 4.2)

4.2.1 Handling and rigging (Subclause 4.2.2)

Insert the following after the word “over-stressed” in the first sentence “or the corrosion protection is damaged”

4.3 METHODS AND PROCEDURES (SUBCLAUSE 4.3)

4.3.1 Laying (Subclause 4.3.1)

4.3.1.1 Cold bends (Subclause 4.3.1.7)

Add the following:

“Cold bends is not permitted for cement mortar lined pipes”

4.3.2 Jointing Methods (Subclause 4.3.2)

4.3.2.1 Flexible Couplings (Subclause 4.3.2.1)

Add the following:

“Unless otherwise specified, all flange adaptors shall be restrained through an appropriate restraining flange welded onto the adjoining special.”

4.3.2.2 Field Welding (Subclause 4.3.2.4)

4.3.2.2.1 General (Subclause 4.3.2.4.1)

Replace the last sentence of the first paragraph with the following: “Field welding will only be permitted on smaller diameter pipes (< DN450) where the internal corrosion protection is by means of a cement mortar lining.”

4.3.2.2.2 Butt-welding (Subclause 4.3.2.4.7)

Replace the first sentence with the following: “Pipes and specials of DN 450 and larger to be joined by field welding shall be supplied with ends bevelled for welding.”

4.3.2.2.3 Fillet welding (Subclause 4.3.2.4.8)

Replace the contents of this clause with the following:

“Pipes and specials smaller than DN450 to be joined by field welding shall be supplied with bell and spigot ends for lap-welded slip joints. The pipes shall be welded externally by means of a concave fillet weld with a throat thickness exceeding the pipe wall thickness. All other requirements as for butt-welding shall be applicable. The internal cement mortar lining shall be made continuous at the pipe joints.”

4.3.3 Casings, anchor blocks and chambers (Subclause 4.3.7)

4.3.3.1 Concrete casing (Subclause 4.3.7.1)

Add the following:

“Unless otherwise specified, the contractor shall allow for a minimum reinforcement of 135 kg per cubic meter of concrete.

Where no encasing width or height is given on the drawings, the encasement shall extend 300 mm above and below the pipe and 300 mm on both sides of the pipe.”

4.3.3.2 Valve Chambers (Subclause 4.3.7.3)

Delete the last sentence of this subclause.

4.3.4 Corrosion Protection (Subclause 4.3.11)

4.3.4.1 Welded field joints (Subclause 4.3.11.2)

Change the heading of this clause to “Welded field joints”.

Add the following at the end of this clause:

Laying and Jointing of Medium-Pressure Steel Pipes and Specials

“Where the diameter of the pipeline is too small for a person enter the pipe (< DN450), the cement mortar lining shall be made continuous at joints as soon as the welding has completed. The contractor shall submit a method statement for the cement mortar lining repair for approval.

The recommended approach is to apply a stiff approved mortar mix to the shoulder of the bell. A swabbing device, such as an inflated rubber ball wrapped in burlap, shall be placed inside the previously installed pipe section. A wire attached to the swabbing device is threaded through the next pipe section to be installed. As the new section is joined, the spigot compresses the mortar into place against the bell shoulder. The swabbing device is then pulled through the joint using the wire, effectively removing excess mortar and ensuring a smooth, flush interior surface.

For small diameter pipes (< DN450), the cement mortar lining repairs/infills at site welded field joints shall be inspected in accordance with Subclause 5.1.8.”

Add the following after subclause 4.3.11:

4.3.5 Pipe marker posts (New Subclause 4.3.12)

The Contractor shall supply and accurately place marker posts on the centreline of buried pipelines, or as instructed by the Engineer. Marker posts shall be placed at all points of intersection, chambers and at a maximum spacing of 200 m. Marker posts shall be placed only once the pipelines, or any sections thereof, have been successfully tested and the trenches backfilled.

The manufacture, installation and identification marks of marker posts shall comply with the drawings. Where no drawing exists, the Contractor shall propose marker posts that are suitable for the purpose, for approval of the Engineer.

The co-ordinates, level and centreline distance (as determined from the as-built survey and drawings) of each marker post shall be accurately determined and recorded by the Contractor. All details shall be given to the Engineer in writing.

4.3.6 Connecting to existing pipelines (New Subclause 4.3.13)

The Contractor shall complete connections between new and existing pipelines as indicated on the drawings and/or as scheduled. The Contractor shall submit a method statement for approval by the Employer's Agent for each connection to existing pipelines. The method statement shall encompass all necessary works, including, but not limited to, the excavation to expose the existing pipeline, the procurement of the required pipe specials and fittings, isolation and draining of the existing pipeline, cutting the existing pipeline, installing the new connection, applying corrosion protection where applicable, testing the connection, recommissioning the isolated pipeline, backfilling the excavation, and restoring the site to its original condition.

Where connections to existing pipelines are required, the Contractor shall excavate well in advance of work being undertaken to expose the connection point to verify that the assumed fittings are available on site and that the connection as proposed can be made. It should be noted that it may be necessary to expose a full pipe length to verify the size and class of pipe in the ground or to locate an existing fitting or Joint.

The Contractor shall liaise with the service owner of the existing pipeline and any other affected authorities to obtain the necessary approvals for the connection. The connection shall be completed within the timeframe specified by the service owner.

4.3.7 Pipe supports (New Subclause 4.3.14)

The Contractor shall provide pipe supports/anchors for pipe, specials and valves inside chambers and buildings in accordance with SPE-MP-7024 and its amendments.

5. COMPLIANCE WITH REQUIREMENTS (CLAUSE 5)

5.1 TESTING (SUBCLAUSE 5.1)

5.1.1 Testing of field welds (Subclause 5.1.2)

5.1.1.1 Destruction Tests (Subclause 5.1.2.1)

Delete this subclause and replace with: "Tests as specified in API 1104 Clause 6.5 shall be carried out for each welder utilised by the contractor and approved by the Employers Agent prior to any field welding being done."

5.1.1.2 Radiographic testing (Subclause 5.1.2.2)

Add the following at the end of the first paragraph: "The first 10 manual field welds for each welder shall be tested radiographically and shall not be deemed to be included in the overall 10% radiography."

Add the following to the second paragraph: "Welds shall be radiographically tested at regular intervals as determined by the Engineer or Independent Inspectorate. All welders on site shall be subject to radiographic testing."

5.1.1.3 Visual Testing (Subclause 5.1.2.4)

Add the following to the end of this subclause: "All fillet weld shall be inspected by means of a fillet weld gauge provided by the Contractor".

Add new subclause after subclause 5.1.7:

5.1.2 Remote video inspection of cement mortar lining for small diameter pipelines (Subclause 5.1.8)

On small-diameter pipelines where human entry is not possible (<DN450), remote video inspections shall be conducted to assess the integrity of the cement mortar linings after the pipeline has been laid with specific emphasis on the repair/infill at welded field joints. The Contractor shall make available a high-resolution, self-propelled or push-type camera with pan-and-tilt functionality and adequate lighting for this inspection.

The camera will record continuous footage, capturing the cement mortar lining over the entire circumference of the pipe. The video footage together with the associated pipeline chainages will be submitted to the Employer's Agent for approval.

6. TOLERANCES (CLAUSE 6)

No amendments

7. TESTING (CLAUSE 7)

No amendments

8. MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 BASIC PRINCIPLES (SUBCLAUSE 8.1)

Add the following after subclause 8.1.4:

Laying and Jointing of Medium-Pressure Steel Pipes and Specials

8.1.1 Corrosion Protection (New Subclause 8.1.5)

Unless specific provision is made in the Bill of Quantities, no separate payment will be made for corrosion protection. The rates tendered for the relevant items under Subclause 8.2 will be held to cover the cost of any protection system specified, as well as the testing specified for the applicable corrosion protection system.

8.1.2 Pipe Supports (New Subclause 8.1.6)

The rates to supply and install pipe specials, valves and meters shall include the cost of the pipe supports required complete with anchoring bolts, grouting and gaskets as indicated on the drawings.

8.1.3 Pipes Tested to Destruction (New Subclause 8.1.7)

Pipes tested to destruction and the repair of the tested pipes for use in the Works, if ordered by the Engineer, will be measured and paid on a daywork basis.

8.2 BILLED ITEMS (SUBCLAUSE 8.2)**8.2.1 SUPPLY, LAY AND BED STEEL PIPES AND SPECIALS COMPLETE WITH COUPLINGS (SUBCLAUSE 8.2.1)**

Change the heading of this subclause to "Supply, lay and bed steel pipes and specials complete with couplings".

Where this subclause refers to "laying of pipes and specials", change the wording to "supplying and laying of pipes and specials".

Add the following items after (k) in the list included in this subclause:

- "(l) design of all specials including all drawings and shop drawings
- (m) Fabrication and Supply of pipes and specials
- (n) factory testing and inspections
- (o) couplings, flanges and/or other jointing materials as specified
- (p) corrosion protection, including the testing of the corrosion protection as specified
- (q) all applicable testing and associated equipment as specified in Clause 5.1."

8.2.2 SUPPLY AND INSTALLATION OF VALVES AND METERS (SUBCLAUSE 8.2.3)

Change the heading of this subclause to "Supply and installation of valves and meters".

Replace the first paragraph with the following:

"The unit rate shall cover the cost of supplying the valves or meters in accordance with the relevant valve specification, corrosion protection as specified, testing of the valve or meter at the factory, factory inspections as specified, taking delivery of these items, inspecting each item for visible signs of damage, transporting to the laying site, off-loading, installing and, except where separately billed, of testing and commissioning of the valves and meters in position in accordance with the manufacturer's instructions and to the satisfaction of the Employers Agent."

Add the following:

"Separate items will be scheduled for each type, size, etc of valve and meter to be installed."

8.2.3 CONCRETE CASING (SUBCLAUSE 8.2.7)

Add the following:

"The rate shall also cover all joints, strapping and other requirements as per Subclause 4.3.7.1."

8.2.4 VALVE CHAMBERS (SUBCLAUSE 8.2.8)

Add the following:

“The rate shall also cover the backfilling and finishing the area around the chamber including erosion protection measures (such as Reno Mattresses) as indicated on the drawings.”

8.2.5 PIPE INSTALLATION WITHIN A SLEEVE PIPE (NEW SUBCLAUSE 8.2.14)

The rate shall be extra-over to 8.2.1 for the welding, fixing and testing steel pipes in sleeve pipe complete with trolley system as detailed on the Drawings. The rate shall include for all additional plant and labour required to lift, weld and install the pipes within a sleeve pipe.

The pipe trolley system shall be designed, fabricated, delivered and installed by the Contractor and shall be strong and sturdy enough to support the full pipe weight and capable of being installed within the sleeve pipe.

Measurement will be by meter of steel pipeline installed within a sleeve pipe.

8.2.6 CONNECTING TO EXISTING PIPELINES (NEW SUBCLAUSE 8.2.15)

The rate shall cover the costs to complete connection to existing pipelines as described in 4.3.14.

The tendered rate shall include full compensation for the cost of excavation, lateral support where required, cutting into and connecting to a pipe of size and material as scheduled, isolation, drainage of water, removal of surplus material, all labour and equipment necessary to make the connection, making good and all liaison with the authorities.

The unit of measure will be sum and each connection will be scheduled separately.

The cost of new pipe specials and couplings (where required) will be measured separately.

8.2.7 PIPE MARKER POSTS (NEW SUBCLAUSE 8.2.16)

The unit of measurement will be the number of marker posts installed.

The tendered rate shall cover all labour, material and plant required to design (where applicable), manufacture, supply and install the marker post in accordance with clause 4.3.13 and the drawings.”

8.2.8 FACTORY INSPECTIONS (NEW SUBCLAUSE 8.2.17)

a) Factory inspectionsUnit: Prov Sum

b) Overheads, charges and profit on item 8.2.17 a) aboveUnit: %

A provisional sum is allowed to cover the total cost of inspections to the factories of pipe, special and valve manufacturers. The sum shall include the cost of an independent inspectorate as well as the flights, accommodation and transport for the Employer and Employer’s Agent for inspections to the factory.

8.2.9 MISCELLANEOUS (NEW SUBCLAUSE 8.2.18)

An item which, in the payment clause column of the Bill of Quantities, refers to this clause, will be measured in the unit scheduled. The sum or rate for such item shall cover the cost of all materials, labour and plant required to execute and complete the work as specified, described in the Bill of Quantities or shown on the drawing(s).

General specification

General Corrosion Protection

Specification number: SPE-JJ-0003

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Rev	Date	Revision details / status	Author	Reviewer	Approver
0	2021/11/11	First Issue	Schalk van der Merwe	Denis Peart	Laura Ingle
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1 Scope

This Specification covers the painting and corrosion protection of plant, equipment in pump stations and water and wastewater treatment works and pipelines exposed to environments with variable corrosive tendencies.

Interpretations and variations of this Specification are set out in the Amendments of this Specification.

2 Normative References

2.1 Supporting Specifications

Where this Specification is required for a project, the following specifications shall, inter alia, form part of the Contract Document:

- (a) Amendments to this Specification;

Equipment, materials and operational methods shall comply with the latest edition of the relevant SANS, ISO, AS, BS, DIN or equivalent American Standard as shown in Annexure A.

3 Definitions and Abbreviations

3.1 Definitions

In this Specification the following shall have the meaning given:

- (a) **Coat:** A single uniform film of corrosion protection material applied to a substrate for corrosion protection purposes.
- (b) **Layer:** A uniform protective film of corrosion protection material applied to plant, equipment and piping in a specified manner consisting out of multiple coats.
- (c) **System:** A corrosion protection coating or lining consisting of multiple coats and/or layers, the type of coat, the number of coats and their thickness, the method of application and the requirements of the complete system.
- (d) **Coating:** A system on the outside of plant, equipment and pipework. However, certain international specifications referred to in this specification (e.g. AWWA specifications) use the term 'coating' to refer also to internal pipe protection and where these specifications are being referred to their terminology is used.
- (e) **Lining:** A system on the inside of plant, equipment and piping.
- (f) **Dis-bonded area:** An area of coating or lining that initially did adhere to the steel substrate after application, but which subsequently became loose from the substrate as a result of mechanical, chemical or other action.
- (g) **Un-bonded area:** An area of coating or lining which at no stage adhered to the steel substrate.
- (h) **Water path:** The shortest distance along the surface of an object embedded in concrete but exposed to water measured along the concrete interface.
- (i) **Holiday:** A discontinuity in a coating or lining which exhibits electrical conductivity when exposed to a specific voltage.
- (j) **Abrasive blast cleaning:** The process of projecting a stream of abrasive particles at high velocity towards a surface for the purpose of removing contaminants from that surface and to produce a textured surface which will increase the surface area and thus increase adhesion of the coating.
- (k) **Dry film thickness (DFT):** The thickness of a coating or lining after it is hard dry.

- (l) **Electrical insulation defect (EID):** Defects in a coating or lining that impair the protective properties of the coating or lining and that are detected instrumentally by either:
 - (m) a low-voltage, wet-sponge detector, or
 - (n) a high-voltage, sparking detector,operated in each case within the parameters specified.

Note: EID's include such defects as steel projections from the substrate, conductive particles embedded in the coatings or linings, voids and those defects commonly known as pinholes and holidays.
- (o) **Fusion bonded epoxy (FBE):** A thermoset epoxy powder coat. (The powder is normally applied by electrostatic spray to a preheated surface. The powder normally melts, fuses and cures at a temperature of 220°C to 250°C.)
- (p) **Inspector:** A person authorised by the Engineer to act as his representative in examining the work and materials and drawing such samples and carrying out such tests as may be necessary to ensure compliance with the specification.
- (q) **Lot:** A number of similar or related items submitted for inspection at one time by the Contractor and of such size that the inspector can reasonably be expected to examine adequately in not more than one working day.
- (r) **Paint:** A liquid material that, when applied as a thin film to a suitably prepared surface by an appropriate method, undergoes a physical or chemical change (or both) that converts it to a solid coating or lining bonded to the surface to which it is applied.
- (s) **Pinhole:** An electric insulation defect detected by the use of a wet sponge detector (see EID).
- (t) **Pot life:** The period, after the contents of the packs of a two-pack paint have been mixed together, during which the paint remains suitable for use without the addition of further solvent.
- (u) **Powder coat:** A material in the form of a dry, free flowing powder that, when applied to a suitably prepared steel surface by an appropriate method, can be fused by application of heat and subsequent cooling to form a continuous coating or lining that is bonded to the surface. A powder coat is classified as thermoplastic when the applied coat may be re-melted by heating, or as thermoset when it cannot be re-melted by heat. Low or medium density polyethylene powder is thermoplastic whilst FBE is a thermoset material.
- (v) **Significant surface:** The part of the article covered or to be covered by the coating or lining and for which the coating or lining is essential for serviceability and/or appearance.
- (w) **Steel:** This term embraces carbon steels, 3CR12 and all grades of stainless steels.
- (x) **Water break free:** A surface which, when wetted all over with plain potable water, maintains a continuously wet surface and the water does not break up into islands surrounded by unwetted surfaces.
- (y) **Wet film thickness (WFT):** The thickness of a coating or lining immediately after application and before any volatile matter has evaporated.
- (z) **Quality control:** The operational techniques and activities that are employed by the Contractor to sustain the required quality of a product, process or service.
- (aa) **SAHDGA:** South African Hot Dip Galvanisers Association.
- (bb) **Sa:** Followed by a number refers to a photographic illustration of the standard of blast cleaning required, as shown in ISO 8501-1
- (cc) **St:** Followed by a number refers to a photographic illustration of the standard of mechanical cleaning required, as shown in ISO 8501-1.

3.2 Abbreviations

The following abbreviations shall have the meaning assigned to them:

µm : Micrometre

3CR12 : A 12% chromium-containing corrosion resistant steel

3LPE	:	Three layer high density polyethylene
ABS	:	Acrylnitrile-butadiene-styrene
Al	:	Aluminium
CI	:	Cast iron
CS	:	Cast steel
DCA	:	Die cast aluminium
DFT	:	Dry film thickness
EID	:	Electrical insulation defect
FBE	:	Fusion-bonded Epoxy
FBP	:	Fusion-bonded Polyester
FBPE	:	Fusion-bonded Polyethylene
GRP	:	Glass fibre reinforced Polyester
HDG	:	Hot-dip galvanized
HDPE	:	High Density Polyethylene
MIO	:	Micaceous Iron Oxide
MS	:	Mild steel
PC	:	Polycarbonate
PVC	:	Polyvinylchloride
QCP	:	Quality Control Plan
SG	:	Spheroidal graphite cast iron
SS	:	Stainless steel – grades 304, 304L, 316 and 316L
UV	:	Ultra Violet
WFT	:	Wet film thickness

4 Requirements

4.1 Contractor's Obligation

The requirements, material, surface preparation and corrosion protection systems prescribed in this Specification is regarded as a minimum requirement for the specific application. No deviation from this Specification shall be allowed without the written approval of the Engineer.

The Contractor is responsible for the design of the corrosion protection system and shall submit to the 333Engineer details of the material selection, surface preparation method and corrosion protection system he intends using as part of his design, including the Manufacturer's Instructions for each product and shall only proceed with the purchase of the corrosion protection materials/paints upon receipt of conformation from the Engineer.

The Contractor shall obtain written evidence from the chosen material manufacturer/supplier that the proposed materials, surface preparation method and corrosion protection system comply with the specified requirements and are suitable for the intended purposes under the specified Environmental Conditions (refer to Clause 4.3). The Contractor shall also obtain the Manufacturer's Instructions (refer

to Clause 4.2). The written evidence and Manufacturer's Instructions shall be submitted to the Engineer for comment before commencement of the work.

In the event that no corrosion protection is specified for any Plant, equipment or pipes within the Specifications or Drawings, this Specification shall be used as a basis to agree on a corrosion protection system for the specific application.

4.2 Manufacturer's Instructions

The manufacturer's instructions shall be regarded as the 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.

The following details shall be made available to the Engineer and the applicator:

- ▶ Brand and type of corrosion protection material;
- ▶ Mixing and thinning instructions;
- ▶ Recommended type and quantity of solvent required for thinning during application;
- ▶ Pot life of mixed product;
- ▶ Minimum and maximum recommended dry film thickness per coat;
- ▶ Minimum and maximum recommended dry film thickness per layer;
- ▶ Recommended time intervals between coats;
- ▶ Recommended minimum and maximum steel surface temperatures during application;
- ▶ Time for complete drying and curing on applicable surfaces;
- ▶ Substrate surface preparation requirements;
- ▶ Recommended primers for substrate;
- ▶ Recommended method of coating and lining application;
- ▶ Repair procedures for damaged coatings and/or linings and field joints on pipelines;
- ▶ Toxicity if in contact with water, and
- ▶ All relevant information the Supplier wishes to submit on his product.

Verbal instructions by the manufacturer's representative will not be accepted unless confirmed in writing by the Contractor.

4.3 Environmental Conditions

Environmental conditions shall be classified according to SANS 10120-3 HC. The corrosion protection system design and applied by the Contractor shall be suitable for the Environmental Conditions specified.

Unless otherwise specified in the Amendment of this Specification the Environmental Conditions shall be classified as follows:

- ▶ Mildly-corrosive: Dry, indoor/internal, above ground and ventilated conditions, not within 5km from the coastline or polluted industrial area. Relative humidity below 70%.
- ▶ Severely corrosive: Submerged, splash-zone, underground, very moist conditions, or within 5km from coastline or polluted industrial area, or in waste water works, or close to electrical power lines. Relative humidity above 85%.
- ▶ Medium Corrosive: All other conditions not included in the abovementioned definitions.

Notwithstanding the abovementioned information the Contractor shall satisfy himself of the environmental conditions on Site and design the final corrosion protection systems accordingly.

4.4 Workmanship

A high standard of workmanship is required. Only experienced personnel shall be used to carry out corrosion protection work. All work shall be carried out under the constant supervision of a qualified supervisor.

Similarly all repair work at Site shall be done by competent personnel under the supervision of a qualified supervisor.

4.5 Compatibility of Materials

4.5.1 Design Precautions

All equipment shall be designed to suppress corrosion in an exposed environment with special reference to galvanic corrosion.

The Contractor shall ensure that dissimilar metals or alloys alongside each other are compatible or are adequately protected if, in the galvanic series, there is more than a 0,3 volt difference in the galvanic potential.

4.5.2 Galvanic Corrosion Prevention

The Contractor shall ensure that the following steps are taken to minimise corrosion:

- (a) If dissimilar metals are used: Coat all surfaces of the whole assembly including the more noble member of the galvanic series.
- (b) If the noble member of the assembly cannot be entirely covered:
 - (i) Keep the anode/cathode ratio as large as possible in the particular component.
 - (ii) Use electrical insulators between two metals. Insulation must be complete, a bolt requires a sleeve as well as washers of an insulating material.
- (c) Joints and crevices between metals shall be sealed.
- (d) Where fastening is unavoidable, the fasteners shall be more noble (cathodic) than the base material. Fasteners shall be coated where possible and/or adequately electrically insulated between fasteners and the base material.

4.6 Handling of Clean Items

After cleaning, surface shall not be contaminated in any way. Operators shall wear clean gloves and all surfaces shall be clean and free from oil, grease, grit, dirt and other contamination.

4.7 Machined and Matching Surfaces

Mating surfaces of joints shall be coated with primer (where specified) or first coat only. The coating or lining shall be uniform in thickness and shall not interfere with the mechanical tolerances. After assembly the outside surface of the joints shall be fully coated.

4.8 Special Areas

Areas that are inaccessible after assembly shall be prepared and fully coated with the specified system to the specified requirements before assembly. The coats shall be fully cured before assembly.

Steel edges to be welded after coating shall not be coated for a distance of 50 mm from the welding edge. The unlined strip of grit blasted surface shall be temporarily protected with a coat of (red or a different colour to the lining/coating) weldable primer between coating and/or lining application and installation.

Friction grip areas shall be left un-coated unless otherwise specified.

4.9 Supports

During coating and/or lining application, the items shall be so supported to prevent damage to the wet coatings or linings until the coatings or linings have hardened adequately. Items shall remain supported during curing, storing and handling.

4.10 Water Retention Areas

Pockets, recesses and crevices in which water and dirt may collect shall be avoided. Water retention areas shall be properly drained by holes as large as possible.

Surfaces of corrodible metals, such as the insides of tanks or hollow Specifications that cannot be protected by any method (e.g. painting or dipping), shall be avoided, or where not possible, be fully sealed against ingress of air and moisture.

4.11 Stripe Coats and Crevices

All complex surfaces including metal edges, up stands, welds, bolts and nuts shall be adequately coated to ensure complete corrosion protection. Additional stripe coats shall be applied after initial priming, if required or ordered by the Engineer.

Special attention shall be given to crevices and edges to ensure complete coverage and uniform paint thickness.

4.12 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and repairs will be subject to inspections as set out in Clause 11.2. Where the damage is extensive the particular remedial procedures for each such instance shall be agreed with the Engineer in writing.

All repairs shall comply with the requirements of the repair-product Manufacturer's Instructions. The Engineer may at his discretion request that repaired areas undergo adhesion tests.

Any damage occurring during transit from the Contractor's premises to the Site shall be the responsibility of the Contractor. The Contractor shall repair any damage occurring on Site during handling, assembly, storage, transport and erection.

A repaired area shall be tested in accordance with Sub-Clauses 5.4 and 5.9 of SANS 1217 for compliance with the relevant requirements for thickness and electrical insulation defects respectively.

Any item showing electrical insulation defects exceeding an average of five per square metre (a cluster of pinholes within a radius of 25 mm being regarded as a single defective area), or flaking or

other signs of loss of adhesion, shall not be repaired. The item shall be blast cleaned and re-coated in accordance with the relevant requirements of this Specification.

Paint surfaces which become streaky because paint has run, will be rejected.

Touching up of damage to the final paint coat will NOT be permitted. If final paint coat is damaged the item shall completely repainted with the finishing coat in accordance with the specifications.

4.12.1 Repair Methods for Minor Defects

The repair of areas showing electrical insulation defects or low film thickness shall, if approved by the Engineer, be carried out as follows:

- ▶ Degrease in accordance with Clause 7.4.1.
- ▶ Thoroughly abrade the area, including an adjacent surrounding area of at least 25 mm wide, with a medium grade 220 abrasive paper.
- ▶ Vacuum-clean the surface to remove dust and debris in accordance with Clause 7.2 to achieve a dust quantity rating 1 and a dust size class 0 in terms of ISO 8502-3.
- ▶ Wipe the abraded paint surface with methyl ethyl ketone and allow to dry.
- ▶ Apply as many coats of repair material as necessary to achieve the specified electrical insulation thickness and finish as to conform to the adjoining corrosion protection system's requirements.
- ▶ Apply a final top coat over the repaired area to achieve a pleasing, uniform finish of the item.

4.12.2 Repair Methods for Major Defects

The repair of areas showing damage down to the steel surface shall, if approved by the Engineer, be carried out as follows:

- ▶ Degrease in accordance with Clause 7.4.1.
- ▶ Blast-clean area to Sa 3 (ISO 8501-1).
- ▶ Feather the surrounding paint for a distance of 25 mm beyond the damaged areas with a medium grade 220 abrasive paper.
- ▶ Vacuum-clean the surface to remove dust and debris in accordance with Clause 7.2 to achieve a dust quantity rating 1 and a dust size class 0 in terms of ISO 8502-3.
- ▶ Wipe only the abraded paint surface with methyl ethyl ketone and allow to dry.
- ▶ Apply as many coats of repair material as necessary to conform to the specified adjoining corrosion protection system's requirements.
- ▶ Apply a final top coat over the repaired area to achieve a pleasing, uniform finish of the item.

4.13 Quality Control

This clause and its sub-clauses shall be read in conjunction with the project's quality control plan, if any.

4.13.1 Submission for Approval

The Contractor shall submit the following to the Engineer, including data sheets where applicable, for approval:

4.13.1.1 Corrosion Protection

- ▶ A programme;
- ▶ The Quality Control Plan (QCP) for corrosion protection indicating hold points;

- ▶ Process Method Statement;
- ▶ Blast material;
- ▶ Proposed corrosion protection systems; and
- ▶ Proposed pickling and passivating products.

4.13.1.2 Manufacture and Corrosion Protection Programmes

The manufacture and corrosion protection programmes shall state the time and place when the following will be conducted:

- ▶ Inspection of material;
- ▶ Hydrostatic testing of uncoated castings, pipes and fittings;
- ▶ Manufacture of components;
- ▶ Fettling or dressing;
- ▶ Degreasing;
- ▶ Water soluble salts test;
- ▶ Blast cleaning and application of the first coat;
- ▶ Application of intermediate and final coats; and
- ▶ The commencement of Site repairs.

4.14 Health & Safety Requirements

4.14.1 Control of Major Classes of Risk

- (a) Health risks, these include:
- (i) Gases/vapours;
 - (ii) Volatile liquids in the paint; and
 - (iii) Powders/dust.
- (b) Fire or explosion risks, these include:
- (i) Fire risk during storage/transport; and
 - (ii) Explosion hazard during application.

4.14.2 General Aspects of Explosion Hazards

The essential precaution to be taken is, inter alia that sufficient ventilation air shall be provided to maintain the ratio of vapour/air to no more than 10% of the lower explosive limit.

4.14.3 General Aspects of Toxic Hazard

Measures shall be taken by the Contractor to ensure that the following are prevented:

- ▶ Inhalation of dust/fumes;
- ▶ Skin contact with paint;
- ▶ Ingestion of paint; and
- ▶ Eye contact/penetration of paint.

Operators shall be provided with the necessary Personal Protective Equipment (PPE), such as masks/hoods, barrier creams and protective clothing to minimize the chances of the above occurring.

Emergency procedure shall be in place and First Aid kit provided to deal adequately with any of the above occurrences.

The Contractor shall ensure that in terms of Clause 6(2) of the Construction Regulations of the OH&S Act 85 of 1993, an assistant construction supervisor is specifically appointed for the application or

repairs of linings inside enclosed or semi-enclosed areas e.g. pipe linings, prior to the execution of any such work.

4.15 Specific Requirements for Pipes and Specials

4.15.1 Cut Back of Coated Pipes

The blast cleaned surface shall be stopped off or cut back by suitable masking which shall not contaminate the cleaned surface. Cut-backs shall comply with the requirements as set out in Table 4-1 below:

Table 4-1: Cut-back of Coatings

PIPE END	CUT-BACK (mm)	COMMENT
Pipe ends prepared for field butt welding	100	All coatings to be mitred or feathered to prevent air entrapment in the joint coating system
Pipe ends prepared for flexible joint couplings	Various	The coating shall be cut back a sufficient distance to accommodate a standard coupling for the particular diameter of pipe
“Bell and spigot” pipe ends prepared for first welding	100	The cut back shall be measured from either side of the (field) external fillet weld position when the spigot is fully inserted into the “bell”

4.15.1.1 Protection of Pipe Ends on Pipes with Cut-Back

Before delivery cut backs of each pipe for field welds shall be coated with an approved rust inhibitor. This inhibitor shall provide corrosion protection for up to 6 months and shall enable good cutting and welding properties (Sigmaweld 120, Plascon etching primer or equivalent approved). Plain ended pipes (to be joined by flexible couplings) are to be coated with an approved rust inhibitor for a distance of 100mm from the pipe ends on the inside and the outside of each pipe. Careful attention must be paid to ensuring the pipe ends are also completely covered. The inhibitor used must be compatible with both the lining and the coating.

4.15.2 Pipe Ends

4.15.2.1 Extension of Lining

For flanged pipes or specials and pipes or specials intended for joining with flexible couplings or for Site welding by means of double sleeve weld-on couplings, the lining shall extend to the ends of pipes and specials including edges and shall overlap by at least 300 mm on the outside of the pipe. Coatings shall overlap surfaces on the outside by at least 25 mm.

4.15.2.2 Butt Weld Edges

For pipes and specials intended for Site butt-welding, lining and coating shall extend up to a distance of 50 mm from pipe ends. The unlined circumferential strip of grit blasted surface shall be temporarily protected between the Works and Site with a coat of weldable primer (of a different colour to the lining/coating).

4.15.3 Field Joints

No welding whatsoever shall be performed on any pipe or special on which the lining or coating has been completed, unless otherwise approved by the Engineer in writing.

The materials used for the repairs to field joints, linings and coatings shall be the same as that used for the pipes, unless otherwise approved by the Engineer in writing.

The linings and coatings of butt welded steel pipes or continuously welded steel cylinder type prestressed concrete pipes, shall be made continuous over joints as soon as possible after approval and acceptance by the Engineer of the welded joint. At no time shall field joints, lining and coating repairs/remedial work lag more than 250 metres behind the last pipe laid.

Flexible couplings shall be provided with external protection as soon as the pipeline has been hydrostatically tested and electrically bonded, where applicable.

4.15.4 Supports

When pipes are installed or mounted on concrete supports, rubber insertion shall be used to insulate the pipe from the support. The thickness of the rubber insertion shall not be less than 10 mm and protrude not less than 20 mm all round.

4.15.5 Sealing

Pipes that enter or exit concrete shall be sealed on their circumference with a continuous polyurethane or polysulphide flexible sealer, in a 25 mm square recess.

4.15.6 Spare Pipes

Corrosion protection of spare pipes shall where applicable be supplied with a top coat of Re-coatable Polyurethane to a DFT of 30 – 50 µm, colour white or silver, for storage and above ground installation.

5 Materials

The material requirements for each corrosion protection system is specified in the relevant clauses of Clause 10 and shall be read in conjunction with this clause.

5.1 General

All materials in a corrosion protection system shall be purchased from the same manufacturer unless approved by the Engineer.

Materials offered and subsequently approved shall not be changed without written approval of the Engineer.

All corrosion protection materials shall be delivered in the manufacturer's original containers clearly marked with the following:

- ▶ Manufacturer's name;
- ▶ Product Brand and Reference Number;
- ▶ Batch Number which may incorporate the date of manufacture;
- ▶ Abbreviated instructions for storage and use of material, which shall include mixing ratios of the components of multi-component materials, minimum and maximum temperature of application and the method of application; and
- ▶ The SANS mark where applicable.

Any conflict between the manufacturer's data sheet and the specification shall be referred to the Engineer for adjudication.

5.2 Toxicity of Lining Material

Materials used for the lining of equipment that will be in contact with water shall be non-toxic and shall not impart any odour, taste, or colour to the water.

5.3 Storage

All corrosion protection materials shall be kept in an approved dry and enclosed store. The temperature shall not drop below 0°C nor exceed 40°C.

Usage of materials shall be on a first in, first out basis and no materials shall be used that have exceeded the shelf life recommended by the manufacturer.

6 Contractor's Equipment

6.1 Handling and Transportation

The plant and equipment used by the Contractor for handling of pipes, valves, pumps and other equipment, for the purpose of corrosion protection shall be such that no pipe shell, valve or pump casing or any other piece of equipment is over stressed during any operations covered by this Specification.

6.2 Surface Preparation Equipment

The Contractor shall provide all the equipment required for abrasive blast cleaning, preparation and cleaning of all surfaces to be coated.

6.3 Compressor

Compressors used for abrasive blast cleaning shall be fitted with an after cooler and oil and water traps such that the air delivered at the nozzle is completely free from oil and water. The volume displacement of the compressors shall be adequate for the number and bore of blast nozzles, the spray equipment and flame spray equipment that may be necessary to carry out the specified coating operations.

6.4 Application Equipment

The Contractor shall provide all the equipment required for airless spray painting, two component hot airless spray painting, electrostatic powder coating, fluidised bed powder coating, or any other approved method of applying the corrosion protection system in the shop or required for site application and repairs to coats. All equipment shall be thoroughly cleaned on completion of each day's work and maintained in clean working order.

6.5 Inspection of Equipment

All facilities and equipment shall be subject to inspection by the Engineer or the independent inspectorate and defects in the equipment shall be rectified when so required.

6.6 Inspection Equipment

The Contractor shall supply all facilities and equipment for inspecting and testing the specified preparation and corrosion protection of all items supplied under the Contract. Recent calibration certificates shall be available for all equipment requiring calibration. This equipment shall be made available to the Engineer or his independent inspectorate for the purpose of testing the specified corrosion protection systems and verifying the accuracy of the test equipment.

7 PREPARATION OF SURFACES TO BE COATED

The surfaces of all items to be coated and/or lined, irrespective of the corrosion protection system used, shall be prepared in accordance with the relevant following requirements.

7.1 Standards

Reference is made to the latest issues of the following Standards:

- SANS 1344** Medium duty solvent detergent.
- SANS 10064** The preparation of steel surfaces for coating.
- ISO 8501-1** Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after overall removal of previous coatings.
- ISO 8502-3** Preparation of steel substrates before application of paint and related products - Tests for the assessment of surface cleanliness Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method).
- ISO 8504-2** Preparation of steel substrates before application of paints and related products – Surface preparation methods – Part 2: Abrasive blast cleaning.
- SANS 5770** Cleanliness of blast-cleaned steel surfaces for painting (freedom of soluble salts).
- SANS 5772** Profile of blast-cleaned steel surfaces for painting (profile gauge).
- ISO 11125** Preparation of steel substrates before application of paints – Metallic blast-cleaning abrasives.

ISO 11127 Preparation of steel substrates before application of paints – Non-metallic blast-cleaning abrasives.

7.2 Surface Condition

Before surface preparation all items to receive a coating or lining shall be in rust condition A to C of ISO 8501-1. Items in rust condition D will be rejected.

Prepared surfaces shall conform to Table 7-1 below. If only surface cleanliness to ISO 8501-1 is specified in the Specifications then the corresponding values of Table 7-1 for degreasing, surface profile and soluble salts shall apply.

Table 7-1: Surface Condition

Cleanliness to ISO 8501-1 (min)	Sa 3	Sa 2½	St 2
Residual dust quantity rating and size class (ISO 8502-3)	1 / 0	1 / 1	1 / 1
Oil, grease and perspiration	Nil	Nil	Nil
Surface Profile(min)	30 µm	30 µm	n/a
Layers up to 200 µm (max)	50 µm	50 µm	
Surface Profile (min)	50 µm	50 µm	n/a
Layers > 200 and up to 300 µm (max)	80 µm	80 µm	
Surface Profile (min)	60 µm	60 µm	n/a
Layers > 300 and up to 500 µm (max)	100 µm	100 µm	
Water soluble salts:			
Maximum at any point.	100 mg/m ²	400 mg/m ²	500 mg/m ²
Average of any 250 cm of Pipe length.	100 mg/m ²	100 mg/m ²	100 mg/m ²

Note: The maximum surface profile shall be less than 1/3 of the coat thickness.

Unless otherwise specified in the Amendments to this Specifications the surface condition shall conform to the following requirements:

- ▶ Sa 3 for the environmental condition classified as severely corrosive,
- ▶ St 2 for Tape Wrapping, and
- ▶ for all other environmental conditions the surface condition shall be Sa 2½.

7.3 Preparation of Items

Prior to the application of any coat, each item shall comply with the following:

- ▶ Weld splatter shall have been removed by chipping or grinding to a smooth surface flush with the surrounding steel.
- ▶ Weld seams shall have a smooth contour, free from sharp edges, protrusions and undercuts.
- ▶ Sharp edges and protrusions shall have been removed by grinding to a smooth radius. The radius shall be a minimum of 3 mm for steel of thickness 6 mm or greater, or a minimum of 50% of the steel thickness for steel of thickness less than 6 mm.

- ▶ Laminations, scabs or occluded scale shall be ground out. If such grinding penetrates deeper than 3.5% of the metal thickness, the area shall be repaired by welding or the metal shall be rejected at the discretion of the Engineer.
- ▶ Articles for hot-dip galvanizing shall not have any overlapping joints. Closed sections shall be suitably vented.

7.4 Cleaning of Items

7.4.1 Degreasing

All surfaces to be coated shall be tested for oil and grease contamination by the water break free test.

In the event that degreasing is required, items shall be degreased by the use of a water based solvent degreaser such as that complying with SANS 1344 or, for use in enclosed systems, with SANS 1365.

Items shall be thoroughly washed with clean potable water to remove all residues. The items shall then be allowed to dry. The washed surfaces shall be tested after degreasing to show that no oil, grease and chemical contamination are present.

Care shall be taken to avoid entrapment of cleaning agents in recesses or other retention areas.

7.4.2 Blast Cleaning

Blast-cleaning shall be done in accordance with the code of practice SANS 10064. Any abrasive used for blast cleaning shall be composed of clean, non-recycled, sound hard particles free from foreign substances such as dirt, oil, grease, toxic substances, organic matter, water soluble salts and foreign metals.

The surface of the items to be coated or lined shall be blast cleaned by centrifugal or air blast cleaning methods, then vacuum cleaned or blown off to achieve the following requirements:

- ▶ The surface condition shall be in accordance with ISO 8501-1 as stipulated in Clause 4.2 and specified in the Amendments and Additions of the Specification, when tested in accordance with SANS 5772.
- ▶ Any laminations revealed by blast cleaning shall be ground out and re-blast cleaned to meet the above requirements. If grinding penetrates the steel to a depth greater than 3.5% of the nominal wall thickness, the item will be rejected.
- ▶ The time interval between abrasive blast cleaning and paint application shall not exceed those given in Clause 9.2.6.2.

7.4.3 Mechanical Surface Preparation

Cleaning by hand or by means of power tools (e.g. wire brushing) shall be carried out in accordance with the methods described in SANS 10064 to the standards specified in the Amendments of this Specifications and as shown in ISO 8501-1 and Clause 7.2.

7.5 Pickling and Passivation

Where specified the following areas shall be pickled and passivated:

- ▶ All un-coated areas;
- ▶ Ground and sheared edges; and
- ▶ Heat affected zones caused by welding or cutting.

Where possible, pickling and passivation shall be done by the dipping process.

Proprietary pickling and passivation chemicals (as supplied by approved suppliers) shall only be used in accordance with the manufacturer's recommendations. Pickling formulations made up of 15 to 20% nitric acid (HNO₃) and 1 to 2% hydrofluoric acid (HF) by volume with potable water are considered suitable. Care shall be taken not to exceed the maximum contact time recommended.

After pickling and passivation, surfaces shall be very thoroughly washed with clean potable water to remove all traces of acid. Repeat the process, if necessary to remove all discolouration. Surfaces shall be allowed to dry, then polished where necessary, using polishing compounds recommended by the stainless steel manufacturer.

8 Surface Preparation Methods

The requirements as specified below shall be read in conjunction with the requirements of Clause 7 Preparation of Surfaces to be Coated. Each preparation method specified below shall also conform to the relevant requirements of Clause 7 and its sub-clauses. Where in conflict with Clause 7 and its sub-clauses the requirements hereunder shall take precedence.

Unless otherwise specified in the Amendments of this Specifications and subject to the approval of the Engineer, the surfaces of all items to be coated and/or lined shall be prepared in accordance with one or more of the following methods.

8.1 Mild Steel

Components manufactured from mild steel shall be degreased and blast clean before the corrosion protection system is applied. Oil and grease contamination, when present, shall be removed to a water break free surface by degreasing (Refer to Clause 7.4.1) before blast cleaning (refer to Clause 7.4.2).

Steel items less than 2 mm thick may distort when blast cleaned. Sheet steel items less than 2 mm in thickness shall be degreased, acid pickled and phosphated with an approved proprietary 7 or 9 stage process to produce a fine grain zinc phosphate surface complying with SANS 10064 Table 1 Lightweight or by a proprietary process approved by the Engineer for the standard of cleaning specified.

All surfaces of steel 2 mm or more in thickness shall be abrasive blast cleaned in accordance with SANS 10064 Section 5.3 and cleaned to achieve the requirements given in Table 4-1 for the standard of abrasive blast cleaning specified.

8.2 Cast Iron and Cast Alloys

Cast iron shall be abrasive blast cleaned until all sand particles, residual burnt-on sand and casting skin have been completely removed. Cast iron surfaces shall be abrasive blast cleaned in accordance with SANS 10064 Section 5.3 to achieve the requirements given in Clause 7.2 for the standard of abrasive blast cleaning specified.

Blowholes and omegas in cast surfaces shall be opened up where necessary and filled with a two component solvent free epoxy filler. When the filler has set hard, the surface shall be abraded to be flush with the surrounding metal.

8.3 Stainless and Corrosion-Resistant Steel

Components manufactured from stainless or corrosion-resistant steel shall be supplied in the fully passivated condition. Sheared edges, welds or surfaces subjected to any form of heat treatment or contamination with iron or mild steel, shall be pickled and passivated in terms of Clause 7.5.

Surfaces shall thereafter be thoroughly degreased in terms of Clause 7.4.1, then rinsed with potable water to obtain a water-break-free surface.

When it is required to paint stainless steel exceeding 2 mm thickness, the surface shall be blast cleaned in accordance with the parameters given in Clause 7.2, using non-metallic abrasives such as iron slag, copper slag or platinum slag. The use of steel shot, steel grit or cast-iron grit 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 the use of 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.

8.4 Aluminium

Generally, aluminium surfaces will be anodized or powder coated and will require no further treatment. Where painting is required, the aluminium 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 micrometres dry film thickness) of wash primer, mixed and applied in accordance with the manufacturer's instructions. Note that the "wash primer" is an adhesion promoter and does not replace the primer specified in the paint system.

8.5 Hot-Dip Galvanized Surfaces

Hot-dip galvanized surfaces shall be thoroughly degreased by scrubbing with water rinsable solvent degreaser, followed by thorough washing with clean, potable water. If the water breaks up into islands of non-wetted surface, the degreasing shall be repeated until a water break free surface is obtained. Small areas may be abraded with a non-metallic abrasive paper prior to painting. Large surfaces may be sweep blast cleaned, using ultra-fine abrasive (particle size 0,2 to 0,8 mm) and a nozzle pressure not exceeding 300 kPa. A uniform matt surface shall be obtained. Loss of zinc thickness shall not exceed 10 µm. Cracking and flaking of the galvanized layer is indicative of excessive blast cleaning by using too coarse abrasive or too high blast pressure. Such surfaces will be rejected. The article shall then be stripped and re-galvanized.

8.6 Painted Surfaces

8.6.1 Primer Only

Where the surface has been contaminated it shall be washed and dried to remove dust and deposits before overcoating.

The succeeding coats shall be compatible with the primer. Where the type of primer is unknown, a test patch shall be applied. There shall be not loss of adhesion or other defects of the primer or between primer and undercoat. If defects or adhesion loss occur, the primer shall be completely removed, feather blasted and replaced by a primer which is compatible with the specified system.

8.6.2 Recoatable Materials

Surfaces painted with recoatable paints shall be abraded with abrasive paper grade 220 to a uniform matt finish, washed and dried to remove dust and deposits before overcoating.

8.6.3 Fully Cured Non-Recoatible Materials

Surfaces painted with fully cured non-recoatible paints that have exceeded their overcoating time shall be thoroughly abraded with abrasive paper grade 220 to a uniform matt finish, washed and dried before overcoating. The edges of any damage shall be smoothly feathered into the sound paint. Repairs to damaged areas shall extend 25 mm beyond the damage.

8.6.4 Two Component Paints within their Overcoating Time

Surfaces painted with two component paints where the paint is still within the overcoating time specified by the manufacturer shall be recoated without special surface preparation. Where the surface has become contaminated, it shall be cleaned.

8.7 Plastic Surfaces Such as PVC and GRP

Where the surface has been contaminated it shall be washed and dried to remove dust and deposits before overcoating.

8.8 Concrete and Plaster Surfaces

Concrete and plaster surfaces to be painted shall be clean, dry and free from laitance, dust or similar friable surface layers and from mould oil or similar contaminants that will interfere with the adhesion of the coating or lining.

Mould oil shall be removed by the use of a water-based detergent followed by high pressure water washing. When all contaminants have been removed, the surface shall be allowed to dry either to a damp condition or to a completely dry condition, depending on the coating or lining to be applied.

For immersion or other heavy duty applications, laitance shall be totally removed by water blast cleaning, with abrasive injection, or by mechanical scabbling of the surface, or by acid pickling, followed by very thorough washing with potable water.

Off shutter concrete usually shows surface blowholes or omegas. Omegas shall be drilled or chipped open to the full hole diameter. Blowholes and opened omegas shall be filled with a suitable filler such as acrylic or solvent-free epoxy. The use of gypsum or cellulose-based fillers is not permitted for underwater or humid conditions. Shutter kicks and similar projections shall be removed by grinding to a smooth surface.

For coatings or linings of low water permeability, such as solvent-borne epoxies, vinyls and chlorinated rubber, the moisture content of the concrete or plaster shall be not more than an indicated 5% when tested with an approved electrical conductivity meter, designed for use on concrete or plaster (such as the Delmhorst meter). The pins of the meter shall penetrate the concrete or plaster to a depth of not less than 5 mm.

The first coat of the coating or lining system may require thinning with the manufacturer's recommended solvent to assist in penetration of the substrate.

9 Application of Corrosion Protection System

All coatings and/or linings, irrespective of the surface preparation method or corrosion protection system used, shall be applied in accordance with the relevant following requirements.

9.1 Conditions During Application

If in the opinion of the Engineer adverse weather conditions are such as to interfere with the successful application of an efficient corrosion protective system, he shall order a stoppage of work. The Contractor will be deemed to have accepted this risk and made provision for it in his rates.

9.1.1 Dusty Conditions

Coats shall not be applied in dusty or contaminated conditions.

9.1.2 Surface Temperature

Coats shall not be applied if the surface temperature of the base metal is less than 3°C above dew point or outside the range 5 - 40°C, unless otherwise recommended in the manufacturer's instructions.

9.1.3 Ambient Temperature

Coats shall not be applied when the ambient temperature is less than the minimum or greater than the maximum recommended by the manufacturer's instructions of the corrosion protection material.

9.1.4 Relative Humidity and Time Interval

The time interval between abrasive blast cleaning and paint application shall not exceed those given in Table 9-1.

Table 9-1: Maximum time interval - Between blast cleaning and coating

Ambient Relative Humidity	Maximum Time (hours)
Below 50%	6
50% - 70%	4
70% - 85%	2
Over 85%	Coating not permitted - Reblast and coat when rel. humidity below 85%

Should immediate lining/coating not be possible, or should any atmospheric oxidation take place between the completion of blast cleaning and commencement of lining/coating, such oxidation shall be removed by flash blasting to restore the specified surface finish.

9.2 Paints

9.2.1 Application Method

The recommendations of the paint manufacturer as per the manufacturer's instruction (refer to Clause 4.2) as shown on his data sheets or given in writing shall be followed.

Apart from touch up, all liquid paints applied in the shop shall be applied by means of airless spray machines. Before use all paints shall be thoroughly stirred so as to be completely homogeneous. Two component paints shall be thoroughly mixed in the correct proportions as specified in the manufacturer's data sheet.

Painting on site shall be carried out to the Engineer's written approval. Significant surfaces to be painted on site shall be those specified in the Specification or shown on the drawings. Site application methods shall comply with the paint manufacturer's recommendations.

9.2.2 Colour

Successive coats shall have distinctively different shades to facilitate coverage of each coat. Unless otherwise specified in the Amendments to this Specification, or directed by the Engineer, the final paint colour shall be that given in Appendix B of this specification and shall be a commercial match to the appropriate colour in SANS 1091 - National Colour Standards for Paint.

9.2.3 Wet Film Thickness

The Contractor shall regularly and frequently monitor wet film thickness and shall calculate the dry film thickness from the volume solids of the paint.

9.2.4 Mixing

All paint components, particularly two- or multi-component materials, shall be thoroughly mixed until a homogeneous mixture is achieved.

9.2.5 Degree of Cure

The degree of cure of paint will vary with time, temperature and ventilation and shall be assessed by solvent wiping in accordance with the method given in SANS 1217 (Methyl Ethyl Ketone Resistance Test).

9.2.6 Overcoating

9.2.6.1 Compatibility of Coats

All primer, intermediate, finishing coats and layers shall be mutually compatible and recoatable paints shall be used where applicable. There shall be not loss of adhesion between the consecutive coats or other defects.

9.2.6.2 Overcoating intervals

The minimum and maximum overcoating intervals provided in the manufacturer's data instructions shall be strictly observed. Times and dates of application shall be recorded for each separate item and coat in the quality control records.

Since overcoating times are frequently quoted at 20 °C or 25 °C, longer overcoating times shall be allowed at lower temperatures. As a rough guide, increase time by 50% for a 5° decrease (or by 100% for a 10° decrease) in the ambient temperature below the temperature quoted in the data sheet.

9.2.6.3 Thickness of Consecutive Coats

Generally a corrosion protection system will be build-up with multiple coats. The thickness of all coats, primer, intermediate or finish coats shall be strictly according to the manufacturer's instructions. For solvent-base paints it is imperative that the applicator does not exceed the maximum film thickness per coat applied in order to prevent entrapment of the solvent and the formation of pinholes.

9.3 Duplex or Multi-Layer Systems

Duplex or Multi-layer systems consist of more than one corrosion protection system applied consecutively e.g. a Hot-Dip Galvanizing and Polyurethane system

The specifications for each of the corrosion protection systems shall be strictly followed. Special attention shall be given to adhesion between the systems.

9.4 Finishing on Site

Repairs, finish painting and cleaning on the site are regarded as inherent parts of the installation. On completion of erection, all pipework, control gear and indicating gear shall be thoroughly cleaned.

After erection, paint work shall be washed down, using nylon brushes and detergent to remove all adhering contamination. It shall then be washed with clean water to remove all traces of detergent and allowed to dry. The finishing coat shall then be applied as specified in the Amendments to this Specification.

All surfaces which cannot be painted after erection shall be painted as specified before erection. The painting system so applied shall be allowed to become fully hard dry (for at least two weeks for epoxy type paints) before erection.

For coatings such as epoxies, having a limited overcoating interval as specified in the manufacturer's data sheets, the surface shall be washed and thoroughly abraded to a matt finish before application of the finishing coats in accordance with the manufacturer's instructions.

9.5 Tolerances

9.5.1 Individual Coats Film Thickness

At least 90% of all thicknesses measured shall comply with the minimum thickness of the system specification. Up to 10% of all readings may be below the specific minimum thickness, but no reading shall be less than 70% of the specified minimum thickness.

9.5.2 Total Dry Film Thickness

Not more than 10% of readings shall be less than the minimum specified and no reading shall be less than 90% of the specified minimum. For severely corrosive conditions no reading shall exceed the specified thickness by greater than 60% of the minimum.

10 Corrosion Protection Systems

The requirements as specified below shall be read in conjunction with the requirements of Clause 9: Application of Corrosion Protection Systems. Each system specified below shall also conform to the relevant requirements of Clause 9 and its sub-clauses. Where the requirements of this clause is in conflict with Clause 9 and its sub-clauses the requirements hereunder shall take precedence.

10.1 Recommended Corrosion Protection System

Unless otherwise specified in the Amendments to this Specification and subject to the approval by the Engineer, Plant, equipment and pipework in pump stations and water and wastewater treatment works

and pipelines shall be corrosion protected with one or more of the corrosion protection systems described in the following paragraphs of this Specification.

10.2 System 1: Alkyd Resin Based

Alkyd systems are intended for use in environments of low corrosivity, where a good decorative finish is required. Materials shall therefore be applied with due cognisance of appearance and protection. Defects such as runs, sags, curtaining, shrivelling or wrinkling will not be permitted.

10.2.1 Standards

Reference is made to the latest issues of the following Standard Specifications:

SANS 630: Decorative high gloss enamel paints.

SANS 681: Undercoats for paints

SANS 1319: Zinc phosphate primer for steel

10.2.2 Material

Alkyd zinc phosphate primer for steel shall comply with the requirements of SANS 1319.

General purpose alkyd undercoat shall comply with the requirements of SANS 681 Type 2.

Alkyd enamel shall comply with the requirements of SANS 630.

10.2.3 Surface Preparation

The substrate surface preparation shall conform to the Manufacturer's Instructions or as specified in the Amendments of this Specification as approved by the Engineer. In the event of it being omitted the surface preparation shall conform to the requirements Sa 2½ (ISO 8501-1) and the corresponding requirements as specified in Table 7-1 and the applicable Method as specified in Clause Surface Preparation Methods8.

10.2.4 Application

Coating thicknesses shall be at least 250 µm unless otherwise specified in the Amendments to this Specification.

10.2.5 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and in Clause 4.12.

10.2.6 Testing

Testing shall conform to the requirements of Clause 11 and SANS 1217.

10.3 System 2: Vinyl Resin Based

Vinyl copolymer (PVC) paints are a single component vinyl resin-based paints have excellent resistance to water, chemicals, dilute acids and hypochlorites. Their resistance to heat is poor and they must never be used on surfaces continually subjected to a temperature of 70 °C or higher. They

are not resistant to solvents and should not be used where there may be contact with oils, grease, kerosene, petrol etc.

The main advantage of vinyls is their easy maintainability. Whereas epoxies are difficult to recoat after about one month's exposure, vinyls may be recoated after any period of time.

Vinyls are recommended for use above water and for interior and exterior use where and could be subject to chemical fumes, as in chlorination rooms.

10.3.1 Material

Vinyl copolymer (PVC) paints shall have a solids content of 50% by mass and 32% by volume with a viscosity of 4,5 poise +_ 0,5 poise. The paint shall be stabilised against UV radiation.

10.3.2 Surface Preparation

The substrate surface preparation shall conform to the Manufacturer's Instructions or as specified in the Amendments of this Specification as approved by the Engineer. In the event of it being omitted the surface preparation shall conform to the requirements Sa 2½ (ISO 8501-1) and the corresponding requirements as specified in Table 7.1.

10.3.3 Application

Coating thicknesses shall be at least 250 µm unless otherwise specified in the Amendments to this Specification.

10.3.4 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and in Clause 4.5.

10.3.5 Testing

Testing shall conform to the requirements of Clause 11 and SANS 1217.

10.4 System 3: Thermal Spray Metal

Thermally sprayed metal coatings shall consist of the metal spray plus the application of a suitable sealant and a suitable coating.

10.4.1 Standards

Reference is made to the latest issues of the following Standard Specifications:

SANS 2063: Thermal spraying - Metallic and other inorganic coatings - Zinc, aluminium and their alloys

10.4.2 Surface Preparation

The substrate surface preparation shall conform to the Manufacturer's Instructions or as specified in the Amendments of this Specification as approved by the Engineer. In the event of it being omitted the surface preparation shall conform to the requirements Sa 2½ (ISO 8501-1) and the corresponding requirements as specified in Table Table 7-1.

10.4.3 Application

Thermally sprayed metal coatings shall consist of the metal spray plus the application of a suitable sealant and a suitable coating.

The minimum coating thickness for both aluminium and zinc shall be 150 µm. Greater thicknesses may be specified for particular applications.

Thermal spray metal paints shall be continuously agitated in a pressure pot to ensure dispersion of the zinc particles in the liquid components.

The time between surface preparation and coating shall be shortened from 4 hours to 2 hours at any application area closer than 10 km from the coast.

10.4.4 Repair of Damaged Coats

The requirements of Clause 10 shall apply.

10.4.5 Testing

The thickness shall be checked on every surface plane at points not more than 300 mm apart for small articles and 500 mm for large articles. Angles shall be checked along all 4 surfaces, channels along all 6 surfaces, pipes in 4 planes. The minus tolerance on thickness in isolated areas shall also not exceed -10 % and such low areas shall not be larger than 50 mm in diameter.

10.5 System 4: Powder Coats

10.5.1 Standards

Reference is made to the latest issues of the following Standards:

BS 5493: Protective coating of iron and steel structures against corrosion.

10.5.2 Material

Material used shall conform to SANS 1217, Type 2, powder coating.

10.5.3 Surface Preparation

The substrate surface preparation shall conform to the Manufacturer's Instructions or as specified in the Amendments of this Specification as approved by the Engineer. In the event of it being omitted the surface preparation shall conform to the requirements Sa 2½ (ISO 8501-1) and the corresponding requirements as specified in Clause 7.2 and Table Table 4-1.

10.5.4 Application

10.5.4.1 Coating Thicknesses

Coating thicknesses shall be at least 250 µm unless otherwise specified in the Amendments to this Specification.

10.5.4.2 Coating Application

Powder shall be applied in the shop by electrostatic spray or by fluidised bed as applicable. Items for powder coating shall after surface preparation, be pre heated to the required temperature, usually in the range 200 to 250 °C, coated by electrostatic spray or by fluidised bed, then post cured if necessary to obtain complete fusion and cure. For surfaces to be immersed the applied coating shall be tested for defects by high voltage spark testing. No defects will be permitted. Thermoset materials such as FBE shall be fully cured.

10.5.5 Repair of Damaged Coats

No repairs of damaged coatings will be accepted.

10.5.6 Testing

Testing shall conform to the requirements of Clause 11 and SANS 1217.

10.6 System 5: Two Pack Epoxy

This corrosion protection system is suitable for large steel items subject to medium corrosive and severely corrosive environmental conditions such as valves, pipes, etc.

10.6.1 Standards

Reference is made to the latest issues of the following Standard Specifications:

SANS 1217: Internal and external organic coating protection for buried steel pipelines.

ISO 2808: Paints and varnishes - Determination of film thickness.

BS 5493: Protective coating of iron and steel structures against corrosion.

10.6.2 Material

The material used for two component (two pack) high build polyamide epoxies shall be based on epoxy-polyamide resins and shall comply with the requirements of SABS 1217. Epoxies shall be of the high build, modified aluminium epoxy mastic type, containing at least 90% solids.

Solvent free epoxies in accordance with SANS 1217 Type 1B is preferred. Type 1A (solvent-borne chemically cured paint material) will only be approved by the Engineer for specific application conditions.

The epoxies shall be non toxic and non tainting when it will be in contact with potable water.

10.6.3 Surface Preparation

Unless otherwise specified in the Amendments to this Specification the surface preparation shall confirm to the requirements Clause 7.2.

10.6.4 Application

10.6.4.1 Dry Film Thicknesses

Dry film thicknesses shall be at least 250 µm unless otherwise specified in the Amendments to this Specification.

10.6.4.2 Mixing

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. For two pack materials, the use of part of the contents (split packs) is strictly forbidden.

In the case of solvent based Epoxy materials, it is recommended that the mixed material be allowed to stand for an induction period, as recommended by the manufacturer, before use.

During application, paint materials shall be agitated regularly to keep the solids in suspension.

The preparation time, induction time and pot life of these materials shall be closely adhered to.

10.6.4.3 Curing

Adequate ventilation (and heating if required), shall be provided for the proper curing of the epoxy coating or lining in all circumstances with special reference remedial work, repairs and to field joints of pipelines.

10.6.5 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and in terms of Clause 4.12 **Error! Reference source not found..**

10.6.6 Testing

Testing shall conform to the requirements of Clause 11 and SANS 1217.

10.6.7 Pipe Field Joints for Epoxy Linings

The internal corrosion protection System of welded field joints, for pipes with epoxy linings, shall be the same as that used for the adjacent pipes.

The surface preparation of the field joint area shall be the same as for the repair of major defects as specified in Clause 4.12.

10.7 System 6: Fusion Bonded Epoxy (Heavy Duty)

This corrosion protection system is suitable for large steel items subject to medium corrosive and severely corrosive environmental conditions such as valves, pipes, etc.

10.7.1 Standards

Reference is made to the latest issues of the following Standards:

SANS 1217: Internal and external organic coating protection for buried steel pipelines.

ISO 12944: Paints and varnishes – Corrosion protection of steel structures by protective paint systems.

10.7.2 Material

Material used shall conform to SANS 1217, Type 2, powder coating.

10.7.3 Surface Preparation

Unless otherwise specified in the Amendments of this Specification the surface preparation shall confirm to the requirements Clause 7.2.

10.7.4 Application

10.7.4.1 Dry Film Thicknesses

Dry film thicknesses shall be at least 250 µm unless otherwise specified in the Amendments to this Specification.

10.7.4.2 Coat Application

Items shall be heated to a temperature of 200°C (only applicable to heavy items) and coated with Fusion-bonded Epoxy by means of an electrostatic powder gun.

The normal procedures pertaining to powder application shall apply.

On completion of the coating or lining, items shall be cured for 60 minutes at 200°C (mean temperature).

10.7.5 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and conform to the requirements of Clause 4.12. with an approved repair kit.

10.7.6 Testing

Testing shall conform to the requirements of Clause 11 and SANS 1217.

10.8 System 7: Hot-Dip Galvanizing (Heavy Duty)

This corrosion protection system is suitable for steel items subject to mildly corrosive and medium corrosive environmental conditions such as handrails, covers, small diameter pipework, etc.

10.8.1 Standards

Reference is made to the latest issues of the following Standards:

SANS 32:	See EN 10240.
SANS 121:	Hot-dip galvanized coatings on fabricated iron and steel articles.
SANS 1344:	Medium duty solvent detergent.
SANS 2063:	Thermal spraying - Metallic and other inorganic coatings - Zinc, aluminium and their alloys.
SANS 5772:	Profile of blast-cleaned steel surfaces for painting.
ISO 752:	Zinc ingots.
ISO 2808:	Paints and varnishes - Determination of film thickness.
ISO 14713:	Protection against corrosion of iron and steel in structures - Zinc and aluminium coatings - Guidelines.
EN 1179:	Zinc and zinc alloys – primary zinc.
EN 10240:	Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic Plants

10.8.2 Material

Impurities in the molten zinc, as defined in ISO 752 and EN 1179, shall not exceed a total of 1.5%.

Steel to be hot-dip galvanized shall be as listed below. In both cases material certification shall be supplied:

- ▶ For aesthetic appearance:
 - Aluminium killed steel, or
 - Silicon-killed steel with a Silicon content not exceeding 0.04% and a Phosphorus content not exceeding 0.02%.
- ▶ For general corrosion protection:
 - Aluminium killed steel, or
 - Silicon killed steel with a Silicon content not exceeding 0.25% and a Phosphorus content not exceeding 0.02%.

The condition of articles to be hot-dip galvanized shall comply with Clause 7.3 of SANS 121.

The condition of tubes to be hot-dip galvanized on a continuous line shall comply with “Annexure A” of EN 10240.

10.8.3 Surface Preparation

Unless otherwise specified in the Amendments of this Specification the surface preparation shall confirm to the requirements of Clause 7.2.

10.8.4 Application

Galvanizing shall only be done by members of the Hot Dip Galvanizers Association of Southern Africa (HDGASA) in accordance with SANS 121 and EN 10240.

The coating of lining thickness shall comply with the values specified for General Applications or Heavy Duty Applications as specified in this Specification.

Galvanized surfaces which are to be painted shall NOT be passivated by the galvanizer.

10.8.5 Special Requirements

10.8.5.1 Steel Specials

10.8.5.1.1 Surface

Surfaces shall be free from nodules, blisters, roughness and sharp points. Un-coated areas, flux residues, lumps and zinc ash will not be permitted.

Notwithstanding Clause 6.1 of SANS 121, in the case of handrails etc. a high quality surface finish is required and a bright smooth surface shall be achieved. Double dipping shall not be allowed.

10.8.5.1.2 Thickness

The thickness of hot-dip galvanizing shall comply with the requirements of the Table 10-1 below.

Table 10-1: System 7 - Minimum Coat Thickness on Items that are not Centrifuged

ARTICLES AND ITS THICKNESS	HEAVY DUTY	LIGHT DUTY	
	Thickness µm (min)	Local Thickness µm (min)	Mean Thickness µm (min)
Steel ≥ 6 mm	105	70	85
3.0 mm ≤ Steel < 6.0 mm	80	55	70
1.5 mm ≤ Steel < 3.0 mm	65	45	55
Steel < 1.5 mm	55	35	45
Castings ≥ 6.0 mm	105	70	80
Castings < 6.0 mm	-	60	70

Heavy duty coats are required except in the following cases:

- ▶ Where a high surface finish is required; and
- ▶ Where otherwise specified in the Amendments to this Specification.

10.8.5.2 Steel Tubes

Steel tubes shall be in accordance with Clause 7 of EN 10240.

10.8.5.2.1 Surface

The surface of the coat shall be continuous, smooth and free from flux residues.

10.8.5.2.2 Thickness

The thickness shall comply with the requirements of the coat quality A1, in accordance with Clause 8, Table 1 of EN 10240, as specified below.

Table 10-2: System 7 - Minimum Local Coat Thickness Requirements for Coat Quality A1

REQUIREMENTS	QUALITY A1
Minimum local coat thickness on the inside surface except at the weld bead	55 µm
Minimum local coat thickness on the inside surface at the weld bead	28 µm
Minimum local coat thickness on the outside surface	55 µm

► Adhesion

The coat shall show no evidence of flaking or cracking when tested in accordance with Clause 11.4 of EN 10240.

► Qualities

Coat qualities shall be A1 for water installations – see Sub-Clause 8.2 of EN 10240. The surface of the coat on the inside shall be as smooth as can be achieved by steam blowing.

10.8.6 Testing

This clause and its sub-clauses shall be read in conjunction with Clause 4.13 and Clause 11.1 of this Specification.

10.8.6.1 Steel Items

10.8.6.1.1 Visual Examination

Where a superior aesthetic appearance of hot-dip galvanizing is requested, a bright mirror surface finish shall be achieved by the galvanizer.

10.8.6.1.2 Thickness

Thicknesses shall be in accordance with Clause 10.8.5 and shall be tested in accordance with Sub-Clause 6.2 of SANS 121.

10.8.6.2 Steel Tubes

10.8.6.2.1 Visual Examination

Where a superior aesthetic appearance of hot-dip galvanizing is requested, a bright mirror surface finish shall be achieved by the galvanizer.

10.8.6.2.2 Thickness

Shall be tested in accordance with Sub-Clause 11.3 of EN 10240 (SANS 32).

10.8.6.2.3 Adhesion

Shall be tested in accordance with Sub-Clause 11.4 of EN 10240 (SANS 32).

10.8.6.3 Chemical Analysis

Items shall be tested in accordance with Sub-Clause 11.5 of EN 10240 (SANS 32).

10.8.7 Repair of Damaged Coats

10.8.7.1 General

Repairs to damaged galvanizing shall be carried out in accordance with the procedures specified in SANS 121 by hot metallic zinc spraying unless the use of an appropriate solder is approved. Conventional solder shall NOT be used. Solder composition shall have been approved in writing by the SANS (Metallurgy Division) or by the SAHDGA.

10.8.7.2 Steel Items

The total un-coated areas for renovation by the galvanizer shall not exceed 0.5% of the total surface area of a component. Each un-coated area for renovation shall not exceed 400 mm². If un-coated areas are larger, the item containing such areas shall be re-galvanized.

The repair method shall be approved by the Engineer before repairs are initiated.

Repairs shall be by zinc thermal spray in accordance with SANS 2063 or three component zinc solvent free Epoxy repair system. The repair shall include removal of any scale, cleaning and any necessary pre-treatment to ensure adhesion – refer to Clause 7.

The coat thickness on the renovated areas shall be a minimum of 30 µm more than the local coat thickness specified in Clause 10.8.5 for the relevant hot-dip galvanized coat unless otherwise specified by the Engineer. The coat on the renovated areas shall be capable of giving sacrificial protection to the steel to which it is applied.

10.8.7.3 Steel Tubes

Repairs shall not be allowed on internal surfaces of tubes. Where repairs are required, tubes shall be re-galvanized. Repairs on external surfaces shall be in accordance with Clause 10.8.7.1.

10.9 System 8: Elastoplastic Polyurethane

This part of the Specification applies to two component solvent free elastoplastic polyurethane. This system shall only be used in limited approved applications.

10.9.1 Standards

Reference is made to the latest issues of the following Standards:

SANS 1217: Internal and external organic coating protection for buried steel pipelines.

10.9.2 Material

The paint material shall be a solvent free two-component polyurethane hybrid based on a polyester type polyol and aromatic isocyanate. The cured paint shall comply with the following requirements:

- ▶ Tensile strength at 3 mm thickness - ASTM D638 - not less than 15 MPa.
- ▶ Adhesion to primed steel - SANS Method 776 - not less than 10 MPa.

- ▶ Impact resistance (direct) - ASTM G14 - not less than 9 Joules.
- ▶ Dielectric Strength - not less than 10 kV/mm.
- ▶ Elongation at break - not less than 25%.
- ▶ Compressibility - not less than 25 MPa.
- ▶ Surface hardness of 5 mm thick sample - not less than 60 nor greater than 80 Shore 'D'.
- ▶ Water Vapour Permeability - not greater than 0.5 g/24 h/m²/mm².
- ▶ Cathodic disbonding - when tested in accordance with ASTM G8 Method A, for 60 days, the disbonded area shall not exceed 500 mm².

10.9.2.1 Adhesive

Adhesive shall be a two component polyurethane adhesive designed to maximise adhesion between used polyurethane and freshly mixed polyurethane.

10.9.3 Application

10.9.3.1 Dry Film Thicknesses

Dry film thicknesses shall be at least as follows unless otherwise specified in the Amendments to this Specification:

- ▶ Overcoating as duplex system:
 - The dry film thickness shall be 40 µm minimum.
- ▶ For corrosive/abrasive environmental conditions:
 - The dry film thickness shall be 1.0 mm minimum.
- ▶ For highly corrosive/abrasive environmental conditions:
 - The dry film thickness shall be 3.0 mm minimum.

10.9.4 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and conform to the requirements of Clause 4.12

10.9.5 Testing

Testing shall conform to the requirements of Clause 11 and SANS 1217.

10.10 System 9: Tape Wrapping

The tape wrapping system is intended to be used in areas where special protection is required due to handling of items e.g. pipelines at road crossings etc. or where it is highly likely that the paint system can be damaged e.g. at specials and addition precaution is required to protect the pipeline. It is also often used to repair field joints of pipelines. It is suitable for severely corrosive environments.

10.10.1 Standards

Reference is made to the latest issues of the following Standards:

SANS 1117: Plastic wrappings for the protection of steel pipelines.

SANS 10129: Plastics tape wrapping of steel pipelines.

10.10.2 Material

Polyethylene pressure-sensitive tape or polyethylene laminated to an elastomeric layer of butyl rubber tapes shall conform to SANS 1117, types A, B or C.

10.10.3 Application

10.10.3.1 General

Steel pipes, fittings and specials, protected by means of tapes, shall be wrapped in accordance with SANS 10129 as amended and supplemented by this Specification. All pipes shall be wrapped outside the trench in accordance with acceptable factory applications. Tape wrapping may be carried out in an "over the trench" operation for pipe diameters up to 450 mm.

10.10.3.2 Surface Preparation

Steel pipe surface preparation shall conform to Clause 3.2 of SANS 10129.

10.10.3.3 Priming

Immediately after surface preparation but not later than 4 hours after cleaning, provided the pipe surfaces are kept dry and free from dust, a primer shall be applied according to Clause 4.2.1 of SANS 10129.

10.10.3.4 Normal Wrapping

Tape wrapping shall be applied with sufficient pre-tensioning immediately after priming, in accordance with Clause 4.2.2 of SANS 10129, and shall ensure a smooth wrap free from wrinkles, blisters, frayed or torn edges, cracks or other defects at temperatures up to 65°C.

For normal wrapping, tape shall be applied in two layers with a minimum overlap of 50 mm on both the inner and outer wraps.

Tape joints and repairs shall be done in accordance with Clause 4.2.3 of SANS 10129.

Hand wrapping shall only be allowed for short lengths that are inaccessible to a wrapping machine, specials, joints, small diameter pipes and small repairs – refer Clause 10.10.6

10.10.3.5 Armouring

Where armour wrapping is specified, two layers of tape wrapping shall first be applied with sufficient pre-tensioning immediately after priming, in accordance with Clause 4.2.2 of SANS 10129, and shall ensure a smooth wrap free from wrinkles, blisters, frayed or torn edges, cracks or other defects even at temperatures up to 65°C.

The first layer of wrap shall overlap by half the tape width plus 25 mm and the second wrap shall overlap by not less than 50 mm.

The above-mentioned layers of tape shall be armoured by the application of a third layer of pressure-sensitive polyethylene tape with a carrier thickness of 750 micrometres and a minimum overlap of 50%.

Armoured wrappings shall generally be applied at the following positions:

- All road crossings through sleeves and culverts;

- ▶ All railway crossings through sleeves or culverts; and
- ▶ Wherever the Engineer may consider that special conditions warrant such measures.

10.10.3.6 Wrapping of Specials

In the case of specials or pipe lengths where length and/or shape preclude the application of a protective wrapping system by any means, the protection shall be carried out either by bitumen-fibre glass or epoxy corrosion protection system in accordance with the requirements of the applicable corrosion protection system. In the case of access, scour, air valve and farmers off-take tees the special shall be deemed to incorporate at least two (2) diameter lengths either side of the main tee barrel.

10.10.3.7 Armour Wrapping of Coated Pipes

Where armour wrapping of coated pipes is specified, a single layer of pressure-sensitive polyethylene tape with a carrier thickness of 750 micrometres and a minimum overlap of 50% shall be applied.

10.10.4 Tolerances

10.10.4.1 Pressure Sensitive Tape Wrapping

The minimum thickness of the inner low-density polyethylene tape carrier component shall be 300 μm and the maximum thickness of the outer high-density tape carrier shall be 1000 μm . Total minimum polyethylene thickness of 1450 μm .

The adhesive part of the inner layer shall be a minimum thickness of 1.5 times the polyethylene tape carrier thickness. For the outer layer the adhesive layer shall be at least equal to the thickness of the polyethylene tape carrier thickness.

10.10.4.2 Butyl Rubber Laminates

The minimum thickness of the completed wrapping shall be 750 μm . The inner layer shall be a butyl rubber laminate of 450 μm minimum thickness of which the butyl rubber film shall not be less than 200 μm thick and the polyethylene film shall not be less than 200 μm thick.

The outer layer shall be high density pressure tape of 300 μm minimum thickness.

10.10.5 Testing

This clause and its sub-clauses shall be read in conjunction with Clause 4.13 and Clause 11.1 of this Specification.

10.10.5.1 Visual Inspection

The wrapping shall have a smooth appearance, free from wrinkles, blisters, bridging across weld beads, frayed edges, cracks, dis-bonding and any signs of physical damage.

10.10.5.2 Non-Destructive Testing

10.10.5.2.1 Electrical Insulation Defect (Holiday) Testing

The entire wrapping of the pipeline shall be tested to ASTM G62 with an approved Holiday Detector equipped with a rolling ring detector around the pipe by the Contractor to the Engineer's satisfaction. The ring shall be in close contact with the surface of the wrapping along the pipe circumference. The test shall be carried out immediately prior to lowering the pipe into the trench. The wrapping on specials or short pipe lengths shall be tested with an approved Holiday Detector fitted with a copper bristle brush detector of suitable form. The wrapping shall exhibit no Holidays when tested with an effective voltage of 12 kV at a nominal pulse frequency of not less than 30 Hz.

The Engineer may instruct any length of pipe or any number of specials to be re-tested using a Holiday Detector with a copper bristle brush detector.

10.10.5.2.2 Insulation Test

The Engineer shall carry out a conductance test on the wrapping over any section of pipeline between valves when the pipeline has been wrapped and installed in the trench with padding and back filling completed. The test shall be conducted as per NACE TM0102 with the valves temporarily removed from the line, at the Contractor's expense, to ensure complete isolation of the pipeline section under test or between gaps left for tie-ins.

The length of the section of pipeline under test shall be carefully measured and the conductance over the section tested shall not exceed 180 micro-Siemens per square metre of pipe surface under all conditions of test. If the results of the test for the section of pipeline tested are not satisfactory, two sections immediately adjacent to the testing section will be tested. If the results on one or both of these sections tested are not satisfactory, all sections of wrapped pipeline shall be tested.

10.10.5.3 Destructive Testing

The Engineer may from time to time collect samples of 10 m of each type of tape and one litre of primer for testing, for compliance with the Specification, by any independent laboratory appointed by the Engineer. The supply of samples shall be for the Contractor's account. The Engineer reserves the right to reject the whole batch of materials from which unsatisfactory samples were obtained.

10.10.5.4 Repair of Damaged Coats

The Contractor shall be required to locate areas of faulty protection on all sections on which unsatisfactory results are obtained and to affect the necessary repairs. The cost of this work and all additional materials provided or supplied, including the reinstatement of the trench and the retest shall be for the Contractor's account.

10.10.6 Repair Methods

Where damage to the wrapping on a pipeline has occurred and where there are creases, wrinkles and folds in the wrapping, proceed as follows:

10.10.6.1 Small Damaged Areas

If the width of the tape being used exceeds by at least 100 mm the length of the section affected, cut the area of damaged wrapping away to bare metal leaving no raised edges or protrusions.

Clean and prime the exposed area in accordance with Clauses 10.10.3.2 and 10.10.3.3 and apply a patch of tape, ensuring an overlap of not less than 50 mm on all sides onto the surrounding wrap.

Apply by hand-wrapping with a 55% overlap, a further layer of tape commencing two turns before and continuing for two turns beyond the patch.

10.10.6.2 Large Damaged Areas

Where the extent of damaged or faulty wrapping is such that the tape cannot span the affected area and provide a 50 mm overlap on all sides it must be completely removed from the pipe over the affected section. The area shall be cleaned and primed in accordance with Clauses 10.10.3.2 and 10.10.3.3. The pipe must be re-wrapped with a 55% overlap, commencing two turns before and finishing two turns beyond the bared section.

10.10.6.3 Damage on Double Wrap

Where damage or a defect has occurred in a section that has been double wrapped and in the case of small Holidays, the outer wrap shall be removed for a distance equal to three (3) times the width of the inner wrap tape on each side of the damaged area.

The appropriate procedure given in Clauses 10.10.6.10.6 shall be used to affect the repair of the inner wrap.

The outer wrap shall be re-instated in accordance with Clause 10.10.3.5.

10.10.6.4 Outer Wrap Damage

Where damage extends through an outer wrap / rockshield (see Section 6 of SANS 10129), this shall be carefully removed for a distance equal to three (3) times the width of the inner wrap tape on each side of the damaged area without damaging the inner wrapping.

The repair shall be carried out by the appropriate method given in Clauses 10.10.6 and the outer wrap/rockshield re-instated in accordance with Clause 10.10.3.5.

10.11 System 10: Petrolatum Wrapping

Profiling mastic and mastic blankets are used for corrosion protection of couplings and flanges in chambers with high humidity and buried in soil.

Standards

Reference is made to the latest issues of the following Standards:

ISO 8501-1: Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after removal of previous coatings.

SANS 10129: Plastics tape wrapping of steel pipelines.

10.11.1 Surface Preparation

Mechanically clean and wire brush the joint to remove all loose rust, scale, old coating or lining and foreign matter to St 2 (ISO 8501-1).

Areas subjected to chemical attack, salt spray, fungus or bacteria shall be neutralized, rinsed with clean potable water and mechanically cleaned as specified above.

10.11.2 Priming

Brush priming solution well over the entire joint area, leaving a thin film (at a nominal coverage rate of 0.8 m²/litre). Apply a liberal amount around the bolt threads, narrow cavities and crevices.

Paste shall be used where excessive surface corrosion has occurred and under high humidity or submerged conditions.

10.11.3 Application

Use profiling mastic and/or strips to fill all voids, crevices and sharp or irregular contours.

Apply mastic tape circumferentially over the area to be coated with a 25 mm overlap on either side of the mastic with a 75 mm end overlap.

Pre-formed petrolatum mastic blanket system (10 mm thick), supported by a coated tape backing, is available to provide a quick and easy method to apply this system.

Eliminate all air pockets, wrinkles and creases.

10.11.4 Top Coat

10.11.4.1 Buried Conditions

Two complete turns of the polyethylene sheeting shall be applied circumferentially. The ends are secured to the pipe barrels with 48 mm wide bands of PVC adhesive tape, which is also applied to the outside diameter of the bolted joint.

10.11.4.2 High Humidity Conditions

Overcoat with a synthetic coat mixed with a cementitious filler to give a tough, flexible coat. The base coat may be over-coated with water based Acrylics or Epoxies.

NOTE:

- Detail of application shall be in accordance with the manufacturer's data sheets and approved by the Engineer.

10.12 System PC1: Solvent Free Polyurethane Coating

This corrosion protection system covers the application of Solvent Free Polyurethane as a coating to steel pipes. Generally the coating is to be applied in accordance with ANSI/AWWA C222-99 'Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings'. Where in conflict with ANSI/AWWA C222-99, the amendments hereunder shall take precedence.

10.12.1 Section Numbers of ANSI/AWWA C222-99

The section (clause) and sub-section numbers in this clause refer to the same numbered sections and subsections in ANSI/AWWA C222-99.

10.12.1.1 ANSI Section 4.2 Test Requirements

Replace 'Table 1 Requirements' with the new Table 1 below.

New Table 1: Physical and Performance Requirements

Property	Polyurethane Coating Material	Test Method Sub-Section
Adhesion , MPa min (laboratory)	15 MPa	ASTM D 4541
Impact resistance Kg m, min	1.6 kg m	ASTM D 2794 Intrusion
Water absorption %, max	max 3%	ASTM D 570 long term
Dielectric strength kV/mm thick min	7.5 kV/mm thick min	SANS 1217 clause 5.9
Resistance to abrasion , mg max	max 100/1000 rev	ASTM D 4090 CS17 1 kg 1000 cycles
Cathodic disbondment	max 12 mm radius	ASTM G 95 at 23 deg C
Durometer Hardness	min 65 Shore D	ASTM D2240
Chemical Resistance 10% sulphuric acid 30% NaCl 30% NaOH Diesel fuel	max 5% in mass, length or width max 5% in mass, length or width max 5% in mass, length or width max 5% in mass, length or width	ASTM D543

10.12.1.2 ANSI Section 4.3 Coating Thickness

ANSI Sub-Section 4.3.1

The minimum dry film thickness of coating is to be 2000 microns within a tolerance of -100 microns and +1000 microns.

10.12.1.3 ANSI Section 4.4 Surface Preparation

The requirements of section 4.4 of ANSI/AWWA C222-99 will apply and will take precedence over Clause 3.2 above.

10.12.1.4 ANSI Section 4.7 Welded Field Joints

ANSI Sub-Section 4.7

The hold backs (cut-backs) are to comply with Clause 4.15.1 of this Specification.

10.12.1.5 ANSI Section 5.3 Coating Tests

ANSI Sub-Section 5.3.1

The basis of acceptance of proposed coating material shall be as per method (1).

10.12.1.6 ANSI Section 5.5 Coated Pipe Inspection

ANSI Sub-Section 5.5.4

Electrical continuity inspection shall be conducted on all pipes as per Clause 5.9 'Dielectric strength' of SABS 1217.

10.12.1.7 ANSI Sub-Section 5.5.3

The adhesion is to be tested in accordance with ANSI/ASTM D4541.

10.12.1.8 ANSI Section 6.5 Affidavit of Compliance

The manufacturer is to submit with his/her first request for payment an affidavit that all material and work has been conducted in accordance with the requirements of this standard.

10.13 System PC2: Fusion-Bonded Medium Density Polyethylene

This coating system shall comply with the Australian Standard Specification AS 4321-1955 entitled "Fusion bonded medium density polyethylene coating and lining for pipes and fittings" except as modified hereunder.

10.13.1 Modifications to Specification AS 4321-1955

10.13.1.1 Preparation of Surface

Delete Clause 5.1 of AS 4321-1955 and replace with Section 3 "SURFACE PREPARATION FOR PIPES TO BE COATED AND LINED" of this specification.

10.13.1.2 Repairs

Delete the last sentence of Clause 8.1 of AS4321-1995 and replace with "Damaged areas that pass the continuity test need not be repaired provided that the coating or lining thickness is equal to or greater than the thickness specified in Table 1 of AS 4321-1995. Generally no more than 3 repairs will be allowed per 9m length of pipe and the area of a single repair is not to exceed 0.01 square m. If the area of a single repair does exceed 0.01 square m the pipe will be rejected. Repairs may be undertaken in accordance with Clause 8 of AS 4321 for the following methods of repair:- Fusion bond; Heat shrink sleeve or Hot gas welding. A wrapping system may also be used if applied as detailed hereunder.

10.13.1.2.1 Repairs with Tape

When repairs are permissible the repairs shall be made using a repair system comprising (1) a polymer bitumen primer (Denso Primer D or equivalent approved), (2) an inner seal of modified rubber bitumen sealing tape (Denso Mastic Sealing Tape or equivalent approved) and (3) an outer protective layer of acrylic coated/modified bitumen adhesive pipeline tape (Denso Acrylic Pipeline Tape or equivalent approved) is to be applied with a 50% overlap, ensuring that it is placed 50mm wider all round than the inner repair tape. The outer protective tape is to be wrapped around the entire pipe.

10.13.1.2.1.1 Pinholes

At each pinhole detected by the electrical test, the surrounding area shall be abraded to at least a minimum area of 175mm by 175mm around the hole. The abrasion shall be carried out (with clean

emery paper of 80 to 100 mesh) around the repair so as to provide a suitable rough surface profile without causing the removal or excessive amounts of coating material. The repair area is to be feathered into the surrounding sound coating. Debris and other deleterious matter are to be removed by means of a clean rag moistened with Cleaning Solvent. The primer is applied and once it has dried the prepared surface is covered with a patch of modified rubber bitumen sealing tape (Denso Mastic Sealing Tape or equivalent approved) of size 150mm by 150mm. The bond is to be free of air bubbles and smoothed out by hand or using an aluminium fluted roller. Finally, acrylic bitumen adhesive pipeline tape (Denso Acrylic Pipeline Tape or equivalent approved) is to be applied with a 50% overlap, ensuring that it is placed 50mm wider all round than the inner repair tape.

10.13.1.2.2 Larger Damaged Areas

The edges of the damaged coating must be chamfered back to remove all potential void areas. The primer and modified bitumen rubber are applied as for pinholes but the modified bitumen rubber tape is pre-cut and applied with 55% overlap. Finally acrylic bitumen adhesive pipeline tape (Denso Acrylic Pipeline Tape or equivalent approved) is to be applied with a 50% overlap, ensuring that it is placed 50mm wider all round than the inner repair tape. Weld beads are repaired with suitable lengths of the above size tapes. When covering weld beads, the centre portion of the square must make contact first. Smooth the tape out with an outward direction to remove all entrapped air.

10.13.1.3 Storage, Handling, Transport and Marking

Add to Clause 11 of AS 4321-1955, Clause 1.5 entitled "Plant and Rigging for the handling and delivery of Pipe and Specials" of this specification.

10.14 System PC3: Three Layer System

The three layer corrosion protection system consists of a powdered epoxy primer, a polymeric adhesive and a polyethylene outer sheath which shall be applied in accordance with Canadian Standards Association Specification (CSA) Z245.20-06 and Z245.21-06.

The application is to be in accordance with, inter alia, the following sections of the Canadian specifications listed below.

10.14.1 Z245.20 External Fusion Bond Epoxy Coating for Steel Pipe

(a) General Requirements

(b) Materials

(i) The following Fusion Bonded Epoxy primers are approved for use.

(a) Akzo Nobel PCL 331

(ii) Jotun CORRO-COAT EP-F 1003HW

Should the Supplier wish to use any other make of primer, samples must be left with the Employer or his/her agent for testing. Delays in approval will not be accepted as a reason for late delivery.

(c) Coating Application

(d) Inspection and Testing

(e) Repair of Coated Pipes

(f) Markings

(g) Handling and Storage

(h) Test Reports and Certificates of Compliance

(i) Test Procedures

10.14.2 Z245.21 External Polyethylene Coating for Pipe

(a) General Requirements

The Polyethylene outer sheath is to comply with System B1

(b) Materials

(i) The following adhesives are approved for use:-

- (a) Borealis Borcoat ME0420
- (b) Industrie Polieco M.P.B. SRL COESIVE L8.92.8

(ii) The following HDPE Outer Sheath materials are approved for use:-

- (a) Borealis Borcoat HE3450
- (b) Industrie Polieco M.P.B. SRL HDPE 2050

Should the Supplier wish to use any other make of adhesive or outer sheath materials, samples must be left with the Employer or his/her agent for testing. Delays in approval will not be accepted as a reason for late delivery.

- (c) Coating Application
- (d) Inspection and Testing
- (e) Repair of Coated Pipes
- (f) Markings
- (g) Handling and Storage
- (h) Test Reports and Certificates of Compliance
- (i) Test Procedure

10.15 System PC4: Bitumen Fibre Coating

10.15.1 General

Where bitumen fibre coating of steel pipes is specified, the method of coating is generally to comply with SABS 1178 'The production of lined and coated steel pipes using bitumen or coal tar enamel'. The lining is to consist of a hot-applied bitumen with a double wrap of glass fibre reinforcing material to a thickness of 5mm. There shall not be less than 1mm of bitumen between the pipe surface and the inner wrapping and also between the inner and outer wrappings. Where in conflict with SABS 1178, the amendments hereunder shall take precedence.

10.15.2 Amendments to SABS 1178

The following details are to be noted. The clause and sub-clause numbers hereunder refer to the same numbered clauses and sub-clauses in SABS 1178.

10.15.2.1 SANS Sub-Clause 3.1.1 Primers

Before the application of external protections, pipes and specials shall be primed with primer type (a) a cold applied bitumen primer complying with SABS 1136 or a synthetic primer for bitumen, complying with SABS 1140.

10.15.2.2 SANS Sub-Clause 3.1.2.1 Bitumen

The bitumen used is to conform to SABS 1137.

10.15.2.3 SANS Sub-Clause 3.1.3 Reinforcement Wrappings

Glass fibre material is to be used as the reinforcement wrapping and is to conform to SANS 1130.

10.15.2.4 SANS Sub-Clause 3.1.4 Reflective Finish

A non-stick, reflective covering shall be applied to the coating. This shall consist of a lime wash based on a dolomitic type lime suitable for non-porous surfaces mixed with water to a slurry and further mixed with boiled linseed oil to improve its water resistance.

10.15.2.5 SANS Sub-Clause 3.2.2 Coating and Table 1

The coating type is to be CB6A as per Table 1. However, the inner wrap may conform to type 1 or type 3 of SABS 1130 and the outer wrap may conform to type 1, type 2 or type 3 glass fibre reinforcing material. The minimum coating thickness excluding the weld seam is to be 5mm. The thickness tolerance shall be +2mm,-0mm.

10.15.2.6 SANS Sub-Clause 3.7.7 Disbonded Areas

Holidays are not to be repaired unless authority to do so is given by Umgeni Water's authorized Quality Inspector.

10.15.2.7 SANS Sub-Clause 3.7.8 Holidays

The coating shall be free from holidays and tested in accordance with Clause 7.2.2 of SABS 1178 at 15 Kv.

10.15.2.8 SANS Clause 6 Markings

Refer to Clause 7 of Sub-Clause 2.2 of this specification.

10.15.2.9 SANS Sub-Clause 7.1 Inspection

Add the following sentence:

Before leaving the shop the coating of every pipe and special shall be inspected visually for all defects including, but not restricted to:- tears, holes, mechanical damage and cracking.

10.15.2.10 SANS Sub-Clause 7.2.2 Holiday Detection

A metallic brush or a jointed spiral ring type of scanning electrode is to be used on the variable voltage detector.

10.15.2.11 SANS Sub-Clause 7.3 Destructive Tests

Sufficient coating material shall be removed from the ends of at least one pipe of each day's production for the purpose of carrying out destructive tests as detailed under Clause 7.3 of SABS 1178.

10.16 System PC5: Polymer Modified Bitumen Coating

This corrosion protection system is suitable for large pipes items subject to medium corrosive and severely corrosive environmental conditions.

This specification relates to factory applied pipe coating operations based on hot applied polymer modified bitumen.

10.16.1 Standards

This standard makes reference to the documents listed below. Unless otherwise specified the latest editions of these documents, including all addenda and revisions, shall apply.

British Standards

BS 410	Specification for test sieves.
BS 1796	Methods using test sieves of woven wire cloth and perforated metal plate.
BS 2000	Methods of test for petroleum and its products.
BS 3900	Methods of test for paints: Part A 6 (replaced by EN 535) – Determination of flow time of paints. Part B 2 (replaced by ISO/DR 1515) – Determination of volatile matter and non-volatile matter.
BS 4147	Bitumen-based hot-applied coating materials for protecting iron and steel, including suitable primers where required.
BS 7079	(Replaced by ISO 8501-8504) – Preparation of steel substrates before application of paints and related products.

Swedish Standard

SIS OS 5900 Pictorial surface preparation standards for painting steel surfaces.

American Standard

ASTM D 113-86 Ductility of bituminous materials.

ANSI AWWA C203-91 Coal-tar Protective Coatings and linings for steel water pipelines – enamel and tape-hot applied.

South African Standard

SANS Method 772 Blast profile.

10.16.2 Materials

10.16.2.1 Primer

The primer shall be of synthetic composition, designed to be used with a specific polymer modified bitumen. The drying rate of the primer shall be suited to the application conditions. The primer shall be supplied in new sealed steel drums.

The primer shall have the characteristics shown in Table 10-3:. In addition, when stored in original sealed containers at ambient temperature, the primer shall retain the properties as set out in Table 3 for not less than 6 months from the date of delivery.

Table 10-3: Characteristics of Primer

CHARACTERISTIC	REQUIREMENTS	METHOD OF TEST
Viscosity at 23°C	35-60 seconds	Flow cup No 4
		BS3900: Part A6 = EN 535
Volatile matter	75	BS3900: Part B2 = ISO/DR
(max. % loss by mass)		1515 (105°C for 3 hours)

10.16.2.2 Polymer Modified Bitumen

10.16.2.2.1 Composition

The polymer modified bitumen shall consist of a uniform mixture of the following:

- ▶ A formulated blend of polymer modified bitumen, as specified in (c) and (d) below.
- ▶ A proportion of approved filler (limestone or asbestos shall not be used).
- ▶ Characteristics of the filler shall be as specified in (b) below.

10.16.2.2.2 Filler Grading

Method of test to BS 1796 modified to use the metric sieves specified in BS 410.

Passing 90 microns – not less than 93%.

Passing 250 microns – not less than 99%.

10.16.2.2.3 Characteristics of the Polymer Modified Bitumen

The material shall conform to the requirements given in Table 4 when tested in accordance with the methods specified.

10.16.2.2.4 Performance Tests of the Polymer Modified Bitumen System

The polymer modified bitumen shall be of thermoplastic rubber/bitumen modification.

The polymer modified bitumen containing mineral filler with the characteristics detailed in 10.16.5.1.2 shall pass the performance test specified in Table 10-4.

Table 10-4: Characteristics and Performance Test for Polymer Modified Bitumen

PROPERTIES	METHOD	UNIT	REQUIREMENTS
Softening Point	ASTM D36	°C	115-130
Penetration @ 25°C	ASTM D5	1/10 mm	15-30
Density @ 25°C	BS 4147	g/cm ³	1.1-1.4
Viscosity @ 170°C	Brookfield	Cp	7000-12000
Viscosity @ 190°C	Brookfield	Cp	3000-6000
Filler Content	BS 4147	%	20-30
Impact @ -10°C	BS 4147	mm ²	Max. 6500
Peel Initial / Delayed	BS 4147	mm	Max:
Sag @ 25°C	BS 4147	mm	3,0/3,0
Sag @ 40°C	BS 4147	mm	3,0/3,0
Sag @ 50°C	BS 4147	mm	3,0/3,0
Sag @ 60°C	BS 4147	mm	3,0/3,0
Sag @ 80°C	BS 4147	mm	Max. 1.5
Aging Test @ 190°C	Phoenix	hours	Min. 72
Bend	BS 4147	mm	Min. 15

NOTES:

- ▶ The test plates shall be cleaned by abrasive blasting to grade Sa 2½ of SIS OS 5900 (BS 7079 and ISO 8501 – 8504) and with a profile of 50 – 75 microns (SANS Method 772). They shall be coated with primer at a rate of 100g per m².
- ▶ For the impact test a plate 12.7 mm thick shall be used and a single impact made in each quarter of the plate. The average of the four areas disbonded shall not exceed the permitted value shown in Table 4.
- ▶ The peel test at 25°C is equivalent to / replaces the preliminary adhesion test in the original Specification.

10.16.2.3 Outerwrap

- (a) The outerwrap consists of a combination of polyester and glass fibres to ensure the required strength and elasticity. This is combined with a glass fabric of uniform quality and amount to control the best application and the required amount of bleed through, in order for the outerwrap to provide maximum protection.
- (b) The outerwrap shall be impregnated with the polymer modified bitumen compatible material to fulfil the characteristics shown in Table 10-5.
- (c) The characteristics of the outerwrap shall comply with the requirements of Table 10-5 and shall be determined in accordance with the test procedure.

Table 10-5: Characteristics of Outerwrap Saturant

CHARACTERISTIC	REQUIREMENT	METHOD OF TEST
Softening Point	Min 100°C	BS 2000
Penetration @ 25°C	60-85 1/10 mm	BS 2000
Saturant	Polymer Modified Bitumen	

Table 10-6: Physical Characteristics of Outerwrap

CHARACTERISTIC	TYPE A	TYPE B	METHOD OF TEST
Minimum Thickness (mm)	0.6	0.6	AWWA C203-91
Weight (g) per m²	500 – 700	500 – 700	AWWA C203-91
Tensile strength (N/50 mm)			
Longitudinal	> 800	> 400	AWWA C203-91
Transverse	> 800	> 200	AWWA C203-91

10.16.3 Application

10.16.3.1 Care of Wrapping Materials

All wrapping materials consigned to the coating yard or factory shall be properly stored to prevent damage or deterioration.

10.16.3.2 Care of Pipe

Throughout the wrapping process pipe and coating materials shall be kept clean and away from all foreign matter.

10.16.3.3 Marking

Any pipe manufacturer's identifying marks shall be removed before the start of the wrapping process and shall be permanently marked on the side of each pipe at both ends with a weatherproof paint. Metallic dye stamping shall only be permitted using approved stamps and only on the pipe bevel.

10.16.3.4 Blast Cleaning

In preparation for the application of primer all grease or heavy soil shall be removed without spreading over the surface with a volatile solvent, e.g. xylene (or approved equivalent) and thereafter the external surface of the pipes shall be cleaned by abrasive blasting to at least Sa 2½ grade SIS O5 009 (BS 7079 and ISO 8501-8504) SANS 772 and surface profile amplitude 75 µm. DWS 9900 C1 for detailed description of surface preparation process.

10.16.3.5 Priming

- (d) Following blast cleaning and within 2 hours, the pipe exterior shall be coated with the primer applied at a controlled rate to the manufacturer's recommendations. Pipes shall be coated within 24 hours of being primed.
- (e) The primer shall be applied to a dry, clean and dust free pipe and thereafter the primed pipe shall be kept free from moisture, dust or any other contaminant. The primed pipe shall be uniform and free from runs, drips, flooded or bare areas. Particular care shall be taken to ensure complete coverage of weld areas.
- (f) The primer should be applied at a pipe temperature of 10°C (or above) or 3°C above the dew point. If the pipe temperature is lower than this level or if moisture is present on the pipe, heating of the pipe may be required.
- (g) Deteriorated or contaminated primer shall not be applied to the pipe. Primer that has deteriorated or become contaminated after its application shall be removed to the satisfaction of the Employer or his representative, at the Contractor's expense. The cleaned area shall then be re-primed.

10.16.3.6 External Coating and Wrapping Application

- (h) The pipe, after priming and when the primer is no longer tacky, shall be passed through coating facilities of a type approved by the Engineer. The machine shall coat the pipe weld (longitudinal or spiral) with a 50 mm wide strip of extruded polymer modified bitumen and thereafter the entire pipe with an extruded coating of polymer modified bitumen and shall simultaneously apply the outerwrap.
- (i) All primed surfaces shall be clean and dust free immediately prior to coating.
- (j) The coating shall have an average thickness of not less than 4 mm, with an absolute minimum thickness of 3 mm. The coating shall be reinforced by a spirally-wound layer of outerwrap pulled into the polymer modified bitumen with an overlap of 20 mm, such that the outerwrap is wetted by the polymer modified bitumen. Particular attention shall be paid to the location of the reinforcement and thickness of the wrapping over the weld. The average thickness shall be determined in the following manner: At least four thickness measurements at approximately the pipe quarter points per lineal metre of pipe length shall be taken. At least 25% of the measurements shall be taken at the weld bead. The average thickness shall be the arithmetic average of all measurements.
- (k) The completed coating shall be well bonded to the pipe metal; uniform, smooth and free from Holidays, laminations, voids or other defects.
- (l) The wrapping shall be carefully trimmed off 100 mm from the ends of each pipe and bevelled throughout its thickness over a minimum length of ± 5 mm, unless otherwise specified by the Employer or his representative.
- (m) Solar protection paint shall be applied to the coated pipe while the coating is still warm. It shall be white in colour, water resistant, continuous and shall cover the wrapping sufficiently to form an effective barrier to solar radiation. The solar protection shall be terminated approximately 100 mm from each end of the wrapping (i.e. 200 mm from each end of the pipe).

10.16.4 Inspection and Testing

The Contractor shall be responsible for, and shall bear the cost of a system of inspection and repair of the wrapped pipe approved by the Engineer. The system shall meet all relevant requirements in this Section and in addition the following requirements:

- (n) Monitoring of grit size and the finish of blast cleaned pipe.
- (o) Viscosity measurement (see Table 3) and control of film thickness of external primer at least once for every batch of primer, in addition to visual checks of the applied prime coating.
- (p) Adequate temperature control the polymer modified bitumen at the application head. In order to ensure that the polymer modified bitumen applied to the pipe has the characteristics specified in Table 4, samples of the polymer modified bitumen shall then be taken from the application head and subjected to the following test and frequency of testing shown in Table 10-7.
- (q) Visual checks on the outer wrap and the appearance of the final wrap.
- (r) Holiday detection of 100% of the surface area of every wrapped pipe with approved equipment operating at a minimum 15 kV, maximum 25 kV with regular calibration of the equipment to the satisfaction of Quality Assurance.
- (s) Test of bond strength and thickness of the wrapping including removal of samples of the wrapping for inspection.
- (t) Adequate and proper repair of any defects to ensure compliance with this Section. A need to repair more than 1 defect per m² of pipe coating shall be sufficient grounds to reject the pipe and cause the Contractor to adjust his process to reduce the number of defects to an acceptable level.

Any necessary repairs of tested pipes shall be carried out by the Contractor at no additional cost to the Employer.

One pipe from every day's production shall be held back for examination on the following day. This examination shall include bond testing, thickness testing and examination for laminations, voids or any other defects.

If, in the opinion of the Engineer, there are a signification number of defects on the test pipe, then a back check procedure will be invoked. This will involve checking the ten pipes immediately preceding and the ten pipes immediately following the faulty test pipe (the pipe numbers shall be available from the final inspection). These twenty pipes shall be subjected to an examination similar to that carried out on the test pipe. Should the number of defects detected be, in the opinion of the Engineer, significant, then the entire production for that week shall be quarantined and jointly investigated by the Contractor and the Engineer.

Should tests in any production batch show a defect rate of more than 10%, the Engineer may reject the whole batch. In such cases the Contractor shall conduct an investigation to establish the cause of the defects.

Table 10-7: 'In Plant Testing'

TEST		FREQUENCY OF TESTING
1.	Softening Point	Twice per working shift
2.	Penetration at 25°C	Twice per working shift
3.	Bond test for coated pipes	One pipe per working shift

These tests should be conducted at the coating Plant by the Contractor and monitored by the Approved Inspection Authority (AIA), who would be trained in the procedures by the coating material supplier.

At least once during the Contract or when the method of surface preparation is changed, a sample wrapped pipe shall be tested for resistance to cathodic disbonding.

When tested, the wrapping shall not be disbanded from the pre-damaged area by more than a 5 mm radius after exposure for 28 days at the specified potential, i.e. -1500 mV (BS 3900:F1 1).

The inspection activities shall be coordinated with the Contractor's operations so as to delay or interfere with the operations as little as possible. The Contractor's methods shall, nevertheless, always permit inspection to be made and allow adequate repair of imperfections.

Prior to dispatch from his Plant, the Contractor shall ensure that the wrapped pipe is correctly marked on the internal painted surface of the pipe at each end with approved paint, with sufficient information to enable subsequent identification of the pipe to be made. Documentation shall be supplied to the Engineer to enable the history of the processing of each pipe to be traced.

10.16.5 Methods of Testing

10.16.5.1 Testing of Wrap Characteristics

10.16.5.1.1 General

The procedures given below are reference methods of test, which shall be used to establish conformity to the Specification in cases of dispute. Other similar methods, however, may be used by manufacturers for routine quality control purposes with the approval of the Engineer.

10.16.5.1.2 Thickness

The thickness shall be determined by means of a suitable instrument fitted with a micrometre dial gauge, a cylindrical brass block 57 mm in diameter and giving a nominal loading of 3.45kN/m² and a surface plate.

The thickness shall be measured by interposing the outer wrap between the cylinder and the surface plate. Measurements shall be made by marking 75 mm square across the effective width of the mat and making a measurement within each square. No single reading across the width of the mat shall be less than the specified minimum thickness.

10.16.5.1.3 Weight per m²

The weight per square metre shall be determined by cutting representative samples from the effective width of the outer wrap. The samples shall be of such a size, that the weight per square metre may be determined to an accuracy of $\pm 2\%$.

10.16.5.1.4 Tensile Strength

The tensile strength shall be measured with approved equipment. The size of the samples cut from the roll shall be 520 mm long and shall have the required width. (See Table 4 for the minimum tensile strength).

When mounted in the equipment, the distance between the jaws shall be 320 mm. The constant rate of separation of the jaws shall be in the range of 100 mm to 610 mm/minute and the tensile strength at breaking point shall be determined. For reference purposes the rate of separation of the jaws shall be 200 mm/minute. At least four samples shall be tested and an average figure obtained. The test may be carried out on narrower samples if required, provided that at least two of the reinforcing strands are included in the specimen. Sealing of the ends is recommended.

The value for tensile strength obtained from a narrower sample shall be extrapolated to 150 mm width.

10.16.5.2 Bond Test for Coated Pipes

- (u) Measure the temperature of the coating with a surface thermometer.
- (v) If the temperature of the coating is not between 10°C and 25°C, cool or warm the pipe in the test area to bring the temperature within this range.
- (w) Using a knife, heated if necessary, make two parallel cuts, through the coating down to the pipe surface. The cuts shall be 100 mm long and 30 mm apart.
- (x) With a stiff flat blade, loosen the coating the full width between the two cuts and lift the wrap upward in a direction at right angles to the pipe surface.
- (y) The bond shall be considered satisfactory if the coating does not peel cleanly from the primer or the pipe surface but is removed with difficulty.
- (z) This bond test should be carried out at the start of each shift or change in production and thereafter at a frequency approved by the Engineer.

10.16.6 Handling

At all times the pipe, unwrapped as well as wrapped, shall be handled with the aid of slings, lifting yokes and protected hooks to the approval of the Engineer.

At all times the coated pipe shall be handled and stacked in such a manner as to prevent damage to the coating. Particular care shall be taken immediately after coating to avoid damage while the enamel is above ambient temperature. No stacking or loading shall be undertaken until the coating has cooled sufficiently to avoid marking.

The coated pipe shall be stored at all times clear of the ground and in such a way that either water or mud cannot accumulate on the inside or outside of the pipe. Storage shall be effected by the use of wooden bearers, suitably covered, or mounds of gravel-free sand, covered with polyethylene sheets.

The pipe shall only be stacked to a height such that no flattening of the wrapping occurs.

The pipes shall be separated from each other with approved polyethylene covered pads.

10.16.7 Repairs

Although the polymer modified bitumen has excellent self-healing properties, damage caused by transportation or laying of the coated pipe may occur. This shall be quickly repaired using torch-on membrane.

Damage shall be repaired by removing the existing coating to at least 10 mm beyond the area of damage. The repair area shall then be cleaned of all deleterious matter to 100 mm beyond the proposed repair area. Exposed metal shall be re-primed in accordance with this Section. The repair patch, which shall lap at least 50 mm onto sound coating, shall be applied by gently heating with a gas torch and applying it to the pipe in a manner, which prevents the entrapment of air bubbles. All air bubbles shall be removed using a wooden roller or by other means and the perimeter of the repair patch shall be neatly finished off. The patched area shall then be Holiday tested in accordance with the Specification.

10.17 System PL1: Cement Mortar Lining

This corrosion protection system covers the application of Cement Mortar as a steel pipe lining. The pipes will be used to convey potable water.

10.17.1 Standards

Reference is made to the latest issues of the following Standards:

AS 1281-2001: Cement mortar lining of steel pipes and fittings

10.17.2 Material

All materials for the cement mortar lining of pipes shall be in accordance with AS 1281-2001.

10.17.3 Application

10.17.3.1 Mixing of Mortar

Components of the mix shall be accurately weighed. Each batch shall be identical. Mixing shall be carried out in a suitable mechanical mixer. Aggregate and cement shall be measured in correct proportions, then dry mixed in the mixer. When homogeneous, water shall be added from a measuring vessel to achieve the correct consistency but shall not exceed the amount stated previously. When correctly mixed, the material shall be used as soon as possible and not later than 1 hour after the first addition of water. Re tempering of the mix by further addition of water or other material shall not be permitted.

From a random batch of each days production prepare three 150 mm test cubes, in accordance with SANS 5863. After 28 days curing, the compressive strength shall not be less than 30 MPa.

10.17.3.2 Placing of Cement Mortar

Cement mortar shall be placed to the specified thickness by spin casting (preferred method) or by mechanical drag trowel. In either case, sufficient centrifugal force shall be used to ensure optimum bonding to the pipe wall and optimum compaction of the cement mortar, with minimum segregation of different sizes of aggregate. The finished lining shall be smooth and uniform. Hand application is not permitted except on specials or by prior agreement of the Engineer.

10.17.3.3 Curing of Lining

After completion of placing, spinning, trowelling an end finish, the lining shall not be disturbed until set. The pipe ends shall be closed with waterproof end covers or caps and the pipe shall be left undisturbed for at least 40 hours. After 48 hours the lining shall be sprayed with a fine mist of water and the covers and caps replaced or shall be steam cured by an approved method. The lining shall be kept wet for not less than 7 days. Pipes shall not be transported within 21 days from the date of applying the lining.

During placing of the cement mortar and the whole of the curing period, the pipes shall be kept constantly in the shade or under cover. Pipes shall not be exposed to direct sunlight.

Some of the pipes are likely to be stored on site for periods in excess of 3 months before being laid.

10.17.4 Testing

The Quality Control Plan and Procedure referred to in Clause 4.13 above will detail the means of demonstrating compliance with AS 1281-2001 and will be based on Appendix B of AS 1281-2001.

10.18 System PL2: Solvent-Free Epoxy Lining

This system is specific design to be used as a lining system for pipelines conveying potable water and raw water.

10.18.1 General

This corrosion protection system covers the application of Solvent Free Liquid-epoxy as a steel pipe lining. Generally the lining is to be applied in accordance with AWWA C210-97 'Liquid-epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines'. Where in conflict with ANSI/AWWA C210-97, the amendments hereunder shall take precedence. The full cost of all the testing is to be included in the rates for coating unless it is itemised separately in the Schedule of Quantities.

10.18.2 Amendments to AWWA C210-97

The section and sub-section numbers in this clause refer to the same section and sub-section numbers in AWWA C210-97.

10.18.2.1 AWWA C210 Section 1.1 Scope

ANSI Sub-Section 1.1.2 Coating and Lining Systems

The lining system is to be type (3), a single coat of a two part, chemically cured epoxy coating. In the event of the thickness being less than the minimum specified the coating shall be removed and the pipe length shall be re-blasted and re-lined to comply with the specification.

10.18.2.2 AWWA C210 Section 4.2 Quality and Safety

Details of all quality related controls and tests are to be included in the QCP&P referred to in Clause 4.13 of the Employer's specification above.

AWWA C210 Sub-Section 4.2.2 Certification

Copies of the certification of the products used, as required by this section, are to be submitted with the tender documents.

10.18.2.3 AWWA C210 Section 4.3 Coating Systems

AWWA C210 Sub-Section 4.3.1 Liquid-Epoxy Coatings.

Add the following:-

The following products have been approved by Umgeni Water: - Sigma Line 523, Carboline 891 and Denso ST100. Should the Manufacturer/ Supplier wish to offer an alternative product it will be necessary to get the approval of the client. Only solvent free epoxies which have been certified non-toxic and non-tainting and suitable for use with potable water will be permitted. Any delays in approval will not be accepted as a reason for late delivery.

AWWA C210 Sub-Section 4.3.2 Coating Thickness

The pipes shall be lined to a dry film thickness of a minimum of 406 and a maximum of 1000 microns, and shall be free from sags and runs.

AWWA C210 Sub-Section 4.3.4 Physical Requirements

Replace Table 1 with the following new Table 1

Tests 1 through 3 in the new TABLE 1 new shall be conducted on every pipe.

Tests 4 and 5(a) and 5(b) in the new TABLE 1 below shall be applied to at least one pipe selected at random from the first day's production or from each new batch of liquid epoxy, whichever is more frequent.

Tests 6, 7 and 8 in the new TABLE 1 below shall be applied to at least one pipe selected at random from the first day's production of each item.

Should the Manufacturer experience difficulties in achieving this specification, additional tests may be required by the Purchaser until the problem(s) has been identified and rectified. Such additional tests shall be to the Purchaser's account.

NEW TABLE 1

No	PROPERTY	REQUIREMENT	TEST METHOD
1	Visual	Smooth glossy or semi-glossy finish, free from excessive runs, sags, orange peel, occlusions or other visible defects	Use an experienced observer
2	Coating Thickness	Min 406 microns Max 600 microns	ISO 2808. Take a minimum of 2 readings per m ² of surface up to 300 mm nominal bore, or 12 per m ² over 300 mm
3	Electrical Insulation Defects	Nil defects at 90 Volts, 10 Mega-ohm	SABS 1217, Section 5.10
4	Impact Resistance	No defect at 1 Joules	SABS 1217, Section 5.6 but modified as given in Note 1
5a	Degree of cure: • Static Test	No softening or discolouration when fully cured	SABS 1217, Section 5.8. Cure time shall be in accordance with the manufacturer's data
5b	• Dynamic Test	No softening or discolouration when fully cured	50 Double rubs with cotton wool swab soaked in MEK. Cure time shall be in accordance with the manufacturer's data
6	Adhesion (Hot water soak)	Not more than 15 mm disbonding from point of V	Immerse in water at 75°C for 48 hrs. Make V cut at 30° angle. Test adhesion when panel has cooled to 25°C
7	Cathodic Disbonding	Total disbonded area not to exceed 40 mm diameter after 30 days. Current flow not to exceed 5mA	ASTM G8 Method B – Magnesium Anode - 20°C – 7 mm holiday
8	Cathodic Disbonding	Total disbonded area (including holiday) not to exceed 20 mm diameter	Impressed current -3, 5 volts potential at 75°C for 48 hours 3 mm artificial holiday

NOTE: Impact resistance shall be carried out on a sample of production pipe firmly clamped and choked (to be rebound free) to a rigid base. No electrical insulation defects shall be detected at the point of impact when tested at 1 Joule.

10.18.2.4 AWWA C210 Section 4.4 Coating Application

AWWA C210 Sub-Section 4.4.1 General

Application by airless spray is required.

AWWA C210 Sub-Section 4.4.2 Pipe Preparation

The requirements of section 4.4.2 of AWWA C210-97 will apply and will take precedence over the Purchaser's Clause 3.2 above.

AWWA C210 Sub-Section 4.4.3.2 Hold-Back for Field Welds

The hold backs (cut backs) are to comply with the Clause 4.15.1 of this Specification.

AWWA C210 Sub-Section 4.4.3.4 Application Temperature

Add the following:-

The cure rate of liquid epoxy coating is very dependent upon temperature, with the rate of cure being very slow below 10°C and the reaction generally ceasing below 5°C. Manufacturer's tendering for this type of lining are therefore expected to have a heated shop or warm air blowers with suitable heat insulating tunnels to enable the temperature of the coating to be maintained at not less than 15°C from the time of application until full cure has taken place. Adverse weather conditions will not be accepted as a reason for delay in supply.

10.18.2.5 ANSI Section 4.5 Coating Repair

AWWA C210 Sub-Section 4.5.1 Defective Coating

Add the following at the beginning of the Clause:

Repairs of electrical insulation defects may be carried out provided that the number of repairs necessary does not exceed 3 per pipe. A cluster of pinholes within a radius of 25mm shall be regarded as one defect. Any pipe needing repairs in excess of this number or where the lining shows any sign of flaking or loss of adhesion shall not be repaired. The lining shall be removed and the pipe length shall be re-blasted, cleaned and re-coated to comply with the requirements of the specification.

AWWA C210 Sub-Section 4.5.1.1

Delete this sub-section and replace with the following:-

Repairs with Epoxy

When repairs with epoxy are permissible, the following method shall be used :-

- ▶ Abrade an area at least 25mm diameter around and beyond the defective area. The abrasive paper shall not be coarser than 220 mesh and shall be preferably 400 mesh. It shall be used preferably wet to avoid excessive removal of coating.
- ▶ The repair area shall be smoothly feathered into the surrounding sound area. The repair area shall be abraded to a matt finish, free from deep scratches and excessive removal of coating. After abrasion, the area shall be wiped clean with M.E.K. or other suitable approved clean solvent and allowed to dry.
- ▶ All repairs shall be undertaken using a repair product recommended by the material manufacturer.
- ▶ Repair material shall be mixed in the proportions supplied by the manufacturer. No splitting of packs shall be permitted unless the material is supplied in self metering packs.
- ▶ The mixed repair material shall be applied to the clean, dry, abraded repair area so as to cover the defect and extend to within 1 or 2mm of the edge of the abraded area. A "halo" of abraded area shall be visible around the repair material.
- ▶ After curing, the repair and at least 250mm surrounding area shall be tested for electrical insulation defects as specified in the contract. There shall be no electrical insulation defects.

11 Compliance with Requirements

11.1 Testing

Tests, instruments, methods and criteria shall be as specified below or in the Amendments of this Specification.

The requirements of Clauses 4.13 shall apply.

11.1.1 Visual Inspection

All surfaces shall be inspected visually and shall be free from tears, runs, sags, wrinkles, blisters, change in colour or gloss, orange peel, dirt, visible pinholes, dust or fluff occlusions or any other visible defects.

11.1.2 Holiday Inspection

100% of all coated surfaces shall be tested and there shall be no electrical insulation defects on any area inspected.

For films exceeding 500 µm thickness, a high voltage, electrical insulation defects detector shall be used in accordance with SABS 1217.

Except on system containing conductive pigment (Zn, Al), low-voltage wet sponge electrical insulation defects inspection shall be carried out in accordance with SANS 1217 for coatings and linings of thickness not exceeding 500 µm.

For systems exceeding 500 µm thickness, the high voltage, sparking electrical insulation defects detector shall be used in accordance with SANS 1217.

During the inspection procedure the Contractor shall ensure that sufficient moisture is present at all times on the surfaces to be tested.

11.1.3 Dry Film Thickness

The dry film thickness (DFT) shall also conform to the requirements of Clause 9.5

- (a) Measurements shall be taken in accordance with ISO 2808.
- (b) 100% of all system thicknesses measured shall comply with the minimum requirements of this Specification.
- (c) Film thickness in excess of the prescribed maxima shall not necessarily constitute reason for rejection if the system is demonstrated to be sound in all respects.
- (d) The method used to measure film thickness, and the significance of the readings for each particular project, shall be agreed upon by all parties prior to commencement of the work.

11.1.4 Degree of Cure of Fusion-Bonded Materials

The degree of cure of corrosion protection material shall be assessed by solvent wiping in accordance with the method given in SABS 1217 (methyl ethyl ketone resistance test)

11.1.5 Free of Oil and Grease

11.1.5.1 Wetting with Water

All surfaces cleaned of oil and grease shall be tested using the “water-break-free” method. The surface shall be wetted with water and the entire surface shall be covered by an unbroken film.

11.1.5.2 Solvent-Wiping

Where water soluble lubricants may be present the surface shall be further tested by wiping with a clean cotton wool swab soaked in solvent. No stain shall be evident on the swab after solvent-wiping.

11.1.6 Water Soluble Salt Contaminants

Substrate surfaces shall be tested for the presence of water soluble salt contaminants in accordance with SANS 5770 or by means of the Weber Reilly Test.

11.1.7 Standard of Mechanical Surface Preparation

Mechanical surface preparation shall be visually compared to the standard shown in SABS ISO 8501-1.

11.1.8 Blast Profile

The blast profile of the substrate surfaces shall be determined in accordance with SANS 5772.

11.1.9 Residual Dust and Debris

Substrate surfaces shall be tested for the presence of residual dust and debris in accordance with ISO 8502-3.

11.1.10 Blasting Material

All blasting-materials shall be approved by the Engineer.

11.1.10.1 Metallic Abrasive

Abrasive shall be tested in accordance with ISO 11125 for particle size, hardness, density, foreign matter and moisture.

11.1.10.2 Non-Metallic Abrasive

Abrasive shall be tested in accordance with ISO 11127 for particle size, hardness, density, moisture and water soluble contaminants.

11.2 Pipe and Specials Specific Testing

11.2.1 Dry Film Thickness (DFT)

Measurements shall be taken in accordance with ISO 2808.

100% of all system thicknesses measured shall comply with the minimum requirements of this Specification.

In the case of coats applied after the erection of steel work on Site, the frequency at which measurements of the DFT are taken shall be at the discretion of the Engineer, and may be dictated by accessibility.

DFT in excess of the prescribed maxima shall not necessarily constitute reason for rejection if the paint film is demonstrated to be sound in all respects.

DFT shall be tested within 7 days of application.

The method used to measure DFT, and the significance of the readings for each particular item, shall be agreed upon by all parties prior to commencement of the coating work.

11.2.1.1 Automated Shop Applied Lining and Coating

The film thickness on the first pipe of a production run and thereafter on at least one pipe selected at random from every day's production, but not less than one pipe out of every ten pipes, shall be measured non-destructively by an approved eddy current instrument. At least four readings at equally spaced intervals around the circumference, approximately 300 mm from each end of the pipe, shall be taken. The first reading shall be over the weld bead. When practicable an additional four readings at equally spaced intervals around the circumference in the centre of the pipe shall be taken. The thickness shall not be less than the minimum specified over 100% of the area including weld beads. The Engineer may at his discretion supplement the above test by checking wet film thickness on any or all pipes during application of the coats.

11.2.1.2 Hand and In-situ Applied Lining and Coating

All the hand applied lining and coating thicknesses shall be tested by means of an approved eddy current or magnetic instrument. At least four readings shall be taken at equally spaced intervals around the pipe circumference at any test point. The first reading shall be over the weld bead. The thickness shall not be less than the minimum specified over 100% of the area including weld beads.

12 Measurement and Payment

12.1 General

The rates tendered under this Specification shall not include for the general obligations, Contractor's Equipment and work deemed to be covered by the Items provided in Specification.

Payment for the requirements of this Specification will be included in the payment item for the particular item supplied including painting or corrosion protection. No separate payment shall be made for painting and corrosion protection unless specifically allowed for in the Bill of Quantities.

12.2 Scheduled Items

12.2.1 QCP and documentation Unit: lump sum (Sum)

Separate Items are provided in the Bill of Quantities for the submission of the Quality Control Plan (QCP) and all other pre-manufacture documentation.

The rate shall include full compensation for the preparation and submission of the QCP and the submission of all pre-manufacture documentation in compliance with the Specification.

Payment will only be made after the QCP and all documentation has been approved by the Engineer.”

ANNEXURE A: Applicable Standards

The following Standards and Codes of Practice are referred to in this Specification:

Standards Australia

AS 1281-2001	Cement mortar lining of steel pipes and fittings
AS 4321-2001	Fusion-bonded medium-density polyethylene coating and lining for pipes and fittings

American National Standards Institute

ANSI B31.3	Standards of pressure piping
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American Petroleum Institute

API 5L	Specification for line pipe
API 1104	Standard for welding pipelines and related facilities

American Society of Mechanical Engineers

ASME BPVC-IX	Boiler and Pressure Vessel Code – Section IX, Welding and Brazing Qualifications
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American Society for Testing of Materials

ASTM A240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A312	Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes
ASTM D543	Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D570	Standard Test Method for Water Absorption of Plastics
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness
ASTM D2794	Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

ASTM D4090

ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

ASTM G8 Standard Test Methods for Cathodic Disbonding of Pipeline Coatings

ASTM G14 Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)

ASTM G62 Standard Test Methods for Holiday Detection in Pipeline Coatings

ASTM G95 Standard Test Method for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method)

American Water Works Association

AWWA M11 Steel pipe – A guide for design and installation (3rd edition)

AWWA: C207 - 1994 Steel pipe flanges 4" through 144".

AWWA: C208 - 1996 Dimensions for fabricated steel water pipe fittings.

AWWA C210-97 Liquid epoxy coating systems for the interior and exterior of steel water pipelines

AWWA C222-99 Polyurethane coatings for the interior & exterior of steel water pipe & fittings

British Standards Institution

BS 970 Specification for wrought steels

BS 2494 Materials for elastomeric joint rings for pipe work and pipelines

BS 2633 Class I arc welding of ferritic steel pipe work for carrying fluids

Canadian Standards Association

CSA Z245.20 External Fusion Bond Epoxy Coating for Steel Pipe

CSA Z245.21 External Polyethylene Coating for Pipe

European Standards

EN 1179	Zinc and zinc alloys – Primary zinc
EN 10240	Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic Plants

International Organization for Standards

ISO 544	Welding consumables - Technical delivery conditions for welding filler materials - Type of product, dimensions, tolerances and markings
ISO 752	Zinc ingots
ISO 2808	Paints and varnishes - Determination of film thickness
ISO 8501-1	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after overall removal of previous coatings.
ISO 8502-3	Preparation of steel substrates before application of paint and related products - Tests for the assessment of surface cleanliness Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)
ISO 8504-2	Preparation of steel substrates before application of paints and related products – Surface preparation methods – Part 2: Abrasive blast cleaning.
ISO 11125	Preparation of steel substrates before application of paints – Metallic blast-cleaning abrasives.
ISO 11127	Preparation of steel substrates before application of paints – Non-metallic blast-cleaning abrasives.

NACE International

NACE TM0102	Measurement of Protective Coating Electrical Conductance on Underground Pipelines
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South African Bureau of Standards

SANS 32	See EN 10240
SANS 62-1	Steel pipes Part 1

SANS 121 (ISO 1461)	Hot-dip galvanised coatings on fabricated iron and steel articles
SANS 630	Decorative high gloss enamel paints
SANS 681	Undercoats for paints
SANS 719	Electric welded low carbon steel pipes for aqueous fluids (large bore)
SANS 1091	National colour standard
SANS 1117	Plastics wrappings for the protection of steel pipelines
SANS 1130	Fibre reinforcing material for pipe wrapping
SANS 1178	The production of lined and coated steel pipes using bitumen or coal tar enamel
SANS 1200 L	Standardized specification for civil engineering construction Section L: Medium-pressure pipe lines
SANS 1217	Internal and external organic coating protection for buried steel pipelines
SANS 1274	Coatings applied by the powder-coating process
SANS 1319	Zinc phosphate primer for steel
SANS 1344	Medium duty solvent detergent
SANS 1365	Solvent degreasers that contain chlorinated hydrocarbons
SANS 1700	Fasteners
SANS 2063	Thermal spraying - Metallic and other inorganic coatings - Zinc, aluminium and their alloys
SANS 5770	Preparation of steel substrates before the application of paints and related products - Test for the assessment of cleanliness of blast-cleaned steel surfaces - Freedom from certain soluble salts
SANS 5772	Preparation of steel substrates before the application of paints and related products - Surface roughness characteristics of blast-cleaned steel surfaces - Profile of blast-cleaned surfaces determined by a micrometre profile gauge
SANS 10044	Welding
SANS 10064	The preparation of steel surfaces for coating
SANS 10120-3 HC	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 3: Guidance for design Section HC: Corrosion protection of structural steelwork

SANS 10129	Plastics tape wrapping of steel pipelines
SANS ISO 14713	Protection against corrosion of iron and steel in structures - Zinc and aluminium coatings - Guidelines

ANNEXURE B: Paint Colour Coding

MECHANICAL AND GENERAL

ITEMS	COLOUR	SANS 1091 CODE
Structural steel, Gates	Light grey	G29
Hydraulic power Pack	Strong blue	F11
Hydraulic oil	Salmon pink	A40
Hazardous objects/areas (restricted headroom, crane hook etc.)	Golden yellow with black chevron	B49*
Handwheels and levers	Golden yellow	B49
Handrails: - vertical - horizontal	Black Golden yellow	G49
Handrails on dam walls - Aluminium - Stainless steel - Galvanized	Un-coated Un-coated Light grey	G29
Floors: - safe and walking areas - restricted areas - open flooring (gratings) – MS galvanized 3Cr12 Stainless steel	Emerald green Golden yellow Un-coated Un-coated Un-coated	E14 B49*
Fire protection Plant	Signal red	A11*
Control panels	Eau de nil	H43

PUMP STATION

ITEMS	COLOUR	SANS 1091 CODE
Electric motors	Light beige	C57
Pumps/control valves: for raw water for chem-treated water	Apple green Middle blue	H29 F07
Fan and coupling guards	Signal red	A11*
Base plates	Black	
Overhead traveling cranes	Golden yellow	B49
Isolating valves: for raw water for chem-treated water	Brilliant green Arctic blue	H10 F28

ELECTRICAL

ITEMS	COLOUR	SANS 1091 CODE
Low voltage panels: Indoor Outdoor	Light orange Light orange	B26* B26
Medium voltage panels: Indoor Outdoor	Admiral grey Admiral grey	G12 G12

ITEMS	COLOUR	SANS 1091 CODE
Panel accessories (gland plates, back plates, interior)	White	
UPS Plant items	Light orange	B26
Transformers	Light stone	C37
LV distribution kiosks, mini subs	Light stone	C37
Standby electrical Plant items(Permanently powered)	Signal red	A11*
General outdoor	Light grey green	H40
All Plant– interior	White	

WATER TREATMENT PLANT

ITEMS	COLOUR	SANS 1091 CODE
Plant	Same colour of respective pipe work	
Handwheels (remote valves)	Same colour of respective pipe work	
PIPE WORK		
Raw water	Brilliant green	H10
Chemical treated raw water	Verdigris green	E22
Clarified raw water	Eau de nil	H43
Filtered water	Pale blue	E39
Chlorinated filtered water	Arctic blue	F28
Backwash water	Cornflower blue	F29
Air saturated water	Turquoise blue	E18
Wash water recovery	Middle buff	B33

SEWAGE PIPE WORK

ITEMS	COLOUR	SANS 1091 CODE
Raw sewage	Dark earth	B11
Settled sewage effluent	Brilliant green	H10
Biologically treated sewage effluent	Verdigris green	E22
Final/chlorinated effluent	Eau de nil	H43
Digested sewage sludge	Middle brown	B07
Raw sewage sludge	Dark brown	B03
Humus sludge	Golden brown	B13
Return activated sludge	Golden brown	B13
Waste activated sludge	Middle brown	B15
Supernatants/underflows returning to head of works	Middle buff	B33

DOSING/CONTROL PIPE WORK

ITEMS	COLOUR	SANS 1091 CODE
Poly-electrolyte	Pinotage	A08
Alum/Ferric chloride	Jacaranda	F18
Chlorine solution	Primrose	C67
Chlorine gas	Lemon	C54
Chlorine liquid	Light orange	B26
Lime slurry	Biscuit	B64
Lime hydrated	Biscuit	B64
Lime saturated water	Biscuit	B64
Air/compressed air	White	
Steam	Pastel grey	G54

NOTE: Colours marked thus * are restricted for specified Plant only.

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AMENDMENTS

The following amendments to this Specification apply to this Contract. The paragraph letters and numbers indicate the relevant clause number to which the amendments apply. Alternatively, the relevant clause number will be shown in brackets as part of the heading. New clauses added to this Specification are assigned with new numbers.

1 SCOPE (CLAUSE 1)

This specification shall be applicable to the steel pipeline and valve component of the project included in the civil works, as well as to the mechanical, electrical and ancillary works where specifically referenced. The corrosion protection for the structural steel is specified elsewhere.

2 CORROSION PROTECTION SYSTEMS (CLAUSE 10)

2.1 RECOMMENDED CORROSION PROTECTION SYSTEM (SUBCLAUSE 10.1)

All stainless steel must undergo pickling and passivation. For materials other than stainless steel, corrosion protection shall be implemented as specified in the table below:

Item	Environment Condition	Surface Preparation and Material	Surface Condition	System
For nominal diameters < DN100 buried in soil/ Outside Valve Chambers				
Mild steel pipes, specials and fittings	Severely Corrosive	Clause 8.1: Mild Steel	Sa 3	System 7: Hot Dip Galvanized (Heavy Duty) AND System 9: Tape Wrapping
Flanges	Severely Corrosive	Clause 8.1: Mild Steel	Sa 3	System 7: Hot Dip Galvanized (Heavy Duty) AND System 10: Petrolatum Tape Wrapping
Couplings	Severely Corrosive	Clause 8.1: Mild Steel	Sa 3	System 6: Fusion Bonded Epoxy AND System 10: Petrolatum Tape Wrapping
For nominal diameters < DN100 in Valve Chambers/ Not buried in Soil				
Mild steel pipes, specials and fittings	Medium Corrosive	Clause 8.1: Mild Steel	Sa 3	System 7: Hot Dip Galvanized (Heavy Duty)
Flanges	Medium Corrosive	Clause 8.1: Mild Steel	Sa 3	System 7: Hot Dip Galvanized (Heavy Duty)
Couplings.	Medium Corrosive	Clause 8.2: Cast Iron and Cast Alloys	Sa 2½	System 6: Fusion Bonded Epoxy

Item	Environment Condition	Surface Preparation and Material	Surface Condition	System
For nominal diameters ≥ DN100 in all conditions				
Mild steel pipes, Specials and fittings	Severely Corrosive	Clause 8.1: Mild Steel	Sa 3	Coating: System PC2: Fusion-Bonded Medium Density Polyethylene AND Lining: System PL1: Cement Mortar Lining AND Welded Field Joints: System 9: Tape Wrapping
Flanges	Severely Corrosive	Clause 8.1: Mild Steel	Sa 3	System 5: Two Pack Epoxy AND System 10: Petrolatum Tape Wrapping
Couplings	Severely Corrosive	Clause 8.2: Cast Iron and Cast Alloys	Sa 2½	System 6: Fusion Bonded Epoxy AND System 10: Petrolatum Tape Wrapping
For all nominal diameters				
Wedge Gate, RSV, Butterfly, Non-return and Air Valves	Severely Corrosive	Clause 8.2: Cast Iron and Cast Alloys	Sa 2½	System 6: Fusion Bonded Epoxy
Water Meters	Severely Corrosive	Clause 8.2: Cast Iron and Cast Alloys	Sa 2½	System 6: Fusion Bonded Epoxy
Mild steel pipe supports, handrails, ladders, etc.	Medium Corrosive	Clause 8.1: Mild Steel	Sa 3	System 7: Hot Dip Galvanized (Heavy Duty)

General specification

Hand-Raked Screen

Specification number: SPE-MM-4009

Document control					
Specification no.		SPE-MM-4009			
Rev	Date	Revision details / status	Author	Reviewer	Approver
0	2021/03/01	First Issue	Denis Peart	Laura Ingle	Nazmier Hassan
Signature					

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1 Introduction

SPE-MM-4009 specifies the requirements for channel mounted hand-raked screens for wastewater which are to be provided by the Contractor.

2 Scope of works

See project specification.

The installation shall be configured as shown on applicable drawings.

3 Normative references

Where this specification is required for a project, the following documents shall form part of the Contract Document:

- ▶ Amendments, Additions and Detailed Requirements SPE-MM-4009).
- ▶ SPE-MM-0001: General Mechanical Requirements.
- ▶ SPE-JJ-0003: General Corrosion Protection.
- ▶ SANS 12944-2: Paints and varnishes – Corrosion protection of steel structures by protective paint systems; Part 2: Classification of environments.
- ▶ National Occupational Health and Safety Act and Regulations.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

4 Performance requirements

The screen shall be suited to the application, shall function effectively and the rake shall be suited for use by a single person. The raking shall be done without spillage and the water from the screenings shall drain back into the channel.

The equipment shall be suited to the specified range of operating flows.

5 Design and construction

5.1 General

The person raking the screen shall be provided with secure, non-slip surfaces for support. This is a requirement for both wet and dry conditions.

5.2 Screen

The screen shall be permanently anchored in the channel. The screen element shall be sized so that the flow speed at average flow does not exceed 0,45 m/s. If the channel is not wide enough to achieve this, then it is acceptable that the screen element simply spans the full width and height of the channel.

The screen element shall stretch from the channel floor level to the collection trough; i.e. a deadplate is not acceptable.

The aperture spacing between bars shall be 20 mm unless otherwise specified.

The screen bars shall be formed from flat bar with cross sectional dimensions of at least 8 mm X 50 mm. The bars shall be arranged so that longitudinal raking using a rake comb is possible.

The bottom of the collection trough shall be above the top level of the channel wall. The collection trough's cross-sectional dimensions shall be at least 320 mm wide and 170 mm deep and it shall be at least as wide as the channel. The bottom shall be perforated with holes of the same, or smaller, diameter as the screen aperture dimension. Standard perforated plate with the smooth side up is preferred.

One end of the trough shall be closed. The other end shall be provided with a chute so that screenings can be slid out of the trough and into a bucket or similar container without spillage. The chute shall be provided with a ramp to minimise water from flowing down the chute during raking.

The screen element shall be at an angle of about 45° to the vertical.

5.3 Rake

The rake shall be light but rigid and the comb head shall minimise obstruction to the water flow. A HDPE comb is acceptable.

The comb shall be of sawtooth pattern so that the teeth match and easily drop into the gap between the screen bars (even when the comb has been pushed into the flow and is not visible).

The rake shall not be of aluminium.

A wall hook shall be provided in a suitable position for the rake to hang on when not in use.

5.4 Floor and guard rail

The unit shall incorporate a platform for the raker to stand on whilst raking the screen. It shall be secure and safe and easy access, preferably via stairs, shall be provided.

The Contractor shall provide surrounding grid flooring and guard railing where this is required for safety.

Grid flooring and guard railing shall comply with SPE-MM-0001.

6 Materials and coatings

6.1 General

Components shall be designed for corrosion resistance to the high corrosivity category (C4) of SANS 12944 2.

Corrosion protection shall comply with SPE-JJ-0003.

Materials shall comply with SPE-MM-0001.

6.2 Equipment

Equipment shall comply with the table below.

ITEM	MATERIAL	COATING
Screen and collection trough	EN Grade 1.4301 (304) stainless steel; or better.	Pickle and passivate.
Platform and guard railing	Carbon steel.	Hot dip galvanised.
Fasteners	EN Grade 1.4401 (316) stainless steel.	N/A
Anchor fasteners	EN Grade 1.4401 (316) stainless steel.	N/A
Wall hook	Stainless steel.	Pickle and passivate.
Auxiliary metal components	EN Grade 1.4401 (316).	Pickle and passivate.
<p>Stainless steel shall be correctly pickled and passivated. Stainless steel surfaces shall be free of ferrous stain and heat tint at commissioning.</p> <p>Metal plating of ferrous materials is not acceptable as the corrosion protection system.</p> <p>Fabrications which are hot dip galvanised and then welded, cut, ground, drilled or have the steel exposed by any other means shall be rejected.</p>		

7 Fabrication

Fabrication and welding shall comply with the requirements of SPE-MM-0001.

8 Installation

Installation work shall comply with SPE-MM-0001.

The Contractor's design shall accommodate the inaccuracy specified for concrete works.

The maximum allowable gap between the screen element and the channel is the same as the specified screen bar spacing.

9 Civils and building

As required in terms of the General Conditions, the Contractor shall:

- ▶ provide the details of civil and building requirements to the Engineer.
- ▶ at an appropriate point, measure on Site in order to check for correctness for the Works.

The Contractor shall ensure that the design can accommodate a tolerance of +/- 40 mm for civil and building items constructed by others unless a tighter tolerance is called for by the Contractor in good time and accepted by the Engineer.

10 Safety

The Contractor shall design and install all equipment installations in accordance with the requirements of the Occupational Health and Safety Act of South Africa.

Edges shall be rounded off so that accidental contact does not result in injury.

11 Inspections

The Contractor shall make all arrangements and shall carry all costs for the Engineer to inspect the complete unit in the workshop prior to despatch to Site.

The Contractor shall make arrangements for the Engineer to inspect the installation on Site prior to commissioning.

12 Testing requirements

The Contractor shall demonstrate the correct operation of the equipment to the Engineer prior to the Works being commissioned.

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1. INTRODUCTION (CLAUSE 1)

No Amendments

2. SCOPE (CLAUSE 2)

Add the following:

“This Specification covers the supply and installation of hand-raked screens required in the civil works for this Contract.”

3. NORMATIVE REFERENCES (CLAUSE 3)

Delete reference to SPE-MM-0001 from the list.

4. PERFORMANCE REQUIREMENTS (CLAUSE 4)

No amendments

5. DESIGN AND CONSTRUCTION (CLAUSE 5)

No amendments

6. MATERIALS AND COATINGS (CLAUSE 6)

6.1 GENERAL (SUBCLAUSE 6.1)

Replace the last sentence of this subclause with the following:

“Materials shall comply with Subclause 9.4 of SPE-MM-7007 and its amendments.”

7. FABRICATION (CLAUSE 7)

Delete the contents of this clause and insert the following new subclauses:

7.1 GENERAL (NEW SUBCLAUSE 7.1)

Steelwork shall generally be constructed, fabricated and erected in accordance with the applicable requirements of SANS 1200 H.

Sharp edges, pits, inclusions, weld spatter, undercuts, indentations or other surface defects are not acceptable.

Edges shall be rounded to a radius of at least 2 mm.

Designs shall avoid inaccessible pockets and hollows.

Sharp edges on items fabricated from thin sheets will not be acceptable and sharp edges shall preferably be avoided by good design.

Inspection of fabrications shall generally be done after fabrication is complete.

7.2 CARBON STEELS (NEW SUBCLAUSE 7.2)

Structural steelwork shall be of grade S 355 JR or of grade S 355 JO in accordance with SANS 50025.

Hand-Raked Screen

The requirements of the Hot Dip Galvaniser's Association of South Africa shall be complied with if the item is to be hot-dip galvanised. Designs shall provide proper access for safe and complete entry of the molten zinc into open spaces so that subsequent drilling at the galvaniser's yard is avoided.

Surfaces to be coated shall be accessible by blast and spray equipment. Inaccessible pockets, such as bad weld profile as well as hollow structures, are unacceptable and the angle of impact of blast material and sprayed coatings shall not be less than 45 degrees. Edges shall be rounded for safety reasons and also to be suitable for the coating system to be applied.

7.3 AUSTENITIC STAINLESS STEELS (NEW SUBCLAUSE 7.3)

Fabrication of austenitic stainless steels shall comply with the recommendations in the "Pocket Guide" issued by Columbus Stainless. Compliance with publications from equivalent authorities will be acceptable.

Stainless steel fabricators shall use permanently dedicated storage and fabrication areas and shall use machines, tools and handling equipment which are suited and permanently dedicated to this type of material.

Fabrications shall be pickled and passivated over their full surface to achieve an even colour. If grinding is required before pickling, the final grinding shall be done with a fine disc in order to remove coarse grinding marks.

7.4 WELDING (NEW SUBCLAUSE 7.4)**7.4.1 Standards (New Subclause 7.4.1)**

Welding shall be in accordance with SANS 15614-1 or with other equivalent standards acceptable to the SAIW.

Welders shall be experienced artisans approved in accordance with BS 4872 or equivalent.

The Contractor shall ensure that all structural welding, including all welding of pipework, is done in accordance with a welding procedure specification (WPS). The welding supervisor shall ensure compliance with the WPS. The document shall be available for scrutiny at all times.

7.4.2 Preparation (New Subclause 7.4.2)

Wire brush and de-grease both surfaces to at least 30 mm from the weld.

Cleaning of stainless steel shall utilise non-chlorinated fluids only.

7.4.3 Continuous Welding and Elimination of Crevices (New Subclause 7.4.3)

Welding shall be continuous on all sides of any joint. Designs which do not allow this shall be re-designed.

Crevices, including those arising from welding on one side only, shall be eliminated. This requirement applies to the welding of all metals and welding procedure shall be designed to prevent unacceptable deformation.

Welds which are only accessible from one side shall be prepared so that the root run provides an acceptable profile and prevents the formation of crevices.

In special cases only, non-continuous welding might be accepted in writing by the Engineer. The resulting crevices shall be sealed with a two part solvent free epoxy which can be applied at thicknesses of up to 600 µm and above such as Sigmaline 523 or Corrocoat Zip E or Sigmacover 1000 or equivalent.

7.4.4 Weld Appearance (New Subclause 7.4.4)

Welding shall be free of blowholes, projections, pinholes, splatter and undercuts and all welding flux, weld spatter and other sharp imperfections shall be removed. Weld beads with a surface irregularity exceeding 3 mm or with sharp crests having a radius under 2 mm shall be ground.

7.4.5 Site Welding (New Subclause 7.4.5)

Site welding shall be kept to a minimum and shall only be undertaken with the acceptance of the Engineer.

7.4.6 Welding of Stainless Steel – Additional Requirements (New Subclause 7.4.6)

Fabrication of austenitic stainless steels shall comply with good practice and as described in the recommendations in the publications issued by Columbus Stainless. Compliance with publications from equivalent authorities will be acceptable.

Stainless steels to be welded shall be of the low carbon grade; e.g. 1.4306 rather than 1.4301 and 1.4404 rather than 1.4401.

The welding rods used shall be the most suitable for the metal and purpose.

Only welders experienced with welding stainless materials shall be used.

Welds which are accessible from only one side shall be executed in a manner to prevent heat tint or shall be post-weld treated in order to remove all traces of heat tint.

All possible steps shall be taken to ensure maximum corrosion resistance and strength of the welds and welded material. Special care shall be taken to avoid prolonged heating. Welds shall be passivated. Discolouration and steel contamination must be removed by pickling or electro cleaning as accepted by the Engineer but should rather be avoided by taking the appropriate measures.

8. INSTALLATION (CLAUSE 8)

Delete the first sentence of this clause and replace with the following:

“The Works shall comply with the following:

- a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.
- b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.
- c) The Contractor is responsible for grouting work associated with the equipment and pipework to be provided in terms of the Contract.
- d) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.
- e) A small amount of a nickel based, anti-seize compound shall be applied along the full length of fastener threads before the nut is applied.
- f) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant.”

9. CIVILS AND BUILDING (CLAUSE 9)

No amendments

10. SAFETY (CLAUSE 10)

No amendments

11. INSPECTIONS (CLAUSE 11)

No amendments

12. TESTING REQUIREMENTS (CLAUSE 12)

No amendments

Add the following new Clause:

13. DOCUMENTS TO BE PROVIDED (CLAUSE 11)

The Contractor shall complete and submit the applicable technical datasheets and shop drawings to the Employer's Agent for approval prior to manufacturing.

General specification

Sluice Gates

Specification number: SPE-MM-7007

Document control					
Specification no.		SPE-MM-7007			
Rev	Date	Revision details / status	Author	Reviewer	Approver
0	2021/03/01	First Draft	Denis Peart	Laura Ingle	Laura Ingle
Signature					

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1 Introduction

SPE-MM-7007 specifies the requirements for sluice gates to be provided by the Contractor for general water and wastewater applications and also for dam applications.

2 Scope of Works

See project specification.

The installation shall be configured as shown on applicable drawings.

3 Normative References

The following form part of the Contract Document:

- (a) Amendments, additions and detailed requirements (SPE-MM-7007).
- (b) SPE-MM-0001: General Mechanical Requirements.
- (c) SPE-JJ-0003: General Corrosion Protection for Pipelines, Water and Wastewater Works.
- (d) SPE-MM-6004: Actuators.
- (e) SANS 12944-2: Paints and varnishes – Corrosion protection of steel structures by protective paint systems; Part 2: Classification of environments.
- (f) National Occupational Health and Safety Act and Regulations.
- (g) SANS 10108: The classification of hazardous locations and the selection of apparatus for use in such locations.

Equipment, materials and operational methods shall comply with the latest edition of the relevant national and/or international standard.

4 Equipment Eligibility

The sluice gates provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available locally. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

Equipment which does not satisfy these requirements is not acceptable unless specifically called for in the specifications or unless the Engineer agrees in writing.

5 Performance Requirements

5.1 Operation

The sluice gate shall open and close smoothly and without snag or slew under all pressures and over its full travel.

The opening and closing force for manually operated sluice gates shall be less than 240 Newtons (i.e. the sum of the tangential force on the wheel shall be less than 240 Newtons over the full opening and closing distances).

5.2 Pressure

Wall and aqueduct mounted sluice gates can be subject to substantially higher pressures than channel mounted sluice gates and sluice gates for dam structures can be subjected to significant pressure. Sluice gates and all components shall be designed to withstand the maximum pressure which could be experienced during all specified operational conditions and shall seal acceptably when subject to this pressure.

5.3 Leakage

Permissible leakage rates apply to the full range of pressures.

The acceptable leakage rate for off-seating sluice gates is 0,02 litres per second per metre of seating perimeter under normal operating conditions.

The acceptable leakage rate for on-seating sluice gates is 0,01 litres per second per metre of seating perimeter under normal operating conditions.

The acceptable leakage between the sluice gate frame and the concrete structure is zero.

5.4 Frequent Operation

Sluice gates which operate frequently shall be designed to perform correctly after at least five years of operation before requiring replacement parts. This includes wearing surfaces.

6 Operation and Control

Manual operation shall be provided in addition to any powered actuation specified.

Actuated sluice gates shall remain in position upon failure of the electrical supply unless automatic shut-down is specified.

Each actuator shall be provided with an emergency stop station in an appropriate position.

If the Contract includes a SCADA system, monitored parameters shall appear on the SCADA/HMI mimics.

7 Design and Construction

7.1 General

The sluice gate shall incorporate the frame, gate, headstock and actuation device.

The design shall allow removal of the gate and replacement of the seals without damage to the frame structure.

The headstock support shall accommodate the gate opening and closing forces with no visible deflection.

Sluice gates shall be designed so that solid material in the flow cannot snag on protrusions such as adjusters and/or prevent closing of the gate.

Fabricated gates which require reinforcing ribs shall have these ribs welded onto the gate. Bolted ribs are not acceptable. Welds shall be continuous and without crevices.

Gates in off-seating applications shall incorporate guides which provide a seating force. Such guides shall be of low friction polymer or of non-ferrous metal.

Wide gates (gates with a width to depth ratio greater than 1,8) shall be provided with dual spindles which are connected by gearing.

Sluice gates shall be of the rising spindle configuration unless not feasible in the application.

Line shafting shall be provided with shaft guides at a maximum spacing of 1 800 mm.

Handwheels shall be mounted approximately 1 000 mm above the operator's floor level.

Manually operated units shall be provided with matched gearboxes and handwheels of a size and construction in order to comply, when subjected to a differential pressure equal to the maximum specified pressure difference across the gate, with the performance requirements for manual operating forces. Suitable gearboxes shall be fitted to achieve the specified manual operating forces.

The open and close directions of handwheels shall be indicated.

The gate, when open, shall be out of the path of the maximum design flow. The gate opening height of channel mounted sluice gates shall be at least 200 mm above the maximum specified water depth in the channel.

The complete unit shall have environmental protection which is suitable for washing by hose.

7.2 Wall Mounted Sluice Gates

Wall mounted sluice gates shall seal on all 4 sides.

Gates, frames and guides shall be structurally capable of resisting the specified differential pressure at any degree of opening and shall operate correctly under this differential pressure.

7.3 Frequently Operated Gates

Sluice gates for regulation and modulation and/or which will be operated daily shall comply with the following additional requirements:

- ▶ The gate shall slide between polymer or non-ferrous alloy materials. Sliding contact between similar metals is not acceptable.
- ▶ Guides, seals, gate nuts and thrust nuts shall be easily replaceable.

7.4 Actuators

Sluice gate actuators shall comply with SPE-MM-6004.

7.5 Gearboxes

Gearboxes shall comply with SPE-MM-0001. They shall have ingress protection to IP 55.

The service factor for motor driven gearboxes shall be chosen in accordance with SPE-MM-0001 or shall comply with the guidelines of AGMA.

7.6 Fabrication

Fabrication and welding shall comply with SPE-MM-0001.

7.7 Seals

7.7.1 Dams

Elastomer seals on dam applications are only acceptable if the design allows seals to be replaced by a diver underwater whilst the sluice gate is in situ. Seals on dam applications shall, otherwise, be metal on metal.

7.7.2 General

Elastomer seals shall be suited to the application. Elastomers in wastewater applications shall be of nitrile or viton.

8 Materials & Coatings - Dams

8.1 Preamble

Sluice gates for dams shall comply with this Clause.

8.2 General

Corrosion protection shall be suitable for the very high - marine corrosivity category (C5-M) of SANS 12944-2.

Corrosion protection shall comply with SPE-JJ-0003.

Materials shall comply with SPE-MM-0001

8.3 Equipment

The materials of construction of sluice gates for dams (i.e. for all sluice gates coming into contact with dammed reservoir water) shall comply with the table below.

ITEM	MATERIAL	COATING
Frame and gate.	EN Grade 1.4462 duplex stainless steel (2205) or EN Grade 1.4410 duplex stainless steel (2507).	Pickle and passivate.
Sliding surfaces	Stainless steel on engineering plastic or non-ferrous alloys.	Not applicable.
Seals – not normally exposed to ultra violet rays.	Metal on metal (preferred)	Not applicable.
	Stainless steel on elastomer	Not applicable.

ITEM	MATERIAL	COATING
Seals – normally exposed to ultra violet rays; including diffused radiation.	Metal on metal.	Not applicable.
Spindles, line shafting, universal joints, muff couplings, spindle adaptors, pins and linkages	EN Grade 1.4401 stainless steel (316) or EN Grade 1.4462 duplex stainless steel (2205).	Pickle and passivate.
Line shaft support brackets	EN Grade 1.4462 duplex stainless steel (2205); EN Grade 1.4401 stainless steel (316) is also acceptable.	Pickle and passivate.
Line shaft support bracket bearing surfaces	Engineering plastic.	Not applicable.
Spindle covers	Stainless steel.	Pickle and passivate.
	Polycarbonate.	Not applicable.
Motors, gearboxes and bearing housings.	Manufacturer's standard.	Corrosion protection suitable for the very high corrosivity category (C5-M) of SANS 12944-2.
Handwheels	Stainless steel	Pickle and passivate.
	Cast iron	Fusion bonded epoxy.
	Cast aluminium	Not required.
Fasteners, including anchor fasteners.	EN Grade 1.4462 duplex stainless steel (2205)	Not applicable.
Carbon steel is not acceptable for any component of the sluice gates.		
Stainless steel shall be correctly pickled and passivated. Stainless steel surfaces shall be free of ferrous stain and heat tint at commissioning.		

9 Materials & Coatings - General

9.1 Preamble

Sluice gates for applications other than for dams shall comply with this Clause.

9.2 General

Corrosion protection shall be suitable for the high corrosivity category (C4) of SANS 12944-2.

Corrosion protection shall comply with SPE-JJ-0003.

Materials shall comply with SPE-MM-0001.

9.3 Equipment

Equipment shall comply with the table below.

ITEM	MATERIAL	COATING
Frame and gate.	EN Grade 1.4401 stainless steel (316) or LDX 2101.	Pickle and passivate.
Sliding surfaces; frequent operation.	Stainless steel on engineering plastic.	Not applicable.
Sliding surfaces; less than once per day.	Stainless steel on engineering plastic or on rubber or on non-ferrous alloys.	Not applicable.
Seals	Elastomer; suitable for the fluid.	Not applicable.
Seating surface	Stainless steel.	Pickle and passivate.
Spindles, line shafting, universal joints, muff couplings, spindle adaptors, pins and linkages	EN Grade 1.4401 stainless steel (316) or LDX 2101 or a suitable Martensitic stainless steel.	Pickle and passivate.
Line shaft support brackets	EN Grade 1.4401 (316) stainless steel or LDX 2101.	Pickle and passivate.
Line shaft support brackets bearing surfaces	Engineering plastic.	Not applicable.
Spindle covers	Stainless steel.	Pickle and passivate.
	Polycarbonate.	Not applicable.
Motors, gearboxes and bearing housings.	Manufacturer's standard.	Corrosion protection suitable for the high corrosivity category (C4) of SANS 12944-2.
Handwheels	Stainless steel.	Pickle and passivate.
	Cast iron.	Fusion Bonded epoxy or equivalent.
	Aluminium.	Not required.
Fasteners, including anchor fasteners.	EN Grade 1.4401 (316) stainless steel or LDX 2101.	Not applicable.
On wastewater applications, copper alloys shall not be used unless completely encapsulated; i.e. thrust nuts for sluice gates for wastewater applications shall not be of brass or bronze unless completely separated from the environment in a gearbox or equivalent.		
On applications not involving wastewater, thrust nuts shall be of manganese bronze or better.		
Carbon steel is not an acceptable material for any component of the sluice gate.		
Stainless steel shall be correctly pickled and passivated. Stainless steel surfaces shall be free of ferrous stain and heat tint at commissioning.		

10 Installation

10.1 General

Installation work shall comply with SPE-MM-0001.

Sluice gates shall be installed by personnel skilled in such installations.

Grout shall be of the non-shrink type and shall be applied strictly in accordance with the manufacturer's instructions.

All concrete surfaces to be grouted shall be scabbled to the approval of the Engineer and shall be blown clean immediately prior to grouting.

10.2 Channel Mounted Sluice Gates

Channel mounted sluice gate frames to be mounted within recesses in the channel walls shall be positioned accurately and held securely with at least six permanent anchors before grouting. Smooth and easy operation of the gate along its full operating distance shall be demonstrated to the Engineer before and after the frame is grouted into position.

Channel mounted sluice gate frames to be mounted on the flat surfaces of channel walls and floor shall be bolted into position using chemical anchors before grouting. Suitable gaps shall be left for the application of grout. Smooth and easy operation along its full operating distance shall be demonstrated to the Engineer before and after the frame is grouted into position.

10.3 Wall Mounted Sluice Gates

The frame of a wall-mounted sluice gate shall be secured using anchors. The frame shall be aligned before grouting. Suitable gaps shall be left for the application of grout. Smooth and easy operation of the gate along its full operating distance shall be demonstrated to the Engineer before and after the frame is grouted into position.

11 Civils and Building

As required in terms of the General Conditions, the Contractor shall:

- ▶ provide the details of all civil and building requirements to the Engineer for incorporation into the structure.
- ▶ at an appropriate point, measure on Site in order to check for correctness of the Works.

The Contractor shall ensure that the design can accommodate a tolerance of +/- 40 mm for civil and building items constructed by others (unless a tighter tolerance is called for by the Contractor in good time and approved by the Engineer).

12 Safety

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

If applicable, the design and supply shall be in accordance with the requirements of SANS 10108 for hazardous areas.

13 Inspections

13.1 Factory, etc.

The Contractor shall make all arrangements and carry all costs for the Engineer to inspect the sluice gates prior to despatch to Site and prior to payment being made.

If the equipment is manufactured and assembled locally, the Contractor shall make all arrangements and carry all costs for the Engineer to inspect equipment in the manufacturer's works prior to despatch to Site. If the equipment is not manufactured and assembled locally, the Contractor shall make all arrangements and carry all costs for the Engineer or for an Engineer approved inspection authority to inspect the equipment in the manufacturer's works prior to dispatch. The inspection authorities' inspection shall include a full report on compliance of the equipment with the specifications and this report shall be acceptable to the Engineer prior to dispatch of the unit from the manufacturer's works.

13.2 Site

The Contractor shall make arrangements for the Engineer to inspect the installation on Site prior to commissioning.

13.3 Inspection During Defects Notification Period

The Contractor shall inspect the operation of the Works three months after the start of the Defects Notification Period and shall provide a condition report to the Engineer.

14 Testing Requirements

The Contractor shall successfully demonstrate the following to the Engineer prior to the commissioning of the Works:

- (a) operation on Site, including smooth and easy operation of the gate along the full operating distance without snag or slew.
- (b) achievement of the specified performance requirements for leakage testing after all installation work has been completed.
- (c) compliance with the maximum peripheral force required for operation of the handwheel.
- (d) correct operation of the control system.

The Contractor shall provide site test reports to the Engineer and shall submit copies in the Manual.

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1. INTRODUCTION (CLAUSE 1)

No Amendments

2. SCOPE (CLAUSE 2)

Add the following:

"This Specification covers the supply and installation of sluice gates required in the civil works for this Contract."

3. NORMATIVE REFERENCES (CLAUSE 3)

Delete reference to SPE-MM-0001 from the list.

4. EQUIPMENT ELIGIBILITY (CLAUSE 4)

No amendments

5. PERFORMANCE REQUIREMENTS (CLAUSE 5)

No amendments

6. OPERATION AND CONTROL (CLAUSE 6)

No amendments

7. DESIGN AND CONSTRUCTION (CLAUSE 5)

7.1 ACTUATORS (CLAUSE 7.4)

Replace the contents of this clause with "Not applicable".

7.2 GEARBOXES (CLAUSE 7.5)

Replace the contents of this clause with the following:

"An over-torque limiting device shall be incorporated.

Grease lubrication points shall be easily accessible. Grease nipples shall be of stainless steel.

A breather designed to prevent moisture from entering shall be fitted."

7.3 FABRICATION (CLAUSE 7.6)

Replace the clause contents with the following:

"Fabrication and welding shall comply with Clause 7 of SPE-MM-4009 and its amendments."

8. MATERIALS AND COATINGS - DAMS (CLAUSE 8)

Replace the contents of this clause with "Not applicable".

9. MATERIALS AND COATINGS – GENERAL (CLAUSE 9)

9.1 GENERAL (SUBCLAUSE 9.2)

Delete the last sentence of this subclause.

Add a new subclause at the end of this clause:

9.2 MATERIALS (NEW SUBCLAUSE 9.4)

All materials used in the manufacture and construction of plant and equipment shall be new and unused.

Carbon Steel

Structural steel shall comply with the requirements of SANS 50025 for grade S 355 JR or for grade S 355 JO.

Stainless Steel:

The grade of stainless steel to be used shall be as specified. Rolled material shall be supplied with a matt, annealed and pickled or otherwise de-scaled surface finish.

Where grades EN Grade 1.4401 (316) and EN Grade 1.4301 (304) are specified, these shall be taken synonymously with the low carbon grades for welding.

If stainless steel is to be coated, it shall be suitably abrasive blasted to ensure adherence of the prime coat.

The Contractor shall provide spectroscopic analyses of stainless steel materials. The analysis shall be undertaken by a local materials laboratory and shall be submitted to the Engineer.

Stainless steel supplied shall be clearly and permanently marked with the grade of stainless steel and cross referenced to the applicable test certificate.

Elastomers:

The Contractor shall select elastomeric materials to be used for common duties as follows:

- Nitrile (NBR) shall be used if oil is present. PTFE or silicone shall be used if the working temperature is above 80 degrees Centigrade.
- EPDM may be used if oil is not present. PTFE or silicone shall be used if the working temperature is above 110 degrees Centigrade.

Plastics:

Thermoplastics and fibre reinforced polymers shall be UV resistant, have adequate tensile strength and high impact strength and generally suit the application. PVC is regarded as too brittle and shall not be used unless accepted in writing by the Engineer before supply.

10. INSTALLATION (CLAUSE 10)

Delete the first sentence of this clause and replace with the following:

“The Works shall comply with the following:

- a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.
- b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.
- c) The Contractor is responsible for grouting work associated with the equipment and pipework to be provided in terms of the Contract.
- d) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.
- e) A small amount of a nickel based, anti-seize compound shall be applied along the full length of fastener threads before the nut is applied.
- f) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant.”

11. CIVILS AND BUILDING (CLAUSE 11)

No amendments

12. SAFETY (CLAUSE 12)

No amendments

13. INSPECTIONS (CLAUSE 13)

No amendments

14. TESTING REQUIREMENTS (CLAUSE 14)

No amendments

Add the following new Clause:

15. DOCUMENTS TO BE PROVIDED (CLAUSE 15)

The Contractor shall complete and submit the applicable technical datasheets and shop drawings to the Employer's Agent for approval prior to manufacturing.

General specification

Metal Seated Wedge Gate Valves

Specification number: SPE-MM-7015

Document control					
Specification no.		SPE-MM-7015			
Rev	Date	Revision details / status	Author	Reviewer	Approver
0	2022/01/23	First Issue	Denis Peart	Laura Ingle	Laura Ingle
Signature					

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1 Introduction

SPE-MM-7015 specifies the requirements for metal seated wedge gate valves.

2 Scope of Works

See project specification.

The installation shall be configured as shown on applicable drawings.

3 Normative References

The following form part of the Contract Document:

- ▶ Amendments, Additions and Detailed Requirements (SPE-MM-7015).
- ▶ SPE-MM-0001: General Mechanical Requirements.
- ▶ SPE-JJ-0003: General Corrosion Protection.
- ▶ SANS 1123: Pipe Flanges.
- ▶ SANS 12944 2: Paints and varnishes – Corrosion protection of steel structures by protective paint systems; Part 2: Classification of environments.
- ▶ National Occupational Health and Safety Act and Regulations.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

4 Equipment Eligibility

The valve provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

5 Performance Requirements

The valves shall be capable of performing the specified duties and shall be rated for continuous operation at those duties.

Valves shall be droptight for all specified duties.

The spindle seal shall not leak.

Valves shall operate smoothly.

Valves and their method of actuation shall be designed to open and close at a differential pressure equal to the full pressure rating of the valve.

Handwheels shall not require a peripheral force greater than 250 Newtons (i.e. the sum of the forces on both sides shall not be greater than 250 Newtons).

6 Operation and Control

The valve shall be positively held over all positions of travel whether under pressure or not.

Indication of current valve position shall be provided.

Valve opening and/or closing direction shall be indicated.

Actuators shall be provided with manual start and stop functions at the valve.

7 Construction and Design

7.1 Requirements for all Valves

7.1.1 General

Valves shall be double flanged. Flanges shall be in accordance with SANS 1123 unless it is required that the valve flanges match an existing pipe flange.

The manufacturer's name, valve size and working pressure shall be cast on the valve body or otherwise permanently indicated on the valve.

Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.

The bore shall be straight through and of full diameter when the valve is open.

Fixing lugs for end of travel limit switches shall be provided.

Manually operated valves shall be provided with handwheels of a size and construction which permit easy opening of the gate when it is subjected to a differential pressure equal to the rated pressure difference across the gate.

7.1.2 Valves for Wastewater Applications

The spindles of valves for wastewater applications shall have their thrust bearing or thrust nut (as applicable) located outboard of the spindle seal; i.e. it shall not come into contact with the wastewater. The thrust housing shall be provided with a stainless steel greasing nipple for lubrication.

7.2 Valves DN 250 and Above (Additional Requirements)

Valves of size DN 250 and larger shall comply with the requirements for all valves and with the additional requirements of this sub-clause.

Valves shall be provided with a small diameter bypass which shall incorporate an isolating valve. This valve shall be a metal seated wedge gate valve.

Valves shall be provided with gearboxes. Gearboxes shall have ingress protection to IP 55 and shall comply with SPE-MM-0001.

A slipping clutch, or equivalent mechanism, shall prevent over torque which would cause damage. Shear pins and other torque limiting devices which have to be replaced after activation are not acceptable.

7.3 Valves DN 350 and Above (Additional Requirements)

Valves of size DN 350 and larger shall comply with the requirements for all valves, with the requirements for valves of DN 250 and above and also with the additional requirements of this sub-clause.

Valves shall be provided with channel guides for the movement of the gate. The gate shall be provided with shoes which slide within the channel guides. Guides and shoes shall guide the gate along the full movement and shall be provided with low friction, wear resistant surfaces.

The body shall incorporate a drain with a stainless steel plug.

8 Materials and Coatings

Equipment shall comply with the table below. Components not specified in the table shall be designed the high corrosivity category (C4) of SANS 12944-2.

ITEM	MATERIAL	COATING
Body	Ductile iron or cast steel	Internal and external surfaces of the valve body shall be protected with a water resistant, non-toxic and non-tainting, fusion bonded epoxy pipe coating to a dry film thickness of at least 250 micron.
Gate Guides and Gate Shoes (where applicable).	Copper based alloy or of engineering plastic or of stainless steel.	N/A.
Body Seat Ring	Stainless steel. Compatible with wedge seat ring.	N/A.
	Non-ferrous metal which is compatible with the wedge seat ring.	N/A
Wedge Seat Ring	Stainless steel. Compatible with body seat ring.	N/A.
	Non-ferrous metal which is compatible with the body seat ring.	N/A
Spindle	Martensitic stainless steel	N/A.
Thrust Nut	Stainless steel; for wastewater applications	N/A
	Bronze; for other applications	N/A
Valve Fasteners	EN Grade 1.4401 (316)	N/A.
Flange Fasteners	As for pipework.	As for pipework.
Auxiliary metal components	EN Grade 1.4401 (316)	Pickle and passivate.
Handwheel	Cast metal.	Manufacturer's standard.

ITEM	MATERIAL	COATING
	Stainless steel.	Pickle and passivate.
Copper based alloys are not acceptable for sewage applications. Surface abrasive blasting to Sa 3 is a minimum requirement prior to the application of any corrosion protection coating with the exception of hot dip galvanising. Corrosion protection shall comply with SPE-JJ-0003. Materials shall comply with SPE-MM-0001. Stainless steel shall be correctly pickled and passivated. Stainless steel surfaces shall be free of ferrous stain and heat tint at commissioning. Metal plating of ferrous materials is not an acceptable corrosion protection system.		

9 Fasteners

Fasteners shall comply with SPE-MM-0001.

10 Installation

Installation work shall comply with SPE-MM-0001.

11 Safety

The Contractor shall design and install equipment installations in accordance with the requirements of the country's Occupational Health and Safety regulations.

The Contractor shall provide all safety signage required for the equipment installation.

12 Inspections

The Contractor shall make arrangements for the Engineer to inspect the valve for compliance prior to payment being made.

13 Testing Requirements

13.1 Factory

13.1.1 General

The following testing shall be done:

- (a) The valve body shall be pressure tested to 1,5 times the pressure rating.
- (b) The valve seating shall be droptight tested to 1,0 times the pressure rating.

13.1.2 Valves \geq DN 250

If the valve is manufactured and assembled locally, the Contractor shall make all arrangements and carry all costs for the Engineer to witness the specified tests prior to the valve being despatched to Site.

If the equipment is not manufactured and assembled locally, the Contractor shall make all arrangements and carry all costs for an Engineer approved, independent inspection authority to witness the testing in the workshop prior to dispatch. The test shall include a full report on compliance of the equipment with this specification and this report shall be submitted to the Engineer prior to dispatch of the unit from the workshop.

13.2 Report

The Contractor shall submit reports for the specified tests to the Engineer prior to the equipment being delivered to Site.

13.3 Site

The Contractor shall successfully demonstrate the following to the Engineer prior to the commissioning of the Works:

- (a) equipment operation.
- (b) compliance with the specification.
- (c) achievement of the specified performance requirements.

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1. INTRODUCTION (CLAUSE 1)

No Amendments

2. SCOPE (CLAUSE 2)

This specification shall be applicable to all Metal Seated Wedge Gate Valves included in the civil works.

3. NORMATIVE REFERENCES (CLAUSE 3)

Delete reference to SPE-MM-0001 from the list.

4. EQUIPMENT ELIGIBILITY (CLAUSE 4)

No Amendments

5. PERFORMANCE REQUIREMENTS (CLAUSE 5)

No Amendments

6. OPERATION AND CONTROL (CLAUSE 6)

No Amendments

7. CONSTRUCTION AND DESIGN (CLAUSE 7)

No Amendments

8. MATERIALS AND COATINGS (CLAUSE 8)

Delete the reference to "SPE-MM-0001" in the table.

All the following at the end of this clause:

"Materials shall comply with Subclause 9.4 of SPE-MM-7007 and its amendments. Castings shall comply with Clause 9 of SPE-MP-7023 and its amendments."

9. FASTENERS (CLAUSE 9)

Replace the contents of this clause with the following: "Flange Fasteners shall comply with Clause 4.3.6 of specification SPE-MP-7001."

10. INSTALLATION (CLAUSE 10)

Delete this clause and replace with the following:

"The valve shall be installed as shown on the drawings. The Works shall comply with the following:

- a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.
- b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.
- c) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.
- d) A small amount of a nickel based, anti-seize compound shall be applied along the full length of fastener threads before the nut is applied.
- e) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant."

11. SAFETY (CLAUSE 11)

No amendments

12. INSPECTIONS (CLAUSE 12)

No amendments

13. TESTING REQUIREMENTS (CLAUSE 13)

Witnessing of factory testing is not required. However, a test report shall be submitted to the Employer's Agent before valve is dispatched from the factory or workshop.

Add the following new Clause:

14. DOCUMENTATION TO BE PROVIDED (NEW CLAUSE 14)

The Contractor shall complete and submit the applicable technical datasheets and manufacturer drawings to the Employer's Agent for approval. A separate datasheet must be submitted for each combination of nominal diameter and pressure class to be used in the project.

General specification

Resilient Seal Gate Valves

Specification number: SPE-MM-7016

Document control					
Specification no.		SPE-MM-7016			
Rev	Date	Revision details / status	Author	Reviewer	Approver
0	2021/04/01	First Draft	Denis Peart	Laura Ingle	Laura Ingle
Signature					

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1 Introduction

SPE-MM-7016 specifies the standard requirements for resilient seal gate valves of the type with rubber lined gate.

2 Scope of Works

2.1 General

The equipment installation to be provided by the Contractor shall be configured as shown on any applicable drawings.

2.2 Works to be Provided by the Contractor

The detail of the work for which the Contractor is responsible is specified elsewhere.

3 Normative References

The following documents are applicable to this specification:

- (a) SPE-MM-0001: General Mechanical Requirements.
- (b) SPE-JJ-0003: General Corrosion Protection.

4 Equipment Eligibility

The valve provided shall have a successful record of use in South Africa in similar applications and shall also have had at least three years of technical support in South Africa. Service and spares shall currently be available in South Africa. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

Equipment which does not satisfy these requirements is not acceptable unless specifically called for in the specifications or unless the Engineer agrees in writing.

5 Performance Requirements

The body shall withstand the internal pressure rating of the valve.

The valve shall open and close smoothly at a pressure difference across the gate equal to the valves' rated pressure.

The gate liner shall, in accordance with SANS 665-3, be so firmly bonded, vulcanised and accurately moulded that, when the valve is tested, the resilient material shall not become torn, loose or detached. Also in accordance with SANS 665-3, the gate shall ensure drop tightness over the full pressure range of the valve and the lining shall have the capacity to accept foreign matter up to 1 mm in particle size.

6 Operation and Control

The valve shall be positively held in position over all degrees of opening whether under pressure or not.

Clear indication of current valve position shall be provided.

Valve opening and closing direction shall be indicated.

All actuated valves shall be provided with manual operation override. Electric actuators shall also be provided with manual start and stop functions on the actuator.

7 Design and Construction

7.1 General

Valves shall be of the double flanged configuration.

Manually operated valves shall be provided with handwheels of a size and construction which permit easy opening of the gate when subjected to a differential pressure equal to the rated pressure difference across the gate. Handwheels shall not require a peripheral force greater than 250 Newtons (i.e. the sum of the forces on both sides shall not be greater than 250 Newtons). Suitable gearboxes shall be fitted to achieve this.

The gate shall be fully lined so that the fluid does not contact any metallic part of the gate.

The gate shall be provided with guides. Sliding surfaces of cast iron are not acceptable.

Valves shall have rising spindles unless otherwise specified or necessary because of space restrictions. Valves with non-rising spindles shall be fitted with an indication of the closing and/or the opening direction.

The spindle shall be of stainless steel.

Manually operated gearboxes shall be provided with a stainless steel grease nipple.

Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.

Valves shall comply with SANS 665 where applicable.

Handwheels shall be of cast metal. The handwheel shall be clockwise closing.

7.2 Valves > DN 150

Valves larger than DN 150 shall be provided with a bypass which incorporates a small bore, flanged, metal seated wedge gate valve.

Valves above DN 150 shall have the manufacturer's name, size and working pressure cast on the valve body.

A slipping clutch, or equivalent mechanism, shall prevent over torque which would cause damage. Shear pins and other torque limiting devices which have to be replaced after activation are not acceptable.

8 Fasteners

Fasteners shall comply with SPE-MM-0001.

Fasteners on the valve shall be of EN Grade 1.4401 (316) stainless steel.

Flange fasteners shall comply with the specification for the pipeline's flange fasteners.

9 Materials and Corrosion Protection

The specific application shall be taken into account in the corrosion protection of valves.

The gate liner shall be of vulcanised EPDM.

Valve bodies shall be of ductile iron or of cast steel.

Cast iron valve components, including valve bodies, shall be protected internally and externally with either a fusion bond epoxy or Rilsan (or equivalent) and shall comply with SPE-JJ-0003. Dry film coating thickness shall not be less than 200 micron.

Metal plating of ferrous materials is not an acceptable corrosion protection system.

10 Installation

Valves shall be mounted firm and level.

The weight of the valve shall be fully supported. Valves of DN 250 and over shall be provided with at least one dedicated vertical support.

Spindles shall be vertical unless approved otherwise by the Engineer.

The handwheel shall be easily accessible to the operator.

Installation shall comply with SPE-MM-0001.

11 Civil and Building Matters

As required in terms of the General Conditions, the Contractor shall:

- ▶ provide the details of civil and building requirements to the Engineer for incorporation into the structure.
- ▶ at an appropriate point, measure on Site.

The Contractor shall ensure that the design can accommodate a tolerance of +/- 40 mm for civil and building items constructed by others (unless a tighter tolerance is called for by the Contractor in good time and approved by the Engineer).

12 Inspections

The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.

If the equipment is manufactured and assembled in South Africa, the Contractor shall make all arrangements and carry all costs for the Engineer to inspect equipment in the workshop prior to despatch to Site.

If the equipment is manufactured and assembled outside South Africa, the Contractor shall make all arrangements and carry all costs for an Engineer approved inspection authority to inspect the equipment in the workshop prior to dispatch. The inspection shall include a full report on compliance of the equipment with this specification and this report shall be submitted to the Engineer prior to dispatch of the unit from the workshop.

13 Testing Requirements

The valve shall be tested to be drop tight at a pressure equal to 1,1 times the nominal design pressure difference across the gate and the test certificate shall be submitted to the Engineer.

The body and gate shall be tested to an internal pressure of 1,5 times the nominal design internal pressure and the test certificate shall be submitted to the Engineer.

The correct operation of the valve shall be demonstrated to the Engineer prior to the commissioning of the Works.

14 General

The equipment shall have been successfully used in similar applications in South Africa.

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1. INTRODUCTION (CLAUSE 1)

No Amendments

2. SCOPE (CLAUSE 2)

No Amendments

3. NORMATIVE REFERENCES (CLAUSE 3)

Delete reference to SPE-MM-0001 from the list.

4. EQUIPMENT ELIGIBILITY (CLAUSE 4)

No Amendments

5. PERFORMANCE REQUIREMENTS (CLAUSE 5)

No Amendments

6. OPERATION AND CONTROL (CLAUSE 6)

No Amendments

7. DESIGN AND CONSTRUCTION (CLAUSE 7)

No Amendments

8. FASTENERS (CLAUSE 8)

Replace the first sentence with the following: ““Flange Fasteners shall comply with Clause 4.3.6 of specification SPE-MP-7001.”

9. MATERIALS AND CORROSION PROTECTION (CLAUSE 9)

Add the following at the end of this clause: “Materials shall comply with Subclause 9.4 of SPE-MM-7007 and its amendments. Castings shall comply with Clause 9 of SPE-MP-7023 and its amendments.”

10. INSTALLATION (CLAUSE 10)

Delete the last sentence of this clause and replace with the following:

“The valve shall be installed as shown on the drawings. The Works shall comply with the following:

- a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.
- b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.
- c) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.
- d) A small amount of a nickel based, anti-seize compound shall be applied along the full length of fastener threads before the nut is applied.
- e) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant.”

11. CIVIL AND BUILDING MATTERS (CLAUSE 11)

No amendments

12. INSPECTIONS (CLAUSE 12)

Delete the contents of this clause and replace with the following: "The Contractor shall make arrangements for the Engineer to inspect the valve for compliance prior to payment being made".

13. TESTING REQUIREMENTS (CLAUSE 13)

Witnessing of factory testing is not required. However, a test report shall be submitted to the Employer's Agent before valve is dispatched from the factory or workshop.

14. GENERAL (CLAUSE 14)

No amendments

Add the following new Clause:

15. DOCUMENTATION TO BE PROVIDED (NEW CLAUSE 15)

The Contractor shall complete and submit the applicable technical datasheets and manufacturer drawings to the Employer's Agent for approval. A separate datasheet must be submitted for each combination of nominal diameter and pressure class to be used in the project.

General specification

Single Door Check Valves

Specification number: SPE-MM-7017

Document control					
Specification no.		SPE-MM-7017			
Rev	Date	Revision details / status	Author	Reviewer	Approver
0	2022/01/23	First Issue	Denis Peart	Laura Ingle	Laura Ingle
Signature					

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1 Introduction

SPE-MM-7017 specifies the standard requirements for single door check valves; with pressure ratings between 10 bar and 25 bar, for water applications in sizes up to DN 1200, and for wastewater and sludge applications in sizes up to DN 800; to be provided by the Contractor.

2 Scope of Works

See project specification.

The installation shall be configured as shown on applicable drawings.

3 Normative References

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

- (a) Amendments, Additions and Detailed Requirements (SPE-MM-7017).
- (b) SPE-MM-0001: General Mechanical Requirements.
- (c) SPE-JJ-0003: General Corrosion Protection.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

4 Equipment Eligibility

The valve provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

Equipment which does not satisfy these requirements is not acceptable unless specifically called for in the specifications or unless the Engineer agrees in writing.

5 Performance Requirements

Valves shall seal drop tight at the PN rating.

The body shall withstand the test pressure.

The valve shall be sized to open fully at the lowest specified flow rate of the system.

The valve shall close before the flow direction can reverse (unless external control and/or damping is specified).

Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.

6 Construction and Design

6.1 General Requirements

Valves shall be double flanged.

Flanges shall comply with BS EN 1092 for the PN rating of the valve unless required to match flanges with a different specification.

The door position shall be indicated.

In accordance with SANS 1551-1, each valve shall be provided with indelible markings which include the manufacturer's name, PN rating, DN size and the direction of flow.

Valves of DN 150 and larger shall incorporate a bypass of DN 25 or larger. The bypass shall incorporate a flanged metal seated wedge gate valve for isolation.

Valves larger than DN 500 shall be provided with damping at closure. The damping shall be provided by external hydraulic oil dashpot or similar.

6.2 Size and Rating

The nominal flow speed at the minimum design flow rate shall not be less than 1,3 m/s.

The pressure rating for the valve shall match the rating for the pipework. The valve's pressure rating shall not, however, be lower than PN 10.

6.3 Pipework Configuration

The configuration of the valve and its pipework shall ensure that the flow requirements of the valve are accommodated.

At least three pipe diameters of straight pipe shall be provided immediately upstream of the valve.

The valve shall be able to open and close without interference from physical obstruction such as an isolation valve, a bend, mortar lining, etc.

The force of the valve closing shall be securely restrained under the worst hydraulic condition expected. It is preferred that a support is provided for the valve itself but it is also acceptable that this thrust force is restrained via properly anchored pipework.

Orientation of the valve shall comply with the manufacturer's recommendation.

Check valves shall be separated from downstream isolation valves by a straight pipe for a distance of at least 1,5 times the diameter.

6.4 Single Door Check Valves for Water

Single door check valves for sizes up to DN 1200 for water which is not expected to contain suspended solids shall be of the slanted seat, tilting door configuration ("Tilting Disc" type).

The valve shall have a side lever and adjustable weight for gravity-assisted closing (unless external damping and/or control is specified for the valve).

Damping shall slow down the movement of the door as it approaches the closed position.

6.5 Single Door Check Valves for Wastewater

Single door check valves for wastewater, for wastewater sludge and for water which is expected to contain foreign matter shall be of the type which allows the door to move fully out of the flow so that solid matter does not catch on it ("Swing Check" type).

The seal shall be of a suitable resilient material.

A side lever and adjustable weight shall provide gravity-assisted closing.

The body shall incorporate a bolted cover to provide access to the disc for cleaning without having to dismantle or remove the valve.

7 Materials and Coatings

7.1 General

Materials shall comply with the requirements for materials in SPE-MM-0001.

Corrosion protection shall comply with SPE-JJ-0003.

Stainless steel shall be correctly pickled and passivated. Stainless steel surfaces shall be completely clear of ferrous stain and heat tint at commissioning.

Metal plating of ferrous materials is not acceptable.

7.2 Environment

Environmental corrosion protection shall be suitable for the high corrosivity category (C4 of SANS 12944-2).

7.3 Equipment

Equipment shall comply with the table below.

ITEM	MATERIAL	COATING
Valve body and door	Cast iron, cast steel or cast stainless steel.	Cast iron and cast steel shall be provided with a coating in accordance with "Fusion Bonded Epoxy (Heavy Duty)" in SPE-JJ-0003. Equivalent systems for water immersion, such as Rilsan or equivalent, are also acceptable.
Shaft (hinge pins)	Stainless steel.	Not required.
Bushes	Engineering plastic; Self-lubricated, non-ferrous metal.	Not required.
Seat	Stainless steel or better.	Not required.
Seal	Elastomer; or metal suitable for contact with seat.	Not required.
Valve fasteners, both internal and external	EN Grade 1.4401 (316).	Not required.

ITEM	MATERIAL	COATING
Flange fasteners	Hot dip galvanised carbon steel.	Chromate passivated.
External metal components	EN Grade 1.4401 (316).	Pickle and passivated.

8 Installation

Installation work shall comply with SPE-MM-0001.

9 Safety

Guarding shall be provided if the movement of the lever arm could cause injury.

10 Inspections

The Contractor shall make arrangements for the Engineer to inspect the valve for compliance prior to payment being made.

11 Testing Requirements

11.1 All Valves

Valves bodies shall be hydraulically tested in accordance with 8.1 of SANS 1551-1 to a test pressure of 1,5 times the PN rating.

Valves shall be tested for seat leakage in accordance with 8.2 of SANS 1551-1 and the acceptable leakage shall be as per clause 4.3.4. The test pressure shall be the PN rating unless otherwise specified by the Engineer. Compliance with the testing procedures and requirements of similar equivalent international standards is also acceptable.

A test certificate shall be submitted to the Engineer for each valve.

The correct operation of the equipment and achievement of the specified performance requirements shall be demonstrated to the Engineer prior to commissioning of the Works.

11.2 Valves DN 250 and Larger

The Contractor shall arrange for the Engineer to witness the testing of valves of sizes DN 250 and larger.

Travel and accommodation arrangements and costs for witnessing of testing shall be the responsibility of the Contractor.

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1. INTRODUCTION (CLAUSE 1)

No Amendments

2. SCOPE (CLAUSE 2)

2.1 GENERAL (SUBCLAUSE 2.1)

This specification shall be applicable to all single door check valves included in the civil works.

3. NORMATIVE REFERENCES (CLAUSE 3)

Delete reference to SPE-MM-0001 from the list.

4. EQUIPMENT ELIGIBILITY (CLAUSE 4)

No Amendments

5. PERFORMANCE REQUIREMENTS (CLAUSE 5)

No Amendments

6. CONSTRUCTION AND DESIGN (CLAUSE 6)

6.1 GENERAL REQUIREMENTS (CLAUSE 6.1)

Delete the last two paragraphs and replace with the following:

"Valves larger than DN 300 shall have a side lever and adjustable weight for gravity-assisted closing. Damping shall be provided to slow down the movement of the door as it approaches the closed position.

The size and pressure rating shall be as schedule or as indicated on the drawings.

The pipework configuration shall be as indicated on the drawings. The force of the valve closing shall be securely restrained under the worst hydraulic condition expected. It is preferred that a support is provided for the valve itself but it is also acceptable that this thrust force is restrained via properly anchored pipework."

Delete the clauses 6.2 to 6.5.

7. MATERIALS AND COATING (CLAUSE 7)

7.1 GENERAL (SUBCLAUSE 7.1)

Replace the first sentence of this subclause with the following: "Materials shall comply with Subclause 9.4 of SPE-MM-7007 and its amendments. Castings shall comply with Clause 9 of SPE-MP-7023 and its amendments."

7.2 EQUIPMENT (SUBCLAUSE 7.2)

Delete the row from the table referring to "Flange fasteners".

Add the following at the end of this subclause: "Flange Fasteners shall comply with Clause 4.3.6 of specification SPE-MP-7001."

8. INSTALLATION (CLAUSE 8)

Delete the contents of this clause and replace with the following:

"The valve shall be installed as shown on the drawings. The Works shall comply with the following:

- a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.

- b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.
- c) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.
- d) A small amount of a nickel based, anti-seize compound shall be applied along the full length of fastener threads before the nut is applied.
- e) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant."

9. SAFETY (CLAUSE 9)

No amendments

10. INSPECTIONS (CLAUSE 10)

No amendments

11. TESTING REQUIREMENTS (CLAUSE 11)

Witnessing of factory testing is not required. However, a test report shall be submitted to the Employer's Agent before valve is dispatched from the factory or workshop.

Add the following new Clauses:

12. DOCUMENTATION TO BE PROVIDED (NEW CLAUSE 12)

The Contractor shall complete and submit the applicable technical datasheets and manufacturer drawings to the Employer's Agent for approval. A separate datasheet must be submitted for each combination of nominal diameter and pressure class to be used in the project.

General specification

Air Valves

Specification number: SPE-MM-7022

Document control					
Specification no.		SPE-MM-7022			
Rev	Date	Revision details / status	Author	Reviewer	Approver
0	2022/03/03	First Issue	Denis Peart	Laura Ingle	Laura Ingle
Signature					

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1 Introduction

SPE-MM-7022 specifies the standard requirements for air valves which are used for air release and vacuum break on pipelines and for air release in pump stations.

2 Scope of Works

2.1 General

The equipment installation to be provided by the Contractor shall be configured as shown on any applicable drawings.

2.2 Works to be Provided by the Contractor

The detail of the work for which the Contractor is responsible is specified elsewhere.

3 Normative References

The following documents are applicable to this specification:

- (a) Amendments, Additions and Detailed Requirements (SPE-MM-7022).
- (b) SPE-MM-0001 - General Mechanical Requirements.
- (c) SPE-JJ-0003 – General Corrosion Protection.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

4 Equipment Eligibility

The air valves provided shall have a successful record of use in South Africa in similar applications and shall also have had at least three years of technical support in South Africa. Service and spares shall currently be available in South Africa. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

Equipment which does not satisfy these requirements is not acceptable unless specifically called for in the specifications or unless the Engineer agrees in writing.

5 Performance Requirements

5.1 Pipelines

Valves shall perform in accordance with the air discharge, air inlet and slam-free conditions specified.

In vacuum break mode, valves shall react immediately in order to prevent the pressure falling to a level which would be unacceptable in terms of the design of the pipeline.

Valves shall be capable of discharging high volumes of air through a large orifice under pressure during filling of the pipeline.

5.2 Other

Valves shall be capable of releasing small quantities of accumulated air at all line pressures up to and including the rated working pressure of the valve.

The large discharge orifice shall close at a differential pressure of between 4 and 6 kPa in order to minimise transient pressure effects. The valve shall continue to release air at a lower rate.

Valves shall seal drop tight at all line pressures between 0,45 bar and the rated pressure.

6 Operation and Control

Valves shall operate autonomously; i.e. a valve shall not require a servo mechanism to control its operation and shall not require an external power supply.

7 Equipment Construction and Design

7.1 General

Air release valves for water pipework shall be of the non-slam type, Vent-O-Mat RBX, or ARI or equivalent.

Air release valves for wastewater pipework shall be of the non-slam type Vent-O-Mat RGX, ARI or equivalent. Valves for wastewater and related duties shall be specifically designed for the application.

The manufacturer's name, pressure rating, nominal size, serial number, Contract number and the material designations of the body shall be permanently displayed on the valve in the form of a plate of corrosion resistant material securely fixed to the body with corrosion resistant fastenings.

A metal seated, wedge gate isolating valve shall be provided and installed so that the air valve can be isolated during full line pressure. The wedge gate valve shall have the same pressure rating as specified for the air valve.

7.2 Hydraulic Design

Valve design and selection shall ensure that pipe collapse does not occur under a "full bore" rupture condition and, additionally, shall comply with the following criteria:

- ▶ Air valves on pipe sizes up to DN 600 shall be designed to ensure that the internal pressure does not drop to less than 8 kPa below atmospheric pressure under a full bore rupture condition.
- ▶ Air valves for pipe sizes larger than DN 600 shall be selected on the basis of a rupture condition which shall be agreed with the Engineer.

The criteria for the valve performance shall have been confirmed by a recognized independent authority.

7.3 Construction

Valves shall be flanged. The flange shall comply with the flange specification for the pipeline.

It shall be possible to remove the valve's working parts without unbolting the bottom flange from the pipeline. Floats and seats shall not, however, require maintenance under normal conditions.

A stainless steel screen shall prevent foreign matter from entering and blocking the air ports.

Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.

8 Fasteners

Fasteners on the valve shall be of stainless steel.

Flange fasteners shall comply with the flange fastener specification for the pipeline.

9 Materials and Coatings

Ductile iron shall be protected with fusion bonded epoxy or Rilsan or equivalent to a dry film thickness of at least 200 micron in accordance with SPE-JJ-0003.

Stainless steel shall be correctly pickled and passivated. All stainless steel surfaces shall be completely clear of ferrous stain upon commissioning.

Floats shall be of HDPE or similar.

Seals shall be nitrile rubber or otherwise approved by the Engineer.

Carbon steels parts shall not be acceptable.

10 Installation

Each air valve shall be provided with a nozzle which shall form an accumulator pocket to capture the air bubbles entrained with the water flow. The nozzle shall be fabricated as an upstand tee and shall have a diameter of at least half the pipeline diameter. The upstand tee's height shall be equal to its own diameter or greater. The upstand shall be flanged and shall be provided with a blank flange. The blank flange shall incorporate a flanged riser which is sized for mounting the air valve onto.

Equipment shall be mounted firm and level.

Installation work shall comply with SPE-MM-0001.

11 Civil and Building Matters

As required in terms of the General Conditions, the Contractor shall:

- ▶ provide the details of civil and building requirements to the Engineer for incorporation into the structure.
- ▶ at an appropriate point, measure on Site.

The Contractor shall ensure that the design can accommodate a tolerance of +/- 40 mm for civil and building items constructed by others (unless a tighter tolerance is called for by the Contractor in good time and approved by the Engineer).

12 Inspections

The Contractor shall make arrangements for the Engineer to inspect the equipment for compliance prior to payment being made.

13 Testing Requirements

The valve body shall be pressure tested to 1,5 times the rated pressure of the valve for two minutes and there shall be no visible leaks.

Valves shall be tested for drop tight sealing at the rated pressure and also at a pressure of 0,45 bar above atmosphere.

A certificate indicating these test results and including the valve's serial number shall be provided to the Engineer.

The Contractor shall demonstrate the valve performance in terms of vacuum break, air release during filling and air release under line pressure. One unit of each size shall be demonstrated to the Engineer and the Employer.

The correct operation of the equipment and achievement of the specified performance requirements shall be demonstrated to the Engineer prior to the commissioning of the Works.

14 Miscellaneous

Valves shall be protected against damage during transport.

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1. INTRODUCTION (CLAUSE 1)

No Amendments

2. SCOPE (CLAUSE 2)

2.1 GENERAL (SUBCLAUSE 2.1)

This specification shall be applicable to all air valves included in the civil works.

3. NORMATIVE REFERENCES (CLAUSE 3)

Delete reference to SPE-MM-0001 from the list.

4. EQUIPMENT ELIGIBILITY (CLAUSE 4)

No Amendments

5. PERFORMANCE REQUIREMENTS (CLAUSE 5)

All air valves shall be triple orifice anti slam air valves with the three orifices functioning as follows:

- Large Orifice: Activates under subcritical airflow for rapid air release during pipeline filling or rapid air intake during negative/vacuum pressures.
- Anti-Shock Orifice: Engages during supercritical airflow to allow controlled release of air during water hammer conditions.
- Small Orifice: Permits the continuous pressurized release of air during normal operating conditions.

Where a different air valve is proposed, the Contractor shall submit supporting documentation to prove that the air valve proposed is equivalent to a triple orifice air valve as described above.

The air discharge and are intake capabilities of the air valves under subcritical conditions shall be comparable those of recognised air valve suppliers such as A.R.I. or Vent-O-Mat or equivalent.

All other requirements of Subclauses 5.1 and 5.2 shall apply.

6. OPERATION AND CONTROL (CLAUSE 6)

No amendments

7. EQUIPMENT CONSTRUCTION AND DESIGN (CLAUSE 7)

7.1 GENERAL (SUBCLAUSE 7.1)

The air valves shall be designed for potable water applications.

7.2 CONSTRUCTION (SUBCLAUSE 7.3)

Add the following

“The air valves or air valve stubs shall be fitted with a ½ inch BST connection and plug to allow the insertion of pressure gauges for pipeline performance testing.”

8. FASTENERS (CLAUSE 8)

No amendments

9. MATERIALS AND COATINGS (CLAUSE 9)

Add the following at the end of this subclause: “Materials shall comply with Subclause 9.4 of SPE-MM-7007 and its amendments. Castings shall comply with Clause 9 of SPE-MP-7023 and its amendments.”

10. INSTALLATION (CLAUSE 10)

Delete this clause and replace with the following:

“The air valve shall be installed as shown on the drawings. The Works shall comply with the following:

- a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.
- b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.
- c) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.
- d) A small amount of a nickel based, anti-seize compound shall be applied along the full length of fastener threads before the nut is applied.
- e) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant.”

11. CIVIL AND BUILDING MATTERS (CLAUSE 11)

No amendments

12. INSPECTIONS (CLAUSE 12)

No amendments

13. TESTING REQUIREMENTS (CLAUSE 13)

Witnessing of factory testing is not required. However, a test report shall be submitted to the Employer's Agent before valve is dispatched from the factory or workshop.

14. MISCELLANEOUS (CLAUSE 14)

No amendments

Add the following new Clause:

15. DOCUMENTATION TO BE PROVIDED (NEW CLAUSE 15)

The Contractor shall complete and submit the applicable technical datasheets and manufacturer drawings to the Employer's Agent for approval. A separate datasheet must be submitted for each combination of nominal diameter and pressure class to be used in the project.

General specification

Design and Manufacture of Medium Pressure Steel Specials

Specification number: SPE-MP-7001

Document control					
Specification no.		SPE-MP-7001			
Rev	Date	Revision details / status	Author	Reviewer	Approver
0	2022/01/24	First Issue	Stephan Kleynhans	Laura Ingle	Laura Ingle
Signature					

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1 Scope

This Specification covers the design, manufacture and delivery to site of electrically welded low carbon steel specials of outside diameter up to 2 280 mm, for transporting water and sewage at ambient temperatures and under working pressures of up to 2,5 MPa.

This Specification shall be read in conjunction with SANS 1200 L, when included in the Contract. Where conflict between this specification and SANS 1200 L occurs, the provisions of this specification shall apply.

Interpretations and variations of this specification are set out in the Amendments to this Specification.

2 Normative References

2.1 Supporting Specifications

Where this Specification is required for a project, the following specifications shall, inter alia, form part of the Contract:

- (a) Amendments;
- (b) SANS 1200 Series of Standardized Specifications;
- (c) SANS 1200 L: Medium-pressure pipelines (see Clause 1 above)
- (d) Specification SPE-MP-7002 : Manufacture of Medium Steel Pipes
- (e) Specification SPE-JJ-0003 : General Corrosion Protection
- (f) Specification SPE-CC-7003 : Laying and Jointing of Medium Pressure Steel Pipes and Specials

The latest issues of the specifications listed in Appendix A shall be deemed to apply to the design and manufacture of welded steel specials manufactured using approved welding techniques.

3 Definitions and Abbreviations

3.1 Definitions

For the purposes of this Specification the definitions and abbreviations given in the applicable clauses of the specifications listed in 2.1 and the following definitions shall apply:

Cut-and-shut bend	A bend formed by cutting out one or more V-shaped sections equally disposed about a line at right angles to the axis of the pipe, preparing the cut-out edges for welding; bending the pipe to form the bend and welding the pipe shut along the prepared edges to complete the bend (see BS 2633, Fig 25)
Fitting	<ul style="list-style-type: none">a) A special or valve.b) Any process of jointing (except welding) straight pipes to one another and to specials and valves.
Flexible pipe	A pipe of which the diameter is reduced by more than 1% under an external radial force before the appearance of cracks.

"H"	The cross-sectional shape of a weld at a skelp.
Manual shielded electric arc process welding	Electric arc welding done by hand using a filler electrode coated with a material that gasifies at the point of arc and excludes oxygen from the weld, thus improving the metallurgical quality of the completed weld.
Mitre welds	Welds which join two lengths of pipe at an angle point in such a manner that the axis of both lengths of pipe proceed in a straight line to the point of intersection.
Nominal diameter (size)	A numerical designation of diameter which is common to all components in the piping system other than components designated by OD or by thread size. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions.
Nominal pressure	A numerical designation which is a convenient round number for reference purposes. All equipment of the same DN designated by the same PN number shall have compatible mating dimensions.
Pinhole	A very small hole indicating a flaw in the weld.
Pipe end bevel	A bevel cut made on the end of a pipe to afford a groove between abutting joints in order to receive weld metal.
Pipework	Includes all pipes, joints, specials, fittings and valves.
Skelp	The jointing edges of steel coils used in the manufacture of spiral welded pipe.
Special	Any pipe other than a straight pipe. Note: Under this definition shall be included all sizes of specials of shapes such as bends, tees, crosses, angle branches, reducers, tapers and flexible couplings with or without centre registers.
Straight pipe	A straight pipe of uniform bore and of standard or non-standard length.
Welding icicles	Congested droplets of metal which extend through the weld to the interior of the pipe, caused by excessive heat or improper welding technique.

3.2 Abbreviations

The following abbreviations (additional to those referred to in 3.1) shall have the meanings given:

AISI	:	American Iron and Steel Institute
DN	:	Nominal diameter (e.g. DN 200 = 200 mm nominal diameter)
DS-AW	:	Double submerged-arc welded
FBE	:	Flanged both ends
FOE	:	Flanged one end
ID	:	Internal diameter
MS	:	Mild Steel
OD	:	Outside diameter, which shall mean the internal diameter + 2x(lining thickness + pipe wall thickness)
p.e.	:	Plain ended.

PN	:	Nominal working pressure (eg. PN 10 = 1 000 kPa)
Scab	:	Unbonded piece of plate in tight contact with the plate
SS	:	Stainless Steel
t	:	Wall thickness of pipes
TP	:	Test pressure
WP	:	Weld preparation

4 Requirements

4.1 Materials

4.1.1 General

Specials and fittings shall be of the types shown on drawings or billed and, unless otherwise required in terms of the Amendments, they and their couplings shall be capable of withstanding the applicable test pressure. All specials and fittings shall be supplied complete with couplings and jointing material.

4.1.2 Types of steel

Unless otherwise billed or shown on drawings, specials and fittings shall be manufactured from the following materials:

4.1.2.1 Nominal Diameter equal to or less than 150 mm

Medium or heavy class steel, complying with the applicable requirements of SANS 62.

4.1.2.2 Mild Steel

Steel grade	Minimum Yield Stress (MPa)	Chemical Composition and Physical Properties
B	241	SANS 719, Table 1
300WA	300	SANS 1431
X42	289	API 5L Table 3.1 & 4.1
X46	317	API 5L Table 3.1 & 4.1
X52	358	API 5L Table 3.1 & 4.1
X56	386	API 5L Table 3.1 & 4.1
X60	413	API 5L Table 3.1 & 4.1
X65	450	API 5L Table 3.1 & 4.1

4.1.2.3 3CR12 Corrosion Resistant Steel

3CR12 corrosion resistant steel plate shall have a No.1 finish and shall be supplied ex-factory ready pickled and passivated.

4.1.2.4 Stainless Steel

Stainless steel shall be either EN Grade 1.4301 (304L stainless steel) or EN Grade 1.4401 (316L stainless steel).

4.1.2.5 Super Duplex Stainless Steel

Duplex stainless steel shall be either EN Grade 1.4162 (2101) or EN Grade 1.4462 (2205). Super Duplex stainless steel shall be EN Grade 1.4410 (2507).

4.1.3 Flanges

Flanges on pipe ends, where applicable, shall be manufactured from the same material as the pipe, unless otherwise specified in the Amendments.

Where mild steel flanges are specified, flanges shall be manufactured from steel plate conforming to BS 4360 or SANS 1431 Grade 300W for working pressures up to PN 25. Flanges rated more than PN 25 and up to PN 60 shall be made from steel manufactured in accordance with BS EN 10222 Grade 460 or as approved. Flanges for pressures exceeding PN 60 and up to PN 250 shall be special flanges and gaskets manufactured by Hydro Power Engineering or equal approved.

4.1.4 Certification

The Contractor shall submit to the Engineer the steel maker's certificates covering all steel used in the manufacture of the specials as required in Clause 4.4 of SANS 719. In addition, all information relevant to pipework fabrication shall be made available to the Engineer during the course of the manufacturing process.

4.2 Design

4.2.1 General

The Contractor shall be responsible for the design of all specials in accordance with the general arrangement shown on the drawings and/or described in the Bill of Quantities and in conformity to BS 534. He shall submit his design calculations and shop drawings to the Engineer for approval before manufacturing commences. The design of saddle type reinforcement shall be in accordance with AWWA M11.

Specials shall be fabricated by welding from pipes which have been tested to SANS 719 and that conform to the requirements applicable to the Manufacture of medium-pressure steel pipes.

Lifting eyes (lugs) shall be welded to all unwieldy specials and to all specials of DN 600 and larger to facilitate handling and minimise damage to the protective coating.

4.2.2 Wall thickness

Specials shall be designed so that 50% of the minimum yield stress of the steel is not exceeded under maximum working pressure and so that 75% of the minimum yield stress of the steel is not exceeded under maximum surge pressure.

An OD/t ratio of more than 100 will not be permitted unless specifically indicated otherwise on the drawings or in the Bill of Quantities.

For all branch connections (tees) the plate thickness of the barrel and branch shall be such that the maximum stress shall not be greater than that for an uncut pipe of the theoretical required minimum thickness. Where it is more economical to provide external reinforcement in the form of collar type rings or crotch plates, as shown on the drawings, these forms of reinforcement shall be used to achieve the same results

4.2.3 Bends

Unless otherwise indicated on the drawings or scheduled in the Bill of Quantities, the dimensions for bends shall be determined in accordance with AWWA C208.

Bends shall either be smooth formed (hot bent) or segmented. The maximum angle between oblique butt-ends of segments for mitred bends shall not exceed 22.5°. Cut-and-shut bends are not permitted. Segmented bends shall be classified as short, medium and long with radii equal to one, two or three diameters respectively. All bends shall be of the long radii type, unless otherwise shown on the drawings or specified in the Amendments or Bill of Quantities.

Mitres for bends (kinks) of 10 degrees and less shall be made in the field as part of the pipe laying operation for buried pipelines.

4.2.4 Branches and Nozzles

The attachment of reinforcement to the pipe branches shall be by full penetration welding. The extent and positioning of external reinforcement is to be determined in accordance with AWWA M11.

Branch connections shall be as remote as possible from the seam weld on the barrel and shall generally be placed as follows, except where specifically indicated to the contrary on the drawings:

For air valve tees the centre lines of the air valve branch and the barrel shall intersect at right angles or vertically, as shown on the drawings, depending on the type of tee specified. The branch shall be flanged and have a nominal diameter greater than 50% of the main pipe diameter.

For scour valve tees the branch, consisting of a 90 degree bend, shall be located centrally on the pipe invert and point vertically downwards with the horizontal section at right angles to the barrel of the pipeline. The branch flange shall be set so that the scour valve spindle points vertically upwards, as shown on the drawings.

Nozzles shall be "stub in" in accordance with ANSI B31.3 and of minimum size DN25. Such nozzles shall be threaded to BSPT and provided with appropriate reinforcement. The Contractor shall ensure that the design will withstand the test pressure of the system.

4.2.5 Reducer Pieces

Taper pieces shall not have more than two longitudinal weld seams and shall have a maximum angle of divergence of 10 degrees, as shown on the drawings.

4.2.6 Pipe Supports

Supports for pipework, valves and specials inside chambers and pump stations shall be designed by the Contractor to adequately secure the pipework to the walls and floors. Details and locations of the supports shall be submitted for approval by the Engineer.

4.2.7 Dimensions

The dimensions of the pipe specials and fittings are shown on the drawings.

4.2.8 Provision of Cadwelding Pads

Where specials are to be jointed by means of flexible couplings the manufacturer shall weld steel plates not less than 50 x 75 x 6 mm thick, 250 mm from each end of all pipes, during the pipe manufacturing process (i.e. before lining and coating) to provide adequate area for cadwelding bonding cables to the piping to make it electrically continuous and enable a cathodic protection system to be applied without damage to the coating.

4.2.9 Shop Drawings

The Contractor shall, before issuing of shop drawings for manufacture, provide detailed pipework layout drawings for approval in principle by the Engineer. Such drawings shall contain general arrangements and assemblies for the pipes, pipe auxiliaries, pipe specials and valves and include materials schedules, standard parts, etc. Drawings shall provide all the information necessary to demonstrate full compliance with the drawings and specifications and to facilitate subsequent submission of shop drawings free of fit-up error. The Contractor shall be fully responsible for determining the actual dimensions of the specials.

Pipe layout drawings shall incorporate all relevant prime and subsidiary dimensions (primarily, but not necessarily limited to, face-to-face dimensions).

Drawings shall be prepared to acceptable industry standards, an example of which shall be submitted for approval before draughting commences. Due account is to be taken in preparing drawings of the necessity, inter alia, to facilitate straight-forward subsequent fit-up on site, without undue site trimming and site preparation for butt welding, so minimizing also the necessity for extensive site repairs to, or extensions of, internal and external corrosion protection.

Only after approval of final pipework layout drawings by the Engineer shall shop drawings for manufacture of pipes and specials commence. For subsequent approval by the Engineer these shall be in such detail as is appropriate for manufacture. No manufacturing of pipework shall be permitted without approval of the shop drawings by the Engineer.

Approval by the Engineer of any drawing shall not relieve the Contractor of responsibility for correct manufacture and subsequent fit-up on site.

4.3 Jointing

4.3.1 Flexible Couplings

Flexible couplings for plain-ended steel pipe and adaptor couplings shall be either of the slip-on type complying with Clause 15 of BS 534 or of the slip-on type without centre register conforming to the drawings, as scheduled. Slip-on flange adaptors for steel pipes shall conform to the relevant drawings.

A coupling shall be able to withstand without failure a hydrostatic test pressure of twice the working pressure specified for the pipe for which the coupling is required, and coupling flanges shall be capable of withstanding without damage all stresses caused by proper tightening of the bolts. Rubber rings shall comply with the relevant requirements of SANS 974: Part I and shall have a hardness of 66 to 75 IRHD.

All grinding off of welds shall conform accurately with the profile of the rolled section and so that no flats occur on surfaces that are supposed to be curved. The centre register (where present) shall be ground off on either side of the weld in such a manner that all sharp edges which would result in weakening of the protective coating are removed. Flexible couplings shall be supplied complete with all necessary bolts, nuts and rubber jointing rings.

4.3.2 Flanges

Flanges shall be designed and manufactured to BS EN 1092 Part 1 for steel flanges and Part 2 for cast iron flanges, unless otherwise specified on the Drawings. Flanges not covered by BS EN 1092 shall be manufactured according to the detailed dimensions and requirements shown on the Drawings.

All flanges shall be suitable for Site welding (SW) to pipes and specials and shall conform to BS 2633, Section 7 with preparation of plate flanges as shown in Fig 41 ("slip-on") for pipes and specials up to DN 100 and Fig 39 or 40 ("bore and fillet") for pipes and specials DN 125 and larger.

The drilling of steel and cast iron flanges shall be off-centre and shall conform to the requirements of SANS 1123, BS EN 1092: Section 3.1, or ISO 7005: Part 1 as applicable, appropriate to the class of pipe specified, except that in the case of flanges, where M27 and M33 bolts are specified in BS EN 1092: Section 3.1, M24 and M30 bolts respectively shall be used as specified in SANS 1123.

Any pipe that has flanges which are incorrectly drilled will be rejected. Reaming of bolt holes to oversize dimension in order to make a particular piece fit will not be permitted.

All flanges shall be machined overall with gramophone finish in accordance with SANS 1123, or as specified below:

Flange sizes up to and including DN 400 with a pressure rating up to and including 1600 kPa shall have flat joint faces, and where the pressure rating exceeds 1600 kPa, shall have a raised face sealing arrangement;

Flange sizes exceeding DN 400 up to and including DN 1000 shall have a raised face sealing arrangement for all pressure ratings up to and including 2500 kPa.

For flanges not covered by BS EN 1092, and for domes and conical ends, thicknesses shall be calculated and where applicable the flanges manufactured in accordance with Section 3 of BS 5500.

4.3.3 Insulated Flanges

Where called for, insulating flanges and materials shall be arranged as set out in Code of Practice No. SAECC/1 or SANS 15589-1.

The design, manufacturing, supplying, installation and testing of the insulating flanges complete with spark gap arrestors shall be in accordance with drawing no. 1A-C6-066 and to the approval of the Engineer. Insulating flanges shall be provided at locations as indicated on the Drawings.

All insulating gaskets, irrespective of pressure rating, shall be full-face gaskets to prevent foreign material from collecting and creating a bridge, thus shorting out the isolation.

4.3.4 Loose Flanges

Loose flanges for welding onto steel pipes on Site shall be manufactured from at least the same steel as specified for the pipes and shall be in accordance with SANS 1123 where applicable (see also 4.3.2), or alternatively in accordance with BS EN 1092.

Loose flanges shall be suitable for field welding to pipes and specials and shall conform to 4.3.2 in respect of attachment.

4.3.5 Gasketing

Each flanged pipe and fitting of less than DN 400 and rated for PN 16 or less shall be supplied complete with one insertion piece (gasket) of the appropriate diameter and made of a material that is suitable for the maximum test pressure, and one set of bolts, nuts and washers.

Unless otherwise specified in the Amendments, asbestos gaskets in accordance with BS 1832 Grade B, and having a minimum thickness of 1,5 mm, shall be supplied for working pressures not exceeding PN 16.

Where working pressures exceed PN 16, and for DN 400 and over, rubber "O" rings dimensioned in accordance with BS EN 1092 Section 3.1, Fig. 4 for Types G and H flanges, shall be supplied to suit appropriately machined flanges.

Where flanges have not been machined in accordance with the above, spiral wound gaskets, style CG to BS 3381 shall be used. The external ring shall be made of carbon steel and electro plated. The metal windings shall consist of Grade 316 L stainless steel with asbestos filler.

Where flanges with flat faces as specified in 4.3.2, paragraph 1, are jointed, the gaskets shall be of the type manufactured by HPE and as specified below:

The gasket shall consist of a seal ring made from ultra high molecular weight polyethylene (UHMWPE) (section 10 mm x 5 mm minimum) which fits snugly inside a 3 mm thick x 30 mm wide (minimum) flat steel outer ring. The reuse of UHMWPE seal rings is inadmissible.

The outer ring shall consist either of:

A mild steel ring, hot-dip galvanized in accordance with SANS 121 to a minimum mean coating thickness of 65 µm. The finish shall be of even thickness to ensure that the ring bears evenly throughout between the two flanges.

or

A 3CR12 steel ring where specified in the Amendments.

4.3.6 Bolts, Nuts and Washers

Bolts and nuts shall comply with the relevant requirements of SANS 1700 or, where high strength friction grip bolts are specified in the Amendments or considered necessary by the Contractor, the bolts shall comply with the requirements of BS 3139, and their use and design shall be as specified in BS 3294: Part 1 and BS 4604.

Locking devices for nuts shall be provided wherever there is a possibility of the nuts becoming loose during service. Bolts shall be of sufficient length for at least two screw-threads to protrude from the nut when assemblies are fully tightened. Two washers complying with SANS 1700 shall be supplied with each bolt.

All bolts, nuts and washers shall be of a material with equal or better corrosion properties than the pipe materials being joined. All anchor bolts and nuts shall be Grade 316 stainless steel or as approved.

4.3.7 Screwed Joints

The threads for screwed joints shall comply with the relevant requirements of SANS 1109. Male ends shall have taper threads and female ends shall have parallel threads.

4.3.8 Plain Ended Specials

Each plain ended or spigot ended special, as shown on the drawings, shall be supplied with one sleeve coupling (or such other type of coupling as is shown on the drawings) to suit the particular pipe with which the special mates. The coupling shall fit the larger end of the barrel in the case of a reducer.

4.4 Plant

All specials and fittings shall be manufactured in an approved works which has the necessary tools, plant and equipment to manufacture pipework consistently in accordance with the specifications.

Manufacturing at only one works will be permitted. No site fabrication of specials, other than kinks of 10 degrees or less on buried pipelines, will be permitted.

4.5 Fabrication

4.5.1 Qualified Welders

Only qualified welders, certified as having passed the qualification tests as specified in Clauses 6.1 to 6.7 inclusive of API Standard 1104 or alternatively, SANS 10044: Part IV, shall be used to do all welding required. Copies of the certificates shall be made available to the Engineer.

4.5.2 Welding

Welding and inspection of welds shall be in accordance with Clauses 7 to 11.4 inclusive of API Standard 1104 or alternatively, SANS 10044: Part III. Where radiographic inspection is specified in the Amendments, the procedure followed shall be in accordance with Clause 11.1 of API Standard 1104. Only qualified radiographers as specified in API Standard 1104 shall be employed to do the radiography.

All butt welds and branch fillet welds on specials shall where practicable have an internal weld. The weld bead of this internal weld shall not protrude above the prolongation of the original inside surface of the special by more than 1 mm.

Internal reinforcement in the form of backing rings at weld seams shall not be permitted.

4.5.3 Preparation of Special Ends for:

4.5.3.1 Mechanical Couplings

Ends for use with mechanical couplings shall be square cut or bevelled plain ends, cut square to the pipe axis, with all edge burrs, weld splatter and scratches removed. The outside of the pipe shall be free of indentations, projections or roll marks for a distance of 250 mm from each end to permit proper make-up of the coupling. Longitudinal or spiral welds on the outside of the plain end shall be ground to plate or sheet surface for a minimum distance of 250 mm.

4.5.3.2 Fillet Welds

Ends for use with fillet welded sleeve joints shall be prepared as specified in 4.5.3.1.

4.5.3.3 Butt Welds

Specials which require joints to be butt welded on site shall be supplied with ends bevelled in accordance with the requirements of SANS 719, Clause 5.1.5. Square cut ends will require approval.

For specials to be jointed by butt welding, the internal weld bead shall be ground flush with the internal surface of the pipe or special for a length of 200 mm from the ends to be jointed.

4.5.3.4 Beveling

All beveling, where required, shall be delayed until after all non-destructive testing has been completed.

4.5.3.5 Flanges

Ends to be fitted with flanges shall have the longitudinal or spiral welds ground to plate or sheet surface for a distance from the ends sufficient to accommodate the flange.

4.5.4 Rectification of Defects

If a special fails to pass any of the tests specified, it will be rejected but the Engineer may permit repairs or alterations to be made to enable the special to pass the test.

Repairs of welded joints will be permitted during the process of manufacture. Where repairs are required the defective weld metal shall be cut out, and the parent metal prepared by grinding, and re-welded, to the satisfaction of the Engineer.

The repair procedure and performance on repairs shall be in accordance with Section 10 of API Specification 5L where not in conflict with SANS 719. Only qualified welders shall be employed. Each repair weld shall be marked with the welder's identifying stamp.

When the repair has been made, it shall be radiographically tested (X-rayed) over the full length of the repair.

On discovery of defective welds the Engineer may, at his discretion, call for additional radiographic examination until it is shown that the necessary standard is being maintained.

Should a weld repair be required on a special subsequent to hydraulic testing, the repaired special shall be retested in accordance with Clause 5.3.2 Hydraulic testing of this specification.

4.6 Coatings and Linings

Coatings and linings of specials shall be undertaken in accordance with the requirements of Specification SPE-JJ-0003.

4.7 Marking

Upon fabrication, each special shall be hard stamped with a unique reference number to ensure traceability. The stamp is to be 100mm from the pipe end and next to a weld. On completion of the contract or at reasonable intervals during the contract, the following pipe information shall be supplied to the Engineer in Microsoft Excel ® format:

- (a) Pipe reference number
- (b) Contract number
- (c) Date of manufacture
- (d) Outside diameter
- (e) Wall thickness/pressure rating
- (f) Grade of steel
- (g) Coating type and nominal thickness
- (h) Lining type and nominal thickness

- (i) Mass of uncoated and unlined special in kg/m
- (j) Applicable drilling tables stamped on the periphery of all flanges
- (k) Bends shall have their “centre plane” marked with two small punch marks close to both ends of the bends to facilitate correct positioning of the bends during laying.

4.8 Storage, Handling and Transport

4.8.1 Handling and Rigging

Specials shall be protected against damage at all stages from manufacture to delivery. Particular care shall be taken to protect the ends of all specials against denting.

In the transportation, loading and unloading of specials, an adequate fleet of vehicles shall be operated and maintained at all times to ensure that specials and their protective linings and coatings are not damaged.

Specials shall be so transported, stored and handled that they are not overstressed at any time and fittings are not damaged in any way. All thin-walled and soft-coated specials shall be handled with particular care and shall be so stored that they are not subjected to concentrated pressure from stones or other objects. Specials damaged or cracked in any way shall be removed from the Site at no cost to the Employer.

If cradles are used to transport the specials they must be rubber lined to avoid damage to the coating. During transportation specials shall be safely secured.

The Contractor shall be responsible for dispatching and transporting of the pipes to site and off-loading.

4.8.2 Protection of Pipe Ends

Satisfactory temporary end covers shall be provided for the protection of flanges, prepared ends of plain-ended fittings, and threads, and to prevent damage to the internal lining during transportation and during handling on Site.

4.8.3 Material that Deteriorate under the Action of Sunlight

All rubber rings or other materials which will deteriorate under the action of sunlight, ozone or inclement weather, shall be stored in permanent shade in lockable weather-proof sheds. Welding and the running of welding machines and electric machinery shall not be permitted in or near places where rubber or plastic products are stored and care shall be taken at all times to prevent contamination of these products by oil or other petroleum derived products.

5 Compliance with Requirements

5.1 Facilities for Testing

The Contractor shall provide at his own cost, all facilities and equipment required for testing and shall carry out all tests at his own expense. Complete records of test results shall be kept.

The testing machines shall be of a design which will allow a steady application of the test pressure and shall be equipped with an accurate pressure gauge. Provision shall be made for expelling all air from any special under test during filling and before application of the pressure.

Test calibration certificates from an independent laboratory, verifying the accuracy of all measuring and testing instruments requiring calibration, shall be provided by the Contractor. Recalibration shall be carried out as necessitated by circumstances but at intervals not exceeding 3 months.

5.2 Quality Assurance

All steel specials shall be fabricated and tested in accordance with an approved quality control plan and procedure. The quality assurance of all specials rated over PN 16 shall be in accordance with ISO 9002 and the manufacturer shall be in possession of a current ISO 9002 certificate.

Manufacture shall not commence until such time as the quality control plan and procedure has been approved by the Engineer.

The quality control plan and procedure shall address, as a minimum, the following tests/inspections:

- (a) Material certification
- (b) Non Destructive Evaluation (NDE) testing
- (c) Verification of tolerances
- (d) Workmanship
- (e) Surface preparation (e.g. cleanliness and blast profile for coatings and linings)
- (f) Material identification
- (g) Personnel certification (including welders and NDE)
- (h) Welding procedures and certification
- (i) Weld preparation
- (j) Compliance with drawings
- (k) Hydrostatic testing

5.3 Inspections

5.3.1 Visual Inspections

All finished pipework shall be visually inspected and shall be free of injurious defects as defined in API 5L Section 10.7.

5.3.2 Hydraulic Testing

When all aspects of fabrication have been completed, but before being cleaned, lined or coated, each and every special is to be tested to a hydrostatic pressure test of P,

Where P = the lesser of: $2 \times 0.85 \times Y \times t/D$ or 7 MPa

Y = Minimum Specified Yield Stress (MPa)

t = Nominal Wall Thickness of pipe (mm)

D = Nominal Diameter of Pipe (mm)

Pipe end plugs shall be restrained during the test to ensure that no longitudinal stresses are induced in the pipe wall. Upon completion of the hydraulic test, the ends of the pipe specials shall be tested by means of Go, No-go gauges to check whether flaring or cupping has occurred. If necessary the ends shall be expanded or ground until they comply with the specification.

The test pressure in the pipe special shall be maintained for at least 10 seconds and thereafter shall be inspected for weeps, leaks or deformation. The special will be deemed defective and may be rejected if any leaks, weeps or deformation are evident. Where defects are repaired, the special shall be re-tested. Should the special, after repair, fail to pass the second hydraulic test the Engineer may order its rejection.

5.3.3 Non-destructive Testing

Non-destructive testing shall be in accordance with Section 9 of API Specification 5L.

On completion of the hydrostatic testing (see 5.3.2) and before the ends of the specials are bevelled, non-destructive tests shall be carried out on all manual or semi-automatic welds, as follows:

All welds shall initially be radiographically tested (X-rayed) over 100% of the weld length. When consistently acceptable results are obtained, the number of welds to be so tested may be reduced on a sound statistically controlled basis by mutual agreement between the Engineer, Inspectorate and Contractor. At least 10% of all welds shall be radiographically tested.

Repairs to welds (see 4.5.4), shall be radiographically tested (X-rayed) over the full length of the repair.

Each radiograph, the test-pieces and results and interpretations of examinations and tests shall be submitted to the Engineer within 24 hours of the particular examination or test.

5.3.4 Testing of Specials

Where hydrostatic testing of specials is not practicable, the welds shall be subjected to 100% dye penetrant tests to determine surface cracks, and/or where ordered by the Engineer, to one of the tests specified in 5.3.3 to determine internal defects. Dye penetrant testing shall be done as specified in Subclause 7.2.1 of SANS 1200 L.

5.3.5 Magnetic Particle Testing

Where requested by the Inspectorate, magnetic particle testing shall be done in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 7.

5.4 Inspectorate

The Engineer may at his sole discretion appoint an independent inspection authority to carry out additional Quality Surveillance at the premises of the manufacturer. The manufacturer shall provide all facilities and shall facilitate access to their premises at reasonable times as may be necessary for the independent inspectorate to perform its function.

The manufacturer's quality control records shall be available for inspection by the independent inspectorate at all reasonable times, and copies of such records shall be made available on request.

Notwithstanding any surveillance carried out by, or on behalf of the Engineer, the Contractor shall retain full responsibility for the quality of specials supplied.

5.5 Marking Procedure

All weld lengths to be radiographed shall be clearly marked by the Inspector using his identification symbol. This symbol shall appear on the respective radiograph. The radiographed weld and symbol shall not be obliterated by finishing processes until the respective weld has been accepted by the Inspector.

5.6 Coatings and Linings

The testing of the coatings and linings of specials shall be undertaken in accordance with the requirements of Specification SPE-JJ-0003.

6 Tolerances

Refer to Clauses 4 and 5 above.

7 Testing

Refer to Clause 5 above.

8 Measurement and Payment

8.1 Basic Principles

8.1.1 Corrosion Protection

Unless specific provision is made in the Bill of Quantities, no separate payment will be made for corrosion protection. The rates tendered for item 8.2.1 will be held to cover the cost of any protection system specified.

8.2 Billed Items

8.2.1 Supply of Specials

Unit: number (No)

Specials will be measured by the number of each type, class, and size.

The unit rates shall cover the cost of the provision of each special, complete with couplings and/or other jointing materials as appropriate, and for the design of all specials including all drawings and shop drawings.

Unless specific provision is made in the Bill of Quantities, no separate payment will be made for the supply and delivery to Site of any additional couplings and jointing materials which may be required for the connection of the specials.

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Annexures

Appendix A. Applicable Standards

Reference is made to the latest issues of the following standards:

API Specification 5L	American Iron and Steel Institute - Specification for LINEPIPE
API Standard 1104	American Iron and Steel Institute - Standard for welding pipelines and related facilities
ASME	Boiler and Pressure vessels Code, Section V, Article 7
AWWA M 11	Steel pipe - A guide for design and installation (3rd edition)
BS 534	Steel pipes and specials for water and sewage
BS 639	Covered electrodes for the manual metal-arc welding of carbon and carbon-manganese steels
BS 1387	Steel tubes and tubulars suitable for screwing to BS 21 pipe threads
BS 1640	Steel butt-welding pipe fittings for the petroleum industry: Part 1 : Wrought carbon and ferritic alloy steel fittings
BS 1832	Compressed asbestos fibre jointing
BS 2633	Class 1 arc welding of ferritic steel pipe work for carrying fluids
BS 3139	High strength friction grip bolts for structural engineering
BS 3294	The use of high strength friction grip bolts in structural steelwork : Part 1 : General grade bolts
BS 3381	Metallic spiral wound gaskets for use with flanges to BS 1560 : Part 1 and 2
BS 4360	Weldable structural steels
BS 4604	The use of high strength friction grip bolts in structural steelwork (metric series)
BS EN 1092	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories. Steel flanges
BS EN 10222	Steel forgings for pressure purposes
PD 5500	Unfired fusion welded pressure vessels
ISO 7005	Metallic Flanges: Part 1 : Steel flanges
ISO 9000	Quality management
ISO 9002	Quality systems. Model for quality assurance in production, installation and servicing
SANS 62	Steel pipes Part 1 Pipes suitable for threading and of nominal size not exceeding 150 mm Part 2 Screwed pieces and pipe fittings of nominal size not exceeding 150 mm.
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specification and test methods
SANS 719	Electric welded low carbon steel pipes for aqueous fluids (ordinary duties)
SANS 974	Rubber joint rings (non-cellular) Part I : Joint rings for use in gas, water, sewer, and drainage systems

SANS 1109	Pipe threads where pressure-tight joints are made on the threads Part 1 Dimensions, tolerances and designation Part 2 Verification by means of limit gauges
SANS 1123	Pipe flanges
SANS 1431	Weldable structural steels
SANS 1476	Fabricated flanged steel pipework
SANS 1700	Fasteners
SANS 10044	Welding
SANS 10121	Cathodic protection of buried and submersed structures
SANS 1200 L	Medium-pressure steel pipelines
SAECC/1	Code of Practice

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AMENDMENTS

The following amendments to this Specification apply to this Contract. The paragraph letters and numbers indicate the relevant clause number to which the amendments apply. Alternatively, the relevant clause number will be shown in brackets as part of the heading. New clauses added to this Specification are assigned with new numbers.

1 SCOPE (CLAUSE 1)

This specification shall be applicable to the steel pipeline component of the project included in the civil works.

In the first paragraph, replace “2 280mm” and “2.5 MPa” with “508 mm” and “4.0 MPa”.

2 NORMATIVE REFERENCES (CLAUSE 2)

No amendments

3 DEFINITIONS AND ABBREVIATIONS (CLAUSE 3)

No amendments

4 REQUIREMENTS (CLAUSE 4)

4.1 MATERIALS (SUBCLAUSE 4.1)

4.1.1 General (Clause 4.1.1)

All mild steel specials and fitting with a nominal diameter of 150 mm and less shall be heavy class steel in accordance with SANS 62.

All mild steel specials and fittings with a nominal diameter greater than 150 mm shall be manufactured from Grade X52 steel.

4.2 DESIGN (SUBCLAUSE 4.2)

4.2.1 General (Subclause 4.2.1)

The Contractor shall submit a shop drawing for each steel pipe fitting or special to be manufactured. The shop drawings shall, at a minimum, include the following information:

- All face-to-face (F/F) or center-to-face (C/F) dimensions of the special
- The nominal diameter (DN), outer diameter (OD), and wall thickness for each cylindrical component of the special
- The pressure class of the special
- The applicable testing pressure for the special
- The applicable flange tables
- The steel type and grade for each component of the special
- The applicable corrosion protection, including associated details such as dry film thickness (DFT) or overall coating thickness

4.2.2 Wall thickness (Subclause 4.2.2)

Insert the following before the first paragraph:

"The wall thickness for specials shall be as scheduled, as indicated on the drawings, or shall match the wall thickness of the main pipeline. Where the wall thickness is not specifically provided, it shall be designed in accordance with this clause.

Design and Manufacture of Medium Pressure Steel Specials

The wall thickness of pipe up to and including DN150 shall be in accordance with SANS62 heavy class."

4.2.3 Branches and Nozzles (Subclause 4.2.4)

Delete the 3^d and 4th paragraphs of this clause and replace with the following: "Tees and crosses shall have dimensions as shown on the drawings. Where no dimensions are given on the drawings, the dimensions shall be in accordance with AWWA C208."

Insert the following after the last paragraph: "For pipes with a cement mortar lining, stubs/branches shall have a minimum size of DN100. The stub shall also have a cement mortar lining. After the placement of the stub, the cement mortar lining shall be repaired from the inside to form a continuous lining from the pipe into the stub."

4.2.4 Dimensions (Subclause 4.2.7)

Pipe specials and fittings with a nominal diameter up to 150 mm shall have an outer diameter in accordance with SANS 62.

Pipe specials and fittings with a nominal diameter greater than 150 mm shall have an outer diameter in accordance with SANS 719.

4.3 JOINTING (SUBCLAUSE 4.3)**4.3.1 Flexible Couplings (Subclause 4.3.1)**

Unless otherwise specified, all flange adaptors shall be restrained through an appropriate restraining flange welded onto the adjoining special.

4.3.2 Flanges (Subclause 4.3.2)

Flange drillings shall be in accordance with SANS 1123.

5 COMPLIANCE WITH REQUIREMENTS (CLAUSE 5)

No amendments.

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)

No amendments.

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

Replace the contents of this clause and replace with the following: "The supply of specials will be measured in SPE-CC-7003".

General specification

Manufacture Of Medium Pressure Steel Pipes

Specification number: SPE-MP-7002

Document control					
Specification no.		SPE-MP-7002			
Rev	Date	Revision details / status	Author	Reviewer	Approver
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1 Scope

This Specification covers the design, manufacture and delivery to site of electrically welded low carbon steel pipes of outside diameter up to 2 280 mm, for transporting water and sewage at ambient temperatures and under working pressures of up to 2,5 MPa.

This Specification shall be read in conjunction with SANS 1200 L. Where conflict between this specification and SANS 1200 L occurs, the provisions of this specification shall apply.

Interpretations and variations of this specification are set out in the Amendments to this Specification.

2 Normative References

2.1 Supporting Specifications

Where this Specification is required for a project, the following specifications shall, inter alia, form part of the Contract Document:

- a) Amendments;
- b) SANS 1200 Series of Standardized Specifications;
- c) SANS 1200 L: Medium-pressure pipelines (see Clause 1 above)
- d) Specification SPE-MP-7001 : Design and manufacture of medium pressure steel specials
- e) Specification SPE-JJ-0003 : General Corrosion Protection
- f) Specification SPE-CC-7003 : Laying and Jointing of Medium Pressure Steel Pipes and Specials

The latest issues of the specifications listed in Appendix A shall be deemed to apply to the manufacture of pipes using either submerged arc spiral welding or longitudinal welded “cans” rolled from low carbon or steel plate and joined by submerged arc circumferential welding to form suitable pipe lengths.

3 Definitions and Abbreviations

3.1 Definitions

For the purposes of this Specification the definitions and abbreviations given in the applicable clauses of the specifications listed in 2.1 and the following definitions shall apply:

Cut-and-shut bend	A bend formed by cutting out one or more V-shaped sections equally disposed about a line at right angles to the axis of the pipe, preparing the cut-out edges for welding; bending the pipe to form the bend and welding the pipe shut along the prepared edges to complete the bend (see BS 2633, Fig 25)
Fitting	<ul style="list-style-type: none">a) A special or valve.b) Any process of jointing (except welding) straight pipes to one another and to specials and valves.
Flexible pipe	A pipe of which the diameter is reduced by more than 1% under an external radial force before the appearance of cracks.

"H"	The cross-sectional shape of a weld at a skelp.
Manual shielded electric arc process welding	Electric arc welding done by hand using a filler electrode coated with a material that gasifies at the point of arc and excludes oxygen from the weld, thus improving the metallurgical quality of the completed weld.
Nominal diameter (size)	A numerical designation of diameter which is common to all components in the piping system other than components designated by OD or by thread size. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions.
Nominal pressure	<p>A numerical designation which is a convenient round number for reference purposes.</p> <p>All equipment of the same DN designated by the same PN number shall have compatible mating dimensions.</p>
Pinhole	A very small hole indicating a flaw in the weld.
Pipe end bevel	A bevel cut made on the end of a pipe to afford a groove between abutting joints in order to receive weld metal.
Pipework	Includes all pipes, joints, specials, fittings and valves.
Skelp	The jointing edges of steel coils used in the manufacture of spiral welded pipe.
Special	<p>Any pipe other than a straight pipe.</p> <p>Note: Under this definition shall be included all sizes of specials of shapes such as bends, tees, crosses, angle branches, reducers, tapers and flexible couplings with or without centre registers.</p>
Straight pipe	A straight pipe of uniform bore and of standard or non-standard length.
Welding icicles	Congested droplets of metal which extend through the weld to the interior of the pipe, caused by excessive heat or improper welding technique.

3.2 Abbreviations

The following abbreviations (additional to those referred to in 3.1) shall have the meanings given:

AISI	:	American Iron and Steel Institute
DN	:	Nominal diameter (e.g. DN 200 = 200 mm nominal diameter)
DS-AW	:	Double submerged-arc welded
E-RW	:	Electric-resistance welded
FBE	:	Flanged both ends
FOE	:	Flanged one end
ID	:	Internal diameter
MSEAP	:	Manual Submerged Electric Arc Process
MS	:	Mild Steel
OD	:	Outside diameter, which shall mean the internal diameter plus 2 x (lining thickness + pipe wall thickness)
p.e.	:	Plain ended.

PN	:	Nominal working pressure (eg. PN 10 = 1 000 kPa)
SA-AW	:	Semi-automatic arc welded
SAW	:	Submerged arc weld
Scab	:	Unbonded piece of plate in tight contact with the plate
SS	:	Stainless Steel
t	:	Wall thickness of pipes
TP	:	Test pressure
WP	:	Weld preparation

4 Requirements

4.1 Materials

4.1.1 General

Steel pipe shall be manufactured in accordance with SANS 719:2011 Edition 3.2, except as added or amended hereunder. Where the amendments hereunder are in conflict with SANS 719, the amendments shall take precedence.

4.1.2 Chemical Composition (SANS 719, Clause 4.2)

Delete Clause 4.2 and replace with:

Unless otherwise billed or shown on drawings, pipes shall be manufactured from the following materials:

Nominal diameter equal to or less than 150 mm:

Medium or heavy class steel, complying with the applicable requirements of SANS 62.

Nominal diameter larger than 150 mm:

Table 1a

Steel grade	Minimum Yield Stress (MPa)	Chemical Composition and Physical Properties
B	241	SANS 719, Table 1
300WA	300	SANS 1431
X42	289	API 5L Table 3.1 & 4.1
X46	317	API 5L Table 3.1 & 4.1
X52	358	API 5L Table 3.1 & 4.1
X56	386	API 5L Table 3.1 & 4.1
X60	413	API 5L Table 3.1 & 4.1
X65	450	API 5L Table 3.1 & 4.1

Flanges on pipe ends, where applicable, shall be manufactured from steel plate conforming to BS 4360 or SANS 1431 Grade 300W for working pressures up to PN 25. Flanges rated more than PN 25 and up to PN 60 shall be made from steel manufactured in accordance with BS EN 10222 Grade 460 or as approved. Flanges for pressures exceeding PN 60 and up to PN 250 shall be special flanges and gaskets manufactured by Hydro Power Engineering or equal approved.

4.1.3 Physical Properties (SANS 719, Clause 4.3)

Insert in the first sentence after “the requirements given in table 1” the following:

“and table 1a”.

4.1.4 Certification (SANS 719, Clause 4.4)

Add the following sentence:

“All information relevant to pipe fabrication shall be made available to the Engineer during the course of the manufacturing process.”

4.2 Design

4.2.1 Dimensional Requirements

4.2.1.1 Pipe Length (SANS 719, Clause 5.1.1)

4.2.1.1.1 General (SANS 719, Clause 5.1.1.1)

Add the following under Clause 5.1.1.1:

“Unless otherwise specified, all pipes shall be manufactured in one fixed standard length between 9 m and 19.5 m. The standard lengths of pipes supplied shall be 9.14 m, 12.19 m or 18.28 m.”

4.2.1.1.2 Random Lengths (SANS 719, Clause 5.1.1.2)

Delete the wording of Clause 5.1.1.2 and replace with:

“Pipes of random length will be accepted subject to their total length not exceeding 10% of the supplied length for each category of pipe and subject to the length of each pipe being within 10% of a standard pipe length.

Standard pipes from which samples for destructive testing have been cut may be jointed together by butt-welding to form single pipe lengths of the required standard length.

Each change in steel grade, pipe diameter or wall thickness will be classes as a separate category.”

4.2.1.1.3 Exact Lengths (SANS 719, Clause 5.1.1.3)

The exact lengths of pipes shall be to a tolerance of -0 mm and +50 mm.

4.2.2 Dimensions (SANS 719, Clause 5.1.2)

Insert the following after b):

"The tolerances on outside diameters of pipe ends for pipe diameters greater than 1250mm and less than 2230mm shall be as for pipes of 1250mm diameter (refer to Table 3 of SANS 719)."

4.2.3 Wall Thickness (SANS 719, Clause 5.1.3)

Delete "+10% or – 8%" and replace with:

"+13.5% or – 0%"

4.2.4 Pipe Ends (SANS 719, Clause 5.1.5)

Add at the beginning of Clause 5.1.5 the following:

"Pipes shall be supplied with each end complying with one of the following criteria:

- a) Bevel ended to be joined by field welding
- b) Plain ended to be joined by flexible couplings
- c) Bell and spigot (plain) ended to be joined by fillet weld as specified in the Amendments and Additions or Bill of Quantities
- d) Flanged ends to be joined by bolts, nuts and washers.

Where both ends are specified as bevel ended or plain ended the requirements of SANS 719 Clause 5.1.5 shall apply.

Bell and spigot ends will generally be specified on pipe diameters of 508 mm or smaller.

The welding requirements for the preparation of these pipe ends shall comply with Clause 4.4.7 of this specification."

4.2.5 Flanges

Flanges shall be designed and manufactured to BS EN 1092 Part 1 for steel flanges and Part 2 for cast iron flanges, unless otherwise specified on the Drawings. Flanges not covered by BS EN 1092 shall be manufactured according to the detailed dimensions and requirements shown on the Drawings.

All flanges shall be suitable for Site welding (SW) to pipes and specials and shall conform to BS 2633, Section 7 with preparation of plate flanges as shown in Fig 41 ("slip-on") for pipes and specials up to DN 100 and Fig 39 or 40 ("bore and fillet") for pipes and specials DN 125 and larger.

The drilling of steel and cast iron flanges shall be off-centre and shall conform to the requirements of SANS 1123, BS EN 1092: Section 3.1, or ISO 7005: Part 1 as applicable, appropriate to the class of pipe specified, except that in the case of flanges, where M27 and M33 bolts are specified in BS EN 1092: Section 3.1, M24 and M30 bolts respectively shall be used as specified in SANS 1123.

Any pipe that has flanges which are incorrectly drilled will be rejected. Reaming of bolt holes to oversize dimension in order to make a particular piece fit will not be permitted.

All flanges shall be machined overall with gramophone finish in accordance with SANS 1123, or as specified below:

- a) Flange sizes up to and including DN 400 with a pressure rating up to and including 1600 kPa shall have flat joint faces, and where the pressure rating exceeds 1600 kPa, shall have a raised face sealing arrangement;

- b) Flange sizes exceeding DN 400 up to and including DN 1000 shall have a raised face sealing arrangement for all pressure ratings up to and including 2500 kPa.

For flanges not covered by BS EN 1092, and for domes and conical ends, thicknesses shall be calculated and where applicable the flanges manufactured in accordance with Section 3 of BS 5500.

4.2.6 Provision of Cadwelding Pads

Where pipes are to be jointed by means of flexible couplings the manufacturer shall weld steel plates not less than 50 x 75 x 6 mm thick, 250 mm from each end of all pipes, during the pipe manufacturing process (i.e. before lining and coating) to provide adequate area for cadwelding bonding cables to the piping to make it electrically continuous and enable a cathodic protection system to be applied without damage to the coating.

4.3 Plant

Pipes shall be manufactured in an approved works which has the necessary tools, plant and equipment to manufacture pipes consistently in accordance with the specifications.

4.4 Fabrication

4.4.1 General

Only qualified welders, certified as having passed the qualification tests as specified in Clause 6 of API Standard 1104 or alternatively, SANS 10044: Part IV, shall be used to do all welding required. Copies of the certificates shall be made available to the Engineer.

4.4.2 Forming (SANS 719, Clause 5.2.1)

Delete the sub-clause and replace with the following:

“Unless otherwise specified in the Amendments and Additions, pipes shall be formed in accordance with one of the following forming techniques:

- a) Electric resistance welding (ERW). This technique may be used for pipes ranging in outside diameter from 219mm to 610mm and ranging in wall thickness from 3.5mm to 12mm.
- b) Submerged arc welding (SAW). This technique may be used for manufacturing spirally welded pipes ranging in outside diameter from 219mm to 2230mm and wall thicknesses ranging from 4.5mm to 18mm.

Where automatic submerged arc welding is employed, at least one pass shall be made on the inside and at least one pass on the outside of all pipes.

The number of longitudinal weld seams on pipes shall not exceed 1 for pipes up to and including DN 1000, and 2 for pipes larger than DN 1000 up to DN 2200.

The fabrication of larger diameters and/or use of thicker plate using these techniques may be agreed between the Manufacturer and the Engineer. In both techniques, circumferential joints shall be at least 1.5m apart and longitudinal welds of mated sections shall be at least 30° apart.”

4.4.3 Welds (SANS 719, Clause 5.2.2.1)

Add the following as the first sentence:

“All X-grade steel is to be welded in accordance with API 1104 ‘Welding of Pipelines and Related Facilities’.”

4.4.4 Weld Reinforcements (SANS 719, Clause 5.2.2.2.7)

All butt welds and branch fillet welds on pipes shall where practicable have an internal weld. The height of the inner weld shall not exceed 1mm.

Internal reinforcement in the form of backing rings at weld seams shall not be permitted.

4.4.5 Seams

Longitudinal seams, spiral seams and shop girth seams shall all be butt welded.

4.4.6 Rounding of Pipe and Sizing of Ends

If it is necessary to reshape pipes after they have been welded, reshaping shall be performed by rerolling or by pressure. Reshaping of pipes by dropping or hammering is not permitted. Sizing of pipe ends to come within specified end tolerances is permitted. This may include expanding pipe ends either mechanically or hydraulically up to a maximum of 1,5% of its original diameter.

4.4.7 Preparation of Pipe Ends for:

4.4.7.1 Mechanical Couplings

Ends for use with mechanical couplings shall be square cut or bevelled plain ends, cut square to the pipe axis, with all edge burrs, weld splatter and scratches removed. The outside of the pipe shall be free of indentations, projections or roll marks for a distance of 250 mm from each end to permit proper make-up of the coupling. Longitudinal or spiral welds on the outside of the plain end shall be ground to plate or sheet surface for a minimum distance of 250 mm.

4.4.7.2 Fillet Welds

Ends for use with fillet welded sleeve joints shall be prepared as specified in 4.4.7.1.

4.4.7.3 Butt Welds

Pipes which require joints to be butt welded on site shall be supplied with ends bevelled in accordance with the requirements of SANS 719, Clause 5.1.5. Square cut ends will require approval.

For pipes to be jointed by butt welding, the internal weld bead shall be ground flush with the internal surface of the pipe or special for a length of 200 mm from the ends to be jointed.

4.4.7.4 Spigot and Socket

Spigot and socket ends shall be rolled or fabricated from plate, sheet or special sections to the required shape without hammering. Longitudinal or spiral welds on the inside of the socket and the

outside of the spigot shall be ground to plate or sheet surface for a distance not less than the depth of insertion of the spigot into the socket.

4.4.7.5 Bevelling

All bevelling, where required, shall be delayed until after all non-destructive testing has been completed.

4.4.7.6 Flanges

Ends to be fitted with flanges shall have the longitudinal or spiral welds ground to plate or sheet surface for a distance from the ends sufficient to accommodate the flange.

4.4.8 Rectification of Defects (SANS 719, Clause 5.2.3)

Add the following to Clause 5.2.3:

"If a pipe fails to pass any of the tests specified, it will be rejected but the Engineer may permit repairs or alterations to be made to enable the pipe to pass the test.

Repairs of welded joints will be permitted during the process of manufacture. Where repairs are required the defective weld metal shall be cut out, and the parent metal prepared by grinding, and re-welded, to the satisfaction of the Engineer.

The repair procedure and performance on repairs shall be in accordance with Section 10 of API Specification 5L where not in conflict with SANS 719. Only qualified welders shall be employed. Each repair weld shall be marked with the welder's identifying stamp.

When the repair has been made, it shall be radiographically tested (X-rayed) over the full length of the repair.

On discovery of defective welds the Engineer may, at his discretion, call for additional radiographic examination until it is shown that the necessary standard is being maintained.

Should a weld repair be required on a pipe subsequent to hydraulic testing, the repaired pipe shall be retested in accordance with Clause 5.5 Hydraulic testing of this specification.

Dents shall, where practicable, be jacked out."

4.5 Coatings and Linings

Coatings and linings of pipes shall be undertaken in accordance with the requirements of Specification SPE-JJ-0003.

4.6 Marking (Sans 719, Clause 7)

Delete this clause and replace with the following:

Upon fabrication, each pipe shall be hard stamped with a unique reference number to ensure traceability. The stamp is to be 100mm from the pipe end and next to a weld. On completion of the contract or at reasonable intervals during the contract, the following pipe information shall be supplied to the Engineer in Microsoft Excel ® format:

- a) Pipe reference number
- b) Contract number

- c) Date of manufacture
- d) Outside diameter
- e) Wall thickness
- f) Grade of steel
- g) Coating type and nominal thickness
- h) Lining type and nominal thickness
- i) Forming technique
- j) Length
- k) Mass of uncoated and unlined pipe in kg/m
- l) Applicable drilling tables stamped on the periphery of all flanges

In addition to the hard stamping, all pipes shall be clearly marked with the unique reference number in appropriate height characters in durable paint on a black background at one end of each pipe. The supplier's and Employer's name and logo shall be stencilled on each pipe.

Where specified in the Amendments, all pipes shall also be clearly marked with colour bands to reflect the grade steel and wall thickness."

4.7 Storage, Handling and Transport

4.7.1 Handling and Rigging

The plant and rigging equipment used for the handling of pipes shall be such that no pipe shell is overstressed during any operation.

In the transportation, loading and unloading of pipes, an adequate fleet of vehicles shall be operated and maintained at all times to ensure that pipes and their protective linings and coatings are not damaged. In particular, the use of excavation equipment for handling of pipes will not be permitted.

Coated pipes shall be moved with the use of padded slings of width sufficient to prevent damage to the coating. The slings shall be at least 500mm wide for pipes up to DN600, 600mm wide for pipes of DN700 and up to DN1200, and 800mm wide for pipes of DN1400 and larger, or as approved by the Engineer. Chain slings, hooks, wire ropes, rope slings without canvas covers, composition belt slings with protruding rivets and any other equipment liable to damage the coating shall not be used.

Slings shall be suitably rated for the loads to be handled and in good condition. The use of deteriorating and frayed slings is prohibited.

All pipes are to be lifted and handled with the aid of a "spreader" lifting beam. Special care shall be taken to ensure that no damage occurs to pipes or coatings as a result of pipes sliding on or hitting adjacent pipes. The dragging or skidding of pipes in contact with the ground is not permitted.

If cradles are used to transport the pipes they must be rubber lined to avoid damage to the pipe coating.

During transportation pipes shall be safely secured to its final destination with slings of an adequate width.

The Contractor shall be responsible for dispatching and transporting of the pipes to site and off-loading.

4.7.2 Dunnage and Storage

Whenever pipes are stacked or otherwise stockpiled or are transported (unless special cradles are used), use shall be made of suitably resilient material as dunnage which shall not disintegrate or deteriorate when exposed to the elements for prolonged periods. Pipes of 6m length shall be stacked with a minimum of 2 dunnage supports. Pipes of 9m and 12m lengths shall be stacked with a minimum of 3 supports (one support at each pipe end and one at mid-span). Pipes of 18m length shall be stacked with a minimum of 4 supports at equal spacing. The supports shall have a minimum width of 500mm for pipes up to DN500 and 1000mm wide for larger pipes. The length of the support shall be a minimum length of 1.5 times the diameter of the pipe to be supported and shall be profiled to match the coated outside radius of the pipe. Pipes shall be stacked with a minimum clearance of 50mm between adjacent pipe walls and a minimum of 200mm clear of the ground.

Pipes shall be stacked with sufficient supports to prevent permanent longitudinal deflections or deformation of the pipe body in excess of 2 per cent of the pipe diameter. Pipes shall also be stacked in a manner that limits loading on lower layers of pipes. Any pipe showing permanent ovality as a result of surcharge loading shall be rejected. Dents causing a protrusion in excess of 3mm into the interior of a pipe may also result in the pipe being rejected.

Each class and size of pipe shall be stacked and stored separately.

Coated steel pipes shall always be supported on a sufficient number of approved soft bolsters to prevent damage or the permanent deformation of coatings. Coated steel pipes shall not be stacked more than two pipes high, each layer separated by bolsters.

The number of layers of bare steel pipes in a stockpile shall not exceed:

$$N = \frac{1730 \cdot f \cdot t}{(D - t)^2}$$

Where N is the permissible number of layers, D is the outside diameter of the pipe in mm, f is the guaranteed minimum yield strength in MPa for the steel plate, and t is the nominal wall thickness in mm.

Any material which is not delivered and off-loaded on Site in the same condition as it left the factory may be rejected by the Engineer.

4.7.3 Protection of Pipe Ends

Before transportation all pipes are to be fitted with end caps made from plastic or other suitable material. Each end cap must remain in place until its pipe has been laid and the pipe end is no longer open to the elements. It must, therefore, remain in place until it is no longer needed to protect the pipe from ingress of foreign material.

In addition, bevel-ended pipes are to be fitted with bevel protectors before leaving the Manufacturer's premises. These are to remain in place until removed to permit the welding operation.

5 Compliance with Requirements

5.1 Facilities for Testing

The Contractor shall provide at his own cost, all facilities and equipment required for testing and shall carry out all tests at his own expense. Complete records of test results shall be kept.

The testing machines shall be of a design which will allow a steady application of the test pressure and shall be equipped with an accurate pressure gauge. Provision shall be made for expelling all air from any pipe under test during filling and before application of the pressure.

Test calibration certificates from an independent laboratory, verifying the accuracy of all measuring and testing instruments requiring calibration, shall be provided by the Contractor. Recalibration shall be carried out as necessitated by circumstances but at intervals not exceeding 3 months.

5.2 Quality Assurance

All steel pipes shall be fabricated and tested in accordance with an approved quality control plan and procedure. Manufacture shall not commence until such time as the quality control plan and procedure has been approved by the Engineer.

The quality control plan and procedure shall address, as a minimum, the following tests/inspections:

- (a) Material certification
- (b) Non-Destructive Evaluation (NDE) testing
- (c) Verification of tolerances
- (d) Workmanship
- (e) Surface preparation (e.g. cleanliness and blast profile for coatings and linings)
- (f) Material identification
- (g) Personnel certification (including welders and NDE)
- (h) Welding procedures and certification
- (i) Weld preparation
- (j) Compliance with drawings
- (k) Hydrostatic testing

5.3 Inspections

5.3.1 Visual Inspections

All finished pipes shall be visually inspected and shall be free of injurious defects as defined in API 5L Section 10.7.

5.3.2 Dimensions (SANS 719, Clause 6.1.1)

Add the following as the first sentence:

“The outside diameter, ovality and straightness of each pipe is to be checked in accordance with this clause.”

5.3.3 Welds (SANS 719, Clause 6.1.2)

Add the following at the end of the clause:

“The welds of each pipe are to be tested using one of the two options below. If not specifically stated elsewhere, pipes manufactured by ERW are to be tested as per Option 2 and spirally welded pipes as per Option 1.

a) Option 1 (excluding ERW pipes)

100% of the welds of all pipes shall be tested by fluoroscopic means. Where defects are detected they shall be adjudicated in accordance with API 5L and, if necessary, repaired in accordance with the requirements of API 1104.

b) Option 2 (ERW pipes)

100% of the welds of all pipes shall be tested by ultrasonic means. Where defects are detected in a pipe by means of ultrasonic testing, the defection section of pipe shall be 100% re-tested by means of X-ray and adjudicated in accordance with API 5L and, if necessary, repaired in accordance with the requirements of API 1104.

For rail, road, river and stream crossings, 100% of the total length of all welds shall be examined radiographically.”

5.4 Destructive Tests (SANS 719, Clause 6.2)

At least one set of the three tests described in SANS 719, Clauses 6.2.1, 6.2.2 and 6.2.3, shall be carried out for each pipe diameter and wall thickness combination. The Engineer may require that, after the first pipe, every 500th subsequent pipe of each diameter and wall thickness combination be tested.

5.5 Hydraulic Test (SANS 719, Clause 6.3)

Delete this clause and substitute with the following:

“When all aspects of fabrication have been completed, but before being cleaned, lined or coated, each and every pipe is to be tested to a hydrostatic pressure test of P,

Where $P = \text{the lesser of: } 2 \times 0.85 \times Y \times t/D \quad \text{or} \quad 7 \text{ MPa}$

$Y = \text{Minimum Specified Yield Stress (MPa)}$

$t = \text{Nominal Wall Thickness of pipe (mm)}$

$D = \text{Nominal Diameter of Pipe (mm)}$

Pipe end plugs shall be restrained during the test to ensure that no longitudinal stresses are induced in the pipe wall. Upon completion of the hydraulic test, the ends of the pipes shall be tested by means of Go, No-go gauges to check whether flaring or cupping has occurred. If necessary the ends shall be expanded or ground until they comply with the specification.

The test pressure in the pipe shall be maintained for at least 10 seconds and thereafter shall be inspected for weeps, leaks or deformation. The pipe will be deemed defective and may be rejected if any leaks, weeps or deformation are evident. Where defects are repaired, the pipe shall be re-tested. Should the pipe, after repair, fail to pass the second hydraulic test the Engineer may order its rejection.”

5.6 Inspectorate

The Engineer may at his sole discretion appoint an independent inspection authority to carry out additional Quality Surveillance at the premises of the pipe manufacturer. The manufacturer shall provide all facilities and shall facilitate access to their premises at reasonable times as may be necessary for the independent inspectorate to perform its function.

The manufacturer's quality control records shall be available for inspection by the independent inspectorate at all reasonable times, and copies of such records shall be made available on request.

Notwithstanding any surveillance carried out by, or on behalf of the Engineer, the Contractor shall retain full responsibility for the quality of pipes supplied.

5.7 Marking Procedure

All weld lengths to be radiographed shall be clearly marked by the Inspector using his identification symbol. This symbol shall appear on the respective radiograph. The radiographed weld and symbol shall not be obliterated by finishing processes until the respective weld has been accepted by the Inspector.

5.8 Coatings and Linings

The testing of the coatings and linings of pipes shall be undertaken in accordance with the requirements of Specification SPE-JJ-0003.

6 Tolerances

Refer to Clauses 4 and 5.

7 Testing

Refer to Clause 5.

8 Measurement and Payment

8.1 Basic Principles

8.1.1 Corrosion Protection

Unless specific provision is made in the Bill of Quantities, no separate payment will be made for corrosion protection. The rates tendered for item 8.2.1 will be held to cover the cost of any protection system specified.

8.1.2 Pipes Tested to Destruction

Pipes tested to destruction and the repair of the tested pipes for use in the Works, if ordered by the Engineer, will be measured and paid on a daywork basis.

8.2 Billed Items

8.2.1 Supply of Pipes

Unit: metre (m)

The supply of pipes will be measured by length. The maximum length measured will be equal to the length as laid, no deductions being made for specials and valves and no extra length measured for waste. (See Subclause 8.2 of SANS 1200 L)

Separate items will be billed for each diameter and wall thickness.

The unit rates shall cover the cost of the fabrication and supply of the pipes, complete with couplings where applicable, the cost of handling where applicable, and the cost of factory testing, inspection and transportation to Site and shall, where it is necessary to limit ovality to within the specified limits, also cover the cost of bracing the pipes internally.

Separate items are provided in the Bill of Quantities for the laying, jointing, testing and commissioning of the pipes.

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Annexures

Appendix A. Applicable Standards

Reference is made to the latest issues of the following standards:

API Specification 5L	American Iron and Steel Institute - Specification for LINEPIPE
API Standard 1104	American Iron and Steel Institute - Standard for welding pipelines and related facilities
ASME	Boiler and Pressure vessels Code, Section V, Article 7
AWWA M 11	Steel pipe - A guide for design and installation (3rd edition)
BS 534	Steel pipes and specials for water and sewage
BS 639	Covered electrodes for the manual metal-arc welding of carbon and carbon-manganese steels
BS 1387	Steel tubes and tubulars suitable for screwing to BS 21 pipe threads
BS 1640 Wrought	Steel butt-welding pipe fittings for the petroleum industry: Part 1 : carbon and ferritic alloy steel fittings
BS 1832	Compressed asbestos fibre jointing
BS 2633	Class 1 arc welding of ferritic steel pipe work for carrying fluids
BS 3139	High strength friction grip bolts for structural engineering
BS 3294 1 :	The use of high strength friction grip bolts in structural steelwork : Part General grade bolts
BS 3381 and 2	Metallic spiral wound gaskets for use with flanges to BS 1560 : Part 1
BS 4360	Weldable structural steels
BS 4604 (metric	The use of high strength friction grip bolts in structural steelwork series)
BS EN 1092	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories. Steel flanges
BS EN 10222	Steel forgings for pressure purposes
PD 5500	Unfired fusion welded pressure vessels
ISO 7005	Metallic Flanges: Part 1 : Steel flanges
ISO 9000	Quality management
ISO 9002 and	Quality systems. Model for quality assurance in production, installation servicing
SANS 62 size	Steel pipes Part 1 Pipes suitable for threading and of nominal size not exceeding 150 mm Part 2 Screwed pieces and pipe fittings of nominal not exceeding 150 mm.
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specification and test methods
SANS 719 duties)	Electric welded low carbon steel pipes for aqueous fluids (ordinary

SANS 974	Rubber joint rings (non-cellular) Part I : Joint rings for use in gas, water, sewer, and drainage systems
SANS 1109	Pipe threads where pressure-tight joints are made on the threads Part 1 Dimensions, tolerances and designation Part 2 Verification by means of limit gauges
SANS 1123	Pipe flanges
SANS 1431	Weldable structural steels
SANS 1476	Fabricated flanged steel pipework
SANS1700	Fasteners
SANS 10044	Welding
SANS 10121	Cathodic protection of buried and submersed structures
SANS 1200 L	Medium-pressure steel pipelines
SAECC/1	Code of Practice

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AMENDMENTS

The following amendments to this Specification apply to this Contract. The paragraph letters and numbers indicate the relevant clause number to which the amendments apply. Alternatively, the relevant clause number will be shown in brackets as part of the heading. New clauses added to this Specification are assigned with new numbers.

1 SCOPE (CLAUSE 1)

This specification shall be applicable to the steel pipeline component of the project included in the civil works.

In the first paragraph, replace “2 280mm” and “2.5 MPa” with “508 mm” and “4.0 MPa”.

2 NORMATIVE REFERENCES (CLAUSE 2)

No amendments

3 DEFINITIONS AND ABBREVIATIONS (CLAUSE 3)

No amendments

4 REQUIREMENTS (CLAUSE 4)

4.1 MATERIALS (SUBCLAUSE 4.1)

4.1.1 Chemical composition (Clause 4.1.2)

Mild steel pipe up to and including DN150 shall comply with SANS 62 heavy class.

Mild steel pipes greater than DN150 shall be manufactured from Grade X52 steel.

4.2 DESIGN (SUBCLAUSE 4.2)

4.2.1 Wall Thickness (Subclause 4.2.3)

The wall thickness for pipes shall be as scheduled or as indicated on the drawings.

4.2.2 Pipe ends (Subclause 4.2.4)

The pipe ends for all pipes supplied under this Contract (<DN450) shall have bell and spigot ends for lap-welded slip joints.

4.2.3 Flanges (Subclause 4.2.5)

All flanges shall be drilled in accordance with SANS 1123.

Delete b) under Clause 4.2.5 and replace with:

“b) Flange sizes exceeding DN 400 up to and including DN 500 shall have a raised face sealing arrangement for all pressure ratings up to and including 4000 kPa.”

5 COMPLIANCE WITH REQUIREMENTS (CLAUSE 5)

No amendments.

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)

No amendments.

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

Replace the contents of this clause and replace with the following: “The supply of pipes will be measured in SPE-CC-7003”.

General specification

Pipe Couplings

Specification number: SPE-MP-7023

Document control					
Specification no.		SPE-MP-7023			
Rev	Date	Revision details / status	Author	Reviewer	Approver
0	2022/03/03	First Issue	Denis Peart	Laura Ingle	Laura Ingle
Signature					

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1 Introduction

SPE-MP-7023 specifies the requirements for pipe couplings to be provided by the Contractor.

Pipe couplings shall be provided for flexibility and to allow dismantling of pipework. Pipe couplings shall also be provided to accommodate possible pipe movement from settlement, etc, and to isolate machine vibration.

2 Scope of Works

See project specification.

The installation shall be configured as shown on applicable drawings.

3 Normative References

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

- (a) Amendments, Additions and Detailed Requirements (SPE-MP-7023).
- (b) SPE-MM-0001: General Mechanical Requirements.
- (c) SPE-JJ-0003: General Corrosion Protection.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

4 Equipment Eligibility

The couplings provided shall have a successful record of use locally in similar applications and shall also have had at least three years of technical support locally. Service and spares shall currently be available locally. Upgraded versions of a manufacturer's earlier designs which comply with these criteria are also acceptable.

Couplings which do not satisfy these requirements are not acceptable unless specifically called for in the specifications or unless the Engineer agrees in writing.

5 Performance Requirements

The coupling shall provide a flexible joint between the two items being connected.

The coupling shall withstand the pipework pressure rating.

6 Construction and Design

6.1 General

The pressure rating of the coupling shall be not less than the rating for as its pipework.

Where the type of coupling is not indicated on the drawing, pipe couplings may be of the mechanical type (VJ coupling or flange adaptor), of the stainless steel bellows type or of the rubber bellows type but, in each case, the type chosen shall be suitable for the duty.

Restraints shall only be provided where required. Restraints shall incorporate three tie bars or more.

6.2 Mechanical Couplings

Mechanical couplings shall be of the rubber ring compression type (i.e. VJ-type flange adaptors or VJ type couplings) and shall be provided in pairs in order to accommodate axial misalignment and/or settlement. All fasteners, including studs welded to flanges, shall be of stainless steel and provided with a solids lubricant to prevent galling. Metal castings shall be of ductile iron or of stainless steel.

Couplings for stainless steel and 3CR12 pipework shall be fully of EN Grade 1.4401 (316) stainless steel construction (except for the seal).

Carbon steel and cast iron components shall be protected against corrosion by Rilsan coating.

6.3 Rubber Bellows Couplings

Suitably rated rubber bellows type couplings with metal backing flanges are acceptable for pipe diameters of DN 300 and below.

The bellows shall be provided with two backing flanges drilled to match their mating flanges. Bellows for low carbon steel pipework shall be provided with hot dip galvanised flanges (i.e. not zinc plated). Bellows for 3CR12 or stainless steel pipework shall be provided with matching flange material.

Rubber bellows couplings are not acceptable for bolting directly to the inlet of centrifugal pumps and mechanical couplings shall be used for this application.

6.4 Stainless Steel Bellows Couplings

Where stainless steel bellows type couplings are required, the flanges and the flange fasteners shall also be of stainless steel.

7 Fabrication

Fabrication and welding shall comply with SPE-MM-0001.

8 Fasteners

Fasteners shall comply with SPE-MM-0001.

9 Castings

Castings shall comply with SPE-MM-0001.

10 Corrosion Protection

Corrosion Protection shall comply with SPE-JJ0003.

Stainless steel shall be correctly pickled and passivated. All stainless steel surfaces shall be completely clear of ferrous stain upon commissioning.

11 Installation

Installation work shall comply with SPE-MM-0001.

Pipework shall be aligned correctly and the pipe coupling shall not be used to accommodate visible misalignment in any direction.

12 Inspections

The Contractor shall make arrangements for the Engineer to inspect the couplings for compliance prior to payment being made.

13 Testing Requirements

The correct operation of the couplings and achievement of the specified performance requirements shall be demonstrated to the Engineer prior to the commissioning of the Works.

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1. INTRODUCTION (CLAUSE 1)

No Amendments

2. SCOPE (CLAUSE 2)

2.1 GENERAL (SUBCLAUSE 2.1)

This specification shall be applicable to all pipe couplings included in the civil works, as well as to pipe couplings in the mechanical works where this specification is specifically referenced.

3. NORMATIVE REFERENCES (CLAUSE 3)

Delete reference to SPE-MM-0001 from the list.

4. EQUIPMENT ELIGIBILITY (CLAUSE 4)

No Amendments

5. PERFORMANCE REQUIREMENTS (CLAUSE 5)

No Amendments

6. CONSTRUCTION AND DESIGN (CLAUSE 6)

6.1 GENERAL (SUBCLAUSE 6.1)

Replace the last paragraph of this clause with the following: "All flange adaptors shall be fully restrained through an appropriate restraining flange welded onto the adjoining pipe or special. Restraints shall incorporate tie bars suitable for the pipelines testing pressure."

Add the following at the end of this subclause: "Materials shall comply with Subclause 9.4 of SPE-MM-7007 and its amendments."

7. FABRICATION (CLAUSE 7)

Replace the clause contents with the following:

"Fabrication and welding shall comply with Clause 7 of SPE-MM-4009 and its amendments."

8. FASTENERS (CLAUSE 8)

Replace the last sentence of this clause with the following:

"Fasteners shall comply with Clause 4.3.6 of specification SPE-MP-7001."

9. CASTINGS (CLAUSE 9)

Replace the last sentence of this clause with the following:

"Castings shall comply with the relevant South African or international standard for the material used, including the following:

Grey Cast Iron	SANS 1034; BS 1452
S. G. Iron	SANS 936/7; BS 2789
Steel (General Purpose)	SANS 1465; BS 3100
Aluminium	SANS 989/992; BS 1490
Stainless Steel	DIN 17 445
Copper and Copper Alloy	SANS 200; BS 1400

Castings shall be clean and sound and shall be neatly fettled and dressed. Surfaces shall be smooth and irregularities caused by mould washaways, and the presence of porosity, inclusions and sharp edges will not be tolerated. Areas under bolt heads, nuts and washers, shall be machined or spot faced to ensure a flat and smooth pressure bearing area, and sufficient space shall be provided for the use of ring or socket spanners.

All pressure retaining castings shall be hydrostatically tested to not less than 1,5 times the maximum working pressure after machining and shall be pressure tight.

No repairs shall be undertaken to castings without the written permission of the Engineer. Cast iron castings shall not be welded.

Castings shall be heat treated to provide optimum corrosion resistance and toughness combined with reasonable machinability. In particular stainless steel castings shall be heat treated so as to ensure that all carbides are in solution, to ensure optimum grain size, and to provide maximum corrosion resistance.

The Contractor shall provide a test certificate for each casting or batch of castings, except for those made of grey cast iron, giving details of the material analysis, the heat treatment and any mechanical tests carried out."

10. CORROSION PROTECTION (CLAUSE 10)

No amendments

11. INSTALLATION (CLAUSE 11)

Replace the first sentence of this clause with the following:

"The couplings shall be installed as shown on the drawings. The Works shall comply with the following:

- a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.
- b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.
- c) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.
- d) A small amount of a nickel based, anti-seize compound shall be applied along the full length of fastener threads before the nut is applied.
- e) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant."

12. INSPECTIONS (CLAUSE 12)

No amendments

13. TESTING REQUIREMENTS (CLAUSE 13)

No amendments

Add the following new Clause:

14. DOCUMENTATION TO BE PROVIDED (NEW CLAUSE 15)

The Contractor shall complete and submit the applicable technical datasheets and manufacturer drawings to the Employer's Agent for approval. A separate datasheet must be submitted for each combination of nominal diameter and pressure class to be used in the project.

General specification

Pipework Anchors

Specification number: SPE-MP-7024

Document control					
Specification no.		SPE-MP-7024			
Rev	Date	Revision details / status	Author	Reviewer	Approver
0	2022/03/03	First Issue	Denis Peart	Laura Ingle	Laura Ingle
Signature					

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1 Introduction

SPE-MP-7024 specifies the requirements for anchors for pipework to be provided by the Contractor.

2 Scope of Works

See project specification.

3 Normative References

Where this specification is required for a project, the following documents shall, inter alia, form part of the Contract Document:

- (a) Amendments, Additions and Detailed Requirements (SPE-MP-7024).
- (b) SPE-MM-0001: General Mechanical Requirements.
- (c) SPE-JJ-0003: General Corrosion Protection.

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

4 Performance Requirements

Pipe anchors shall resist the forces from pressure and from inertial flow changes. The pipe anchors shall restrain and anchor the pipework, valves and other heavy fittings and shall withstand loads and thrust forces and prevent them from being transferred to pump flanges and other equipment which might be damaged or have shortened lifespans.

Pipework shall accommodate settlement, expansion and contraction.

Pipework shall be structurally capable of withstanding the vibration to which it is subjected without fatigue fracture. Vibration shall be restricted to the source and shall not be transferred via pipework.

Pipe supports shall not restrict dismantling of equipment.

5 Design & Construction

5.1 General

In order to achieve the specified performance requirements, the Contractor shall analyse the forces at isolation valves, check valves, bends, reducers and any other cause which are present during normal operation, during dormant conditions, during testing, during start up and during shut down of each pump individually and during operation of the pump station as a whole. The steel pipe anchors shall be designed to transfer all such forces to the concrete structure.

Pipe anchors shall be provided so that pipework does not place any external loading on items of rotating mechanical equipment such as pumps, compressors, etc.

Provision shall be made for settlement as well as for expansion and contraction due to variations in temperature or pressure.

Pipe anchors shall be designed and located so that when an item of mechanical equipment, such as a pump or blower, is removed, the associated pipework and equipment is still adequately anchored.

Pipe anchors shall be provided at or close to all heavy items such as valves of size DN 200 and larger.

Pipe anchors which only anchor the weight of horizontal pipework may be of the sliding type and shall be vertically adjustable.

Pipework anchors, other than cast-in puddle pipes, shall be of carbon steel or of stainless steel.

Pipe anchors which resist thrust forces shall incorporate doubler plates welded on the pipe and shall be as short as feasible. The doubler plates shall be of the same or greater thickness than the pipe wall thickness and shall be contoured to match the pipe. Other reinforcing designs will also be acceptable.

Low carbon steel pipe anchors shall be fabricated from heavy duty hot rolled steel sections. The complete assembly shall be hot-dip galvanised after all fabrication is completed. Welds shall be continuous “all round”; i.e. no crevices.

Stainless steel pipe anchors shall be fabricated of plate with a minimum thickness of 4,5 mm or shall be fully triangulated, boxed or closed sections. Welds shall be continuous “all round”; i.e. no crevices.

Where appropriate, 3 mm thick neoprene strips shall be placed between pipes and pipe anchors or clamps to protect the paintwork and to limit corrosion.

Where roller or sliding anchors are used to accommodate movement, suitable wear blocks shall be fixed to the pipe to prevent damage to the pipe structure from sliding and corrosion.

5.2 Pipe Anchors for Steel Pipework

The maximum allowable spacing between pipe anchors for steel (including stainless steel) pipe of diameter, d [mm], shall be calculated as follows:

$$\text{Spacing (mm)} = 1\,500 + 6d.$$

This applies to pipe only. Valves and other heavy items shall be anchored separately.

5.3 Pipe Anchors for Plastic Pipework

The maximum allowable spacing between pipe anchors for plastic pipe of diameter, d [mm], shall be calculated as follows:

$$\text{Spacing (mm)} = (1\,500 + 6d) / 2.$$

This applies to pipe only. Valves and other heavy items shall be anchored separately.

5.4 Fastening

At least four anchor fasteners shall be provided for the foot of each pipe anchor.

Cantilevered pipe anchors are not preferred. Their spacing between anchor fasteners on the foot shall be not less than one quarter of the cantilevered length. Gussets between the column and the foot are normally required and these shall be positioned so as to minimise the distance between the gusset and the anchor fastener. The requirements in this paragraph do not apply to cantilevered pipe anchors which only provide vertical support.

Pipe anchors shall be aligned using nuts above the foot and stainless steel shims below the foot. Anchor fasteners shall be tensioned when their nuts are tightened; i.e. it is not acceptable to use a nut below the baseframe to position it; and the holding down force shall be loaded into the concrete structure.

Concrete surfaces under foot plates shall be scabbled before the pipe anchor is placed and shall be blown clean using compressed air immediately before grouting. A space of at least 20 mm shall be left and this space shall be filled using non-shrink grout once alignment has been completed. Grouting shall be done in accordance with the manufacturer's instructions. Alternative designs and installations may be submitted by the Contractor.

5.5 Concrete Anchors

Concrete pipe anchors shall be designed for purpose.

6 Fabrication

Fabrication and welding shall comply with SPE-MM-0001.

Pipe anchors will be inspected by the Engineer after fabrication is complete.

7 Fasteners

Anchor fasteners shall be of EN Grade 1.4401 (316) stainless steel.

Nuts for anchor fasteners shall be provided with both a spring washer and a flat or fender washer.

Fasteners shall comply with SPE-MM-0001.

8 Corrosion Protection

Corrosion Protection shall comply with SPE-JJ-0003.

Stainless steel shall be correctly pickled and passivated. All stainless steel surfaces shall be completely clear of ferrous stain upon commissioning.

Carbon steel shall be hot dip galvanised after all fabrication has been completed.

9 Installation

Installation work shall comply with SPE-MM-0001.

10 Inspections

The Contractor shall make arrangements for the Engineer to inspect the pipe anchors for compliance prior to payment being made.

11 Documents to be Provided

Proposed designs of pipe anchors, preferably indicated on the General Arrangement design drawings, shall be submitted to the Engineer for review prior to manufacture.

The calculations for pipe anchors designed to withstand the thrust from reducers, bends and check valves shall be included.

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1. INTRODUCTION (CLAUSE 1)

No Amendments

2. SCOPE (CLAUSE 2)

Add the following:

"This Specification covers the supply and delivery of pipe supports required in the civil works for this Contract, as well as pipe supports required in the mechanical works where this specification is specifically referenced."

3. NORMATIVE REFERENCES (CLAUSE 3)

Delete reference to SPE-MM-0001 from the list.

4. PERFORMANCE REQUIREMENTS (CLAUSE 4)

No amendments

5. EQUIPMENT CONSTRUCTION AND DESIGN (CLAUSE 5)

5.1 GENERAL (SUBCLAUSE 5.1)

In the first sentence, replace the words "pump station as a whole" with "system".

Add to the end of the clause:

"Pipe anchors shall be manufactured from the same material as the pipe/pipe special that it supports unless otherwise approved by the Employers Agent.

Materials shall comply with Subclause 9.4 of SPE-MM-7007 and its amendments."

6. FABRICATION (CLAUSE 6)

Replace the clause contents with the following:

"Fabrication and welding shall comply with Clause 7 of SPE-MM-4009 and its amendments."

7. FASTENERS (CLAUSE 7)

Replace the last sentence of this clause with the following:

"Fasteners shall comply with Clause 4.3.6 of specification SPE-MP-7001."

8. CORROSION PROTECTION (CLAUSE 8)

No amendments

9. INSTALLATION (CLAUSE 9)

Replace the clause contents with the following:

"The Works shall comply with the following:

Pipework Anchors

- a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.
- b) The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.
- c) The Contractor is responsible for grouting work associated with the equipment and pipework to be provided in terms of the Contract.
- d) Corrosion protection requirements shall be carefully attended to and the requirements of SPE-JJ-0003 must be noted. All mating faces must be coated before and sealed after assembly.
- e) A small amount of a nickel based, anti-seize compound shall be applied along the full length of fastener threads before the nut is applied.
- f) Crevices which are formed between two metal surfaces shall, prior to final fastening, be filled with a suitable packing, Denso tape or equivalent, or with a suitable mastic or sealant."

10. INSPECTIONS (CLAUSE 10)

No amendments



11. DOCUMENTS TO BE PROVIDED (CLAUSE 11)

No amendments

General specification

Wiring and Outlets

Specification number: SPE-EE-0013

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1 Scope

1.1 Application

This document specifies the standard requirements for the design, installation, testing and commissioning of electrical installations operating on voltages up to 1 000 Volts AC / 1 500 Volts DC.

The primary intention of this specification is to ensure the provision of an electrical installation, which has been designed and constructed to ensure safe, reliable, operation and to facilitate safe inspection, testing and maintenance.

Note however that this specification only covers such installations (or sections of installations) that are covered by SANS 10142-1. Note also that certain provisions of this specification are inappropriate for direct application to installations where additional measures (such as earthing, intrinsic safe equipment, etc.) are required by SANS 10142-1 and SANS 10108 (i.e. medical and hazardous locations). For these types of installations, thorough reference must be made to the relevant statutory documentation.

1.2 Electrical System Characteristics

The design of the installation shall comply with SANS 10142-1.

The design of the installation shall consider the following supply characteristics:

- (a) Voltage, frequency and number of phases
- (b) Maximum prospective short circuit current (phase to phase and phase to neutral)
- (c) Type of system, e.g. TN-S, TN-C-S
- (d) Maximum earth loop impedance of the earth fault path external to the installation
- (e) Type and rating of the cut-out or switch device
- (f) Load capability of the supply source, particularly the effects on the supply voltage of the starting of new equipment and any fault contributions from new equipment

The installation protective devices shall be correctly co-ordinated within the installation and with respect to existing installations. Discrimination studies shall be performed to validate the co-ordination of the installation.

All equipment which requires operation or attendance by a person, or requires cleaning or maintenance in service, shall be constructed and installed to allow adequate and safe means of access and working space for such activities. Similarly, the positioning of equipment shall not impede access to, or working space at, non-electrical equipment and services for operation and maintenance activities.

The installation shall be suitable for access and use by electrically unskilled persons.

Where additions or alterations to an existing installation are to be performed, the rating and condition of existing equipment, including that associated with the supply, shall be verified to confirm its suitability to carry any additional load. The earthing and equipotential bonding arrangements shall also be verified. No addition or alteration shall have an adverse effect on the existing installation.

2 Standards

2.1 Associated Documentation

This Specification identifies the Employer's standard modifications and requirements which shall be applied to the statutory and recognised standards. The detailed specification of the project or site-specific requirements will be found in the Particular Specification and its accompanying Technical Data Sheets, which shall be read in conjunction with this Specification.

Any items not specifically detailed in this Specification, which are necessary to provide a safe and fully operational working system, shall be deemed to be included.

The Contractor shall operate an auditable quality assurance procedure covering the design, construction, inspection and testing of the Installation.

2.2 Regulations, Specifications and Standards

The design, construction, inspection and testing of the installation shall comply with all relevant Statutory Regulations and Directives including:

- (a) Occupational Health and Safety Act (Act 85 of 1993)
- (b) Construction Regulations 2003 issued in terms of Section 43 of the Act
- (c) Local Fire Regulations; and
- (d) Regulations and by-laws of the Local Supply Authority

and the latest editions (current at the time of Tender) of all relevant South African National Standards, as well as International Standards, including but not limited to:

Table 1: Reference Standards

Standard Number	Description
SANS 32	Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic plants
SANS 97	Electric cables – Impregnated paper insulated metal-sheathed cables for rated voltages 3,3/3,3kV to 19/22kV (excluding pressure assisted cables)
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
SANS 156	Moulded-case circuit-breakers
SANS 164	Two-pole and earthing-pin plugs and socket outlets
SANS 475	Luminaires for interior lighting, streetlighting and floodlighting - Performance requirements
SANS 767	Earth leakage protection unit
SANS 950	Unplasticized polyvinyl chloride rigid conduit and fittings for use in electrical installations
SANS 1063	Earth rods, couplers and connections
SANS 1085	Wall outlet boxes for the enclosure of electrical accessories
SANS 1088	Luminaire entries and spigots
SANS 1091	National colour standards of Paint
SANS 1195	Busbars
SANS 1213	Mechanical cable glands
SANS 1239	Plugs, socket-outlets and couplers for industrial purposes

Standard Number	Description
SANS 1266	Ballasts for discharge lamps (excluding tubular fluorescent lamps)
SANS 1411	Materials of insulated electric cables and flexible cords
SANS 1431	Weldable structural steels
SANS 1507	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V)
SANS 1700	Fasteners
SANS 1777	Photoelectric control units for lighting
SANS 1783	Sawn softwood timber
SANS 1973	Low-voltage switchgear and controlgear Assemblies
SANS 2001	Construction Works
SANS 10155	Accuracy in buildings
SANS 10199	The design and installation of earth electrodes
SANS 10225	The design and construction of lighting masts
SANS 10177	Fire testing of materials, components and elements used in buildings Part 2: Fire resistance test for building elements
SANS 10142-1	Wiring of Premises Part 1: Low Voltage Installations
SANS 10400	The application of the National Building Regulations
SANS 60269	Low-voltage fuses
SANS 60309	Plugs, socket-outlets and couplers for industrial purposes
SANS 60529	Degrees of protection provided by enclosures (IP Code)
SANS 60614-2	Conduits for electrical installations - Particular specification for conduits
SANS 60669	Switches for household and similar fixed-electrical installations
SANS 60947	Low-voltage switchgear and controlgear
SANS 61000	Electromagnetic compatibility (EMC)
SANS 61010	Safety requirements for electrical equipment for measurement, control, and laboratory use
SANS 61048	Auxiliaries for lamps - Capacitors for use in tubular fluorescent and other discharge lamp circuits - General and safety requirements
SANS 61238	Compression and mechanical connectors for power cables for rated voltages up to 30 kV(U _m = 36 kV)
SANS 61643	Low-voltage surge protective devices
Other Standards	Description
ARP 035	Guidelines for the installation and maintenance of street lighting
BS 88	Specification of supplementary requirements for fuses of compact dimensions for use in 240 / 415 V industrial and commercial electric installations
IEC 157	Low voltage switchgear and control gear
IEC 408	Low voltage air-break switches, air-break disconnectors, air-break switch disconnectors and fuse combination units
IEC 12373	Aluminium and aluminium alloys. Anodizing. Method for specifying decorative and protective anodic oxidation coatings on aluminium
IEC 50086	Conduit systems for cable management
IEC 60898	Specification for circuit-breakers for overcurrent protection for household and similar installations

Standards are often tailored to the conditions of their country or origin (in terms of permissible voltages, expected ambient temperatures, etc.). Therefore, and unless normatively referenced to the contrary in a Standard of higher precedence, the decreasing order of precedence of Standards shall be:

- (a) South African National Standards (SANS, VC, etc.)
- (b) South African Sectoral Standards and Specifications (NERSA, CKS, ARP, NRS, PIESA, etc.)
- (c) ISO Standards
- (d) IEC Standards
- (e) Harmonized British Standards (BS EN)
- (f) Other Harmonized European National (EN) Standards (CEN, CENELEC, ETSI)
- (g) Non-Harmonized British Standards (BS)
- (h) Other international standards

Where Standards of the same order are not in agreement with each other, the Standard with the most rigorous requirements shall apply.

The installation shall also comply with:

- (a) This Specification, including all Technical Data Sheets; and
- (b) Any documentation issued by, or on behalf of, the Employer in respect of the Installation.

3 Components and Equipment

3.1 General

All equipment and components shall be suitable for their operating environment, particularly with respect to the following:

- (a) The degree of ingress protection against dust and moisture (IP rating)
- (b) The corrosion resistance of the materials of construction; and
- (c) Mechanical properties (especially impact strength)

3.2 Power Outlets

3.2.1 Commercial Socket Outlets

All socket outlets with switches shall fully comply with SANS 164 and SANS 60669-1.

Units for flush mounting shall be suitable for a 100 x 100 x 50 mm deep flush wall box. Surface mounted patterns shall be housed in heavy pressed steel boxes. Shutters shall be included on the live and neutral socket holes.

All socket outlets with switches shall be continuously rated at 16A and shall be suitable for operation on a 250V, 50 Hz, AC system.

Cover plates shall have bevelled edges which overlap the box.

Socket outlets and their cover plates must adhere to the following colour and earth pin convention:

- (a) White, with round earth pin, where outlets are protected by an earth leakage sensing device;

- (b) Red, with shaved earth pin, where outlets are not protected by earth leakage sensing device (which outlets shall be referred to as "dedicated").

3.2.2 Industrial Socket Outlets

- (a) Plugs, couplers and socket outlets shall conform to the requirements of SANS 1239.
- (a) Where pilot connections are required, they shall disconnect before the main phase connectors disconnect.
- (b) 3-Phase Socket Outlets
 - (i) 400V socket outlets shall be five poled (three phases, one neutral and one earth), incorporating isolation mechanically interlocked with the plug.
 - (ii) The equipment enclosures shall be at least IP 55 to SANS 60529.
 - (iii) All welding plugs and socket outlets shall be 5 poled (3-phase, plus neutral, plus earth).
- (c) Single Phase Outlets
 - (i) 16 A, 250 V socket outlets shall be two pole and earth, incorporating isolation mechanically interlocked with the plug.

3.2.3 Local Isolators (Switch-disconnectors)

Local isolators shall be selected from the following:

- (a) Isolator in accordance with SANS 60947-3, complete with additional late-make, early-break auxiliary contacts as required
- (b) Plug and socket assembly to SANS 60309-1 and SANS 60309-2, incorporating isolation mechanically interlocked with the plug; or
- (c) Plug and socket assembly to SANS 60309-1 incorporating a de-contactors arrangement or additional late-make early-break auxiliary contacts.

4 Installation of Components and Equipment

4.1 General

Final positions of equipment shall be agreed with the Engineer on site, prior to installation.

All equipment shall be securely mounted using propriety (i.e. suited to and manufactured for such use) fixtures and fittings.

The method of equipment installation shall not adversely affect the function or structural integrity of the structure to which the equipment is attached.

Equipment terminals and covers shall be readily and safely accessible after installation.

The method of equipment installation shall not adversely affect the IP rating of the equipment.

No horizontal chasing shall be allowed into brick or concrete work.

It is the Contractor's responsibility to work closely together with the relevant parties responsible for the civil construction work to establish coordination in the installation program of components and conduits, as well as to establish a neat installation showing no indication of 'last minute changes'. Modification to existing structures shall be approved by the Engineer.

4.1.1 Framework and Brackets

Site-fabricated framework and brackets shall not be used.

Framework and brackets shall be positioned so as not to adversely affect the removal and replacement of equipment.

Where it is necessary to modify on site any pre-fabricated galvanised mild steel framework, the cut edges shall be dressed and treated immediately with an approved cold-galvanising paint to prevent corrosion.

4.1.2 Fasteners

Fasteners securing equipment to framework and brackets shall be independent of those securing framework and brackets to walls and floors.

No electroplated fasteners will be allowed. Only hot dipped galvanised or stainless steel fasteners will be allowed.

4.1.3 Positioning of Equipment

Equipment shall be positioned with due regard to the aesthetics of the installation.

Equipment (e.g. outlets, switches, distribution boards, etc.) shall be installed plumb. If an imaginary line is drawn from the vertical side of any such component, the deviation of such imaginary line from the vertical shall not exceed ± 5 mm for every 1 m increase in height, with a maximum deviation from the vertical of ± 10 mm.

The permissible deviation from the mounting heights indicated for equipment covered by this document shall be ± 10 mm, with a maximum of ± 5 mm deviation from the horizontal between adjacent outlets, isolators, luminaires, assemblies and / or switches.

Where a group comprises a number of items at different mounting heights, with not more than one item at any one height, then all items shall be sited on a common vertical centre line.

Where a group comprises a number of items mounted at the same height, then all items shall be sited on a common horizontal centre line.

Where a group comprises a number of different sized items they shall be arranged with the largest item at one end of the group and a progressive reduction in size of the remaining items.

Where a group comprises a number of items at different mounting heights with more than one item at any height, then a common vertical centre line shall be established and the items arranged on, or symmetrically about, this centre line.

Where a group comprises a number of items at the same mounting height with more than one item at the same position, then a common horizontal centre line shall be established and the items arranged on, or symmetrically about, this centre line.

4.1.4 Mounting height of Components

Mounting heights shall be as follows unless otherwise specified:

Table 2: Mounting height of components

Distribution boards	Top frame 2000 mm above finished floor level, except where the board may be accessible to infants, where then the bottom frame shall be 1200 mm above finished floor level
Switches	All security controls and light switches shall be horizontally aligned with door handles and other fixtures and fittings (other than socket outlets) between 900 mm and 1,2 m above the finished floor level
Socket outlets	See b)
Telephone outlets	Underside 500 mm above finished floor level

All distribution boards, switches and socket outlets shall be of the flush mounted type.

4.2 Installation of Socket Outlets

4.2.1 General

The Contractor should only start installation of power outlets in the conduit outlets after plasterers and painters have completed their work in the vicinity of the outlet.

Socket outlets shall be installed at the following heights above finished floor level, measured to the underside of the outlet:

- (a) 500 mm above finished floor level for general applications
- (b) 500 mm above fixed ground level where they are to be installed outside buildings
- (c) 1200 mm above finished floor level in kitchens
- (d) 300 mm above counter tops

4.2.2 Connections to geysers

Each geyser shall be connected to a separate circuit with a separate earth conductor.

The conduit from the distribution board shall terminate in a 100 x 100 x 50 mm outlet box within 1 metre of the geyser. A suitably rated double pole isolator shall be installed in the outlet box. A flexible length of conduit shall be installed between the isolator and the geyser.

4.2.3 Connections to heaters, fans, air conditioners and hand blowers

A suitably rated double pole isolator shall be supplied and installed within 1 metre of heaters, fans and air conditioners. Where the equipment is out of reach the isolator, which must then be of the type capable of being locked in the open position, shall be installed 1,5 m above floor level, and a sign indicating location of the isolator shall be fixed onto or next to the equipment that it switches. Flexible cords may be used for the final connection to the equipment, provided the cables are correctly current rated.

Where control units (for HVAC, BMS, etc.) are to be installed, the units shall be installed 1,5 m above the finished floor level.

4.3 Installation of Telecommunication Services and Accessories

4.3.1 Telephone distribution boards

Telephone distribution boards are to be installed with their bottom frames 1 200 mm above finished floor level.

All conduits and sleeves to telephone outlets or telephone sub-distribution boards in the buildings or elsewhere on the site, as well as the main incoming sleeves, shall terminate at the main telephone distribution board, as shown on the relevant drawing.

4.3.2 Separation of services

Wireways provided for telecommunication or other related services shall under no circumstances be used for any other purpose.

Power cables, conductors and accessories shall be installed at a minimum distance of 300 mm away from the routes reserved for telecommunication cables.

Conduits and other channels shall be installed in such a way as to avoid telecommunication cables from crossing power cables.

4.4 Telecommunication outlets

Telephone and / or data outlets in walls shall comprise of 100 x 100 x 50 mm deep wall boxes which shall be flush mounted in the wall, in the position shown on the relevant drawing, with the underside fixed 500 mm above the finished floor level. The wall box shall be fitted with a white coloured blank cover plate.

All outlet boxes shall align neatly with adjacent socket outlet wall boxes.

Outlets in floors fitted with floor ducting shall be of the same type as the floor outlets for power socket outlets, and shall be provided in the same outlet box.

Outlets in power skirting shall be provided at the positions indicated on the relevant drawing, and the Contractor need only provide a separate short length power skirting cover at these positions. The cover for the fixing of outlet shall not exceed 250 mm in length, and shall be secured in such a manner that adjacent cover plate sections can be removed without disturbing the telephone outlet.

5 Wireways

5.1 Conduit

5.1.1 Plain-end metallic conduit and accessories

Plain-end conduit shall be manufactured from mild steel having a minimum wall thickness of 0,9 mm and shall comply with SANS 60614.

Galvanised conduits shall be hot-dipped on both the internal and external surfaces, in accordance with SANS 121.

Epoxy powder-coated metal conduit may not be used in installations where bending of conduit will be required (unless prior approval of use has been granted by the Engineer).

Bending and setting of plain-end conduit shall be undertaken using the correct bending apparatus as recommended by the manufacturer of the conduit. After the bending of galvanized conduit, cold galvanizing paint shall be applied.

5.1.2 PVC conduit and accessories

PVC conduit shall comply with SANS 950 and shall bear the SABS mark.

PVC conduit shall be constructed from rigid PVC. PVC conduit shall be white in colour and shall be non-flammable. The minimum softening temperature shall be 75 °C.

All PVC conduit accessories shall be fully in accordance with SANS 950 and shall bear the SABS mark.

5.1.3 Flexible conduit

Flexible steel conduit and adaptors shall comply with IEC 50086 where applicable.

Flexible steel conduit shall be of a galvanised steel construction. It does not need to be waterproof, but shall be vermin proof and suitable for protection of cables against mechanical damage.

In moist or damp areas, flexible steel conduit shall be of the plastic sheathed galvanised steel type.

Flexible polypropylene tubing shall only be fastened to PVC conduit installations.

5.1.4 Conduit Accessories

5.1.4.1 Earth clamps

Earth clamps shall comprise of copper strips having a minimum thickness of 1 mm and shall not be less than 12 mm wide. Earth clamps shall be provided complete with a 25 mm x 4 mm brass bolt, washer and nut and shall be constructed such that the clip can be firmly attached to the conduit without the need for any additional packing.

5.1.4.2 Flush mounted wall boxes

Flush mounted PVC wall boxes shall be manufactured from rigid PVC and shall be white in colour. All PVC wall boxes shall comply with SANS 950.

Flush mounted steel wall boxes shall be manufactured from heavy gauge sheet steel and shall be galvanised. All steel wall boxes shall comply with SANS 1085.

The boxes shall be provided with the necessary mounting lugs to suite the units for which the box is intended and be provided with 20 mm knock-outs.

Facilities shall be provided for the fixing of earth terminals to the box.

5.1.4.3 Round group-type circular boxes

Steel round boxes shall be manufactured in accordance with SANS 1065 and shall be of the long spout pattern, constructed from either store enamelled jet black or galvanised steel, or from malleable cast iron.

PVC round boxes shall be manufactured in accordance with SANS 950 and of the same dimensions, but having web-reinforced spouts.

The two cover fixing holes of both steel and PVC boxes shall be diagonally opposite each other, and shall be drilled and tapped at 50 mm centres. Internal dimensions shall be approximately 60 mm in diameter by 60 mm deep for use in concrete work. Shallower boxes shall be used in open roof spaces.

The cover screw pillars shall be provided with tapped brass inserts and provision shall be made for a brass earthing terminal adjacent to one or both of the pillars.

PVC round box covers shall be of PVC and shall be secured by means of brass screws at 50 mm centres.

5.1.4.4 Draw wires

Draw wires for unused conduits shall either be galvanised steel wire or nylon, but shall have a minimum diameter of 2 mm.

5.1.5 Conduit Installation

5.1.5.1 General

The conduit installation shall comply with par. 6.5 of SANS 10142-1.

Where the conduit installation is surface mounted, space-bar saddles must be used in order to provide an air gap between the conduit and mounting surface.

The conduit system shall be mechanically continuous, secure and rewirable.

All unused, screwed entries shall be fitted with a blanking plug. Female PVC bushes shall be fitted to all free ends.

Conduits shall not be used to support the weight of fittings etc., except where specifically designed to do so. Conduit boxes supporting luminaires or accessory boxes shall be fixed to the fabric of the building independently of the conduit.

Sufficient conduit and drawing boxes shall be provided to facilitate cable installation and removal. In general, no more than 2 bends or off-sets or one coupling shall be permitted without a conduit box.

Steel conduit shall not be relied upon for earth continuity

All PVC conduits shall be installed in accordance with Appendix C, SANS 950.

Draw boxes should be as far as possible be placed out of sight and shall be indicated on the "as built" drawings.

The edge of flush mounted outlet boxes shall not be deeper than 10 mm from the final surface. Where necessary, spacer springs shall be used under screws.

Oversize cover plates shall be provided on all flush mounted round conduit boxes, where required. Surface mounted boxes shall be provided with standard size cover plates.

5.1.5.2 Flexible conduit

In installations where the equipment has to be moved frequently to enable adjustment during normal operation, for the connection of motors or any other vibrating equipment, for the connection of thermostats and sensors on equipment, for stove connection and where otherwise required, flexible conduit shall be used for the final connection to the equipment.

Flexible conduit shall be connected to the remainder of the installation by means of a draw box. The flexible conduit may be connected directly to the end of a conduit if an existing draw box is available within 2 m of the junction and if the flexible conduit can easily be rewired.

Flexible conduit shall consist of metal reinforced plastic conduit or PVC covered metal conduit with an internal diameter of at least 15 mm, unless approved to the contrary. In false ceiling voids, flexible conduit of galvanised steel construction may be used. Connectors for coupling to the flexible conduit shall be of the gland or screw-in type, manufactured from either brass or mild steel plated with zinc or cadmium.

5.1.5.3 Installation in concrete

In order not to delay building operations, the electrical Contractor shall ensure that all conduits and accessories which are to be cast in concrete are placed in position in good time. The Contractor or his representative shall be in attendance when the concrete is cast.

Draw boxes, expansion joints and round ceiling boxes shall be installed where required and shall be neatly finished to match the finished slab and wall surfaces. Ceiling draw boxes shall be of the deep recessed type. In columns where flush mounted draw boxes are installed, the conduits shall be offset from the surface of the column immediately after leaving the draw box.

Sharp bends and elbows for conduits of 32 mm diameter will not be allowed in concrete slabs.

Draw boxes and/or inspection boxes shall, where possible, be grouped together under a common approved cover plate. The cover plate shall be secured by means of brass screws.

All conduits shall be installed as close as possible to the neutral axis of concrete beams, slabs and columns. The conduits shall be rigidly secured to the reinforcing to prevent movement towards the surface of the concrete.

All conduits, draw boxes, etc., shall be securely fixed to the shuttering to prevent displacement when concrete is cast. Draw boxes and outlet boxes shall preferably be secured by means of a bolt and nut installed from the back of the box through the shuttering. Fixing lugs may also be used to screw the boxes to the shuttering where off-shutter finishes are required. Where fibre glass shuttering is used by the builder, the equipment shall be fixed to the steel only and no holes shall be drilled or made in shuttering. All draw boxes and outlet boxes shall be plugged with wet paper before they are secured to the shuttering.

As far as possible, conduits shall not be installed across expansion joints. Where this is unavoidable a conduit expansion joint shall be provided. The expansion joint shall consist of two draw boxes with an interlinking flexible conduit connection. The draw box shall be installed adjacent to the expansion joint of the structure and a conduit sleeve, one size larger than that specified for the circuit, shall be provided on the side of the draw box nearest to the joint. The one end of the sleeve shall terminate at the edge of the joint and the other shall be secured to the draw box. The circuit conduit passing through the sleeve shall be terminated 40 mm inside the draw box, and, in the case of metallic conduit, the conduit end shall be fitted with a brass bush. The gap between the sleeve and the conduit at the joint shall be sealed with TiC-TaC (Titanium Carbide / Tantalum Carbide) or equal sealing compound, to prevent the ingress of wet cement. The other end of the circuit conduit shall be secured to the draw box by means of a standard bushed adaptor for other PVC types. The cover plates shall be installed before the ceiling is painted. Where a number of conduits are installed in parallel they shall cross the expansion joint of the structure via a single draw box. A number of draw boxes adjacent to each other will not be allowed.

The installation of conduits in floor screed shall be kept to a minimum. Where conduits are installed in screed, the top of the conduit shall be at least 20 mm below the surface of the screed. Where the screed is laid directly on the ground, galvanised conduits shall be used. A minimum distance of twice the outside diameter of the conduit shall be left free between adjoining conduits. Conduits shall be

secured to the concrete slab at intervals not exceeding 2,0 m. The Contractor shall ensure that conduits are not visible above the screed where the conduits leave the screed.

All draw boxes, conduits, etc., which are installed in concrete shall be cleaned with compressed air and provided with draw wires two days after removal of the shuttering. Errors that occurred during the installation of the conduits, or any lost draw boxes or blocked conduits shall be reported to the Engineer immediately.

Where it is necessary to cut or drill holes in the concrete structure, prior permission shall be obtained from the Engineer in writing.

5.1.5.4 Installation in brickwork

Recessed conduits and accessories installed in brickwork shall be built-in. In order not to delay building operations the Contractor shall ensure that all conduits and accessories which are to be built-in are placed in position in good time.

Any conduit draw boxes, outlet boxes, etc., which have been damaged, lost or omitted, shall immediately be reported to the Engineer.

5.1.5.5 Surface and roof space installations

All conduits shall be installed horizontally or vertically as determined by the route. The electrical Contractor shall take all measures to ensure a neat installation.

Conduits shall be firmly secured by means of saddles and screws and in accordance with SANS 10142, par. 5.4.2(b). Conduits shall be secured within 150 mm before and after each 90° bend.

Only approved plugging materials, such as fibre plugs or plastic plugs, etc., and round head screws shall be used when fixing saddles, switches, plugs etc., to walls. Wood plugs are not acceptable, nor should plugs be installed in joints in brick walls.

5.1.5.6 Chasing and builder's work

Except where the project involves upgrading existing facilities, all flush mounted conduits, accessories, switchboard trays, bonding trays etc., shall be built-in and no chasing shall be allowed.

5.1.6 Installation of Cables in Conduit

The cable installation in the conduit shall conform to par 6.5.6 of SANS 10142-1 and other portions of SANS, where applicable.

Conduit shall be deburred and swabbed prior to cables being pulled in.

Cables of other classifications and purpose (e.g. DC, Fire Detection, Audio, etc.) shall be installed in separate conduits.

Circuits supplied from different distribution boards shall not be installed in the same conduit.

Final sub-circuits shall not be installed in the same conduit as sub-mains circuits.

5.2 Power Skirting

5.2.1 Construction

Power skirting must comply with all relevant parts of SANS 61084.

Except where room dimensions dictates shortening thereof, in which case only one length per wall may be trimmed, power skirting and covers shall be installed in their standard (manufactured) lengths.

The covers shall either snap on, or shall be fixed by means of toggle or swivel nuts.

Only socket outlets that are compatible for use with the particular type of power skirting may be used.

Propriety internal and external bends, and off-sets of the same manufacture and product range, shall be used.

Over and above the requirements of SANS 10142-1, all conductive power skirting that will contain telecommunication and / or control wiring shall be bonded in accordance with NRS 083-2 (details bonding methods that provide enhanced protection against the effects of electromagnetic cross-interference).

5.2.2 Installation

Conduits for the circuit wiring to the power skirting must terminate in flush conduit boxes behind the power skirting at the respective heights of the compartments for the telephone, power and other service compartments.

Notwithstanding the requirement to provide adequate capacity for the installation of data and telecommunication cables, conduits installed to power skirting installations shall have a minimum of 50 % spare capacity, to allow for future expansion

The wiring shall pass through large diameter holes, suitably bushed, cut in the rear of the power skirting. Where metallic skirting is installed, the holes shall be provided with rubber grommets.

Where power skirting is interrupted by doorways, bridging conduits shall be installed for each of the service compartments.

To allow for the easy removal of plugs from outlets, in multi compartment installations the bottom compartment(s) shall be for telecommunication services and the top compartment(s) for power circuits.

5.3 PVC Cable Trunking

5.3.1 Construction

Cable trunking must comply with relevant parts of SANS 61084.

Cable trunking and covers shall be installed in their standard (manufactured) lengths, except at the end of runs as dictated by room dimensions.

The covers shall either snap on, or shall be fixed by means of toggle or swivel nuts.

Propriety internal and external bends, and off-sets of the same manufacture and product range, shall be used.

5.3.2 Installation

All wiring exiting cable trunking shall pass through large diameter holes, suitably bushed, cut in the rear of the trunking.

5.4 Wiring inside wireways

5.4.1 General

All unarmoured conductors shall be installed in conduits, trunking or power skirting, and such conductors shall not be exposed to possible mechanical damage.

Any debris and moisture inside of wireways shall be removed prior to the installation of conductors.

In the event that lubrication of cables is required in order to facilitate their installation, the lubricant shall be suitable for use with the type of cable as well as the type of wireway. The Contractor shall take steps to ensure that only the minimum amount of lubrication is applied. Should any seepage of lubricants into building elements or fixtures occur, it shall be the responsibility of the Contractor to remove the oil and fix the damaged building elements or fixtures, regardless of whether he installed the wireways or not.

5.4.2 Circuits

The circuits for the installation are indicated on the relevant drawings. Where not indicated on the drawings, the maximum number of points to be connected to each type of circuit shall be:

Table 3: Circuits

Light points per circuit	=	8
Single socket outlets per circuit	=	4
Extraction fan, Air conditioner points per circuit	=	2
Stove points per circuit	=	1

When determining the number of outlets per circuit, double socket outlets count as two single socket outlets.

In kitchens, the number of socket outlets per circuit shall be reduced to 2.

Where maintained emergency lighting are to be installed two live wires shall be installed to the luminaire:

- (a) The normal, switchable, circuit
- (b) An unswitched circuit, for battery charging only

For 20 mm or small diameter conduit only one circuit will be allowed, with the exception of the wiring from switch boards to fabricated sheet metal boxes located close to switchboards, in which case more than one circuit will be allowed. For larger conduit sizes the requirements of SANS 10142, par. 6.5.6, shall be met.

5.4.3 Looping and joints

A loop-in wiring system, where conductors are looped from outlet to outlet, shall be employed. Joints in conductors shall be avoided as far as possible, but where it becomes unavoidable, joints will be accepted in conduits. Joints shall be soldered or shall alternatively consist of approved ferruling, properly covered with propriety heat-shrink sleeves. The use of PVC insulation tape is not acceptable.

5.4.4 Grouping of conductors

In cases where the conductors of more than one circuit are installed in the same wireway, the conductors of each separate circuit, including the circuit earth continuity conductor, shall be grouped at intervals of at least one metre using plastic cable ties. The conductors of different circuits shall however remain separate in order to ensure that any given circuit may be withdrawn from the wireway. Conductors entering distribution boards or control boards shall be grouped and bound by means of plastic cable bands. The use of PVC insulation tape for grouping conductors will not be accepted.

5.4.5 Pulling-through of conductors

The Contractor shall take utmost care whilst pulling conductors through conduit to ensure that the conductors are not kinked, twisted or strained in any manner. Care shall furthermore be taken to ensure that conductors do not come into contact with materials or surfaces that may damage or otherwise adversely affect the insulation and durability of the conductor.

5.4.6 Earth continuity conductors

Only stranded copper conductors, which shall be bare or PVC insulated (coloured green/yellow), shall be used as earth continuity conductors. Although it shall be terminated such that it can fulfil this function (except where inappropriate, as will be the case of single core cable installations), under no circumstances shall the armouring and/or shielding of cables be relied upon to provide protective earth continuity.

When earth continuity conductors are looped between the earth terminals of equipment, the looped conductor ends shall be twisted together and then ferruled or soldered to ensure that continuity is maintained when the conductors are removed from any earth terminal.

Where bare copper earth wires are specified for circuits installed in power skirting and floor ducting, the Contractor shall provide a suitable length of PVC sleeving over the bare earth conductor where it passes behind or is connected to power outlets, to ensure that such an earth conductor does not come into contact with any live parts.

5.4.7 Wiring inside vertical wireways

Conductors installed in vertical wireways shall be secured at intervals not exceeding 5 m to support the weight of the conductors. Approved clamps shall be supplied and installed in suitable draw-boxes for this purpose.

5.4.8 Conductor sizes

The following minimum conductor sizes shall be used:

Table 4: Conductor sizes

Circuit	Minimum Conductor (Size)	
	Phase (mm ²)	Earth (mm ²)
Lighting	2,5	2,5
Socket outlet	2,5	2,5
Stove	6	6
Bell	1,5	1,5
Clock	1,5	1,5
Air conditioner	4	2,5
Control Wiring	1.5	1.5

5.4.9 Single pole switches

Single pole switches shall only be connected to the phase conductor (never the neutral conductor).

5.4.10 Three phase outlets

With the exception of three phase outlets, wiring to circuits connected to different phases shall not normally be present at lighting, switch or socket outlet boxes. Where this is unavoidable, barriers shall be provided between terminals or connections of the various phases and the box shall be suitably labelled internally to indicate the presence of line voltages.

A separate neutral conductor shall be installed together with each three phase circuit to outlets intended for equipment connection by means of isolators or socket outlets, irrespective of whether the particular equipment may require a neutral or not.

6 Drawings and Documentation

6.1 General

All drawings, information, and documentation shall be in English, and each item shall be identified with:

- (a) The Client's name and contact details
- (b) Client's project / scheme / contract reference title and numbers
- (c) The Engineer's name and contact details
- (d) Engineers reference numbers
- (e) Contractor's works / contract / order references.

Drawings for acceptance shall be provided on A4 or A3 paper copies as specified.

6.2 Drawings for Approval

The following documentation and drawings shall be submitted to the Engineer prior to the installation of cables and wireways and before civil construction have started on the areas where cable routes are required:

- (a) Cable route layout drawings showing
 - (i) Type of wireways
 - (ii) Trenching
 - (iii) Cable junction boxes

6.3 As-built Drawings

Detailed "as-built" drawings, clearly labelled as such, and consisting of 3 sets of drawings printed to their original size, and, where the original drawings were larger than A3, 3 sets of drawings printed (with reduced scaling, but without omitting any information from the printed area), to A3, shall be provided by the Contractor, indicating positions of the following:

- (a) Equipment (e.g. light fittings, draw boxes, outlets etc.)
- (b) Wireways (e.g. trenches, conduit, cables ladder/trays, power skirting etc.); and

- (c) Cable routes (including any cable joints)
- (d) General arrangement drawings
- (e) Single Line Diagrams

6.4 Operating and Maintenance Manual

Three Operation Manuals, three Maintenance Manuals and three Certification copies shall be provided for all equipment supplied. The manuals shall be in A4 format.

The operating and maintenance manuals shall include at least the following:

- (a) A schedule of installed components and equipment, containing the following information:
 - (i) Manufacturers name and contact details
 - (ii) Circuit number (DB name, circuit breaker e.g. DB01-CB08); and
 - (iii) Function (e.g. switching lighting circuit DB03-L1)
- (b) A schedule of all installed cables, with the following information:
 - (i) Circuit number (DB name, circuit breaker e.g. DB01-CB08)
 - (ii) Size
 - (iii) Installed length; and
 - (iv) Function (e.g. "Feeding Submersible pump IW-SP-01")
- (c) Description and details w.r.t:
 - (i) Detailed description of the function of all operator controls
 - (ii) Procedures for fault finding
 - (iii) Maintenance instructions for all components and including repair, overhaul, change-out and installation procedures
 - (iv) Inspection schedules; and
 - (v) Spare part information and recommended spares.

7 Testing and Commissioning

7.1 General

The installation shall be inspected and tested in accordance with SANS 10142-1.

Inspection and testing shall only be performed by personnel with approved, current qualifications. The Contractor shall provide qualified personnel for the supervision for all inspection and testing activities.

The Contractor shall provide all necessary safety equipment and test instruments. All test instruments shall comply with SANS 61010 and be covered by a current test and calibration certificate.

The Contractor's safe working arrangements shall comply with the safety management systems and procedures prevailing on site. Where there may be a risk of injury to personnel, the Contractor shall submit a risk assessment and method statement for approval, prior to starting work.

Unless otherwise specified in the Particular Specification, all inspection and test results shall be recorded using proforma documentation (test certificates and schedules) complying with SANS 10142-1.

The Contractor shall make provision for all inspection and testing activities to be witnessed. Unless otherwise specified in the Particular Specification, the period of notice for witness testing shall be 5 working days.

Where most of the inspection and testing activities are not witnessed, the Contractor shall allow for 10 % of the inspection and testing activities to be repeated for witness testing.

If there is a requirement for additional inspection and test activities to be performed as part of process commissioning, this shall be specified in the Particular Specification.

Unless otherwise agreed by the Employer, no part of the installation shall be commissioned until all defects or omissions revealed by inspection and testing have been rectified. Where a defect or omission renders all or part of the installation unsafe for use, the Contractor shall take approved precautions to ensure that no part of the installation can be commissioned.

7.2 Test Sequence

7.2.1 Inspections before Testing

Before testing, inspections shall be performed to verify:

- (a) All equipment and material is of the correct type and complies with applicable SANS and IEC standards
- (b) All parts of the installation are correctly selected and erected
- (c) No part of the installation is visibly damaged or otherwise defective
- (d) The installation is suitable for the environmental conditions; and
- (e) The installation complies with this Specification

7.2.2 Testing of Installation



On satisfactory completion of the inspections specified in 7.2.1 the following tests shall be undertaken in the sequence listed as per SANS 10142-1:

- (a) Continuity of conductors
- (b) Resistance of Earthing conductor
- (c) Continuity of ring circuits Earth fault loop impedance at main switch
- (d) Elevated voltage on supply neutral Earth Resistance
- (e) Insulation resistance
- (f) Voltage, main distribution board - no load
- (g) Voltage, main distribution board - on load
- (h) Voltage at available load
- (i) Operation of earth leakage units
- (j) Earth leakage test button
- (k) Polarity at points of consumption
- (l) Switching devices

General specification

Lighting

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1 Scope

1.1 Application

This document specifies the standard requirements for the design, installation, testing and commissioning of electrical installations operating on voltages up to 1 000 Volts AC / 1 500 Volts DC.

The primary intention of this specification is to ensure the provision of an electrical installation, which has been designed and constructed to ensure safe, reliable, operation and to facilitate safe inspection, testing and maintenance.

Note however, that this specification only covers such installations (or sections of installations) that are covered by SANS 10142-1. Note also, that certain provisions of this specification are inappropriate for direct application to installations where additional measures (such as earthing, intrinsic safe equipment, etc.) are required by SANS 10142-1 and SANS 10108 (i.e. medical and hazardous locations). For these types of installations, thorough reference must be made to the relevant statutory documentation.

1.2 Electrical System Characteristics

The design of the installation shall comply with SANS 10142-1.

The design of the installation shall consider the following supply characteristics:

- (a) Voltage, frequency and number of phases
- (b) Maximum prospective short circuit current (phase to phase and phase to neutral)
- (c) Type of system, e.g. TN-S, TN-C-S
- (d) Maximum earth loop impedance of the earth fault path external to the installation
- (e) Type and rating of the cut-out or switch device
- (f) Load capability of the supply source, particularly the effects on the supply voltage of the starting of new equipment and any fault contributions from new equipment

The installation protective devices shall be correctly co-ordinated within the installation and with respect to existing installations. Discrimination studies shall be performed to validate the co-ordination of the installation.

All equipment which requires operation or attendance by a person, or requires cleaning or maintenance in service, shall be constructed and installed to allow adequate and safe means of access and working space for such activities. Similarly, the positioning of equipment shall not impede access to, or working space at, non-electrical equipment and services for operation and maintenance activities.

The installation shall be suitable for access and use by electrically unskilled persons.

Where additions or alterations to an existing installation are to be performed, the rating and condition of existing equipment, including that associated with the supply, shall be verified to confirm its suitability to carry any additional load. The earthing and equipotential bonding arrangements shall also be verified. No addition or alteration shall have an adverse effect on the existing installation.

2 Standards

2.1 Associated Documentation

This Specification identifies the Employer's standard modifications and requirements which shall be applied to the statutory and recognised standards. The detailed specification of the project or site-specific requirements will be found in the Particular Specification and its accompanying Technical Data Sheets, which shall be read in conjunction with this Specification.

Any items not specifically detailed in this Specification, which are necessary to provide a safe and fully operational working system, shall be deemed to be included.

The Contractor shall operate an auditable quality assurance procedure covering the design, construction, inspection and testing of the Installation.

2.2 Regulations, Specifications and Standards

The design, construction, inspection and testing of the installation shall comply with all relevant Statutory Regulations and Directives including:

- (a) Occupational Health and Safety Act (Act 85 of 1993)
- (b) Construction Regulations 2003 issued in terms of Section 43 of the Act
- (c) Local Fire Regulations; and
- (d) Regulations of the Local Supply Authority

and the latest editions (current at the time of Tender) of all relevant South African National Standards, as well as International Standards, including but not limited to:

Table 1: Reference Standards

Standard Number	Description
SANS 32	Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic plants
SANS 97	Electric cables – Impregnated paper insulated metal-sheathed cables for rated voltages 3,3/3,3 kV to 19/22 kV (excluding pressure assisted cables)
SANS 121	Hot dip galvanized coatings on fabricated iron and steel articles - Specifications and test methods
SANS 156	Moulded-case circuit-breakers
SANS 164	Two-pole and earthing-pin plugs and socket outlets
SANS 475	Luminaires for interior lighting, streetlighting and floodlighting - Performance requirements
SANS 767	Earth leakage protection unit
SANS 950	Unplasticized polyvinyl chloride rigid conduit and fittings for use in electrical installations
SANS 1063	Earth rods, couplers and connections
SANS 1085	Wall outlet boxes for the enclosure of electrical accessories
SANS 1088	Luminaire entries and spigots
SANS 1091	National colour standards of Paint
SANS 1195	Busbars
SANS 1213	Mechanical cable glands
SANS 1239	Plugs, socket-outlets and couplers for industrial purposes

Standard Number	Description
SANS 1266	Ballasts for discharge lamps (excluding tubular fluorescent lamps)
SANS 1411	Materials of insulated electric cables and flexible cords
SANS 1431	Weldable structural steels
SANS 1507	Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V)
SANS 1700	Fasteners
SANS 1777	Photoelectric control units for lighting
SANS 1783	Sawn softwood timber
SANS 1973	Low-voltage switchgear and controlgear Assemblies
SANS 2001	Construction Works
SANS 10155	Accuracy in buildings
SANS 10199	The design and installation of earth electrodes
SANS 10225	The design and construction of lighting masts
SANS 10177	Fire testing of materials, components and elements used in buildings Part 2: Fire resistance test for building elements
SANS 10142-1	Wiring of Premises Part 1: Low Voltage Installations
SANS 10400	The application of the National Building Regulations
SANS 60269	Low-voltage fuses
SANS 60309	Plugs, socket-outlets and couplers for industrial purposes
SANS 60529	Degrees of protection provided by enclosures (IP Code)
SANS 60614-2	Conduits for electrical installations - Particular specification for conduits
SANS 60669	Switches for household and similar fixed-electrical installations
SANS 60947	Low-voltage switchgear and controlgear
SANS 61000	Electromagnetic compatibility (EMC)
SANS 61010	Safety requirements for electrical equipment for measurement, control, and laboratory use
SANS 61048	Auxiliaries for lamps - Capacitors for use in tubular fluorescent and other discharge lamp circuits - General and safety requirements
SANS 61238	Compression and mechanical connectors for power cables for rated voltages up to 30 kV(Um = 36 kV)
SANS 61643	Low-voltage surge protective devices
Other Standards	Description
ARP 035	Guidelines for the installation and maintenance of street lighting
BS 88	Specification of supplementary requirements for fuses of compact dimensions for use in 240 / 415 V industrial and commercial electric installations
IEC 157	Low voltage switchgear and control gear
IEC 408	Low voltage air-break switches, air-break disconnectors, air-break switch disconnectors and fuse combination units
IEC 12373	Aluminium and aluminium alloys. Anodizing. Method for specifying decorative and protective anodic oxidation coatings on aluminium
IEC 50086	Conduit systems for cable management
IEC 60898	Specification for circuit-breakers for overcurrent protection for household and similar installations

Standards are often tailored to the conditions of their country or origin (in terms of permissible voltages, expected ambient temperatures, etc.). Therefore, and unless normatively referenced to the

contrary in a Standard of higher precedence, the decreasing order of precedence of Standards shall be:

- (a) South African National Standards (SANS, VC, etc.)
- (b) South African Sectoral Standards and Specifications (NERSA, CKS, ARP, NRS, PIESA, etc.)
- (c) ISO Standards
- (d) IEC Standards
- (e) Harmonized British Standards (BS EN)
- (f) Other Harmonized European National (EN) Standards (CEN, CENELEC, ETSI)
- (g) Non-Harmonized British Standards (BS)
- (h) Other international standards

Where Standards of the same order are not in agreement with each other, the Standard with the most rigorous requirements shall apply.

The installation shall also comply with:

- (a) This Specification, including all Technical Data Sheets; and
- (b) Any documentation issued by, or on behalf of, the Employer in respect of the Installation.

3 Components and Equipment

3.1 Lighting and Accessories

3.1.1 Luminaires

- (a) Luminaires shall comply with SANS 60598 (relevant parts).
- (b) Luminaires shall be supplied complete with lamps of a type suitable for the luminaire design.
- (c) Upon the Engineer's request, simulation data files must be made available for each luminaire.

3.1.2 Control Gear and Enclosures

High frequency, electronic control gear shall be used for tubular (double capped) and compact (single capped) fluorescent lamps, and, where appropriate, for discharge lamps.

3.1.3 Switches

- (a) Flush mounted switches
 - (i) Flush mounted switches shall comply with SANS 60669-1 and shall bear the SABS mark.
 - (ii) All flush mounted switches shall be suitable for mounting in 100 x 50 x 50 mm galvanised steel or PVC wall boxes.
 - (iii) The switch mechanism shall be of the tumbler-operated micro-gap type with silent operation, and shall be rated for 16 A continuous loading at 50 Hz and 250 V.
 - (iv) Switches shall have protected terminals for safe wiring. Multi-lever switches shall be constructed so as to enable individual defective switches to be removed and replaced without having to remove the remaining switches.

- (v) The mounting holes provided on the yoke strap shall be slotted to allow for easy alignment. A brass earthing terminal shall furthermore be provided on the yoke to ensure the positive earthing of the switch assembly.
- (b) Cover plates for switches
 - (i) Cover plates for flush mounted switches shall have levelled edges which overlap the wall box in order to conceal all wall imperfections.
- (c) Surface mounted switches
 - (i) Surface mounted switches shall comply with SANS 60669-1 and shall bear the SABS mark.
 - (ii) Surface mounted switches shall consist of single or multiple switches, not exceeding four, and shall be mounted in a pressed steel box of heavy duty construction.
 - (iii) The switch mechanism shall be of the tumbler operated micro-gap type with silent operation and shall be rated for 16 A continuous loading at 250 V and 50 Hz.
 - (iv) A brass earthing terminal shall furthermore be provided on the switch construction to ensure the positive earthing of the switch assembly and enclosure.
 - (v) The covers of surface mounted switches shall have toggle protectors.
- (d) Photo-Electric daylight switches
 - (i) The unit shall comprise a photo-cell, thermal actuator and change-over switch. The cover of the unit shall be manufactured from a tough, durable material providing protection against tampering. The cover shall have good weathering properties. It shall be ultra violet resistant and shall not deteriorate when exposed to sunlight for prolonged periods.
 - (ii) The units shall be capable of operating in dusty conditions, and over an ambient temperature range - 15 °C to + 55 °C.
 - (iii) The units shall be designed to withstand damage by hail and stones thrown by vandals. If the units do not possess this quality, separate wire screens shall be provided for this purpose.
 - (iv) All parts shall be treated to be corrosion-proof.
 - (v) The operation level shall be factory pre-set for "ON" at a light level of 60 lux and "OFF" at 90 lux, with a permissible deviation of 12 lux either way. Voltage variations shall not materially affect the operational levels.
 - (vi) A time delay, of not less than 15 seconds, shall be provided to prevent the unit from functioning due short-duration changes in illumination, such as lightning.
 - (vii) The unit shall be effectively safeguarded against voltage surges by means of a suitable surge protector, which shall preferably form an integral part of the unit.
 - (viii) The unit shall be of the wall mounting type and shall be supplied complete with a suitable bracket.
 - (ix) The change-over switch shall be capable of switching 10 A AC at 250 V.
- (e) Dimmer modules
 - (i) Dimmer modules shall comply with SANS 60929.
 - (ii) Units shall be rated at 250 V, and capable of powering inductive (minimum power factor of 0.65 lagging) and capacitive (minimum power factor of 0.75 leading) loads.
 - (iii) The efficiency of modules may not be less than 95 %, and the harmonic current injection not more than 1 % THD, at full load (where such load is resistive).

- (iv) Furthermore, the units shall be provided with automatic over-temperature, over-current and short-circuit cut-out features. Where over-current of short duration is expected (i.e. luminaire starting current), over-current protection may be by way of self-regulation (i.e. a reduction in output voltage).
- (v) Dimmer modules shall be sound-attenuated, such that audible noise is limited to 30 dB (all weightings) measured at a distance of 1 m from the module.
- (vi) The output of modules shall be controlled by propriety pushbutton-type switches. An additional switch, located in the same enclosure as the pushbutton, shall be provided for switching the input to the dimmer module.
- (vii) Unless prior approval in this regard has been gained from the Engineer, dimmer modules may not be paralleled.
- (viii) Dimmer modules shall be selected and installed such that 30 % spare capacity will be available for future additions to the output circuitry.

4 Installation of Components and Equipment

4.1 Installation of Lighting and Accessories

4.1.1 Mounting of light fittings

Surface mounted down light holders, such as the bayonet / screw-in type lamp holders used for incandescent fittings, shall be screwed to the ceiling by means of at least two 4 mm diameter self-tapping screws. Plastic expansion plugs, of good quality, are to be used where the surface is concrete, plaster or brick. For suspended and soft ceilings, a solid timber backing strip of at least 40 x 40 mm timber must be supplied and installed between supports, with the screws fixed to these backing strips.

Channelled fittings, such as fluorescent fittings, shall be firmly mounted to ensure close contact with the ceiling over the entire length of the fitting. On concrete slabs the fittings shall be mounted by means of two screws into the ceiling conduit box, as well as two round-headed 4 mm x 30 mm electroplated self-tapping screws and plastic expansion plugs, one at either end. Where fittings are to be installed underneath suspended ceilings, they shall be mounted in an equal manner, but timber backing strips of at least 40 x 40 x 450 mm (at both ends) shall be placed in position on top of the ceiling board and the end screws secured to these strips, such that the weights of the fittings distribute evenly.

To ensure the safety of people below, where fittings are clamped or bolted directly to trusses or other building elements (as in the case of some high bay and floodlight installations) they shall be provided with an additional safety chain or safety cable of appropriate corrosion-proof material. This safety cable / safety chain assembly shall be connected independently of the luminaire-supporting clamps or bolts, such that either assembly can be loosened and removed without affecting the other. The safety assemblies shall have a load safety factor not less than 3.

Specialized light fittings (i.e. types of fittings not mentioned in this specification) must be installed strictly in accordance with their manufacturer's requirements and guidelines.

5 Drawings and Documentation

5.1 General

All drawings, information, and documentation shall be in English, and each item shall be identified with:

- (a) The Client's name and contact details
- (b) Client's project / scheme / contract reference title and numbers
- (c) The Engineer's name and contact details
- (d) Engineers reference numbers
- (e) Contractor's works / contract / order references.

Drawings for acceptance shall be provided on A4 or A3 paper copies as specified.

5.2 Drawings for Approval

The following documentation and drawings shall be submitted to the Engineer prior to the installation of cables and wireways and before civil construction have started on the areas where cable routes are required:

- (a) Cable route layout drawings showing:
 - (i) Type of wireways
 - (ii) Trenching
 - (iii) Cable junction boxes

5.3 As-built Drawings

Detailed "as-built" drawings, clearly labelled as such, and consisting of 3 sets of drawings printed to their original size, and, where the original drawings were larger than A3, 3 sets of drawings printed (with reduced scaling, but without omitting any information from the printed area), to A3, shall be provided by the Contractor, indicating positions of the following:

- (a) Equipment (e.g. light fittings, draw boxes, outlets etc.)
- (b) Wireways (e.g. trenches, conduit, cables ladder/trays, power skirting etc.); and
- (c) Cable routes (including any cable joints)
- (d) General arrangement drawings
- (e) Single Line Diagrams

5.4 Operating and Maintenance Manual

Three Operation Manuals, three Maintenance Manuals and three Certification copies shall be provided for all equipment supplied. The manuals shall be in A4 format.

The operating and maintenance manuals shall include at least the following:

- (a) A schedule of installed components and equipment, containing the following information:
 - (i) Manufacturers name and contact details
 - (ii) Circuit number (DB name, circuit breaker e.g. DB01-CB08); and

- (iii) Function (e.g. switching lighting circuit DB03-L1)
- (b) A schedule of all installed cables, with the following information:
 - (i) Circuit number (DB name, circuit breaker e.g. DB01-CB08)
 - (ii) Size
 - (iii) Installed length; and
 - (iv) Function (e.g. "Feeding Submersible pump IW-SP-01")
- (c) Description and details w.r.t:
 - (i) Detailed description of the function of all operator controls
 - (ii) Procedures for fault finding
 - (iii) Maintenance instructions for all components and including repair, overhaul, change-out and installation procedures
 - (iv) Inspection schedules; and
 - (v) Spare part information and recommended spares

6 Testing and Commissioning

6.1 General

The installation shall be inspected and tested in accordance with SANS 10142-1.

Inspection and testing shall only be performed by personnel with approved, current qualifications. The Contractor shall provide qualified personnel for the supervision for all inspection and testing activities.

The Contractor shall provide all necessary safety equipment and test instruments. All test instruments shall comply with SANS 61010 and be covered by a current test and calibration certificate.

The Contractor's safe working arrangements shall comply with the safety management systems and procedures prevailing on site. Where there may be a risk of injury to personnel, the Contractor shall submit a risk assessment and method statement for approval, prior to starting work.

Unless otherwise specified in the Particular Specification, all inspection and test results shall be recorded using proforma documentation (test certificates and schedules) complying with SANS 10142-1.

The Contractor shall make provision for all inspection and testing activities to be witnessed. Unless otherwise specified in the Particular Specification, the period of notice for witness testing shall be 5 working days.

Where most of the inspection and testing activities are not witnessed, the Contractor shall allow for 10 % of the inspection and testing activities to be repeated for witness testing.

If there is a requirement for additional inspection and test activities to be performed as part of process commissioning, this shall be specified in the Particular Specification.

Unless otherwise agreed by the Employer, no part of the installation shall be commissioned until all defects or omissions revealed by inspection and testing have been rectified. Where a defect or omission renders all or part of the installation unsafe for use, the Contractor shall take approved precautions to ensure that no part of the installation can be commissioned.

6.2 Test Sequence

6.2.1 Inspections before Testing

Before testing, inspections shall be performed to verify:

- (a) All equipment and material is of the correct type and complies with applicable SANS and IEC standards
- (b) All parts of the installation are correctly selected and erected
- (c) No part of the installation is visibly damaged or otherwise defective
- (d) The installation is suitable for the environmental conditions; and
- (e) The installation complies with this Specification

6.2.2 Testing of Installation



On satisfactory completion of the inspections specified in 6.2.1 the following tests shall be undertaken in the sequence listed as per SANS 10142-1:

- (a) Continuity of conductors
- (b) Resistance of Earthing conductor
- (c) Continuity of ring circuits Earth fault loop impedance at main switch
- (d) Elevated voltage on supply neutral Earth Resistance
- (e) Insulation resistance
- (f) Voltage, main distribution board - no load
- (g) Voltage, main distribution board - on load
- (h) Voltage at available load
- (i) Operation of earth leakage units
- (j) Earth leakage test button
- (k) Polarity at points of consumption
- (l) Switching devices

General specification

MV & LV Earthing

Specification number: SPE-EE-0020

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1 Scope

1.1 Application

This Standard Specification covers the materials, components and installation requirements for earthing systems of industrial medium- and low voltage electrical installations.

General standard requirements are dealt with in this specification, and the project-specific requirements are dealt with in the Project Specification.

This standard specification covers protective earthing and bonding, but not functional earthing and bonding which shall be provided in accordance with the specifications of electrical and electronic equipment suppliers.

This standard specification does not cover electromagnetic compatibility (EMC) earthing and bonding, which shall be provided as specified in the Project Specification if required.

Whilst this specification covers earth termination systems for a building lightning protection system (LPS), it does not cover the LPS itself and surge protection for equipment.

The following does not fall within the scope of this standard specification:

- (a) The earthing of outdoor open-terminal MV substations.
- (b) The earthing of electronic systems and equipment.

1.2 General Requirements

The completed earthing systems shall incorporate all materials and components necessary to provide the required protective earthing and bonding.

All materials and components shall be new and unused, shall be of current manufacture, and shall be free from any defects or imperfections.

2 Standards

2.1 Associated Documentation

This Specification contains standard amendments and requirements, which shall be applied to the referenced statutory and national standards. The project-specific requirements are provided in the Project Specification, which shall be read in conjunction with this Specification.

The design, construction, installation, inspection, testing and commissioning of the earthing systems shall comply with all relevant statutory regulations, and the latest editions (current at the time of tender) of all relevant South African National Standards.

2.2 Statutory Requirements

The earthing systems shall comply with the following:

- (a) Occupational Health and Safety Act of 1993 and Regulations
- (b) SANS 10142-1 The Wiring of Premises Part 1: Low-voltage Installations
- (c) SANS 10142-2 The Wiring of Premises Part 2: Medium-voltage Installations

2.3 Reference Standards

The following national standards shall be complied with as applicable:

Table 1: Reference Standards

Standard Number	Description
SANS 1063	Earth rods, couplers and connections
SANS 1411-1	Materials of insulated electric cables and flexible cords - Part 1: Conductors
SANS 10198-3	Power cables up to 33 kV: Earthing systems - General provisions
SANS 10198-12	Power cables up to 33 kV: Installation of earthing system
SANS 10199	The design and installation of earth electrodes
SANS 10200	Neutral earthing in medium-voltage industrial power systems
SANS 10292	Earthing of low-voltage distribution systems
SANS 62305-3	Protection against lightning: Physical damage to structures and life hazard

3 Earthing of Transformer and Generator Neutrals

3.1 Distribution Transformers

The neutrals of distribution transformers shall be either solidly- (directly) or resistively earthed as specified in the Project Specification.

Unless otherwise specified in the Project Specification, the earthing connection shall be made with 70 mm² bare copper earth conductor to the installation's main earthing bar(s) or to dedicated combined MV and LV earth electrodes in the case of remotely installed transformers or mini-sub (refer Clauses 6.2 and 6.3).

Where artificial neutrals are required for transformers with delta-connected secondary windings, neutral electromagnetic couplers /neutral earthing compensators (NECs) shall be provided as specified in the Project Specification.

Where neutral earthing resistors (NERs) are required to limit earth fault current, they shall be provided as specified in the Project Specification, either as separate units or in combination with NECs (and referred to as NECRs).

3.2 Standby Generators

LV standby generators shall be earthed in accordance with SANS 10142-1: The Wiring of Premises Part 1: Low-voltage Installations unless otherwise specified in the Project Specification.

The neutrals of MV standby generators shall be resistively earthed with NERs dedicated to the individual generators unless otherwise specified in the Project Specification.

Unless otherwise specified in the Project Specification, the earthing connection shall be made with 70 mm² bare copper earth conductor via the installation's main earthing bar(s).

4 Earth Electrodes

4.1 General

Earth electrodes shall be provided as specified in the Project Specification for power systems, electrical equipment and LPS earthing.

The earth electrodes shall be constructed in accordance with Sub-clauses 4.2 to 4.8 of this specification as relevant.

Earth electrodes shall be tested in accordance with Clause 9 of this specification and shall be extended as directed by the Engineer in writing if required to achieve a lower earth resistance.

4.2 Earth Grids

Earth grids for electrical equipment yards shall be constructed in the form of a large rectangular arrangement of conductors buried in trenches and divided by longitudinal and transverse conductors into a number of smaller rectangles having mesh dimensions as specified in the Project Specification.

The horizontal conductors shall be high-conductivity, annealed, stranded copper conductors with a cross-sectional area of 70 mm² unless otherwise specified in the Project Specification.

Where horizontal conductors cross each other they shall be joined by exothermic welding or oxy-acetylene brazing.

Horizontal conductors shall be buried directly in the ground at 500 mm below finished ground level (unless otherwise specified in the Project Specification), before any stone layer is put down, in 300 mm wide excavated trenches which shall be backfilled in well-compacted layers.

Supplementary earth rods shall be provided as specified in the Project Specification and shall comply with Clause 4.8 of the specification.

4.3 Ring and Foundation Earth Electrodes

A foundation earth electrode shall comprise a continuous length of bare copper earth conductor installed under the perimeter concrete foundation of a building, with the ends brought out to the main earthing bar to form a closed loop. The conductor shall be fixed to the top of the blinding layer just before the concrete foundation is poured to avoid theft of the conductor.

At each corner of the building a 2 m conductor tail shall be exothermically welded to the foundation earth electrode and buried in an accessible location to allow the electrode to be extended if required.

Supplementary earth rods shall be provided as specified in the Project Specification and shall comply with Clause 4.8 of the specification.

A ring earth electrode shall be similar to a foundation earth electrode, except that it shall be external to the structure and in contact with soil for at least 80 % of its total length. Unless otherwise specified in the Project Specification, the ring earth electrode shall be installed 500 mm below finished ground level and 1000 mm from external walls. Ring earth electrodes shall only be provided in place of specified foundation earth electrodes with the Engineer's written approval.

Horizontal conductors shall be as specified for earth grids in Clause 4.2.2 of this specification.

4.4 Array of Rods

An array of rods interconnected with horizontal conductor in the form of a “T” shall be constructed with horizontal conductor lengths and rod quantities and lengths as specified in the Project Specification to achieve the required earth resistance.

The horizontal conductor shall comply with Clause 4.2.2 of this specification.

The earth rods shall comply with Clause 4.8 of this specification.

The horizontal conductor and the tops of the earth rods shall be 500 mm below finished ground level.

4.5 Trench Electrodes (Cable-route Earth Electrodes)

Trench earth electrodes shall comprise buried horizontal conductor and supplementary earth rods installed in a linear arrangement in MV/LV cable trenches.

The conductor lengths and rod quantities and lengths shall be as specified in the Project Specification to achieve the required earth resistance.

The horizontal conductor shall comply with Clause 4.2.2 of this specification.

The earth rods shall comply with Clause 4.8 of this specification.

4.6 Earth Termination Systems for Lightning Protection

Earth termination systems (ETs) for lightning protection systems (LPSs) for structures shall be either Type A or Type B arrangements (defined in SANS 62305-3) as specified in the Project Specification.

Ring- and foundation earth electrodes as specified in Clause 4.3 of this specification meet the requirements for Type B arrangements and shall be provided where called for in the Project Specification.

Type A arrangements shall comprise horizontal and/or vertical electrodes (i.e. conductors and/or rods) installed outside the structure to be protected, connected to down conductors, and not forming a closed loop. The required arrangement for a particular structure shall be as specified in the Project Specification.

4.7 Earth Mats

Earth mats shall be provided as called for in the Project Specification where required to provide an extra protective measure to minimize the danger of exposure to high step or touch potentials for operators of outdoor electrical equipment.

Earth mats shall be constructed out of 70 mm² bare copper conductor in the form of a grid with outer dimension 1500 mm x 1500 mm and with longitudinal and transverse conductors spaced 100 mm apart. Crossovers shall be exothermically welded.

Earth mats shall be buried 500 mm below finished ground level.

4.8 Earth Rods

Earth rods used for the earthing system shall be of the “A” grade and shall have a 250 micron copper jacket. Unless otherwise specified in the Project Specification, the rods shall comply with the following:

- (a) The earth rods shall be extendible, copper clad, high tensile steel (500 MPa) rods and shall bear the SABS mark of approval. They shall be at least 16mm in diameter and shall have hardened steel tips with driving caps.

- (b) Individual rods shall not have a length of more than 1.5 m.
- (c) Connections between individual rods shall be by screwed joints in accordance with one of the following:
 - (i) The ends of the rods shall be externally threaded and be joined by a counter bored, threaded coupler designed to completely enclose the threaded section of the rod. The external threads shall be roll-formed with a minimum copper coating thickness of 0,05 mm at the root of the threads. Couplers shall be manufactured from high strength silicon or aluminium bronze; or
 - (ii) The ends of the rods shall be internally threaded and joined by a screwed phosphor bronze dowel. A corrosion inhibiting paste shall be applied to the threads before assembly.
- (d) A single earth rod assembly shall be not more than 6 m long and the separation between adjacent earth rod positions shall be not less than 1,25 times the length of the longest earth rod assembly.
- (e) The absence of any buried services, down to the maximum driving depth, shall be established before rods are driven into the ground.

5 Earthing Bars and Conductors

5.1 Earthing Bars

A main earthing bar shall be provided in every MV switchroom or in the main LV switchroom for installations with an LV bulk electricity supply. Supplementary earthing bars shall be provided in other electrical rooms as specified in the Project Specification.

All earthing bars connected to earth electrodes shall have one disconnecting terminal to allow for testing of the associated earth electrodes and shall be constructed in accordance with Standard Drawing for Earthing Bar (Figure 1).

Unless otherwise specified in the Project Specification, earthing bars shall be mounted on the side walls of cable trenches in the positions indicated on the layout drawings.

The earthing bar arrangement shall be as per the following detail sketch:

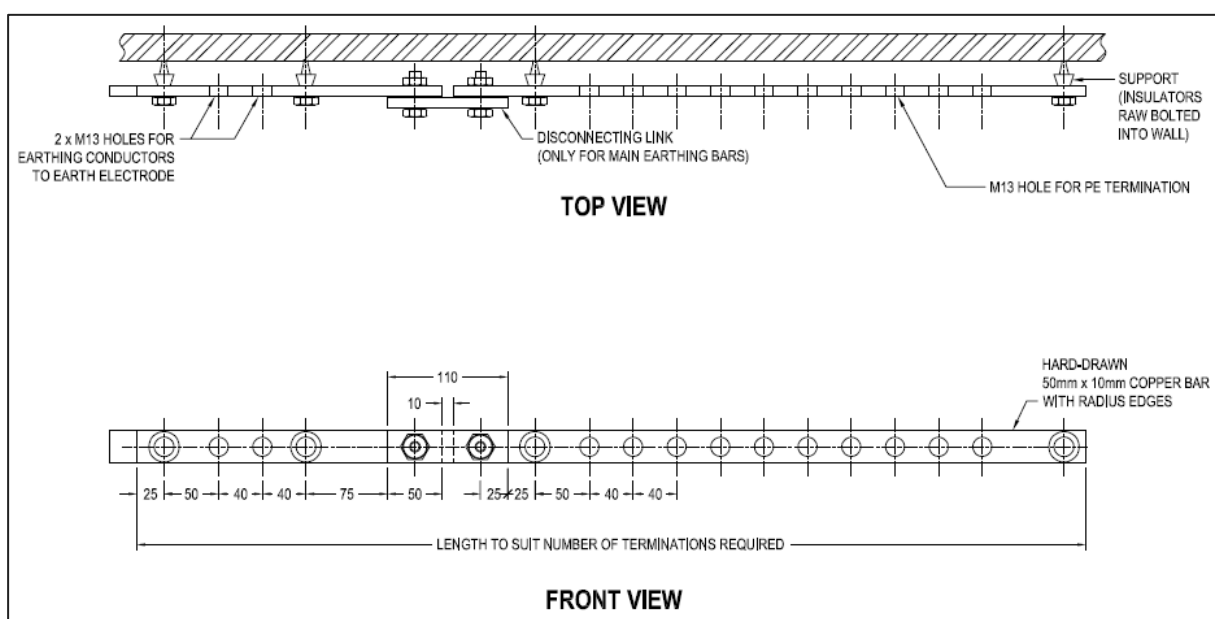


Figure 1: Earthing Bar

5.2 Earthing-, Parallel Earthing-, and Earth Continuity Conductors

Earthing conductors shall be provided to link earthing bars to earth electrodes, except where the conductor ends of ring- and foundation earth electrodes are terminated at the earth bars. Earthing conductors shall be bare 70 mm² annealed stranded copper conductors, unless otherwise specified in the Project Specification.

Parallel earthing conductors shall be provided as specified in the Project Specification to provide a low impedance connection between separate earthing arrangements. Unless otherwise specified, the conductors shall be laid along cable routes, and shall be bare 70 mm² annealed stranded copper conductors.

Earth continuity conductors (ECCs) shall be provided:

- (a) With supply cables to MV switchgear and to LV Assemblies
- (b) To earth the exposed conductive parts of all electrical equipment in accordance with SANS 10142: The Wiring of Premises.

ECCs for MV equipment shall be connected from the MV earthing bar and ECCs for LV equipment shall be connected from the earthing bars in the LV Assemblies from which the equipment receives supply.

ECCs shall be separate conductors or shall form part of the equipment supply cables as specified in the Project Specification. ECCs which does not form part of a cable shall be annealed copper stranded conductors of the specified cross-sectional area and shall be either bare or PVC-insulated as specified in the Project Specification.

6 Earthing of MV and LV Equipment and Electrical Yard Fences

6.1 MV Switchgear

The earthing bars of MV switchgear shall be connected to the main earthing bar by means of two 70 mm² bare copper earth conductors, unless otherwise specified in the Project Specification. These protective earthing conductors shall be taken from opposite ends of the switchgear earthing bars.

For ring main units (RMUs) in mini-substations, the RMU and cable termination enclosure earthing bars shall be bonded to the mini-sub's MV earth bar and to each other in accordance with SANS 1874: Metal-enclosed ring main units.

For RMUs in outdoor steel kiosks, the steel enclosure shall be bonded to the RMU earth bar with 70 mm² bare copper earth conductor.

6.2 Distribution Transformers

Outdoor ground-mounted distribution transformers shall be provided with an equipotential earth electrode in accordance with the Standard Drawing for Distribution Transformer Earthing (Figure 2).

Unless otherwise specified in the Project Specification, the transformer tank earthing terminal shall be separately connected to the closest indoor main earthing bar with a 70 mm² bare copper earth conductor.

Unless otherwise specified in the Project specification, remotely-installed transformers (i.e. which are not installed close to indoor main earthing bars) shall be provided with dedicated combined MV- and LV earth electrodes in accordance with the Standard Drawing for Distribution Transformer Earthing (Figure 2).

Transformer LV neutrals shall be bonded to the earthing terminal in the LV terminal box.

Distribution transformers shall be earthed and bonded in accordance with the Standard Drawing for Distribution Transformer Earthing (Figure 2):

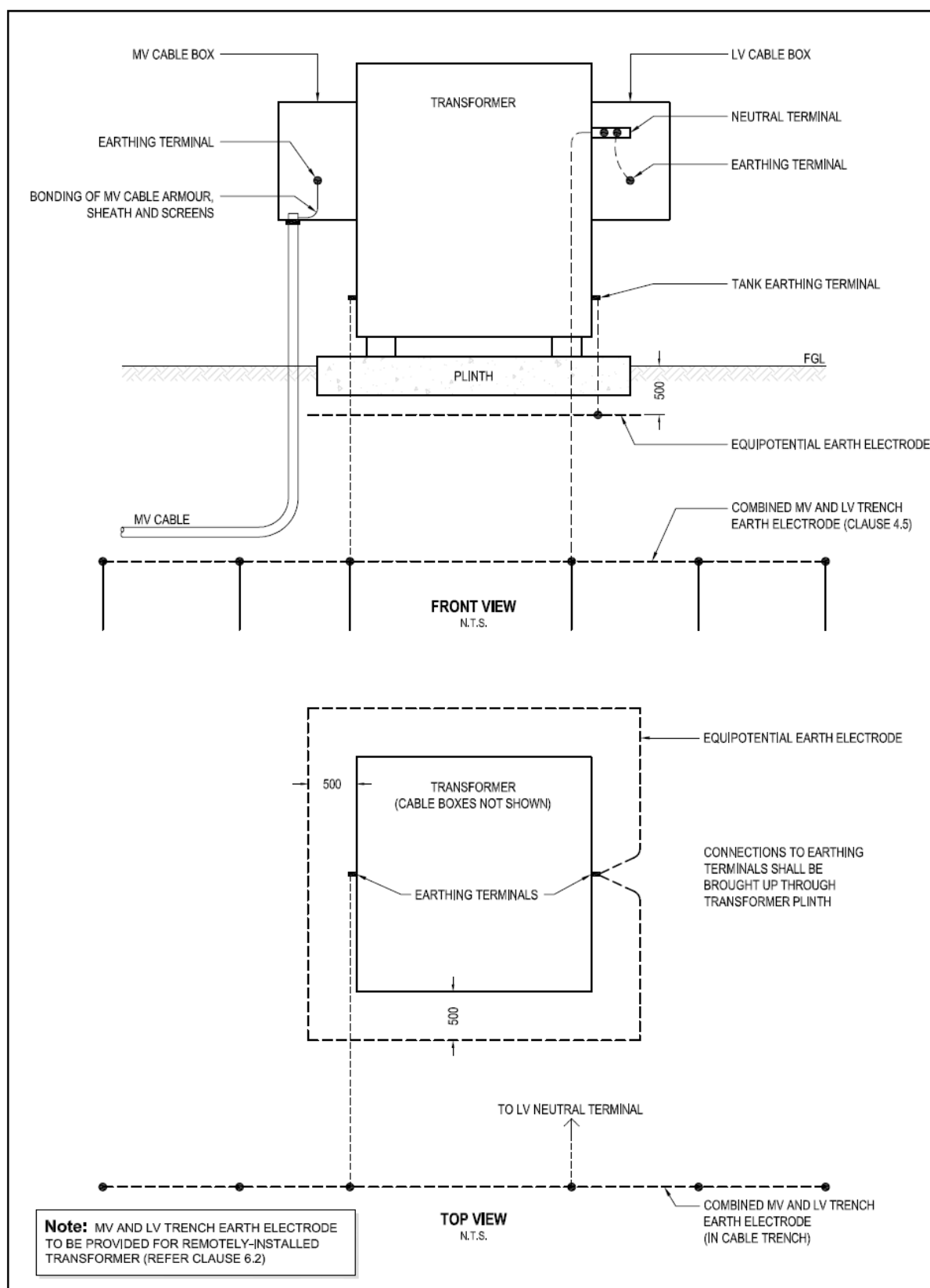
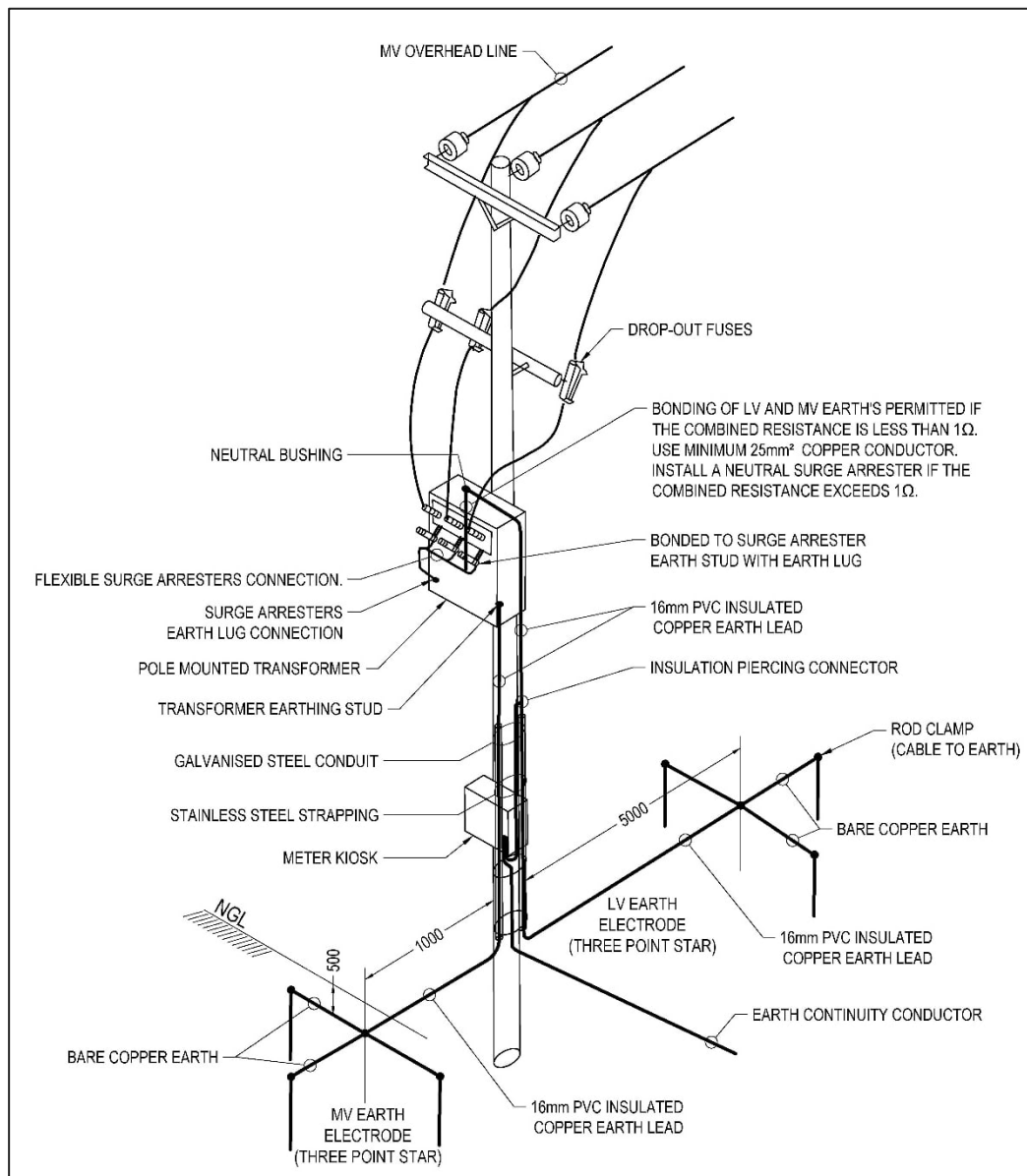


Figure 2: Distribution Transformer Earthing

Pole-mounted transformers shall be earthed in accordance with the Standard Drawing for Pole-Mounted Transformer Earthing (Figure 3):



NOTES

1. THE STEELWORK, TRANSFORMER TANK AND MV SURGE ARRESTORS ARE TO BE BONDED AND CONNECTED TO THE MV EARTH ELECTRODE.
2. THE TRANSFORMER NEUTRAL, LV SURGE ARRESTORS AND TRANSFORMER METERING BOX ARE TO BE BONDED AND CONNECTED TO THE LV EARTH ELECTRODE.
3. THE EARTHING CONTINUITY CONDUCTOR (ECC) SHOULD NOT BE SMALLER THAN HALF THE CROSS SECTIONAL AREA OF THE LARGEST CURRENT CARRYING CONDUCTOR OF THE SUPPLY CABLE.
4. A MINIMUM SEPARATION DISTANCE OF 5000mm IS TO BE MAINTAINED BETWEEN THE MV & LV EARTH ELECTRODES.
5. EARTH ELECTRODES SHALL BE COMBINED IF RESISTANCE IS LESS THAN OR EQUAL TO 1Ω.

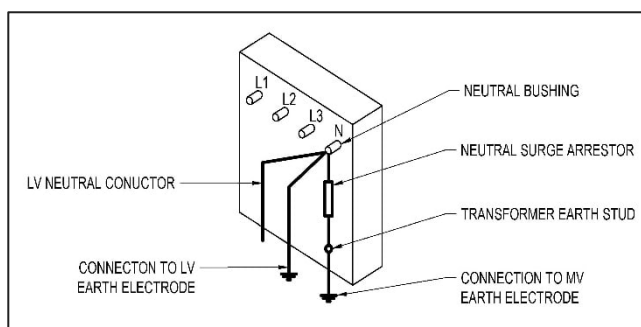


Figure 3: Earthing at MV/LV transformer pole mounted transformer

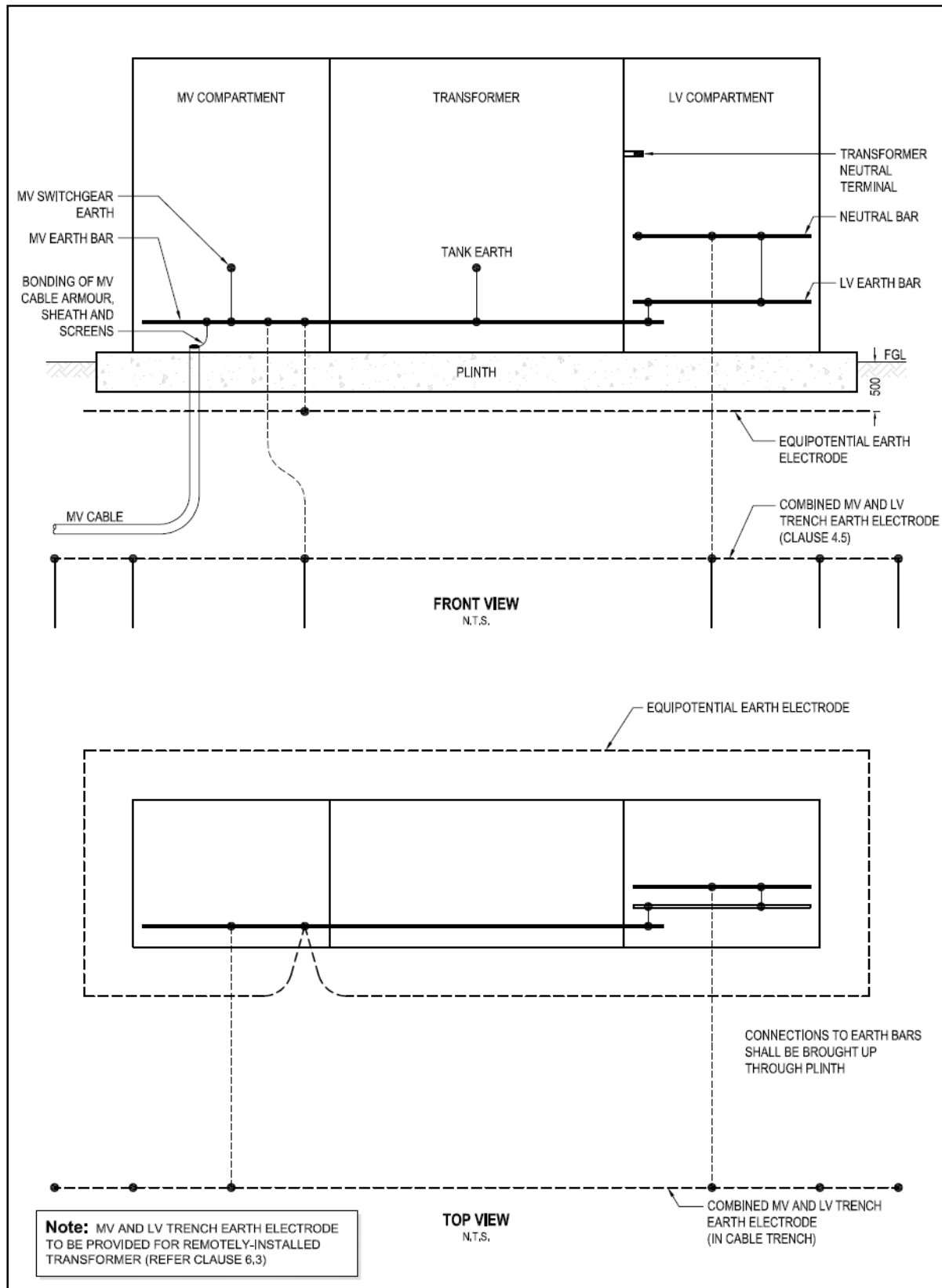
6.3 Miniature Substations (Mini-subs)

Mini-subs shall be provided with an equipotential earth electrode in accordance with Figure 4.

Unless otherwise specified in the Project Specification, the mini-sub MV earth bar shall be separately connected to the closest indoor main earthing bar with a 70 mm² bare copper earth conductor.

The internal earthing arrangement of mini-subs shall be in accordance with SANS 1029: Miniature Substations as applicable to combined MV- and LV earth electrodes.

Unless otherwise specified in the Project Specification, remotely-installed mini-sub's (i.e. which are not installed close to indoor main earthing bars) shall be provided with a combined MV- and LV earth electrode, to which the mini-sub MV earth bar shall be connected, in accordance with Figure 4.



6.4 Motors

Where the protective earth conductor forms part of the supply cable to an LV motor, it shall be connected to the earth terminal inside the motor terminal box.

Separate protective earthing conductors shall be connected to the external frame earth terminal of a motor and a jumper shall be provided from the frame terminal to the motor's terminal box. The jumper shall be crimped to the protective earth conductor and not separately bolted to the frame terminal.

Separate protective earthing conductors shall be PVC-insulated copper conductors with cross-sectional areas as specified in the Project Specification.

Earthing connections to converter-fed motors shall be in accordance with the Standard Drawing for Converter-Fed Motor Earthing.

6.5 PFC Capacitor Banks and Harmonic Filters

The capacitor casings and metal support frames of free-standing PFC capacitor banks shall be earthed in accordance with the supplier's installation instructions.

The support base/insulators of free-standing air-cored reactors shall be earthed in accordance with the supplier's installation instructions, with care being taken to not create closed loops within which currents can be induced.

Free-standing iron-cored reactors and filter resistors shall be earthed in accordance with the supplier's installation instructions.

Where equipment is installed indoors, the earthing connections shall be made with copper earthing continuity conductors to the main earthing bar.

Where the equipment is installed outdoors in a fenced yard, the earthing connections shall be made to the earth grid of the yard.

6.6 MV and LV Cables

The metal components of cables shall be earthed in accordance with the following standards:

Table 2: MV and LV Cable earthing standards

Standard Number	Description
SANS 10142-1	The Wiring of Premises Part 1: Low-voltage Installations
SANS 10198-9	Power Cables Up To 33 kV: Jointing and Termination of Extruded Solid Dielectric-Insulated Cables up to 3,3 kV
SANS 10198-10	Power Cables Up To 33 kV: Jointing and Termination of Paper-Insulated Cables
SANS 10198-11	Power Cables Up To 33 kV: Jointing and Termination of Screened Polymeric-Insulated Cables
SANS 10198-12	Power Cables Up To 33 kV: Installation of Earthing System

Unless otherwise specified in the Project Specification, metal sheaths, metal screens and armouring of single-core cables shall be earthed at both ends of the cables.

Unless otherwise specified in the Project Specification, metal sheaths, metal screens and armouring of single-core cables shall be earthed at both ends of the cables.

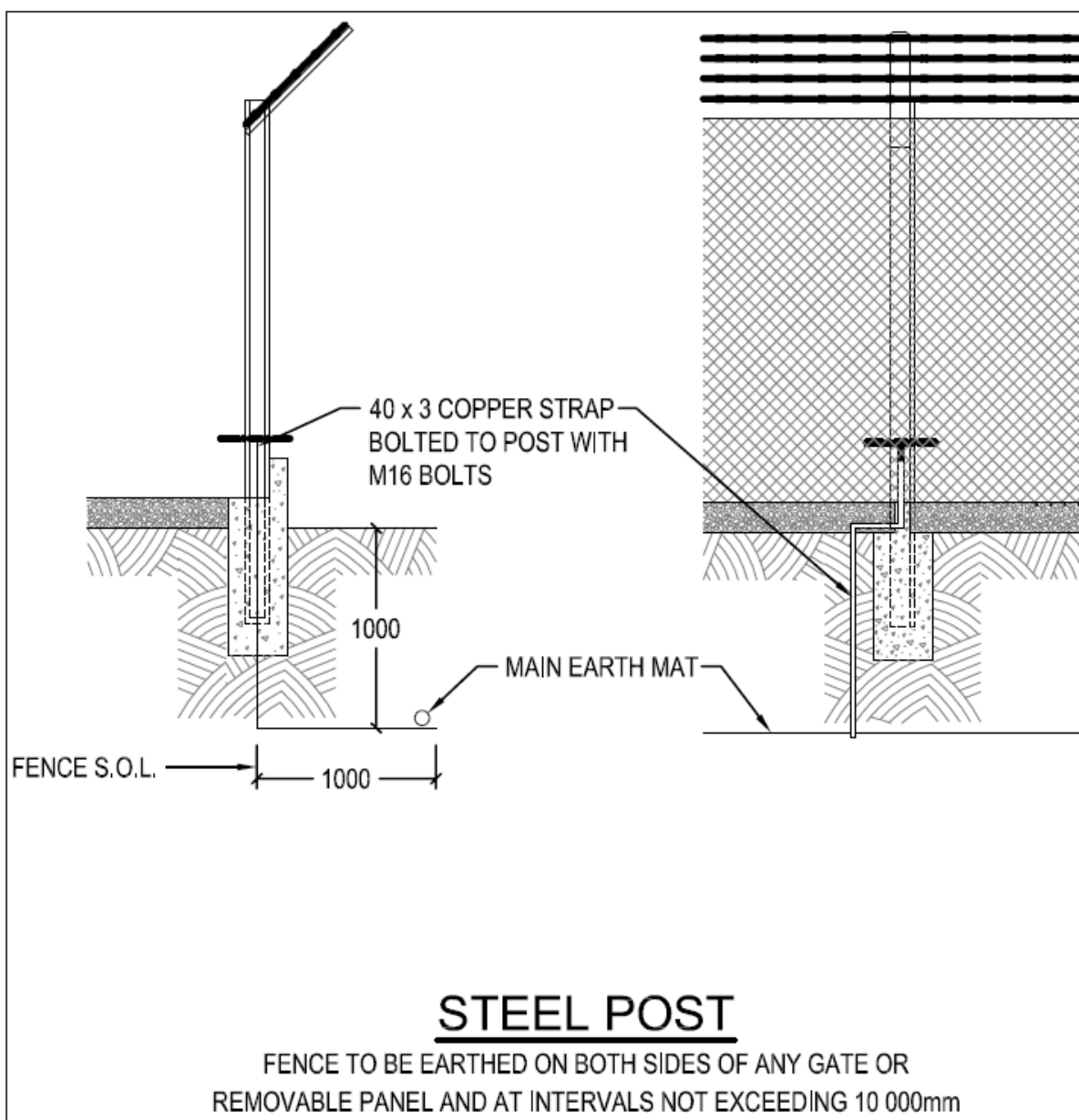
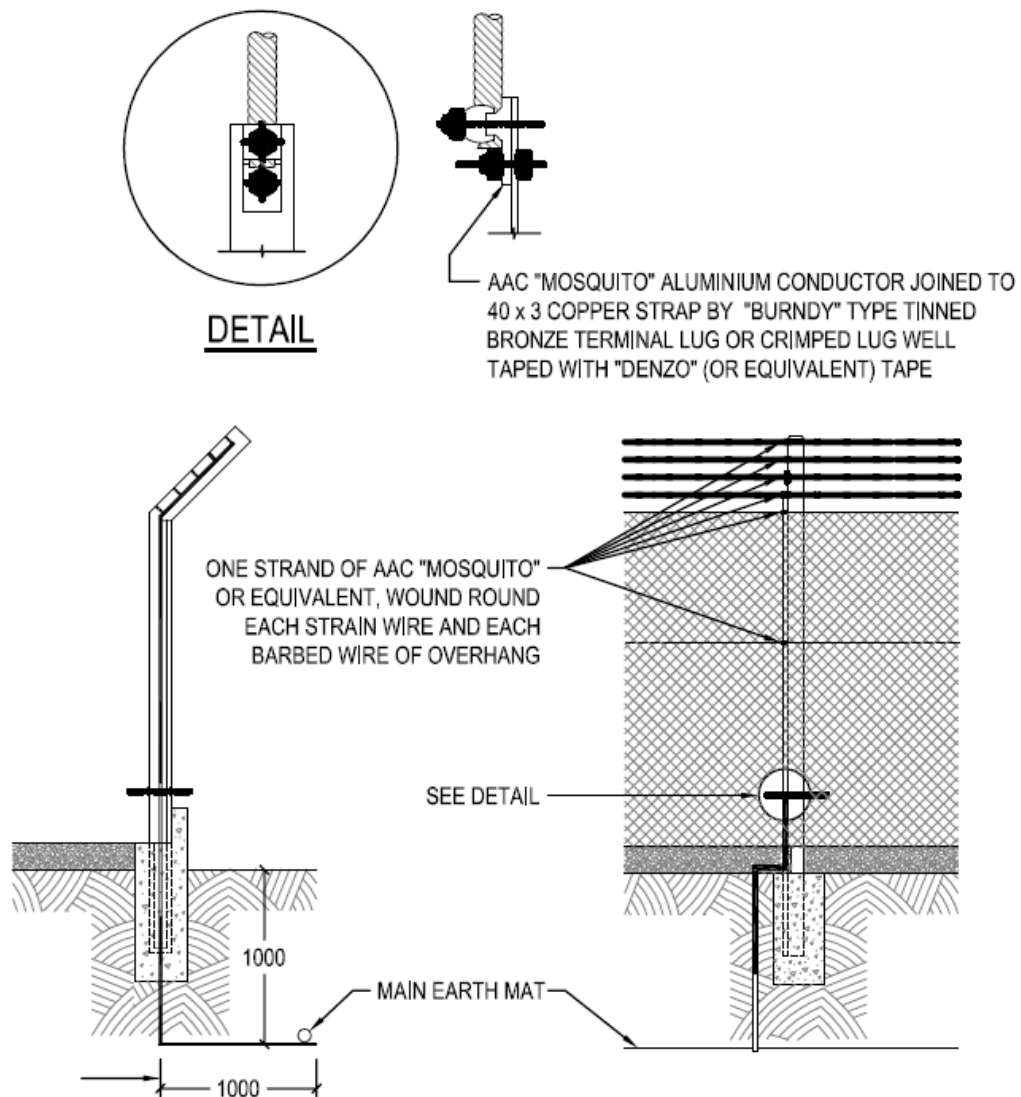


Figure 6: Earthing of Equipment Yard Fences



CONCRETE POSTS WITH ALUMINIUM WIRE FENCE

FENCE TO BE EARTHED ON BOTH SIDES OF ANY GATE OR REMOVABLE PANEL AND AT INTERVALS NOT EXCEEDING 10 000mm

6.9 LV Electrical Equipment

LV electrical equipment shall be earthed in accordance with SANS 10142-1: The Wiring of Premises Part 1: Low-voltage Installations.

7 Equipotential Bonding

7.1 Main Equipotential Bonding

Main equipotential bonding shall be provided in accordance with SANS 10142-1 from the main earth bar to the following extraneous conductive parts of an installation:

- (a) Hot and cold water systems
- (b) Antennas

(c) Other services in conductive material

Main equipotential bonding conductors to the above shall be bare copper earth conductors with a cross-sectional areas as follows:

- (a) Water systems: 0,5 x installation earthing conductor (6 mm² min to 25 mm² max)
- (b) Antennas: 2,5 mm²
- (c) Other services: 2,5 mm²

7.2 Supplementary Equipotential Bonding

Mandatory supplementary equipotential bonding shall be provided in accordance with SANS 10142-1.

Supplementary equipotential bonding shall be provided between exposed conductive parts of the installation where these parts are 2,5 m or less apart. The bonding conductor shall be bare copper earth conductor and shall not be smaller than the smaller of the two earth continuity conductors to the items of equipment.

Supplementary equipotential bonding shall be provided between exposed conductive parts and extraneous conductive parts where these are 2,5 m or less apart. The bonding conductor shall be bare copper earth conductor and shall be at least equal to the half the size of earth continuity conductor to the electrical item of equipment.

Bonding conductors shall be connected to equipotential bonding terminals on equipment/devices or, if these are not provided, shall be bolted to the equipment/devices to the approval of the Engineer.

7.3 Bonding of Wireways

A 70 mm² bare copper earth conductor shall be installed along each cable ladder/tray and each third section shall be bonded to the earth conductor with 35 mm² bare copper earth bonding conductors and purpose-made earth clips. At least one end, but where practicable both ends, of the earth conductor shall be connected to the main earthing bar.

Rigid metal conduiting shall be bonded in accordance with SANS 10142-1.

8 NECR and NER

8.1 Neutral Electromagnetic Coupler/Resistor Combinations

Neutral electromagnetic couplers (NECs), also referred to as neutral earthing compensators, shall be provided as specified in the Project Specification to create artificial MV supply/transformer neutral points for earthing via a neutral earthing resistor (NER). The NEC and NER shall be a combined unit, referred to as an NECR.

NECRs shall comply with Aurecon Engineering Standard SPE-EP-0024: Neutral Electromagnetic Couplers (NEC) with NERs and Auxilliary Transformers.

8.2 Neutral Earthing Resistors

Standalone NERs shall be provided as specified in the Project Specification for resistive earthing of the neutrals of star-connected transformer secondary windings and MV generator windings.

NERs shall comply with Aurecon Engineering Standard SPE-EP-0024: Neutral Electromagnetic Couplers (NEC) with NERs and Auxilliary Transformers.

9 Testing

9.1 Soil Resistivity Survey

A soil resistivity survey shall be carried out in accordance with SANS 10199 if specified in the Project Specification.

The Wenner method of measurement shall be followed unless soil depths of greater than 20 m are to be investigated.

The survey shall be carried out in the area where the earth electrode will be installed and readings shall be taken in at least two different directions. Unless earth rods are to be installed to greater depths than 12 m, measurements shall be taken with at least the following electrode spacings: 1/2/3/5/10/15 m.

The results of the survey shall be submitted to the Engineer in the form of a table showing soil resistivity in ohm.metres for the various depths of measurement, as well as in the form of a graph. If the graph shows a significant variation in soil resistivity with depth, then a two layer soil model shall be constructed.

9.2 Earth Electrode Resistance Measurement

The earth resistance of an earth electrode shall be measured in accordance with SANS 10199.

The resistance curve and the calculated earth electrode resistance shall be submitted to the Engineer who will issue a written instruction if it is necessary to extend the earth electrode to lower its resistance.

9.3 Earth Surface Potential Measurement

Where called for in the Project specification earth surface potential measurements shall be made by measuring touch- and step potential contact resistance at specified outdoor equipment.

The proposed measurement method shall be approved by the Engineer and resistance readings shall be submitted to the Engineer for the calculation of touch- and step potentials.

9.4 Earth Continuity and Bonding

Earth continuity and bonding tests shall be carried out in accordance with SANS 10142: The Wiring of Premises Parts 1 & 2.

10 Documentation and Training

10.1 General

All Assembly drawings, documentation and reports shall be in English, and each item shall be identified with:

- (a) Employer's name and contact details
- (b) Employer's contract reference title and numbers
- (c) Engineer's name and contact details

- (d) Engineer's reference numbers
- (e) Contractor's works / contract / order references
- (f) Contractor's name and contact details

Drawings for acceptance shall be provided on A4 or A3 paper copies as specified.

10.2 Drawings for Acceptance by the Engineer

Where alternative earthing arrangement designs to those specified are proposed by the Contractor, drawings shall be submitted to the Engineer for his acceptance before construction commences.

10.3 Testing Documentation and Reports

Test reports for soil resistivity tests shall contain the following:

- (a) Methodology statement
- (b) Measurement results in tabulated form
- (c) Measurement results in graphic form
- (d) Overlay of measured graph on master graph as per SANS 10199
- (e) Calculated resistivity results for two layer model

Test reports for earth resistance tests shall contain the following:

- (a) Methodology statement
- (b) Measurement results in tabulated form
- (c) Measurement results in graphic form
- (d) Calculated resistance value for earth electrode under test

10.4 Operating and Maintenance Manual

As-built drawings and all test reports shall be included in the Operating and Maintenance Manual which must be provided under the Contract.

General Specification

General Electronic Installations

Specification number: SPE-II-0001

Document control					
Specification no.		SPE-II-0001			
Rev	Date	Revision details / status	Author	Reviewer	Approver
1	2023/05/16	Major revision	JA v Niekerk	S Masondo	O Fair
0	2015/06/25	First Issue	K O'Kennedy	A Schroder	O Fair
Signature					

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1 Scope

1.1 Application

This General Specification defines the requirements for the supervision, labour, manufacture, supply, delivery, installation on site, calibration, testing and commissioning of all electronic equipment, instruments, cables, cable trays, supports, enclosures, consumables and any other equipment or services associated with electronics systems.

1.2 General Requirements

The Contractor shall visit, examine the site and take cognisance of the local conditions, plant and equipment, as well as any rules, regulations and procedures likely to have an impact on their work and associated costs.

Daily, on site activities and responsibilities of the Contractor will include but not necessarily be limited to:

- (a) Compliance to site specific health and safety requirements
- (b) the continual monitoring, controlling and reporting of all facets of his activities to Engineer as and when required
- (c) the attendance of project co-ordination, scheduling, progress and safety meetings
- (d) the implementation of a progressive quality control program
- (e) the implementation of a good housekeeping system for site lay down and working areas
- (f) the control of personnel and their movement

In addition to the above, but not necessarily limited to this, the Contractor will supply supervision, labour, materials, consumables and any other equipment, generally associated with the manufacture, delivery, installation on site, calibration, testing and commissioning (as and when required) of control system equipment, enclosures, field instruments, junction boxes, power distribution boxes, cables, cable trays, supports and brackets, as detailed in the Project Specification and Bill of Quantities.

The Contractor is responsible for the timeous delivery of materials as listed in the Bill of Quantities. The Contractor shall advise the Engineer in writing and in good time of any foreseeable delays, the potential impact on the construction program and related costs. The Contractor shall also prove, within reason, that he/she has tried to circumvent such delays, and/or that he/she has action plans in place to rectify/regain delays/lost time.

The Contractor shall be responsible for all material take-off (not measured in the Bill of Quantities) for ordering purposes and therefore must ensure that work is done in accordance with the latest revisions. The quantities indicated in the cable and cable racking schedules are provisional estimates and shall therefore only be used as guidelines.

The Contractor will not procure any items that are deemed necessary and part of this scope but have not been listed or specified herein, without written approval from the Engineer. The instruction/approval will be clear as to the type of items, the manufacturer/supplier, the model number if applicable, quantities required, when required by and the reason as to why it's required.

All installation work shall be carried out under supervision of the Contractor's site agents, who shall have full charge of the work and who shall be thoroughly experienced and qualified in the installation and supervision of the work to be executed. The Contractor shall provide evidence of such qualifications on request.

The Contractor shall be responsible for the rectification of all defects pertaining to the installation work done by him/her and / or any of his/her sub-contractors as per this scope of work, subject to the approval of the Engineer. All items/services will be guaranteed for a period of 12 months (min), starting from the day on which the “installation” is officially handed over to the client and considered to be complete and functional as per the requirements of this specification.

2 Standards

2.1 Associated Documentation

This Specification contains standard amendments and requirements, which shall be applied to the referenced statutory and national standards. The project-specific requirements are provided in the Project Specification, which shall be read in conjunction with this Specification.

The installation shall comply with all relevant statutory regulations, and the latest editions (current at the time of Tender) of all relevant South African National Standards.

2.2 Statutory Requirements

The Assembly as manufactured, and as installed on site, shall comply with the following:

- (a) Occupational Health and Safety Act of 1993 (as amended)
- (b) Mines Health and Safety Act 29 of 1996 and regulations (as amended). Only applicable for mining projects
- (c) Minerals Act No. 50 of 1991 (as amended). Only applicable for mining projects

2.3 Reference Standards

The installation shall comply with the latest published edition of all relevant national standards, including the following:

Table 1 Reference Standards

Standards	Description
SANS 62305-4	Protection against lightning - Electrical and electronic systems within structures
SANS 10142-1	The wiring of premises, Part1 - Low-voltage Installations

The following general specifications shall be read in conjunction with this specification and shall be deemed to form part thereof:

Table 2: General Specifications

Specification Number	Description
SPE-EE-0002	Training, testing and commissioning
SPE-EE-0003	Documentation and drawings
SPE-EE-0010	LV and MV earthing.
SPE-II-0002	Programmable Logic Controllers
SPE-II-0005	SCADA
SPE-II-0007	Instrumentation
SPE-II-0009	Control and instrumentation enclosures

3 Quality Assurance Requirements

All aspects of electronic installations, as described throughout this document, shall be subject to quality control.

The quality control certificates shall progressively track the progress of the work, and approved copies of the same shall be required to support progressive payment claims from the Contractor. As a minimum, the following documents shall be used as “control documents”.

- (a) Cable rack installation quality control plan complete, including the red-lines of racking and routing drawings
- (b) Fibre optic and copper cable quality control plan complete, including the red-lines of cable block diagrams and updating of actual lengths measured on the cable schedules
- (c) Instrumentation equipment quality control plan complete, including calibrations certificates and red-lined instrumentation index
- (d) Signal and impulse tubing quality control plan complete
- (e) Electronic enclosures’ quality control plan complete
- (f) Overall loop check sheets complete

The originals of the quality control certificates shall be formally transmitted, upon completion of the work as an integral part of the quality control data pack.

4 Earthing

4.1 General

The complete electronic installation shall be earthed in accordance with the latest issues of the applicable South African National Standards (SANS) and any applicable bylaws of the local supply authority as well as any relevant client specific requirements as stipulated in the Project Specification.

The electronic installation shall incorporate a protective (power supply) earth system and a separate functional (instrumentation / data communications) earth system both of which shall be connected to the overall low-voltage installation’s main earth system.

The Contractor shall familiarise himself with the low-voltage installation’s earthing system at the plant or works (existing or installed by others) in order to tie the electronic earth system to the main earth system in compliance with the chosen earthing concept as defined in SANS 10142-1.

All functional earth conductors shall be insulated conductors providing a clean earth arrangement.

All cable trays, racking, conduit, trunking, cable sheaths/armouring, ducts, boxes, instrument stands and all other metal work shall be bonded to the protective earth system by means of stranded insulated conductor with a minimum cross-sectional area as defined in SANS 10142-1, which is terminated in a ring lug and down at both ends.

External earth straps i.e., cable tray to earth rod, will be installed in such a way as to not being a safety hazard i.e. tripping.

Where an earthing conductor is exposed to possible mechanical damage, it shall be protected by means of a suitable conduit or angle iron.

4.2 Earth Bars

For installations that include control rooms or computer rooms (housing information technology and telecommunications equipment), the functional earth shall consist of an earthing busbar and/ or earth mat as directed by the Project Specification.

Control system cabinets are equipped with separate protective earth and functional earth bars (refer to SPE-II-009 “Control and Instrumentation Enclosures”). These earth bars shall be bonded directly to the protective earth busbar and functional earthing busbar and/ or earth mat respectively via the shortest route, all with insulated earthing conductors of minimum cross sectional area as defined in SANS 10142-1.

4.3 Earth Electrode

Where a protective earth electrode does not exist or has NOT been installed as part of the low-voltage installation by others, this contract shall include for the supply and installation of a suitable main earth electrode as stipulated in the Project Specification and the general specification SPE-EE-0010 “LV and MV Earthing”.

A separate clean earth electrode will not be accepted.

4.4 Earthing of Communication and Signal Cables

For the purpose of this specification, communication cables shall mean all data and network communication cables, and signal cables shall mean all instrument voltage; current loops and sensor cables.

The screen of signal cables and 0 V reference of field signal power supplies shall be connected to the functional earth of the control system cabinet in order to provide a well-defined return path for stray currents.

The screen of communications cables shall be connected to the functional earth to protect them against the negative effects of electromagnetic, inductive, and capacitive coupling so that noise on cables is limited to an absolute minimum thereby preventing communication faults from occurring.

This shall be achieved by shielded, twisted conductor pair cables with the outer screen of all communication cables earthed at the source (electronic enclosure) only. The route that the screened wire follows to the electronic enclosure’s functional earthing point shall be as short as possible.

Where communications cables carry high frequencies (above 1 MHz) the screen shall be earthed to a parallel running functional earth conductor of minimum 2.5 mm² insulated copper conductor (or earth grid/ mat) in order to limit the effects of high frequency resonance.

When communications or signal cables are installed where there is a significant risk of high frequency interference; (e.g. in signal circuits connected to equipment containing power electronics), they shall have their screens capacitively connected to earth as directed by the specific equipment supplier.

5 Installation Requirements

5.1 Instrumentation

Refer to general specification SPE-II-0007 “Instrumentation”.

5.2 Cable Rack and Supports

Refer to general specification SPE-EE-0012 "Cable Support Systems".

5.3 Enclosures

Field mounted enclosures shall be installed so that the enclosures are readily accessible yet protected from accidental impacts and spillages, they do not obstruct access ways and that the doors can open without hindering.

The mounting heights of equipment above the floor, unless shown otherwise on drawings shall be:

- (a) 1,2 m for stop/start push buttons
- (b) 1,5 m for control boxes
- (c) 1,8 m to the top of junction boxes

The positioning of local control gear shall be placed such as to give the best view of the driven machinery for reasons of safety and convenience.

LCD type displays shall have suitable protection from direct sunlight or positioned such that they face in a Southerly direction.

Local push-button stations shall be mounted as close as is practicable to the driven items, but in any event shall not be mounted more than 2,0 m from the driven item.

All mountable enclosures shall be mounted on suitable wall and floor standing frames, properly bolted down and grouted in where required. All component supports and mounting brackets shall be of ample strength and rigidity to ensure proper operation of the equipment.

Careful attention shall be given to ensure that components are not mounted on handrails or attached to equipment or structures subject to vibration.

5.4 Instrumentation Cable Installation

In addition to general specification SPE-EE-0011 "LV Cables" the following requirements apply.

The Contractor shall inspect all cables prior to and after installation for any visible defects and ensure that the dielectric is sound, that all cores are correct and continuous from end to end, and that they comply with cable schedule details and specifications.

The cable sizes shall be as specified on the cable schedules. Cable lengths indicated on the drawing and cable schedules are to be used as guides. Differences greater than 15% in planned lengths and actual installation shall be reported to the Engineer.

Cables are to be installed on racks, open trays or on supports in a neat orderly manner to enable the easy installation, later additions, and replacement of any individual cable. No cable shall be buried directly in the ground except with the approval of the Engineer.

Instrumentation signal cables shall be segregated and separated from power cables on parallel routes by a minimum distance of at least 300 mm.

5.5 Instrumentation Cable Terminations

Field cable core connections to enclosures shall be identified using the field device tag references. This information will be provided by the design, and the Contractor shall use these field identifiers when identifying the signal field terminations.

Cable cores shall be terminated using crimped cable ends, lugs or any other approved method that is appropriate for the conductor size and type of termination. Bootlace type ferrules are preferred for instrumentation cable signal cores.

All conductors shall be terminated in an insulated double crimped termination of the appropriate type and size and shall only be fixed using the proper crimping tool as recommended by the maker of the termination. All crimping tools shall be of the ratchet type.

All of the strands forming the conductor shall be connected at the point of termination. Soldered connections shall only be used on electronic equipment where it is not practical to use any other termination method.

Cores shall be left sufficiently long to reach the furthest terminal and shall be neatly coiled before terminating.

Spare cores shall be strapped together with PVC tape or heat shrinkable tubing and marked with the cable number, if spare terminals are not provided for their termination. The stripped length of the spare cores shall exceed the obvious route to the furthest termination point.

The joining of a conductor and hiding it inside of trunking / wire ways is not allowed.

Multi-core signal cabling, which include individual and/or overall screens, shall be connected to the functional earth at one point only – usually at the assembly housing the I/O modules. Continuity of screening shall be maintained where cable-to-cable connections occur. Single point earthing shall be maintained.

Termination of cable screens is to be by covering with heat-shrink sleeving the companion screen wire to be earthed where required by drawings. The screen wires at the unearthed end are to be tied back and covered with heat-shrink sleeving - under no circumstances may they be cut back.

5.6 Network Cable Terminations

Only certified installers shall be allowed to prepare network cabling for terminations and connections.

Only proprietary type tools shall be used for the cutting and stripping of network cabling.

Network cable shall be “made off” as per supplier’s recommendation regarding the cutting and stripping of insulation, screen and copper cores.

5.7 Instrument Tubing

Tubing/piping shall be carefully routed and installed in order to meet process and instrument requirements. Special attention shall be given to process take-offs, piping gradients, process temperatures, drainage and isolation.

Special care shall be given to the cutting and bending of small-bore tubing and as such will be subjected to same pressure and leak testing as process pipe.

Clips, saddles, or clamps for the securing of pipes and tubes shall have smooth and rounded edges. The Engineer shall approve the types of saddle or clamp before installation commences.

Tubing shall only be cut with a proper tubing cutter; the use of hacksaws is not permitted. The Contractor shall ensure that pipe cutting and bending tools supplied by him are in good condition. The ID of cut tubing shall be reamed to remove burrs. Tubing shall be blown clear of all chips and debris before final connections are made.

Isolating valves shall be accessible for operation from floors and operating platforms unless otherwise approved. The tubing shall not interfere with access to valves or equipment and shall not obstruct passageways. Headroom clearance of 2000 mm minimum shall be maintained below all piping.

When installing tubing using compression type fitting, all the fitting manufacturer's instructions shall be followed exactly, which will include:

- (a) Proper cutting of the tube
- (b) Proper cleaning of the tube
- (c) Proper installation of the ferrules
- (d) Proper torque applied to compression nut.

Unions or break couplings shall be provided for dismantling lines at equipment, control valves, meters or similar items. Unions or break couplings shall also be installed in lines, which would interfere with the handling or lowering of equipment.

Where not specified in the Project Specification, fittings shall be sized correctly for both tubing and port connections. The Contractor is to identify the port size and thread prior to installation. Preferred threads for ports are NPT and BSP.

5.8 Painting and protective coatings

All mild steel fabrications, if not hot-dipped galvanised, shall be sand blasted, primed and first coated before delivery to the construction site.

5.9 Transportation and installation

The Contractor shall be responsible for disassembly, packaging, delivery to site (including loading and offloading) as well as reassembly of all equipment on site.

The Contractor shall provide timely information regarding all specialized handling and storage requirements for equipment to be transported and /or handled on the site until finally installed in the operating location.

6 Testing and Commissioning

6.1 Factory acceptance test (FAT)

For details on the factory acceptance tests and inspections required before equipment is delivered to site, refer to the relevant sub sections of the different equipment standard specifications.

- (a) SPE-II-0002 "Programmable Logic Controller"
- (b) SPE-II-0005 "SCADA"
- (c) SPE-II-0007 "Instrumentation"
- (d) SPE-II-0009 "Control and Instrumentation Enclosures"

6.2 Commissioning procedure

The Contractor shall ensure that the control system's (typically consisting of PLC or telemetry equipment installed in a cabinet with a SCADA or HMI as operator interface) system integrator assists during the commissioning of the control system, whereby the functionality of the control system and software shall be proven. During commissioning the Contractor shall make such adjustments, software modifications as are deemed necessary to provide the level of plant functionality and performance specified by the Client. All such changes shall be immediately incorporated into the 'As-Built' documentation and the Operating and Maintenance Manual, by the Contractor.

All equipment and every circuit that was altered or disturbed, after the completion of the FAT or for shipping and site erection, shall be specifically re-tested for integrity and functionality.

The Contractor shall provide a comprehensive commissioning checklist that shall be used to record the control system and other electronic equipment commissioning and tests results and make provision for formal sign-off of the installation by the Engineer and the Client.

Commissioning shall follow a staged approach as discussed in the following sections. Each stage must be completed before progressing to the next stage. The Contractor shall prepare the required acceptance certificates.

6.2.1 Construction acceptance

The Contractor shall verify that all electronic equipment, instruments, cables, cable trays, supports, enclosures, consumables and any other equipment or services associated with the control system has been constructed according to design.

All electronic circuits and wiring shall be tested for continuity and insulation resistance. A 500 V DC insulation tester shall be provided and used by the Contractor. Testing requirements are screen to screen 250 V DC, core to screen 500 V DC, core to core 500 V DC. The minimum acceptable value of insulation resistance shall be 1 M ohm line to line or line to ground.

The use of “meggers” for checking instrumentation and cables shall be strictly prohibited.

Special attention shall be given to testing the shielding of cables and wires to ensure continuity of shield(s) and earthing. Continuity checks, using a volt/ohm meter, shall be performed on all cable and wiring for instruments, to ensure that there are no open circuits and/or faults, and that all wiring is in accordance with electrical schematics and wiring diagrams.

The procedure for checking a cable shall be as follows:

- (a) Instruments shall be disconnected from the cable before commencing checking.
- (b) Check signal wires for continuity with a suitable instrument.

Insulation checks shall be made as follows:

- (a) Each core to each other core in the same multi-core cable.
- (b) Each core to screen or wire armour.
- (c) Screen to earth.
- (d) Wire armour to earth.

The results of all tests and observations are to be recorded on the appropriate form as per the Contractors quality management system and shall typically include:

- (a) Cable rack checklist
- (b) Cable checklist
- (c) Instrument installation checklist
- (d) Pratley box checklist
- (e) Junction box checklist
- (f) Solenoid valve box checklist
- (g) Field control box checklist
- (h) Instrument power distribution board checklist
- (i) Instrumentation air supply and impulse line checklist

(j) Control system cabinet checklist

The Engineer will prepare a punch list of all construction and installation defects and categorise the defects according to:

- (a) Category A critical: Defect will cause hazardous or unsafe conditions or result in operational down time.
- (b) Category B major: Defect will not affect the safety of personnel but will result in reduced operational capacity.
- (c) Category C minor: Defect will not affect the safety of personnel and will not cause operational down time.

The construction acceptance certificate must be signed off before proceeding to the next stage of commissioning. The Engineer will sign off this stage when the following has been achieved:

- (a) All category A and B punch list items cleared.
- (b) Completion of all the tests and observations forms as per the Contractors quality management system (refer to typical list above).

6.2.2 Pre-commissioning tests

During pre-commissioning the Contractor shall power up instrumentation, validate calibration of instrumentation, cross check operational ranges in the control system, conduct loop tests, energise motor contactors via the control system while the main busbars of the Motor Control Centre (MCC) are isolated, validate interlocks, alarms and pre-start warnings.

Refer to general specification SPE-II-0007 "Instrumentation" for detailed requirements pertaining to instrumentation commissioning.

The Contractor shall check and set power supply voltages and air supply pressure.

The Contractor shall check and calibrate all analogue signals for correct operation, range and span.

Loop testing shall not commence until the calibration certificate(s) for that loop have been issued.

The results of all calibrations and loop tests are to be recorded on the appropriate form as per the Contractors quality management system and shall typically include:

- (a) Calibration and test certificate
- (b) Loop test certificate
- (c) Interlock checklist, both hard-wired and software based
- (d) Alarm and pre-start warning checklist

The Contractor shall prepare a loop package for each loop comprising all the relevant certificates as noted above, collated in numerical order.

A sample package per type of loop shall be submitted to the Engineer for approval, before collation of the packages for the remainder. These samples shall form the basis of all loop packages and all loop packages shall comply with them. The loop package shall typically include the following documentation with relevant loop data highlighted; instrument data sheet, cable schedule, cable block, termination schedules, I/O list, P&ID, calibration and test certificate and loop test certificate.

The Contractor shall prepare the loop package before commencing testing of the loop.

Final loop documents shall only be signed off when all the documents are in place and the final loop check has been completed. No loop package shall be signed off unless all outstanding items have been rechecked and signed off.

Perform functional checks of loops, by simulating plant conditions when possible. Control circuits shall be tested with live control bus wires for correct operation of control push-buttons, interlocks, trip switches, pre-start alarms, contactor retaining circuits, indicators, etc. Precautions shall be taken to ensure that the main bus bars do not become energised during the testing operations.

Loop checking shall cover the entire circuit from the instrument or final actuator to the operator interface. Digital states, alarms setpoints, zero values, spans, engineering units shall be verified for consistency between instrument/ actuator and operator interface.

The pre-commissioning acceptance certificate must be signed off before proceeding to the next stage of commissioning. The Engineer will sign off this stage when the following has been achieved:

- (a) Completion of the loop packages
- (b) Completion of all the tests and observations forms as per the Contractors quality management system (refer to typical list above)
- (c) Completion of all hardwired interlocks and operational protective systems
- (d) Loss control (e.g., fire detection and suppression) and applicable security checks completed

6.2.3 Direction testing

The Contractor shall energise the MCC, variable frequency drives, motorised or pneumatically actuated valves and validate motor direction tests, valve actuation, confirmation of travel limits and control valves stroking.

The results of all tests are to be recorded on the appropriate form as per the Contractors quality management system and shall typically include:

- (a) Motor starter test checklist
- (b) On-off and actuated valve test checklist

The direction testing acceptance certificate must be signed off before proceeding to the next stage of commissioning. The Engineer will sign off this stage when all the tests and observations forms as per the Contractors quality management system have been completed.

6.2.4 No-load commissioning

The Contractor shall conduct no-load commissioning in accordance with SPE-EE-0002 "Training, Testing and Commissioning" with specific attention to the following:

- (a) As far as possible, start equipment and sequences under no-load conditions and verify correct operation of the control system.
- (b) Verify correct operation of instrumentation (that which can be verified without the introduction of product)

The result of all no-load sequence starts are to be recorded on the appropriate form as per the Contractors quality management system and shall typically include group or sequence start test certificate conducted under no-load conditions.

The no load commissioning acceptance certificate must be signed off before proceeding to the next stage of commissioning. The Engineer will sign off this stage when all the test forms as per the Contractors quality management system have been completed.

6.2.5 Final commissioning

The Contractor shall conduct final commissioning the works in accordance with SPE-EE-0002 "Training, Testing and Commissioning".

The Contractor shall demonstrate the process functionality of each aspect of the control system and its operator interface(s).

Acceptance shall be subject to the successful completion of the commissioning trial period.

7 Documentation and Training

7.1 Documentation

Design documentation and drawings, operating and maintenance manuals and final as built documentation shall be compiled in accordance with general engineering specification SPE-EE-0003 "Documentation and Drawings".

All installation work shall be performed in accordance with the "Approved for Construction" documents furnished.

The Contractor's document controller shall be responsible for logging one copy of each drawing as the "Site / Master " and the others as "Working" copies. Any additional prints will be for the Contractors account.

The "Site/Master" drawing shall be kept "current", by red-lining the "agreed/approved" changes and "resolved" discrepancies, as and when occurred. The mark-ups shall be done in a neat and legible fashion, without any guesswork required on the part of design office, as to what the mark up is all about, at the time of back draughting such drawing.

Construction/Installation type drawings shall only be considered and accepted as "As Built" if:

- (a) the actual construction is complete and accepted
- (b) all changes were redlined and recorded
- (c) such drawing has been stamped as "as Built" by the Contractor
- (d) such drawing has been signed off by Contractor
- (e) it was formerly issued on the Contractor's document transmittal

7.2 Training

The Contractor shall provide training sessions for the operation and maintenance of any 3rd party or vendor packages supplied by the Contractor in accordance with general engineering specification SPE-EE-0002 "Training, Testing and Commissioning". The program shall at a minimum cover the following:

- (f) General overview of the system
- (g) Functional operation of the system i.e.:
 - (i) System start-up and shut-down procedures
 - (ii) Equipment operation
 - (iii) Alarms
 - (iv) Fault finding



- (v) Incident reporting
- (vi) Maintenance
- (vii) Maintenance schedule
- (viii) Standard maintenance procedures
- (ix) Spare part lists



General Specification

Video Surveillance

Specification number: SPE-II-0008

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1 Scope

1.1 Application

This general specification covers the design, construction, installation, inspection, testing and commissioning of video surveillance equipment including cameras, video management software, servers, storage, network infrastructure and equipment supports.

1.2 General Requirements

All materials, components, and equipment of the Video Surveillance System shall be new and unused, shall be of current manufacture, and shall be free from any defects or imperfections.

Equipment shall be suitable for the environmental conditions, particularly with respect to corrosion resistance, Ultra Violet (UV) radiation and ingress protection.

2 Standards

2.1 Associated Documentation

This specification contains standard amendments and requirements, which shall be applied to the referenced statutory and national standards. The project-specific requirements are provided in the Project Specification, which shall be read in conjunction with this Specification.

The design, construction, installation, inspection, testing and commissioning of the Video Surveillance System shall comply with all relevant statutory regulations, and the latest editions (current at the time of Tender) of all relevant South African National Standards (SANS).

The Manufacturer shall follow an approved, auditable quality assurance system covering the design, construction, programming, configuring, inspection and testing of the Video Surveillance System.

2.2 Regulations, Specifications and Standards

The design, construction, inspection and testing of the video surveillance equipment shall comply with all relevant Statutory Regulations and Directives including:

- (a) Occupational Health and Safety Act (Act 85 of 1993);
- (b) Independent Communications Authority of South Africa (ICASA) regulations and related Acts;
- (c) Manufacturer's specifications and installation instructions.

and the latest editions (current at the time of Tender) of all relevant SANS standards, including:

Table 1: Reference Standards

SANS Number	Description
SANS 470	Concrete poles for telephone, power and lighting purposes
SANS 1063	Earth rods, couplers and connections
Other	Description
ONVIF	ONVIF an open industry forum promoting and developing global standards for interfaces of IP-based physical security products.

The following general specifications shall be read in conjunction with this specification and shall be deemed to form part thereof:

Table 2: General Specifications

Specification Number	Description
SPE-II-0001	General Electronic Installations

3 General

The Contractor shall design, manufacture, assemble, supply, configure, deliver, install, test and commission a fully functional Video Surveillance System (VSS).

The VSS shall be an incident driven system complete with video motion detection, video recording facilities and video management.

All necessary system design, programming (i.e. videotext, point descriptors, display maps, alarm message text), network configuration and address allocation shall be included.

Data of all outdoor cameras shall be transmitted by means of fibre optic cable, to mitigate the impact of lightning surges.

Surveillance equipment supplied shall provide the resolution required to achieve the functional requirements expressed as either detection, recognition or identification as referred to in the camera schedule provided in the Project Specification.

Table 3: Resolution Requirements

Operational Requirements	Horizontal Pixels/face	Pixels/cm
Identification (Good conditions)	40 px/face	2,5 px/cm
Recognition	20 px/face	1,25 px/cm
Detection	4 px/face	0,25 px/cm

4 Cameras

Cameras shall:

- (a) comply with the Technical Data Sheets;
- (b) be IP (Internet Protocol) communication compliant;
- (c) be Open Network Video Interface Forum (ONVIF) compliant;
- (d) be provided with suitable mounting brackets;
- (e) be labelled with the reference designation provided;
- (f) be phase locked and synchronised to ensure clean, roll-free switching and image stability;
- (g) be installed and commissioned to ensure focus, clarity and brightness of image at the video monitor;

Ethernet connections to cameras shall be CAT6 certified and plenum rated 10Gbit patch cords.

Installation lengths for CAT6 cable shall be strictly adhered to.

4.1 External (Bullet Cameras)

External cameras shall be suitable for outdoor conditions and provide an ingress protection rating of at least IP66.

4.2 Internal (Dome Cameras)

Internal (indoor) cameras shall be of the vandal-resistant dome type with a mechanical impact rating of at least IK10.

4.3 Camera Junction Boxes

Camera junction boxes shall comply with the requirements of Engineering Standard SPE-II-0001 – “General Electronic Installation”

All external cameras connected to the IP network by means of fibre optic media shall be equipped with a camera junction box. Cameras may share a junction box, provided that those cameras are mounted on the same structure (e.g. pole hosting multiple cameras).

Camera junction boxes, including the cable glands, shall have an ingress protection rating of no less than IP 65.

All equipment inside the junction box shall be mounted by either DIN rail or directly screwed onto the removable chassis plate.

Where cameras are equipped with junction boxes, those junction boxes shall include at least:

- (a) 6,3 A 5 kA circuit breaker to isolate the camera junction box and protect against overload and short circuits;
- (b) a fibre splice box, suitable to terminate at least two 8 core armoured cable, spliced and patched to ports for cross patching with patch leads;
- (c) an Ethernet fibre to copper converter;
- (d) a power sourcing midspan, PoE Ethernet switch or camera power supply with 230 VAC input power;
- (e) a suitable surge suppressor to afford protection against surges of the pulse shape 8/20 μ s with a nominal discharge current of 5 kA between phase and neutral and 10 kA between neutral and earth;
- (f) an Ethernet patch lead to connect to the camera, with moulded-booted patch cords;
- (g) an earth stud to bond the junction box to the site's equipotential earth; and
- (h) all patching, wiring and termination requirements for fibre and copper.

Junction boxes shall be clearly labelled with the reference designation using 20 mm letters on sandwich board (e.g. trafolyte).

To reduce the impact of lightning and other electrical surges, cable braiding shall be securely bonded to the site's equipotential earth.

5 Video Management Software

The video management software shall be an open platform software system.

Note: Open platform describes a software system which is based on open standards, such as published and fully documented external application programming interfaces (API) that allow using the software to function in other ways than the original programmer intended, without requiring modification of the source code.

The video management software shall:

- (a) supports ONVIF compliant devices;
- (b) scalable without restriction to video servers, clients or cameras (including PTZ cameras);

- (c) provide remote access via web interfaces; and
- (d) provide the following video compression algorithms: MJPEG, MPEG4 and H.265.

The video management software shall provide:

- (a) the facility to view images as full-screen or multi-camera matrix displays;
- (b) means to control the pan, tilt and zoom of PTZ cameras.

It shall be possible to select any of the cameras for display without having to switch, change or open new video management or display applications.

Video management functions shall include:

- (a) automated device discovery;
- (b) pre-event video recording;
- (c) simultaneous recording to archive and real-time surveillance;
- (d) capability to use different streams from a camera for recording and display;
 - (i) record a minimum 15 frames per second when triggered and offer the following recording options : security, event, surveillance, continuous, input driven and output driven recording controlled in combination with pre-event history;
 - (ii) display live video at 25 frames per second;
- (e) synchronous playback of video footage recorded by several cameras;
- (f) playback with fast- or slow-motion in forward or reverse;
- (g) audio and video analytics;
- (h) archive navigation through events recognized by video analytics or tagged by operators;
- (i) event-driven response scenarios: recording, alarm generation, activation of relays and starting PTZ camera through user defined pre-sets, notification by SMS, e-mail or through camera speaker output. Continuous or alarm recording (including initiated by an operator);
- (j) multi-level user rights; and
- (k) support for widescreen displays and cameras, and touch screen displays.
- (l) Compatible with operating systems: Microsoft Windows XP(SP2, SP3) / Windows Server 2003 R2 SP2 / Windows Server 2008 SP2 / Vista SP2 / Windows Server 2008 R2 SP1 / Windows Storage Server 2008 R2 SP1 / Windows Home Server 2011 SP1 / Windows Small Business Server 2011 SP1 / Windows 7 SP1 / Windows 8 / Windows Server 2012 / Windows 10 / Windows 10 Pro.

The video management software shall include the following features:

- (a) Time Compression - view of moving objects in recorded video simultaneously. Time Compressor allows the user to set a time range for video footage and get a short video clip of all moving objects in the scene. Objects and events captured at different times are displayed simultaneously in a condensed "video synopsis". When the user identifies an object of interest it can be selected to play the corresponding video fragment in full.

6 Digital Recording and Playback Server

The server shall:

- (a) support the following compression technologies: MJPEG, MPEG4 and H.265 with built in digital watermarking;

- (b) be compatible to third-party ONVIF compliant cameras, including PTZ cameras;
- (c) support the total count of IP video inputs as per the camera schedule provided in the Project Specification, including an additional 20% capacity;
- (d) support the total count of video outputs equal to video inputs including spare capacity;
- (e) be capable of recording to a resolution equal of the highest camera resolution offered, but not less than 8 megapixels;
- (f) be capable of recording video streams at the full speed of 6 Mbps per stream;
- (g) be 19" rack mountable;
- (h) provide a USB 3.0, or better, interface to support exporting video of particular incidents (selected by the operator) to USB devices in original recorder format;
- (i) provide at least 2 off 100/ 1000Mbps network interfaces;
- (j) support the required storage capacity.

7 Video Storage

Refer to the Project Specification for the required storage capacity.

The storage scheme shall support Hard Disk Drive (HDD) hot-swappable RAID-5 storage.

Video shall be stored on loops. When storage capacity of the HDD array is reached, recording shall continue by overwriting the oldest data.

8 Video Surveillance Workstation

Video surveillance workstations are required where it is not feasible for the server to host the video display and playback features.

Where multiple playback locations are required at a particular site, the camera images selected to be viewed on the various workstations shall be independent of each other.

The video surveillance workstation shall be equipped with the necessary graphics processors to meet the demands of the video display monitor but shall be no less than full 1080p high-definition resolution.

The workstations shall be capable, in terms of processing and display capability, of displaying footage of up to 16 cameras simultaneously.

The workstations shall either be 19" rack mounted with keyboard, video and mouse extension cables or a small form computer mounted behind the screen or beneath the control desk in accessible locations with support for more than one display per workstation.

9 Video Display Monitor

Refer to the Project Specification for the size and resolution of the monitor.

Monitors and terminals shall be equipped with all the necessary interface connections, software and mounting brackets and/or stands to view recorded or real time video footage.

10 Camera Poles

10.1 General requirements

Camera poles shall be reinforced, hollow, concrete poles compliant with SANS 470.

Camera poles shall be supplied complete with an integral earthing system consisting of stainless steel ferrules connected to the pole's reinforcement wire.

10.2 Cable entries

Camera poles shall be provided with two cable access openings, positioned opposite each other, of at least 200 x 75 mm to allow daisy chaining of sleeves.

The edges of the access opening shall be smooth to prevent any damage to the sleeves carrying cables.

The access opening shall be positioned such that the opening is at least 500 mm below ground level after the pole has been erected.

A mounting plate shall be fixed to the pole on the inside of the access opening to support the following:

- (a) six of "Klippon" type terminal blocks, of which two are earth terminals;
- (b) a 2,5 mm², 3 core cable to power the camera junction box installed inside the camera pole, terminated on the pole access open terminals and camera junction box circuit breaker; and
- (c) a gland plate to take up to four cables, two power cables and two fibre cables shall be installed on the mounting plate.

Earth terminals shall be connected to the pole's integral earthing system.

For concrete poles supporting a camera as well as luminaires, the mounting plate shall support the following:

- (a) a 6,3 A 5 kA circuit breaker to power the luminaire;
- (b) 6 of "Klippon" type terminal blocks for the camera power;
- (c) 10 of "Klippon" type terminal blocks for the luminaire; and
- (d) a gland plate to take up to six cables shall be installed on the mounting plate.

10.3 Access Aperture

At a height of at least 600 mm above ground level a rectangular opening, of at least 230 mm high by 100 mm wide, shall be provided on the poles.

The opening shall be covered with a weather-proof cover plate with a profile similar to that of the pole, securely fixed to the poles.

10.4 Excavations

The holes for poles shall be excavated to the following depths:

- (a) Poles exceeding 10,5 metres : 2,0 metres.
- (b) Poles between 7,5 and 10,5 metres : 1,8 metres.
- (c) Poles less than 7,5 meters : 1,35 metres.

The holes for poles shall have minimum dimensions of 1 m (length) by 0,5 m (width).

Once the poles have been erected the excavations shall be backfilled and compacted in layers of 150 mm to 95% MOD AASHTO using material free of stones, vegetation, etc.

Where the soil is sandy, loose or marshy, the poles shall be planted in a 12:1 sand/cement mixture.

10.5 Camera earthing and lighting protection

Each camera pole shall be equipped with an air termination rod, protruding at least 300 mm from the top of the camera pole.

An 1800 mm x M16 copper or steel-cored copper rod compliant to SANS 1063 shall be installed at the base of each camera pole.

The air termination rod shall be connected to the earth spike by means of the pole's integral earthing system.

The concrete pole earthing ferrules shall be connected to the earth spike by means of 16 mm² bare Cu earth wire.

The pole mounted camera junction box earth stud shall be connected to the concrete pole earthing ferrules by means of 16 mm² bare Cu earth wire.

Subsoil bare Cu earth joints shall be exothermic welded connections.

11 Testing and Commissioning

The VSS shall be tested and commissioned as described in the Engineering Standard SPE-II-0001 "General Electronic Installations" with specific attention to the following:

- (a) validation of camera coverage against the coverage map;
- (b) validation of the resolution requirements for the purposes of detection, recognition or identification as per the camera schedule;
- (c) validation of the video management software including the recording and playback rates and analytics as specified in the Project Specification; and
- (d) validation that sufficient storage has been provided for the specified storage duration.

12 Drawings and Training

Comprehensive documentation, training and operations & maintenance manuals shall be provided for the VSS all as described in the Engineering Specification SPE-II-0001 "General Electronic Installations".

In addition to the documentation prescribed by SPE-II-0001, the Contractor shall

- (a) provide network architecture drawings showing all the cameras, network equipment, servers, workstations and operator displays;
- (b) fibre optic cable termination schematics; and
- (c) location and coverage maps of the cameras.

SPECIFICATION BE1

BUILDING ELECTRICAL

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1. BUILDING ELECTRICAL

- a) The electronic portion of the Works is covered in the Building Electronic Specifications.
- b) Where equipment becomes outdated from the time of tender to Contractor design, the latest model shall be used during design and installation. All products installed shall still be in active sales; no products installed shall have received a product end of active-sales notification or be near its end-of-service.
- c) All material supplied must be new and unused, and free from any defects and imperfections. SABS mark-bearing material shall have preference.

1.1 NORMATIVE REFERENCES

The building electrical installation shall be in accordance with the following standard specifications and datasheets:

- Zutari General Specification SPE-EE-0013: Wiring and Outlets
- Zutari General Specification SPE-EE-0014: Lighting
- Zutari Engineering Standard SPE-EE-0020: MV & LV Earthing
- Datasheet DS-EE-0010S: Distribution Boards and Kiosks
- Datasheet DS-EE-0013: Small Power and Lighting
- Datasheet DS-EE-0014: Luminaire Schedule

This detail specification provides details and/or amendments of the standard specification related to this project.

1.2 SCOPE OF WORKS

The building small power and electrical installation shall include the following:

- a) Liaison with the Mechanical and Electrical Contractor to coordinate electrical power connections.
- b) Supply, installation and testing of the 400V/230V small power and lighting distribution boards.
- c) Lighting installation (interior and exterior).
- d) Power outlets and power skirting.
- e) Conduits and conductors from distribution boards to light fittings and power outlets.
- f) Data outlets and CAT-6 data cabling.
- g) Earthing and Bonding.
- h) Certificates of Compliance.
- i) Labelling.
- j) Testing and commissioning.
- k) As-Built drawings.

1.3 DISTRIBUTION BOARDS

- a) Distribution boards shall be installed to supply all small power, HVAC and lighting related to the relevant area. Each building erected under this contract shall be installed with a dedicated low voltage flush mounted distribution board. The following

distribution boards shall be designed, factory tested, supplied, installed, and commissioned:

- i) Abstraction Works – MCC room DB (ABS-DB-01)
 - ii) Abstraction Works – Transformer room DB (ABS-DB-02)
 - iii) WTW – Pump and Clearwell Complex DB (DB-PS)
 - iv) WTW – Administration Building DB (DB-ADM)
 - v) WTW – Chemical Dosing Building DB (DB-CHM)
 - vi) WTW – Guardhouse DB (DB-GH)
 - vii) WTW – Staff House 1 DB (DB-H1)
 - viii) WTW – Staff House 2 DB (DB-H2)
 - ix) WTW – Staff House 3 DB (DB-H3)
 - x) WTW – Area Lighting Kiosk 1 (EK-01)
 - xi) WTW – Area Lighting Kiosk 2 (EK-02)
- b) The Contractor shall make provision for a temporary supply to the distribution boards for testing if permanent supply has not been installed.
- c) The distribution boards shall be supplied from nearest PV distribution board as indicated on the single line diagrams.
- d) The distribution boards shall be fitted with name plates on the front of the panel. Details to be sent to the Engineer for approval prior to installation.
- e) All small power and lighting for the relevant building shall be supplied from the local distribution board.
- f) The equipment for the distribution board shall be installed to match the single line diagrams.
- g) A legend card shall be mounted on the inside of each distribution board. The legend shall be durable and suitable for industrial environments and shall indicate the following:
- i) Circuit breaker number
 - ii) Circuit designation/tag number
 - iii) Circuit description
- h) A Certificate of Compliance (CoC) shall be sent to the Engineer to check prior to the Engineer being requested to come to site and check the building power and lighting services installation.

1.4 LIGHTING (BUILDING INTERIOR AND EXTERIOR)

For the lighting installation, the Contractor shall be responsible for:

- Supply and installation of all types of luminaires, sensors, and control equipment
- Wiring of all circuits back to the distribution boards
- Testing of all circuits
- Phase balancing of all circuits
- Labelling of all circuits indicating the circuit number and the supply distribution board

- a) Exterior lighting for the Water Treatment Works shall be controlled by means of a contactor (located in the DB) and photocell mounted on the external wall preferably close to the DB where practically possible.
- b) Exterior lighting for the Abstraction Works shall be controlled by means of a light switch mounted in the MCC room.
- c) All new light switches shall be flush mounted into walls 1200mm above final floor level.
- d) Power to the interior and exterior lighting shall be supplied by means of 2.5mm² single core PVC insulated, general purpose, high conductivity, stranded conductor through PVC conduits, as per the single line diagrams.
- e) The permanent light fittings intended for installation shall not be used for temporary lighting during construction. The certificate of completion for the installation shall not be issued unless all light fittings and lamps are in working order.
- f) All light fittings and light fitting components shall be approved by the Engineer and electronic ballasts shall bear the SABS/CE mark of approval.
- g) The lamps for all fittings shall primarily be LED type, with a colour temperature as specified within the schedule and minimum colour rendering index (Ra) of at least 80.
- h) The Contractor shall install appropriately rated luminaires and light switches in hazardous classified areas.
- i) Emergency light fittings shall be maintained (shall operate as normal light fittings under normal operating conditions and shall automatically switch on upon loss of mains power). The permanent live and switched live shall be supplied from individual circuit breakers and shall be installed on the same phase. The light fittings shall be maintainable and installed such that access to the back-up batteries is possible. Warning labels shall be placed on emergency light fittings indicating the dual supply.
- j) Manufacturer's data sheets and photometric data of the offered light fittings shall be included in the tender offer.
- k) The Contractor shall submit samples for approval of all types of light fittings to the Engineer prior to procurement thereof. The approved samples of each luminaire type shall be held on site in a samples area and shall always be available for inspection by the Engineer. No claims for delays due to late approval of samples due to late provision of samples by the Contractor shall be entertained.
- l) Luminaires shall be supplied complete with lamps, cable glands, earth labelling, secondary rubber insulated cables, mounting brackets, labelling of circuits and all other material required for installation of the light fitting.
- m) All light fittings shall be as per luminaire schedule and as indicated on the drawings.

1.5 SMALL POWER

For the small power installation, the Contractor shall be responsible for:

- Supply and installation of all types of outlets below
- Wiring of all circuits back to the distribution boards
- Testing of all circuits
- Balancing of all distribution board phases
- Labelling of all circuits indicating the circuit number and the supply distribution board

- a) All single phase switched socket outlets shall be installed flush mounted into walls 300mm above final floor level, except where outlets are positioned in power skirting or above kitchen/lab counters, these outlets shall be flush mounted and positioned 100mm above the countertop or unless noted otherwise. Single socket outlets installed in the industrial areas shall be mounted at 500mm above final finished floor level or unless noted otherwise.
- b) All single-phase outlets shall be complete with the SANS 164-1 and SANS 164-2 three pin outlets.
- c) All single phase switched socket outlets shall be supplied by means of 4mm² single core PVC insulated, general purpose, high conductivity, stranded conductor as per the single line diagrams.
- d) All three phase switched socket outlets shall be supplied by means of 6mm² 4 core PVC insulated SWA Cu cables.
- e) Two pole or three pole switch-disconnectors shall be installed within 1500mm of each relevant unit.
- f) All switch-disconnectors mounted externally shall be IP 65 rated.
- g) Industrial 3-phase switched socket outlets shall be 32A 5-pin and surface mounted, supplied by surface mounted conduit.
- h) All boardrooms shall have the universal modular floor box complete with galvanized box, flange, faceplate and covers with outlets as indicated on drawings and HDMI outlet. Contractor to allow for conduits from the floor box to the screen for data and power cabling. Contractor to allow for conduits from the floor box to the distribution board.

1.6 CONDUITS

- a) All internal conduits shall be PVC ($\geq 25\text{mm } \varnothing$), and shall be surface mounted on brickwork, concrete, steel or ceiling voids or cast into concrete or built/chased into brickwork or concrete and installed within walls or partitioning.
- b) All external surface mounted conduits shall be hot dipped galvanised steel ($\geq 20\text{mm } \varnothing$), bonded to an earthing point.
- c) Where the conduit or round boxes may have shifted during the casting of concrete, the Contractor shall be responsible to locate the openings and/or open them up for usage. Where concrete might have run into the conduit during casting, the Contractor shall be responsible to open the conduits either mechanically or with the relevant chemicals. The Contractor shall be responsible for providing draw-wire for all routes in which he/she will need it. All conduits not utilised during this installation shall be left with draw-wire to accommodate future installations.
- d) Exposed conduits shall be hot dipped galvanised steel ($\geq 20\text{mm } \varnothing$), bonded to an earthing point. Conduit work under open roof structures and inside ceilings shall be done in a rectangular grid pattern. Caddy clamps shall be used on roof purlins; maximum spacing of saddles and clamps shall be 750mm.
- e) All conduit installations shall be complete with bends, couplings, glue, round conduit boxes placed in position etc.

1.7 POWER SKIRTING

- a) Double compartment grey PVC power skirting with cover shall be installed around the Administration building and office / control room areas. The bottom compartment shall be used for data communication systems and the top compartment shall be used for power conductors.

1.8 CABLE SUPPORT SYSTEMS

- a) Each cable tray shall be of the return-flange type. Only purpose-made (standard accessories) splices, risers, offsets and bends etc. shall be used.
- b) The Contractor shall calculate the weight of the cables on the cable ladders and trays and select the appropriate duty.
- c) All trays shall be adequately fixed to fixing surfaces. All cable trays shall be earthed to the local DB earth bar by means of 16mm² earth conductors and be continuously bonded.
- d) Wire mesh trays shall be of the galvanised type and shall be suspended from roof purlins or slab where applicable and shall make use of standard accessories with splayed corners for elbows, tees, crossovers etc.
- e) Trunking shall be of the galvanised type and shall be installed according to routes shown on drawings.
- f) Trunking shall be suspended from roof purlins and slabs as per drawings and shall make use of standard accessories with splayed corners for elbows, tees, crossovers etc. (lids to be on the upper side of the trunking). All trunking shall be earthed to the local DB earth bar by means of 16mm² earth conductors and be continuously bonded.
- g) Wire mesh trays shall be installed for electronic building services cable reticulation.
- h) Cables may be run on the same cable tray/ladder as power cables, except where electromagnetic interference may affect the electronics signals. Electronic cables shall be installed at least 300 mm away from power cables.

1.9 CONDUCTORS

- a) All conductors to light fittings, light switches and single phase power outlets shall be supplied by single core PVC insulated, general purpose, high conductivity, stranded conductor through PVC conduits installed in the wall (flush mounted). Conductor sizes shall be as indicated on the single line diagrams.
- b) All conductors to lighting, single phase sockets outlets and data outlets shall be done through PVC conduit, installed in concrete or brick walls and floors which are covered afterwards. It shall be the Contractors' responsibility to ensure conduits are installed in time before brick walls are constructed or concrete is cast.
- c) Where conduits shall be required to run on surface mounted routes, the routes shall be approved by the Engineer. All surface mounted conduit shall be hot dipped galvanised steel.
- d) Power to the distribution boards shall be supplied from the PV distribution boards by PVC insulated SWA Cu cable installed in suspended or wall mounted cable trays.
- e) Incomer cables will be supplied and installed by a separate contractor.
- f) All incoming sleeves and openings into or at concrete structures and into buildings shall be thoroughly sealed as per the Engineer's specifications after the cable

installation is complete to limit water ingress into sleeves, buildings and building trenches.

- g) Where the Contractor is required to carry out cable trenching, core drilling, chasing sleeves or conduits, it shall be the Contractor's own responsibility to coordinate such activities with relevant sub-contractors.
- h) Cables shall enter and exit the Junction Boxes from the bottom of the panels.

1.10 EARTHING AND BONDING

1.10.1 GENERAL REQUIREMENTS

- a) All electrical equipment shall be earthed and bonded.
- b) All exposed conductive parts and accessible extraneous conductive parts shall be bonded in accordance with SANS 10142-1.

1.10.2 EARTH ELECTRODES

- a) A building ring earth electrode (70mm² Bare Copper Earth Conductor) shall be installed around all electrical buildings as indicated on the earthing layout drawings. The installed earth resistance shall be no greater than 1 Ohm.
- b) The earth electrode shall be brought out to a copper building electrode earth bar, which shall be installed in the concrete trench of each electrical building or as indicated on the earthing layout drawings.
- c) A 1500mm earth rod (16mm Diameter, copper plated, with 2000mm tail) shall be installed as indicated on the earthing layout drawings.
- d) Each building housing a MCC room shall be equipped with a main copper earthing bar located in the building cable trench in the MCC room. Each assembly's earthing bar shall be connected to its designated building's main earthing bar
- e) All joints shall be CAD welded and witnessed by the Engineer. No earth electrodes shall be closed up in sand / backfill until the Engineer has witnessed the earthing installation.

1.10.3 EARTH CONTINUITY CONDUCTORS

- a) Earthing conductors shall be PVC-insulated copper conductors or bare copper earth conductors as indicated and sized in accordance with the single-line diagrams
- b) Where no separate earthing conductor is shown on the single-line diagrams, the intention is that a spare core in the power cable shall serve this function.

1.10.4 BONDING

- a) All exposed conductive parts and accessible extraneous conductive parts shall be bonded to earth.

1.11 GENERAL

1.11.1 LABELLING

- a) Clear labelling of all termination points and/or outlets is required.

- b) All cables shall be labelled with plastic markers (equal to "Grafoplast") which will be strapped to the cables at both ends. The label shall indicate the use, origin and destination in 3mm letter font.
- c) Sample of labelling method to be submitted to the Engineer for approval before labelling of all outlets is undertaken.

1.11.2 TESTING AND COMMISSIONING

- a) If the Contractor is not qualified to perform specific tests, it shall be the duty of the Contractor to appoint a subcontractor, deemed to be suitably competent to perform relevant tests.
- b) The Contractor is required to test the functionality of each sub-system to the Engineer's approval and acceptance before proceeding with the overall system functionality.
- c) The Contractor shall perform all necessary tests to confirm the functionality of the system to the Engineer's approval.
- d) Each system shall be tested before being presented to the Engineer for final inspection. The Employer or the Engineer will witness the re-testing of the installations.
- e) During final inspection, a factory-trained representative of the installer shall demonstrate the system features, performance, and operation.
- f) Records of all inspections, tests and reports shall be submitted to the Engineer for acceptance before taking over of the works.
- g) It shall be the responsibility of the Contractor to make any correction to ensure the system is compliant to all relevant regulations.

1.11.3 AS-BUILT DRAWINGS

- a) Clear and accurate post construction drawings are required as a project deliverable.
- b) All post construction CAD drawings shall be A3 size, neatly folded and placed in a reinforced holder with transparent Perspex cover. One set shall be supplied.
- c) Drawings shall also be submitted on a USD flash drive in AutoCAD 2023 or later, .dwg format, as well as Adobe Acrobat PDF format.

1.12 MEASUREMENT AND PAYMENT CLAUSES

1.12.1 DISTRIBUTION BOARDS (DB)

Supply:

The tendered rate shall include full compensation for the design, factory drawings, factory acceptance test and internal labelling of the DBs as specified in associated drawings and design documents. Factory drawings shall include layout and single line diagram drawings for each DB. This shall also include all the equipment inside the DBs.

Unit: Sum

Install:

The tendered rate shall include full compensation for the installation, testing of the DBs complete with all the specified electrical equipment and wiring of the DBs. The installation allowance shall include all mounting brackets, fastening bolts, paint repair done on site, repairs to brickwork and plaster (flush mounted DBs) and earthing/bonding of the panel. For flush mounted DBs, the installation allowance shall include the liaison with the civil contractor for space allowance in the wall, the chasing/breaking out in the wall and making good (including paintwork) required to flush mount the panel neatly into the wall.

Unit: Sum

1.12.2 LIGHTING

1.12.2.1 Luminaires

Supply:

The tendered rate shall include full compensation for the supply of the fittings and luminaires including lamps, filters as specified, control gear, cable gland, earth labelling and secondary rubber insulated cable and mounting brackets.

Unit: No.

Install:

The tendered rate shall include full compensation for the installation, testing of the installation, balancing of phases for the lighting.

Unit: No.

1.12.2.2 Light Switches

Supply:

The tendered rate shall include full compensation for the supply of the complete switch as specified in associated drawings and design documents. This will include the associated square box, cover plate conduit connections, electrical wiring, switch mechanism with all fittings, dimmer, screws, bolts, labelling, glands, and enclosures required to install the socket. For flush mounted switches, the installation allowance shall include the liaison with civil contractor for space allowance in the wall, the chasing in the wall and making good (including paintwork) required to flush mount the switch neatly into the wall.

Unit: No.

Install:

The tendered rate shall include full compensation for the handling, inspection, fastening, testing, labelling, connecting and fitting of the cover plate. This will also include the cost of providing and installing all hardware screws and wall plugs in the case of surface mounted switches required to install the switch in accordance with the specification.

Unit: No.

1.12.3 SMALL POWER**1.12.3.1 Power Outlets and Switch-disconnectors****Supply:**

The tendered rate shall include full compensation for the supply of the complete power socket or switch-disconnector as specified in associated drawings and design documents. This will include the associated square box, cover plate, conduit connections, electrical wiring, switch mechanism and socket outlet with all fittings, screws, bolts, labelling, glands and enclosures (includes weatherproof box with sliding door for all external installations). The installation allowance shall include the liaison with the civil contractor for space allowance in the wall, the chasing in the wall and making good (including paintwork) required to flush mount the socket outlets or switch-disconnectors neatly into the wall. For socket outlets installed into power skirting, the rate shall include the cutting and positioning of the power skirting face plate.

Unit: No.

Install:

The tendered rate shall include full compensation for the installing, labelling, testing, balancing of phases, phase and earth continuity testing of the power sockets and switch-disconnectors. This will also include mounting and termination associated with the switch-disconnectors.

Unit: No.

1.12.3.2 Data Outlets**Supply:**

The tendered rate shall include full compensation for the supply of the complete data (RJ45) outlet as specified in associated drawings and design documents. This will include the associated square box, cover plate, conduit connections, data wiring, modular mechanism, RJ11/45 connection with all fitting, screws, bolts, labelling, glands and enclosures required to install the outlet.

Unit: No.

Install:

The tendered rate shall include full compensation for the installing, labelling and continuity testing of the outlets. For flush mounted outlets, the installation allowance shall include the liaison with civil contractor for space allowance in the wall, the chasing in the wall and making good (including paintwork) required to flush mount the outlet neatly into the wall. For outlets installed into power skirting, the rate shall include the cutting and positioning of the power skirting face plate.

Unit: No.

1.12.4 CONDUITS**Supply:**

The tendered rate shall include full compensation for the supply of the conduit as specified in associated drawings and design documents. This also includes the couplings to join the conduit, conduit boxes and any other required equipment to fasten the conduit to different surfaces.

Unit: m

Install:

The tendered rate shall include full compensation for the installing including bending, jointing, terminating, chasing of conduit and fixing the conduit to different surfaces as specified. This may include brick work and paintwork on the surface of structures or installing the conduit in ceiling voids. The Contractor shall be responsible to select the proper conduit route through the concrete and brick structures and install these in time before concrete is cast or brickwork completed.

Unit: m

1.12.4.1 Conduit Boxes

The tendered rate shall include full compensation for the supply of conduit outlet boxes and shall include blank cover plates where no equipment is installed in the boxes.

Unit: No.

Install:

The tendered rate shall also include full compensation for installing the conduit boxes in concrete, in brick walls, including the chasing thereof and fixing the boxes to different surfaces as specified. This may include brick work repair and paintwork on the surface of structures. This will also include blank cover plates where no equipment is installed in the boxes.

Unit: No.

1.12.5 POWER SKIRTING

Supply and Install:

The tendered rate shall include full compensation for the specified power skirting including cover plates, internal bends, external bends, end pieces and all material required to install the power skirting. The tendered rate shall also include full compensation for installing the power skirting and mounted against the wall.

Unit: m

1.12.6 CABLE SUPPORT SYSTEMS

Supply:

The tendered rate shall include full compensation for the supply of the wire mesh or cable trays as specified in associated drawings and design documents. This also includes the couplings to join the systems, bends and any other required equipment to fasten the cable support systems to different surfaces.

Unit: m

Install:

The tendered rate shall include full compensation for the installing including bending, jointing, terminating and fixing the systems to different surfaces as specified. This may include brick work and paintwork on the surface of structures or installing the support systems in ceiling voids. The Contractor shall be responsible to select the proper routes.

Unit: m

1.12.7 CONDUCTORS

Supply and Install:

The tendered rate shall include full compensation for the supply, installation and testing of the conductors as specified in associated drawings and design documents, including all terminations. Only conductors installed on site will be measured and paid. All wastage, including off cuts and losses due to wrong on-site measurements or remainder of wire drum shall not be included in the installed amount. The rate will include any equipment required to install and join the conductor.

Unit: m

1.12.8 EARTHING AND BONDING

1.12.8.1 Earth Electrode

Supply and Install:

The tendered rate shall include full compensation for the supply, installation and termination of the specified earth electrodes. All welding required to form the relevant cable route or earth matt shape shall be included in the rate. Earth continuity tests and earthing resistance (in Ohms) readings may be required by the Engineer. These tests and test certificates shall be included in the rate.

Unit: No.

1.12.8.2 Rods

Supply and Install:

The tendered rate shall include full compensation for the supply and installation of the specified earthing rods. This will also include all equipment required to bond them to the earthing electrode by proper clamps or welding.

Units: No.

1.12.8.3 Earth Bar

Supply and Install:

The tendered rate shall include full compensation for the supply and installation of the specified earth bar. This will also include all equipment required to install them at the location as agreed with the Engineer on site.

Unit: No.

1.12.9 GENERAL

1.12.9.1 Power Supply Liaison

The tendered rate shall include the cost of interfacing and liaising with other contractors or supply authority to arrange for the temporary site connection or permanent electrical supply.

Unit: Sum

1.12.9.2 Labelling

The tendered rate shall include the full compensation for the labelling of the electronic system under each section according to the specification.

Unit: Sum

1.12.9.3 Testing and Commissioning

The tendered rate shall include full compensation for the testing, troubleshooting and commissioning of the small power and lighting. This will be done under the supervision of the Client and Engineer. The testing and commission shall comply with the quality verification of the project.

Unit: Sum

1.12.9.4 Certificates of Compliance

The tendered rate shall include the full compensation for a certified person to test and verify the compliance of the electrical installation. The responsibility of the Contractor shall be to make any correction to ensure the system is compliant to all relevant regulations. The tendered rate shall also include issuing the certificate to the Employer and a copy to the Engineer.

Unit: Sum

1.12.9.5 As-Built Drawings

The tendered rate shall include the full compensation for marking up, printing costs for hardcopies and PDF drawings on a USB flash drive. The rate shall also include for the Contractor to update all final drawings electronically to match what has been installed on site before drawings are printed.

Unit: Sum

1.12.10 MISCELLANEOUS

The tendered sums or rates shall cover all costs required to complete the work and activities as scheduled and specified and are to include for items and activities ancillary to the work. This shall, for example, include full compensation for the supply of all materials, manufacturing/providing, delivery to site, storage, all equipment and plant, labour, preparation, application, installation, applying finishes, testing, all temporary work and safety precautions, replacement of defective work, protection of completed work and clean-up after completion.

Unit: Prov Sum or Sum

1.12.11 DELIVERY

The tendered rate shall cover the cost of delivery of the Goods and offloading at the delivery point stated in the Scope of Work or at the Site (as applicable). The rate shall further include for disassembly, packaging, taking due care to protect the equipment during transport, unpacking, checking, providing the Engineer with all delivery notes he may require, and reassembly of the Goods on the Site, as applicable.

Unit: Sum

END OF SECTION

SPECIFICATION BE2

BUILDING ELECTRONICS

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1. BUILDING ELECTRONICS

- a) The building electronics portion of the Works shall comply with the Standard Specifications in the Building Electrical Specification but as varied by this Detailed Building Electronics Specification, the Data Sheets and Drawings.
- b) The electrical portion of the Works is covered in the Building Electrical Specifications.
- c) Where equipment becomes outdated from the time of tender to Contractor design, the latest model shall be used during design and installation. All products installed shall still be in active sales; no products installed shall have received a product end of active-sales notification or be near its end-of-service.
- d) All material supplied must be new and unused, and free from any defects and imperfections. SABS mark-bearing material shall have preference.

1.1 NORMATIVE REFERENCES

The building electronics installation shall be in accordance with the following standard specifications and datasheets:

- Zutari General Specification SPE-II-0001: General Electronic Installations
- Zutari General Specification SPE-II-0008: Video Surveillance
- Zutari Engineering Standard SPE-EE-0020: MV & LV Earthing
- Datasheet DS-EL-0001: Building Service Network
- Datasheet DS-EL-0003: CCTV
- Section 1.10 of the Detailed Building Electrical Specification

This detail specification provides details and/or amendments of the standard specification related to this project.

1.2 SCOPE OF WORKS

The building electronics installation shall encompass the following:

- a) Liaison with a separate contractor to coordinate fibre installation.
- b) Closed Circuit Television (CCTV) for all plant buildings and exterior work areas.
- c) Site wide optical fibre ring.
- d) Wi-Fi Access points.
- e) Labelling.
- f) Testing and commissioning.
- g) Training.
- h) As built drawings.
- i) Operating and Maintenance Manual.

1.3 GENERAL

- a) The detailed design shall undergo review by the Engineer and the Employers to confirm all design requirements and industry regulations are adhered to.
- b) The Contractor shall review the project construction program and plan the installation accordingly taking into consideration critical path items such as fibre installation and sources of power for the different buildings.

- c) The Contractor shall liaise with the electrical subcontractors to ensure conduits, wireways and outlets are installed to all electronics equipment, and socket outlets are installed to all electronics equipment requiring 230 VAC power.
- d) All equipment lists and data sheets shall be neatly presented to the Engineer in an electronic format for approval. Samples of all equipment shall also be presented to the Engineer for approval before any equipment is ordered.
- e) Where temporary power is required during construction, the Contractor is responsible for providing this power source.
- f) All external metal enclosures shall be manufactured from 316 stainless steel powder coats electric orange.
- g) All cable entries shall be IP65 compression glands mounted on the bottom of the enclosure.
- h) All equipment must be mounted on a backplate.
- i) All terminals must be rail mounted.

1.4 CCTV SYSTEM

1.4.1 GENERAL REQUIREMENTS

- a) The Contractor shall employ a certified Designer to review the Engineer's design providing comments and updates to the design where required.
- b) The purpose of the CCTV system shall be to monitor, alert and record the following:
 - i. All access points to the site.
 - ii. Access to buildings as indicated on the CCTV layout drawings
 - iii. Access and coverage of Electrical rooms
 - iv. Specific process areas/equipment as indicated on drawings.
- c) The CCTV system shall be installed as per issued layout drawings.
- d) The Contractor shall be certified to install and setup the OEM specific CCTV system.
- e) The installation shall include the supply, installation, testing and commissioning of the following:
 - i. Fixed IP cameras with sufficient detail to be able to recognise people's faces upon replay.
 - ii. Associated networking equipment and network management software.
 - iii. Power Supplies.
 - iv. UPSs.
 - v. Network panels
 - vi. Utility boxes.
 - vii. PoE CCTV cabling system.
 - viii. Video recording equipment and software.
 - ix. Connection of all cameras onto the IP CCTV system server.
 - x. A display and management system which shall be situated at the WTW in the Admin building.
- f) All CCTV systems shall allow at least 20% spare capacity for future expansion.
- g) The system will be internet protocol (IP) based with the primary CCTV rack installed in the process controllers' room of the Admin building at the WTW. Additional CCTV

switches shall be installed in the rest of the buildings and linked via fibre optic cable back to the process controllers' room.

- h) The network enclosures shall be installed in the following buildings:
 - i. Abstraction Works MCC room.
 - ii. Pump and Clearwell Complex MCC room (Link A to main server).
 - iii. Chemical Dosing Building MCC room (Link B to main server).
 - iv. Guardhouse (Link C to main server).
 - v. Admin Building Process Controllers' room (Main CCTV Server).

1.4.2 VIDEO MANAGEMENT SOFTWARE

- a) Alerts and alarms shall be designed to meet end-user requirements. These requirements shall be obtained from the end-users (plant supervisors and operators) and Engineers through at least three (3) workshops during construction.
- b) Recording shall only be indicated on motion and/or object detection. All cameras shall be optimally setup to reduce nuisance recordings.
- c) Regions of motion and object detection interest shall be agreed per camera with the Employer or Engineer during workshops.
- d) Motion or object detection alerts at the monitoring station shall be setup for specific cameras confirmed by the Employer or Engineer.
- e) A site wide interactive map of all buildings with CCTV shall be developed. Clicking on the building shall open an interactive map of the building showing camera positions and coverage. Clicking on the camera icon should show live footage of the camera.
- f) The software shall create a log of all events on the CCTV system.
- g) Minimum spare capacity of 20% shall be available on the storage unit. The system shall also have the capacity to notify the operator to back up the data every 2 months and once the initial 3-month period lapses, a first in first out approach will be implemented.
- h) Backing up of the system shall be done by making use of RAID level 1 to ensure that no data is lost in the event of drive failure. Access to the stored recording shall be limited to users with administrative rights to access the data to avoid any security breaches.
- i) The CCTV system shall make use of a fibre optic ring network to communicate between all localised video network enclosures and the video display monitors.
- j) The Contractor shall be responsible to connect to the fibre optic patch panel at each of the building areas to relay information over the network. Two cores of the 8-core fibre optic cable shall be dedicated for the transfer of CCTV video imaging

1.4.3 CAMERAS

- a) Only High Definition (1080p) IP cameras shall be used in the system.
- b) The dome cameras shall be installed in all internal areas and the bullet cameras shall be installed in all external locations. The large industrial facilities shall be limited to 360 degrees dome cameras to monitor activity only and not focused on equipment.
- c) All external cameras shall be mounted in an IK10 and IP66 rated cover to ensure protection from the physical elements.

- d) The primary storage of recordings will be done on hard drives within the server. Sufficient capacity shall be provided to store at least 3-months continual recording at full frame rate and definition.
- e) Product, positioning and lenses to be pre-approved by the Engineer prior to construction.
- f) All cameras shall be Onvif compliant.

1.4.4 POWER SUPPLY

- a) A dedicated UPS AC power shall be used for the CCTV network equipment powered from corresponding building electrical system.
- b) A DC power supply shall be supplied where required for network switches.
- c) Power supply shall be sufficiently sized to power both the network switch and the PoE injector where the PoE is not internal to the network switch.

1.5 CAT CABLES

- a) All cameras shall be physically networked via CAT6 copper cabling from the appropriate switches and the cable lengths to each camera shall be limited to 90 meters. Any lengths more than 90 meters shall be networked via a fibre cable.
- b) Purple CAT copper cabling shall be used from cameras and monitoring station to the network switches. They shall also be Screened, Twisted Pair (STP).

1.6 FIBRE OPTIC CABLES

- a) The Contractor shall employ a Certified Optical Network Associate (CONA) Designer to complete the optical fibre detailed design based on the Engineer's preliminary design.
- b) An 8-core, armoured single-mode blown fibre optic cable shall be used. Control and engineering communication shall be separated from data transfer (supervision). This shall be achieved by using different set of cores in the cable. The fibre core layer allocation shall be as follow:

Table 1 - Fibre Optic network layers

CORE NUMBERS	SERVICE
01 - 02	Control Data
03 - 04	Supervisory
05 - 06	CCTV
07 - 08	Spare

- c) The Contractor shall install a single-mode blown fibre optic cable between the following points:
 - i. The Abstraction Works and the Water Treatment Works along the pipeline route.
 - ii. The Water Treatment Works and the Booster Pump Station at the Nduku reservoir along the main pipeline route.
- d) The installation shall be completed by personnel with CONA certification or installed by Certified Optical Fibre Installer (COFI) and inspected and signed off by a CONA.

- e) Optical fibre cables shall be installed in continuous lengths with fibre-optic drawpits in between.
- f) The Contractor shall use the fusion method with locale injection and detection for all fibre optic splicing.
- g) The average splice loss of each fibre shall be 0.15dB or less per splice. The average splice loss is defined as the summation of the attenuation as measured in both directions through the fusion splice, divided in half. No individual splice loss measured in a single direction shall exceed 0.20dB.
- h) Point-to-point OTDR tests shall be undertaken according to SANS 11801 and test report provided for each core.
- i) The optical fibre cable shall be installed according to TIA-598-C colour code.
- j) The optical fibre shall be terminated in each building's dedicated services network panel and installed at the top of the panel.
- k) The Contractor shall protect loops from tangling or kinking. At no time shall the cable's minimum bending radius specification be violated. To accommodate long, continuous installation lengths, bi-directional pulling of the fibre optic cable is permitted.
- l) The Contractor shall seal all cables where the cable jacket is removed. The cable shall be sealed as per the cable manufacturer's recommendation with an approved blocking material.
- m) All splices shall be contained in splice trays utilising strain relief such as heat shrink wraps, as recommended by the splice tray manufacturer.
- n) The Contractor shall co-ordinate fibre entry and exit details for each building with other building services and sub-contractors.

1.7 WIFI ACCESS POINTS

1.7.1 GENERAL REQUIREMENTS

- a) The Contractor shall provide a WiFi network for the Admin building on the WTW that is connected to the internet and separate from the plant networks for operators to access the internet and communicate.
- b) Internet connectivity shall be provided via LTE connection or a local ISP for the duration of the defects notification period. Internet speed shall be at least 10MB/s.
- c) The Contractor shall provide all the necessary WiFi access point routers complete with installation accessories and cabling.
- d) The Contractor shall provide all interface equipment required for a fully functional WiFi system.

1.8 GENERAL

- a) For Labelling, Testing and Commissioning and As-Built drawings, refer to the Detailed Building Electrical Specification, section 1.10 - General.

1.8.1 TRAINING

- a) The training of operators and security personnel forms part of this Contract.
- b) Training shall commence during the commissioning period of the installation.

- c) It shall be the responsibility of the Contractor to ensure that all training is carried out and that all relevant staff is sufficiently trained. The following minimum aspects are to be covered:
 - i. Operation of the CCTV system software and alerting
 - ii. Backup procedures.
 - iii. Archiving data and related recovery procedures.

1.8.2 MAINTENANCE

- a) For the full duration of the DNP period (twelve months after practical completion), the Contractor shall be responsible for the following:
 - i. The routine maintenance of the system, according to the Operating and Maintenance documentation (including relevant OS updates)
 - ii. Replacement of defective equipment.
 - iii. Re-adjustment of equipment
 - iv. Attending to any equipment faults or complaints made by the clients authorised representative

1.8.3 O&M MANUALS

- a) The Contractor shall prepare and provide comprehensive maintenance and operation manuals of the systems installed in accordance with all the requirements of the specifications.
- b) The manuals shall be detailed and shall be written to enable any supplier of maintenance organisation to maintain the system.
- c) The Contract shall be deemed incomplete until the documentation submission has been approved by the Engineer.
- d) All manuals will also be submitted on USB flash drive, with pdf formatted copies of manuals (3 sets).
- e) The manuals shall contain the following as a minimum requirement:
 - i. Operating instructions.
 - ii. Fault finding procedures (flow diagram).
 - iii. Datasheet of each system component.
 - iv. Equipment setup and commissioning parameters (test values/settings)
 - v. List of suppliers/manufacturers involved with the procurement process, including addresses and component rates.
 - vi. Inspection schedules.
 - vii. Testing procedures.
 - viii. Commissioning procedures.
 - ix. As-built drawings.

1.9 MEASUREMENT AND PAYMENT CLAUSES

1.9.1 CCTV SYSTEM

1.9.1.1 Cameras (all types)

Supply and Install:

The tendered rate shall include full compensation for the supply and installation the cameras as specified in associated drawings and design documents. This will include the camera housing, all glands, bonding, labelling, secondary rubber insulated cable, mounting brackets and all other material required to install the camera.

Unit: No

1.9.1.2 CCTV Network Panels

Supply and Install:

The tendered rate shall include full compensation for the supply, installation and labelling of the CCTV network panel as specified in associated drawings and design documents. This will include power distribution unit, all securing screws, the surge protector, circuit breaker, fuse terminals, din rail, trunking and earth termination bar and all other material required to install a complete functional unit.

Unit: No

1.9.1.3 CCTV Utility Box

Supply and Install:

The tendered rate shall include full compensation for the supply, installation and labelling of the CCTV Utility Box as specified in associated drawings and design documents. This will include the surge protector, circuit breaker, fuse terminals, din rail, trunking and earth termination bar and all other material required to install a complete functional unit.

Unit: No

1.9.1.4 Small Form Factor Pluggable Transceiver (SFP)

Supply and Install:

The tendered rate shall include full compensation for the supply and installation of the small form factor pluggable unit as specified in associated drawings and design documents. This will include the connector type matching for its intended purpose and meeting the speed requirements.

Unit: No

1.9.1.5 CCTV Network Management Software

Supply and Install:

The tendered rate shall include full compensation for the supply, installation and configuration of complete network management software including development of software mimics and alerting functionality.

Unit: Sum

1.9.1.6 CCTV server C/W software

Supply and Install:

The tendered rate shall include full compensation for the design, provision of product data sheets, supply, installation and training of the video server as specified in associated drawings and design documents. This will include the server panel, internal circuit boards, software, all gland plates, bonding, labelling, secondary rubber insulated

cable, mounting brackets, intruder protection, internal wiring and termination and all internal equipment as required to make it functional.

Unit: No

1.9.1.7 CCTV Operator Computer Workstation

Supply and Install:

The tendered rate shall include full compensation for the design, provision of product data sheets, supply, installation and training of the video monitoring system as specified in associated drawings and design documents. This will include the monitor, client hardware and software, wiring, labelling, mouse, keyboard, mounting brackets and all internal equipment as required to make it functional.

Unit: No

1.9.1.8 Displays

Supply and Install:

The tender rate shall include full compensation for the supply, installation of the displays as specified in associated drawings and design documents. This will include the wiring, display brackets and all equipment required to make it functional.

Unit: No

1.9.2 CAT CABLES

1.9.2.1 CAT 6e cables

Supply and Install:

The tendered rate shall include full compensation for the supply, installation and labelling of the data cable as specified in associated drawings and design documents, including all cable securing accessories required. Only cables installed on site will be measured and paid for. All wastage, including off cuts and losses due to wrong on-site measurements or remainder of wire drum shall not be included in the installed amount. The rate will include any equipment required to install and secure cables.

Unit: m

1.9.2.2 CAT6e cable Terminations

Supply and Install:

The tendered rate shall include full compensation for the supply and installation of the data cable keystone termination as specified in associated drawings and design documents, including all securing accessories required. The rate will include any equipment required to install and secure keystones.

Unit: No

1.9.3 FIBRE OPTIC CABLES

Supply and Install:

The tendered rates shall include full compensation for the supply and installation of the optical fibre cable including compression glands, electrical tap, and all cable securing accessories.

Unit: m

1.9.3.1 Fibre Patch Panels

Supply and Install:

The tendered rates shall include full compensation for the supply and installation of the fibre patch panel unit as specified in associated drawings and design documents. This shall include the required number of splice trays/cassettes, mid-couplers, mounting brackets, brush panels and all other material required to install a complete functional unit.

Unit: No

1.9.3.2 Fibre Patch Cable

Supply and Install:

The tendered rates shall include full compensation for the supply and installation of the fibre patch cable including all cable securing accessories. This will include the correct connector type, cable type, typical wavelength and all other material required to install a complete functional unit.

Unit: m

1.9.3.3 Fibre Splice

Supply and Install:

The tendered rate shall include full compensation for the supply and installation per a single optical fibre core splice including a pig-tail and splicing equipment required to complete splice per the specification.

Unit: No

1.9.3.4 Fibre-optic drawpit

Supply and Install:

The tendered rate shall include full compensation for the supply and installation of the drawpit and all other material required to install a complete functional unit.

Unit: No

1.9.4 WI-FI SYSTEM

Supply and Install:

The tendered rate shall include full compensation for the supply and installation of the Wi-Fi system according to the specification. This shall include all other materials required to install a complete functional system.

Unit: Sum

1.9.5 GENERAL

1.9.5.1 Design and co-ordination

The tendered rate shall include full compensation for the design by specialist sub-contractors where required, the liaison, and coordination of the electronics system under each section with the main-contractor and other sub-contractors including all setting out of services, cable routes and equipment.

Unit: Sum

1.9.5.2 Labelling

The tendered rate shall include the full compensation for the labelling of the electronics system under each section according to the specification.

Unit: Sum

1.9.5.3 Testing and Commissioning

The tendered rate shall include full compensation for the testing, troubleshooting, and commissioning of the respective electronic system. This will be done under the supervision of the Client and Engineer. The testing and commission shall comply with the quality verification of the project.

Unit: Sum

1.9.5.4 Certificates of Compliance

The tendered rate shall include the full compensation for a certified person to test and verify the compliance of the electronics system under each section. The responsibility of the Contractor shall be to make any correction to ensure the system is compliant to all relevant regulations. The tendered rate shall also include issuing the certificate to the Employer and a copy to the Engineer.

Unit: Sum

1.9.5.5 As-Built drawings

The tendered rate shall include the full compensation for marking up, printing costs for hardcopies and PDF drawings on a USB flash drive. The rate shall also include for the Contractor to update all final drawings electronically to match what has been installed on site before drawings are printed.

Unit: Sum

1.9.5.6 O&M Manuals

The tendered rate shall include the full compensation for the compiling, issuing, printing and delivery of the O&M documentation as per the specification. This shall include site visits to ensure continuous operation of the system, system fault callouts, maintenance work as per all equipment requirements during this period.

Unit: Sum

1.9.5.7 Training

The tendered rate shall include full compensation for training on the electronics system setup and use of the respective electronics system during training.

Unit: Sum

1.9.6 DELIVERY

The tendered rate shall cover the cost of delivery of the goods and offloading at the delivery point stated in the scope of work or at the site (as applicable). The rate shall further include for disassembly, packaging, taking due care to protect the equipment during transport, unpacking, checking, providing the Engineer with all delivery notes he may require, and reassembly of the goods on the site, as applicable.

Unit: Sum

1.9.7 MISCELLANEOUS

The tendered sums or rates shall cover all costs required to complete the work and activities as scheduled and specified and are to include for items and activities ancillary to the work. This shall, for example, include full compensation for the supply of all materials, manufacturing/providing, delivery to site, storage, all equipment and plant, labour, preparation, application, installation, applying finishes, testing, all temporary work and safety precautions, replacement of defective work, protection of completed work and clean-up after completion.

Unit: Prov Sum or Sum

END OF SECTION

Project report
SIDWADWENI RBWSS TSITSI RIVER SUPPLY
**ABSTRACTION WORKS FIRE SAFETY
SPECIFICATIONS**
OR Tambo District Municipality

Submission date: 2024/02/15
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Fire Extinguisher (DCP)	Error! Bookmark not defined.



1. Fire Safety and Protection Specifications

1.1 General

The particular specifications included in this document define the systems, materials and equipment to be used for the fire services installation.

This Standard Specification shall be read in conjunction with the Bills of Quantities, if any, the Detailed Specification and Drawings, in which the exact extent of the work will be identified. All rules, regulations, by-laws, codes and standards as specified in the technical specifications shall apply unless otherwise specified in the particular specification.

The building is to be equipped and protected by means of a conventional fire protection installation designed, supplied, installed, tested and commissioned in accordance with the relevant SANS Standard requirements and the requirements of the Local Authority having Jurisdiction.

1.2 Description of the Works

The Works required by the fire contractor shall be to supply and install wet fire protection and regulatory signage items included but are not limited to; hydrants, hose reels, fire extinguishers and regulatory fire signage as itemized in this specification and BOQ provided.

1.3 Confidentiality

All drawings, memoranda, ideas and information supplied for the works shall remain the property of the party so supplying such drawings, memoranda, ideas and information on the express understanding that they will be treated as private and confidential and not be used in any way, except in connection with the single installation for which they are intended.

No details of any drawings, memoranda, ideas and information shall be published or disclosed in any trade or technical paper or elsewhere without the previous consent in writing of the party that supplied such drawings, memoranda, ideas and information.

1.4 Compliance with Regulations

The works shall comply with all the requirements and bylaws of the relevant local authorities. Where the proposed layouts, or any of the materials specified, etc., do not comply with the regulations, the matter shall immediately be brought to the attention of the Engineer in writing.

The complete works shall comply in particular with the specifications and requirements of:

- SANS 10400, Section T and Section W Fire Protection and Fire Installation, as amended.
- The Occupational Health and Safety Act, Act 85 of 1993, as amended.
- SANS 1910 - Portable Fire Extinguishers
- SANS 1186 – Symbolic Safety Signs
- This detailed specification and the Engineer's drawings forming part of the tender documents.

Certificates of approval/inspection from the local authority shall, if called for, be submitted to the Engineer before the final payment certificate will be issued.

The above shall take preference over all other specifications and requirements. However, any deviation from this specification shall immediately be reported to the Engineer.

The works shall furthermore comply with all the requirements and bylaws of the relevant local authority. Where the proposed layouts, or any of the materials specified, etc., do not comply with these regulations, the matter shall immediately be brought to the attention of the Engineer.

The Subcontractor shall furthermore issue all notices and pay all fees required to be given or paid in terms of statutory and regulatory requirements and the relevant local authority's bylaws.

1.5 Deviations from Standard Specification

The quality of workmanship, materials to be used, equipment etc, shall be as specified in these documents. Where discrepancies exist between the Bills of Quantities, the Standard Specification and the Detailed Specification, the Detailed Specification shall have preference over both the Bills of Quantities and Standard Specification. The Standard Specification shall furthermore have preference over the Bills of Quantities.

Any discrepancies found between the Bills of Quantities, Standard and Detailed Specifications shall be brought to the attention of the Quantity Surveyor and Engineer in writing within seven (7) days of its discovery

1.6 Make of Equipment

Similar items of equipment used throughout this contract shall be of the same make and, where applicable, of the same model.

1.7 Firefighting Equipment

Should a fire-fighting system be included in this contract, the items of equipment to be used, and size of fittings, nozzles, couplings, etc., shall not only be complimentary to each other, but shall also comply with the requirements of the local Fire Department.

1.8 Materials, Workmanship and Alternative Manufacture

All materials shall be of the qualities specified and the subcontractor shall, upon request by the engineer, furnish the engineer with proof to his reasonable satisfaction that the materials are of the specified quality

The subcontractor shall keep the engineer informed regarding the placing of all orders for materials and the progress of manufacture or any article or materials

All materials shall be new unless otherwise instructed or specified.

Materials, goods and equipment described by trade names or catalogue references shall be of the type and manufacture specified. Alternative materials, goods and equipment equal to those specified may be offered. The decision whether the alternative articles are acceptable shall rest with the engineer

Where alternatives for such materials, goods and equipment are permitted, the subcontractor shall be liable for latent defects in such materials, goods and equipment and or the cost of making good physical loss and repairing damage to the works resulting therefrom.

Once accepted, the same type and make of material, goods and/or equipment shall be used and installed throughout the project for a specific application.

1.9 Protection

The subcontractor shall protect all work and material, i.e., his and others, from damage by his work and workmen, and shall be liable for all damage caused should the protection not be provided or prove to be inadequate. The subcontractor's responsibility in this respect shall extend until his work and equipment have been finally inspected, tested and accepted.

Open ends of pipework shall be closed with temporary covers or plugs during storage and construction to prevent entry of obstructing material. This shall be strictly enforced.

1.10 Commissioning

Comprehensive pre-commissioning, commissioning as well as quality monitoring and checking will be done on all the Fire protection Services systems, Conventional Fire system, and fire services controls, installations in accordance with the relevant SANS Commissioning Codes.

The commissioning report shall be submitted which must:

- Demonstrate that the services were commissioned in compliance with the relevant SANS Commissioning Codes;
- Include commissioning dates, records of all functional/commissioning testing undertaken, a list of any future seasonal testing, and a written list of outstanding commissioning issues;
- Include the outcomes and changes made to the building as a result of the commissioning process, accounting for all the recommendations; and
- Reference appended extracts of commissioning records for major plant and equipment as deemed appropriate by the relevant project team members involved in the commissioning process and as referenced in the commissioning report.

Commissioning shall be meticulous and all procedures as stipulated by the suppliers of the equipment shall be strictly adhered to.

The Subcontractor shall prepare detailed commissioning schedules well in advance of the programmed practical completion inspection date.

The schedules shall make allowance for all measurements that will be required, checking of operational and safety set-points, test results, etc., and shall be submitted to the Engineer for approval prior to the start of commissioning.

The Subcontractor shall submit the completed schedules to the Engineer for checking after commissioning has been completed, and prior to the completion inspection.

Each task in these schedules shall be countersigned by the Subcontractor's Commissioning Engineer to ensure that any discrepancies between site and commissioning conditions/data can be clarified.

The minimum commissioning requirements are:

Initial visual check

- Correct models or equipment.
- Equipment located in correct positions and parallel to building lines unless otherwise specified.
- Signage installed securely (NO adhesives/double sided tape allowed) and in correct orientation.
- Installation workmanship and finish.

Pre-commissioning checks

- These checks shall include, but not be limited to:
- General state of system

- General system checks

1.11 Testing and Inspections

The subcontractor shall, at his own cost, make all necessary arrangements and provide all necessary facilities for testing and inspection of the installation by the local authorities concerned and other authorised interested parties. The subcontractor shall provide any instruments or equipment required for these tests. The execution of these tests shall be to the complete satisfaction of the inspecting authorities/parties.

1.11.1 General Construction and Installation Requirements

All equipment, component parts, fittings and materials supplied and/or installed, shall conform in respect of quality, manufacture, test and performance to the requirements of the applicable current SANS specifications and codes, except where otherwise specified or permitted with approval from the Engineer in writing.

All materials and workmanship, which may in the opinion of the Engineer, be inferior to that specified for the work, will be condemned. All condemned material and workmanship must be replaced or rectified as directed by the Engineer, to the satisfaction of the Engineer.

The Contractor shall submit a complete, detailed equipment and material list to be used to the Engineer for approval prior to placing orders or commencing installation.

All new equipment, materials and systems shall be installed in such a manner and positioned as to not impede on access routes, entrances and other services. The Contractor shall co-ordinate these items taking into account other services and equipment.

All control equipment and serviceable items shall be installed in such a manner and positioned to be accessible and maintainable.

The Contractor shall ensure that all safety regulations and measures are applied and enforced for the full Contract period to ensure safety of the workforce, public and user.

All materials and equipment shall be carefully examined for defects and flaws prior to installation. All defective and/or flawed materials and equipment shall be replaced with new.

All pipe installations shall be neatly fitted and properly secured and bracketed. Any underground pipework shall be treated and prepared by the contractor.

During construction all pipe ends shall be kept plugged to prevent any ingress of dirt and foreign matter.

All piping shall be installed in such a manner as to allow for contraction and expansion.

1.11.2 Equipment and Drawing Approval

The contractor shall supply equipment data for approval. Should the contractor deviate from the Engineers drawings, they will need to provide a drawing for approval.

1.11.3 Guarantee and Maintenance

The subcontractor shall guarantee the works against defects for a period of one (1) year from date of completion.

The guarantee shall cover all defects to the works and shall provide for the replacement or repair of all components that become defective during the guarantee period. Consumable components are excluded from the guarantee.

Where component parts or equipment are supplied by the employer, the contractor or the agent or where the make is specified without an alternative, then the subcontractor shall be responsible for such component parts or equipment only to the extent that the subcontractor is able to assign to the employer the benefit of warranties by the supplier or manufacturer.

The works is to be operated and maintained in accordance with the Operating and Maintenance Manuals prepared by the subcontractor. Any damage to the works resulting from the employer's failure to comply with the procedures set out in these manuals will not be covered by the guarantee.

The sub-contractor shall provide free maintenance for a period of 1 (one) year following the hand over to the client. The maintenance shall include for all management, labour, lubricating materials, cleaning materials and transport.

The guarantee shall be given to the Principal Contractor. Where the guarantee period extends beyond the patent defects liability period of the Principal Building Agreement, the guarantee shall be ceded to the employer for the remainder of the period.

1.12 Technical Specification for Regulatory Fire Signage

A full set of Fire Design drawings for the buildings as well as a Bill of Quantities forms part of this tender. The tenderer is to price for the installation of external and internal fire safety signage as specified on the drawings, in accordance with the relevant SANS Standard allowing for all costs associated with procurement, installation, fixing and any other items/functions that may be required to complete the installation.

These items include but are not limited to;

- Identification Signs: For each extinguisher arrangement, or independently located item.
- Escape Route Signs: At each discharge point as well as strategic wayfinding.

The tenderer shall price and ensure that the entire Regulatory fire safety signage installation is in full compliance with all the relevant statutory requirements.

The design as indicated on the tender drawings shall be checked by the Tenderers against the statutory requirements.

These amendments shall be indicated in red on the tender drawings, which are to be returned with the tender documents, and noted in a tender covering letter. The Tendered Subcontract Sum shall include the relevant costs, if any, for the above amendments.

Comprehensive written reports including repairing of defects, covering all routine maintenance shall be issued to the Fire Engineer during the 12-months period after practical completion. Written reports of all callouts shall be issued to the Fire Engineer, including rectification work undertaken and the reasons for the call-out.

1.13 Fire Protection Equipment Specifications

1.13.1 Fire extinguisher

Fire extinguishers shall be supplied and installed on a correctly sized and secured bracket as indicated and detailed on the drawings. The fire extinguisher shall be installed in accordance with SANS 1910, or other relevant SANS standard.

Fire Extinguishers shall be installed inside each fire cabinet and where elsewhere indicated on the drawings.

Fire extinguishers shall have the following capacity:

DCP (Dry Chemical Powder)	-	4.5 kg
DCP (Dry Chemical Powder)	-	9 kg
CO2 (Carbon Dioxide)	-	5 kg

In diversity there is beauty and there is strength.

MAYA ANGELOU

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Project report

SIDWADWENI RBWSS TSITSI RIVER SUPPLY
HLPS & CLEARWELL COMPLEX FIRE
SAFETY SPECIFICATIONS
OR Tambo District Municipality

Submission date: 2024/02/15
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1. Fire Safety and Protection Specifications

1.1 General

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The building is to be equipped and protected by means of a conventional fire protection installation designed, supplied, installed, tested and commissioned in accordance with the relevant SANS Standard requirements and the requirements of the Local Authority having Jurisdiction.

1.2 Description of the Works

The Works required by the fire contractor shall be to supply and install wet fire protection and regulatory signage items included but are not limited to; electric hydrant pump set and all associated fittings and fixtures, hydrants, hose reels, fire extinguishers and regulatory fire signage as itemized in this specification and BOQ provided.

1.3 Confidentiality

All drawings, memoranda, ideas and information supplied for the works shall remain the property of the party so supplying such drawings, memoranda, ideas and information on the express understanding that they will be treated as private and confidential and not be used in any way, except in connection with the single installation for which they are intended.

No details of any drawings, memoranda, ideas and information shall be published or disclosed in any trade or technical paper or elsewhere without the previous consent in writing of the party that supplied such drawings, memoranda, ideas and information.

1.4 Compliance with Regulations

The works shall comply with all the requirements and bylaws of the relevant local authorities. Where the proposed layouts, or any of the materials specified, etc., do not comply with the regulations, the matter shall immediately be brought to the attention of the Engineer in writing.

The complete works shall comply in particular with the specifications and requirements of:

- SANS 10400, Section T and Section W Fire Protection and Fire Installation, as amended.
- The Occupational Health and Safety Act, Act 85 of 1993, as amended.
- SANS 1128, Part 1:2010, Components of underground and above-ground hydrant systems, as amended.
- SANS 543:2004, Fire hose reels (with semi-rigid hose).
- SANS 1567, Hydrant Installation
- SANS 1910 - Portable Fire Extinguishers
- SANS 10252. Part 1:2004, Water Supply Installation for Buildings, as amended.

- This detailed specification and the Engineer's drawings forming part of the tender documents.

Certificates of approval/inspection from the local authority shall, if called for, be submitted to the Engineer before the final payment certificate will be issued.

The above shall take preference over all other specifications and requirements. However, any deviation from this specification shall immediately be reported to the Engineer.

The works shall furthermore comply with all the requirements and bylaws of the relevant local authority. Where the proposed layouts, or any of the materials specified, etc., do not comply with these regulations, the matter shall immediately be brought to the attention of the Engineer.

The Subcontractor shall furthermore issue all notices and pay all fees required to be given or paid in terms of statutory and regulatory requirements and the relevant local authority's bylaws.

1.5 Deviations from Standard Specification

The quality of workmanship, materials to be used, equipment etc, shall be as specified in these documents. Where discrepancies exist between the Bills of Quantities, the Standard Specification and the Detailed Specification, the Detailed Specification shall have preference over both the Bills of Quantities and Standard Specification. The Standard Specification shall furthermore have preference over the Bills of Quantities.

Any discrepancies found between the Bills of Quantities, Standard and Detailed Specifications shall be brought to the attention of the Quantity Surveyor and Engineer in writing within seven (7) days of its discovery

1.6 Make of Equipment

Similar items of equipment used throughout this contract shall be of the same make and, where applicable, of the same model.

1.7 Firefighting Equipment

Should a fire-fighting system be included in this contract, the items of equipment to be used, and size of fittings, nozzles, couplings, etc., shall not only be complimentary to each other, but shall also comply with the requirements of the local Fire Department.

1.8 Materials, Workmanship and Alternative Manufacture

All materials shall be of the qualities specified and the subcontractor shall, upon request by the engineer, furnish the engineer with proof to his reasonable satisfaction that the materials are of the specified quality

The subcontractor shall keep the engineer informed regarding the placing of all orders for materials and the progress of manufacture or any article or materials

All materials shall be new unless otherwise instructed or specified.

Materials, goods and equipment described by trade names or catalogue references shall be of the type and manufacture specified. Alternative materials, goods and equipment equal to those specified may be offered. The decision whether the alternative articles are acceptable shall rest with the engineer

Where alternatives for such materials, goods and equipment are permitted, the subcontractor shall be liable for latent defects in such materials, goods and equipment and or the cost of making good physical loss and repairing damage to the works resulting therefrom.

Once accepted, the same type and make of material, goods and/or equipment shall be used and installed throughout the project for a specific application.

1.9 Protection

The subcontractor shall protect all work and material, i.e., his and others, from damage by his work and workmen, and shall be liable for all damage caused should the protection not be provided or prove to be inadequate. The subcontractor's responsibility in this respect shall extend until his work and equipment have been finally inspected, tested and accepted.

Open ends of pipework shall be closed with temporary covers or plugs during storage and construction to prevent entry of obstructing material. This shall be strictly enforced.

1.10 Commissioning

Comprehensive pre-commissioning, commissioning as well as quality monitoring and checking will be done on all the Fire protection Services systems, Conventional Fire system, and fire services controls, installations in accordance with the relevant SANS Commissioning Codes.

The commissioning report shall be submitted which must:

- Demonstrate that the services were commissioned in compliance with the relevant SANS Commissioning Codes;
- Include commissioning dates, records of all functional/commissioning testing undertaken, a list of any future seasonal testing, and a written list of outstanding commissioning issues;
- Include the outcomes and changes made to the building as a result of the commissioning process, accounting for all the recommendations; and
- Reference appended extracts of commissioning records for major plant and equipment as deemed appropriate by the relevant project team members involved in the commissioning process and as referenced in the commissioning report.

Commissioning shall be meticulous and all procedures as stipulated by the suppliers of the equipment shall be strictly adhered to.

The Subcontractor shall prepare detailed commissioning schedules well in advance of the programmed practical completion inspection date.

The schedules shall make allowance for all measurements that will be required, checking of operational and safety set-points, test results, etc., and shall be submitted to the Engineer for approval prior to the start of commissioning.

The Subcontractor shall submit the completed schedules to the Engineer for checking after commissioning has been completed, and prior to the completion inspection.

Each task in these schedules shall be countersigned by the Subcontractor's Commissioning Engineer to ensure that any discrepancies between site and commissioning conditions/data can be clarified.

The minimum commissioning requirements are:

Initial visual check

- Correct models or equipment, specification of piping, types of valves, etc. provided.
- Equipment located in correct positions and parallel to building lines unless otherwise specified.
- All piping neatly arranged and cleaned
- Shipping fasteners, clamps, etc. removed or released.

- Joints tight and correctly fitted.
- All fasteners in position and tight.
- Signage installed securely (NO adhesives/double sided tape allowed) and in correct orientation.
- Coil piping correct configuration. (Counter flow, IN-at-the-bottom, OUT-at-the- top, etc.).
- Existence of sufficient, and where applicable, correctly fitted bleed-off, vent valves, drains, etc., as specified. (Both at components and in pipework.)
- Soundness and alignment of general supports.
- Installation workmanship and finish.

Pre-commissioning checks

- These checks shall include, but not be limited to:
- General state of system
- Checks before pipe filling
- Process for system filling and venting, including pressure testing
- Full system flushing and cleaning
- General system checks

1.11 Testing and Inspections

The subcontractor shall, at his own cost, make all necessary arrangements and provide all necessary facilities for testing and inspection of the installation by the local authorities concerned and other authorised interested parties. The subcontractor shall provide any instruments or equipment required for these tests. The execution of these tests shall be to the complete satisfaction of the inspecting authorities/parties.

1.11.1 General Construction and Installation Requirements

All equipment, component parts, fittings and materials supplied and/or installed, shall conform in respect of quality, manufacture, test and performance to the requirements of the applicable current SANS specifications and codes, except where otherwise specified or permitted with approval from the Engineer in writing.

All materials and workmanship, which may in the opinion of the Engineer, be inferior to that specified for the work, will be condemned. All condemned material and workmanship must be replaced or rectified as directed by the Engineer, to the satisfaction of the Engineer.

The Contractor shall submit a complete, detailed equipment and material list to be used to the Engineer for approval prior to placing orders or commencing installation.

All new equipment, materials and systems shall be installed in such a manner and positioned as to not impede on access routes, entrances and other services. The Contractor shall co-ordinate these items taking into account other services and equipment.

All control equipment and serviceable items shall be installed in such a manner and positioned to be accessible and maintainable.

The Contractor shall ensure that all safety regulations and measures are applied and enforced for the full Contract period to ensure safety of the workforce, public and user.

All materials and equipment shall be carefully examined for defects and flaws prior to installation. All defective and/or flawed materials and equipment shall be replaced with new.

All pipe installations shall be neatly fitted and properly secured and bracketed. Any underground pipework shall be treated and prepared by the contractor.

During construction all pipe ends shall be kept plugged to prevent any ingress of dirt and foreign matter.

All piping shall be installed in such a manner as to allow for contraction and expansion.

1.11.2 Equipment and Drawing Approval

The contractor shall supply equipment data for approval. Should the contractor deviate from the Engineers drawings, they will need to provide a drawing for approval.

1.11.3 Painting

The complete hydrant and hose reel installations, including all alarms, pipes, fittings, hangers, valves, etc., shall be painted by the Subcontractor.

All grease, oil, rust, scale, etc., shall be removed from the works by the application of solvents and wire brushing. The works shall then be primed with a coat of high-quality zinc chromate primer and finished with two coats of high gloss enamel paint.

The primer coat shall be allowed to dry completely before applying two coats of gloss enamel paint. The finishing paint colour shall be No. A-11, Signal Red. The first coat shall be left to dry completely before the next coat is applied. The final coat of paint shall only be applied after the system has been tested and the ceilings have been painted.

1.11.4 Guarantee and Maintenance

The subcontractor shall guarantee the works against defects for a period of one (1) year from date of completion.

The guarantee shall cover all defects to the works and shall provide for the replacement or repair of all components that become defective during the guarantee period. Consumable components are excluded from the guarantee.

Where component parts or equipment are supplied by the employer, the contractor or the agent or where the make is specified without an alternative, then the subcontractor shall be responsible for such component parts or equipment only to the extent that the subcontractor is able to assign to the employer the benefit of warranties by the supplier or manufacturer.

The works is to be operated and maintained in accordance with the Operating and Maintenance Manuals prepared by the subcontractor. Any damage to the works resulting from the employer's failure to comply with the procedures set out in these manuals will not be covered by the guarantee.

The sub-contractor shall provide free maintenance for a period of 1 (one) year following the hand over to the client. The maintenance shall include for all management, labour, lubricating materials, cleaning materials and transport.

The guarantee shall be given to the Principal Contractor. Where the guarantee period extends beyond the patent defects liability period of the Principal Building Agreement, the guarantee shall be ceded to the employer for the remainder of the period.

1.12 Technical Specification for Regulatory Fire Signage

A full set of Fire Design drawings for the buildings as well as a Bill of Quantities forms part of this tender. The tenderer is to price for the installation of external and internal fire safety signage as specified on the drawings, in accordance with the relevant SANS Standard allowing for all costs associated with procurement, installation, fixing and any other items/functions that may be required to complete the installation.

These items include but are not limited to;

- Identification Signs: For each extinguisher arrangement, or independently located item.
- Escape Route Signs: At each discharge pint as well as strategic wayfinding.

The tenderer shall price and ensure that the entire Regulatory fire safety signage installation is in full compliance with all the relevant statutory requirements.

The design as indicated on the tender drawings shall be checked by the Tenderers against the statutory requirements.

These amendments shall be indicated in red on the tender drawings, which are to be returned with the tender documents, and noted in a tender covering letter. The Tendered Subcontract Sum shall include the relevant costs, if any, for the above amendments.

Comprehensive written reports including repairing of defects, covering all routine maintenance shall be issued to the Fire Engineer during the 12-months period after practical completion. Written reports of all callouts shall be issued to the Fire Engineer, including rectification work undertaken and the reasons for the call-out.

1.13 Technical Specification for Conventional Protection

1.13.1 Scope

This standard specification covers the standards, materials and code of practice for the supply and installation of conventional fire protection systems for the building services trade.

This specification shall form an integral part of the contract document and shall be read in conjunction with the schedule of quantities, drawings and additional and particular specifications compiled as part of this document.

This specification shall act as a guideline to the particular specification, where in conflict the particular specification shall take precedence.

The Contractor shall at all times adhere to this specification unless otherwise specified in the particular specification.

1.13.2 Pressure Test

All pipes shall be pressure tested before taken into use. The Engineer shall witness this pressure test.

The Contractor shall provide two pressure tests to the entire system. The first test shall consist of a compressed air test to a minimum pressure of 1000 kPa. The second pressure test shall consist of water test to a minimum pressure of 1600 kPa and shall only be performed once the complete system has been installed and inspected and approved by the Engineer. The water to be used for the water pressure test shall be sterilized as described in section 2.13. On completion and approval of the water pressure test the system shall be drained and flushed and only filled with approved water from the completed water supply system on approval from the Engineer.

For water tests completed sections of the pipe installation shall be filled with water after all outlets have been plugged, sealed or closed. The section of pipe shall be hydraulically pressure tested by means of a suitable manually operated or mechanically driven pressure pump. A pressure of at least 1.5 times the working pressure of the class rating of pipes or fittings, with a minimum pressure of 1600 kPa shall be applied for a period of time specified in the specifications or as recommended by the manufacturers.

Tests should not be performed against closed valves.

Leakages that occur shall be measured and calculated and checked against the allowable losses.

For underground pipe installations if the completed section of pipe complies with all specifications and passes the tests and inspection, it could be approved and the Contractor may be instructed to backfill the open sections of trench at the joints and connections, where applicable. The Contractor shall then proceed to build all the valve chambers, inspection chambers, etc.

1.13.3 Flushing of Fire Water Systems

Before any pipeline is taken into use, it shall be flushed over its complete length and including the fittings. The pipe shall be filled with potable water or similar approved water sources. The pipeline shall be filled for flushing in such a manner that no air is trapped in the pipeline.

At least 14 days prior to the commencement of flushing the Contractor shall submit full details of the proposed method of flushing the pipeline to the Engineer for his approval.

The cost of water for filling the pipeline for flushing shall be borne by the Contractor.

The Contractor shall provide all necessary materials, tools, equipment and labour necessary to flushing the pipeline. After flushing the pipeline, the Contractor shall, at no extra cost, empty the pipeline and dispose of the water in a manner approved by the Engineer.

1.14 Requirements for Conventional Fire Protection Installation

All conventional fire protection installations shall adhere to the technical and particular specifications and shall include the following general requirements:

Piping shall conform to applicable SANS Standards. Reference to a Specification from recognized authorities to establish basis of quality shall mean current edition at date of Tender.

Routes of pipes in roof spaces are shown on the drawings as a guide only and the Contractor must ensure that no pipes are placed in positions impeding on access routes and entrances and other services.

All pipes are to be carefully examined for defects and flaws before installation and shall be neatly fitted.

The ends of all pipes are to be cleaned, free from burrs and rough edges and joined together tightly. An approved pipe joint compound may be sparingly used with best quality hemp. All surplus or exposed hemp is to be thoroughly cleaned off joints before the painting of pipes.

All vertical pipes must be securely fixed with brackets and supports of an approved type, securely fixed into the wall not more than 40 mm from the wall. These fixings must be strictly adhered to.

Pipes installed in service ducts and ceiling voids are to be perfectly plumbed and to be secured by approved brackets securely fixed at distances not exceeding the specified distances and not more than 40 mm away from the face of the walls or soffits. Pipes inside buildings and where specified shall be chased into walls, wrapped with building paper and properly secured and covered. Pipes must be free to move in the brackets.

Pipes passing through the walls and concrete floors are to be provided with suitable pipe sleeves extending 10 mm beyond finished floor or wall surfaces. All pipe fixings and throughways shall be free to allow movement for expansion, and contraction. Any pipe fitting feeding a pipe, which is rigidly secured to a structural element, shall be securely anchored to prevent any stress developing between the fitting and the structural element.

Chromium or nickel-plated metal covering plates are to be provided and fixed securely to pipes passing through the ceilings and walls. This is not applicable for concrete floors and ceilings.

Pipes passing through the ceilings or floors shall be offset from the wall to the front of the cornice with sufficient clearance to allow for the clear fixing of a ceiling plate. Pipes installed directly through the cornice will not be allowed. The same shall apply in multi-storey buildings where wall thicknesses vary.

All offsets shall be evenly and symmetrically set, the offsets are to be as high and as near the ceiling as possible.

Pipes shall be installed in such a manner as to allow for contraction and expansion.

Fire hydrants, hose reels and fire extinguishers shall be placed in position as indicated on drawings, provided that the relevant coverage distances and areas as required by the relevant codes and regulations shall be adhered to. The equipment to be placed in such a position that the approach to these units is not obstructed.

During construction all pipe ends shall be kept plugged to prevent any ingress of dirt, rubble, etc.

1.14.1 Fire Water Pipework Specification

1.14.1.1 Black Mild Steel Pipe Installations

All steel pipes shall be medium gauge mild steel screwed and socketed pipes to BS 1387 and shall be normalized and marked as such by the manufacturer. Pipes shall be hot dipped galvanized.

All fittings shall be malleable cast iron fittings.

All 80mm Ø and larger pipes shall be joined with Class 16 flanged couplings. The bolts, nuts and spring washers to be used on these joints shall be cadmium plated.

In pipe ducts and elsewhere pipes shall be fixed onto walls, soffits etc. with approved type of supports, holderbats, clamps, etc. Brackets shall be designed to structurally support and fix the pipe system and shall have sufficient clearance from walls, soffits, etc. to enable insulation of hot water pipes and maintaining of equipment.

Pipes shall be supported according to the manufacturer's specifications at the following maximum intervals:

PIPE SIZE (mm)	HORIZONTAL (mm)	VERTICAL (mm)
15 Ø to 20 Ø	1200	1830
32 Ø to 40 Ø	1830	2450
50 Ø to 150 Ø	2450	3050

Pipes shall be installed in such a manner as to prevent airlocks. A minimum rise of 1:250 shall be maintained to high points, which shall be fitted with suitable air release valves.

All pipes shall be marked according to the Local authority requirements or as specified by the Engineer. All surface pipes shall be painted to the required colour as specified by the Principal Agent.

Pipes shall be installed flush unless otherwise instructed by the Engineer.

Provision shall be made for thermal contraction and expansion.

The type of pipe joint compound shall be approved by the Engineer and sparingly used with good quality hemp. For pipes larger than 80 mm Ø a jointing compound such as Epedermix 32 shall be used.

Any pipe buried shall have at least 900 mm cover and be coated and wrapped and tested in the presence of the Engineer.

All pipe-work and fittings shall be pressure tested and sterilized to the Engineers specifications.

1.14.1.2 uPVC Underground Pipe Installations

Unless otherwise specified all underground pipework > 50 mm Ø shall be Class 16 uPVC with rubber ring type joints.

All bends shall be uPVC Class 16 type fittings with rubber ring joints.

All other fittings such as T-pieces, Reducers, Flanges, etc. shall be bitumen dipped cast iron rubber ring jointed fittings.

No solvent weld type fittings will be allowed.

All cast iron fittings shall be coated and wrapped.

All pipes shall be laid on a 100 mm sand-bedding cradle and covered with 300 mm sand before backfilling.

All backfilling shall be to the Engineers specification and approval.

Pipe trenching and bedding:

AREA	MINIMUM COVER (mm)	BEDDING TYPE	MAIN FILL
Vehicle traffic	1100	Flexible pipe bedding	Soilcrete
Under surface bed	600		Soilcrete
Other areas	900		90 % MOD AASHTO

All thrust blocks shall be cast between the pipe and the undisturbed trench material.

No concrete shall come into direct contact with the uPVC pipe. At the thrust blocks the bend shall be wrapped with a "Densopol 80 HT Tape" or similar approved.

All pipes shall be laid with at least 900mm cover to the top of the pipe.

Marker blocks shall be installed at all tees or changes of directions.

HDPE pipe connections to uPVC pipes up to 50mm Ø can be done by means of SG Iron manufactured saddles with the appropriate gaskets and cadmium plated bolts and nuts.

All pipe crossings under traffic areas shall be backfilled with soilcrete and compacted as specified.

All pipework shall be pressure tested with all joints uncovered, to the satisfaction of the Engineer.

Suitably sized air release valves built into valve chambers shall be installed at all high points of the pipeline.

1.15 Fire Protection Equipment Specifications

1.15.1 Valves for Fire Water Installations

Gate valves underground in valve chambers to connect to uPVC piping (65 NB and larger)

Gate valves to be equipped with non-rising spindle, spherical graphite iron body Grade 42, cast iron nitrile butadiene rubber covered gate, stainless steel spindle, nitrile butadiene rubber O-rings and seals, cast iron bonnet and gunmetal thrust collar to BS 1400 LG2.

The valve shall be capable of withstanding a working pressure of 1 600 kPa.

The valve shall be fitted with a square key spindle top to close the valve in a clockwise direction and socket ends to fit into uPVC Class 16 pipe and installed to detail.

1.15.2 Non-Return Valves

Non-return valves for cold water (65 NB and larger)

The non-return valve shall be of the spring-loaded dual flap plate type fitted between two flanges. (Wafer)

The non-return valve shall be equipped with a cast iron body, aluminium bronze plates, stainless steel springs and neoprene seals on the plates. The valves shall be suitable for a working pressure of 1 000 kPa.

Non return valves (up to 100 Ø)

The non-return valve shall be of the spring-loaded piston type, with bronze or dezincified brass body, stainless steel spring and bronze disc with neoprene seal fitted with BSP threaded socket ends. The valve shall be suitable for a working pressure of 1 000 kPa and a temperature of up to 90°C. All valves shall be installed as to be removable without extensive pipework removal.

1.15.3 Fire hydrant

Fire hydrants to be installed shall be of the type as approved by the local authority and shall be installed as indicated and detailed on the relevant drawings. The Hydrants shall comply with SANS 1567. The hydrants shall be installed inside purpose-manufactured cabinets as approved by the Architect and Local Authority. Hydrants shall be of the 65 mm bore instantaneous female coupling type conforming to SANS with single-lug twist release. The valve shall be fitted with a blank cap fixed to a chain.

Where the supply pressure is higher than 5.2 bars a pressure-limiting device shall be installed inside the cabinet before the Hydrant.

1.15.4 Fire booster connection

The fire booster connection shall be of the four-way breeching inlet type with end caps fixed to chains and shall comply with the local authority's requirements. The coupling shall comply with SANS and the inlet breeching piece shall comply with SANS. The booster connection shall be installed as indicated and detailed on the relevant drawings.

1.15.5 Fire hose reel

The fire hose reels shall be supplied and installed in accordance with SANS 543.

Each hose reel shall be of the recessed, swinging pattern with automatic operation after unwinding a short length. The fire hose reels shall be supplied and installed in accordance with SANS 543.

Each hose reel shall be of the recessed, swinging pattern with automatic operation after unwinding a short length of hose.

The hose reel shall be suitable for working pressures of up to 10 bars.

The hose shall be of the 25 mm dia. (ID) rubber fire hose reinforced with double braiding and 30 meters in length. The hose reel shall be fully equipped with nozzle and stop cock.

The hand wheel shall be marked with an arrow and the words "OPEN" to indicate direction of opening.

The hose reel shall be securely fixed to the hose reel cabinet or structure if installed separately. The hose reel cabinet shall be of the 12 SWG steel cabinet fabricated type for surface mounted or recessed mounted. The cabinet is to be fitted with doors in accordance with the Architects and Local authority requirements. The cabinet shall be clearly marked "HOSE REEL".

Where the supply pressure is higher than 5.2 bars a pressure-limiting device shall be installed inside the cabinet before the Hose reel.

1.15.6 Fire extinguisher

Fire extinguishers shall be supplied and installed on a correctly sized and secured bracket as indicated and detailed on the drawings. The fire extinguisher shall be installed in accordance with SANS 1910, or other relevant SANS standard.

Fire Extinguishers shall be installed inside each fire cabinet and where elsewhere indicated on the drawings.

Fire extinguishers shall have the following capacity:

DCP (Dry Chemical Powder) - 4.5 kg

DCP (Dry Chemical Powder)	-	9 kg
CO2 (Carbon Dioxide)	-	5 kg

1.15.7 Labelling of Valves

All main stop valves, control valves, etc. shall be labelled by means of rust-free metal tags indicating their purpose and the section they isolate, if isolating valves.

The tags shall be securely fixed to the valve and shall be clearly legible.

All letters on labels shall be engraved or punched. No painted or plastic embossed labels will be accepted.

Alternatively, 12 mm wide stainless steel tape embossed labels, may be used, fixed with copper wire to the relevant valves.

1.15.8 Colour Coding of Pipes

Identification of the contents of a pipeline shall be by means of applying a colour code on the specific pipe in the colours as specified by the Local Authorities.

Generally, the primary colour shall be applied to the entire length of pipework.

However, where short lengths of pipe run through occupied areas and in plant rooms, the primary colour shall be applied to their entire length.

2 Hydrant Pump Installation

Where required by the particulars of a specific fire protection installation, and as detailed in the Particular Specification and drawings, a fire pump set shall be installed. The pump set shall consist out of the number and type of pumps and ancillary equipment as detailed in the Particular specification. The following components shall form part of the installation:

- Electrical driven jockey pump set
- Electrical driven main fire pump and drive.
- Fire pump starting arrangement.
- Electric drive controllers and ancillary equipment.
- Water flow test devices.

The fire pump set shall be installed, tested, commissioned, and certified in accordance with the Local Authorities requirements.

Prior to ordering and installation, the Contractor shall provide a full set of plans and detailed data describing the following for approval by the Engineer and Local Authority:

- Pumps
- Pump drivers
- Drive controllers
- Power supply
- Starting arrangements
- Piping and fittings
- Suction and discharge connections
- Water supply and/or storage conditions

Each pump unit shall be provided with certified test curves by the manufacturer showing brake horsepower, flow and head capacities. The Contractor shall provide this information to the Engineer and Local Authorities for approval.

The Contractor shall perform and certify a full field acceptance test on the completed installation. This test shall be witnessed by the Engineer and Local Authority.

3 Fire Jockey Pump

The fire jockey pump installation shall consist of an electrical driven pump, installed with the necessary valves, strainers, non-return valves, pressure gauges, starting arrangement, drive controllers, etc.

The pump shall be completely equipped with an electric driven direct or close-coupled motor. The electrical drive shall be fitted with an approved drive controller fitted with the necessary safety features.

The electric motor shall conform to BS 2613 and BS170 and be drip-proof. The windings must at least be according to IP 55 of IEC 144. High temperature, permanent sealed bearings shall be used.

The rotation speed of the pump shall not exceed 2 950 revs/min and the pump must be able to pump water with temperatures between 0°C and 45°C.

Preference will be given to pumps of the self-regulating type and where the power consumption characteristic is such that with an increase in delivery to beyond a certain limit, the power consumption decreases, thereby ensuring that the motor is not overloaded in the event of a large reduction in pumping head.

The pumps shall be manufactured according to the latest relevant rules and regulations of the local authorities and statutory bodies and be freely available on the market, including back-up service and parts.

The design and fabrication of each pump unit shall allow for easy dismantling and removal of any serviceable part or piece of equipment, which functions as part of the pump units. The pump's serviceable parts or pieces of equipment shall allow for easy inspection. Parts, subjected to wear and tear, shall be replaceable and may not form an integral part of the body unit. The types and angle between suction and delivery points shall be suitable for this installation.

All parts and pieces of equipment, which make up the pump units, shall be manufactured of suitable approved material to minimize wear and tear. Complete details in this respect shall accompany the tender. Cast iron parts shall have an anti-corrosion coating on the inside and outside. The shaft shall be of stainless steel. Rotating elements of the pumps shall be balanced accurately to prevent vibration and noise. Adequate anti-vibration transfer measures shall be incorporated into the system, such as anti-vibration pad mountings to bases and flexible couplings to inlet and outlet.

Sturdy mild steel bases, adequately corrosion protected by either hot dip galvanising after manufacturing or painted with 1 coat of zinc chromate primer on a clean surface and followed by 2 coats enamel paint of approved manufacture, shall be provided. The pump base shall be filled in with concrete and properly secured to the floor.

The manufacturer's name, model, serial number and date of manufacture shall be clearly indicated on the pump body. A test certificate for each pump unit, providing satisfactorily laboratory test runs, shall accompany the delivery of the pumps.

A complete test of performance characteristics and shop drawings shall be handed to the Engineer and Local Authority for written approval before ordering, supplying and installation commences. This includes flow charts, power consumption-, NSPH-, and efficiency curves. General pump curves as supplied by the pump manufacturer are not acceptable.

4 Main Hydrant Pump

One pump equipped with electrical motor shall be installed. This pump shall deliver the full design capacity of the installation.

The Contractor shall select the required pump and submit his calculations and selection to the Engineer and Local Authority for approval prior to ordering.

The main pump shall be of the centrifugal end-suction type listed for fire protection service. It shall be possible to remove the impellers without removing the pump from its mountings.

The pump shall comply with the following requirements:

The impeller shall be a single entry radial impeller and be made of bronze or cast iron.

The casings shall be of cast iron with renewable casing wear rings. The casing wear rings shall be made of bronze.

The bearings shall be grease lubricated anti friction bearings.

The pump shaft shall be made of stainless steel.

An auto priming system shall be provided.

Pump cooling device preventing over heating of pump when operating at closed head.

The performance characteristics of the pump shall be such that the pressure falls progressively with the rate of demand.

Characteristic curves showing capacity, head, efficiency NPSH, power required and operating range shall be submitted to the Engineer at tender stage. Prior to installation, a complete set of test certificates shall be submitted to the Engineer and Local Authority indicating all performance characteristics of the pump to be installed for approval.

In all cases the pump plate shall give the rated speed for the pressures and flows specified. For the particular pump concerned the maximum flow rate required. A pressure gauge must be provided downstream of the pump outlet backpressure valve and on the pump suction side. There must be an approved flow test device and pipe connection coupled to the pump delivery branch downstream of the backpressure valve, to facilitate a running flow/pressure test on the pump at approximately the full load condition when the test valve is fully open.

The pump shall be operational within 30 seconds after starting.

Sturdy mild steel bases, adequately corrosion protected by either hot dip galvanizing after manufacturing or painted with 1 coat of zinc chromate primer on a clean surface and followed by 2 coats enamel paint of approved manufacture, shall be provided. The pump base shall be filled in with concrete and properly secured to the floor.

Starting Mechanism

Provision shall be made for two separate methods of engine starting. Two separate batteries of adequate capacity must be provided for automatic and manual starting of the engine. Where electric starting is used, the system must operate from a battery supply recommended by the engine supplier.

Automatic starting shall be by means of a battery powered electric starter motor of the axial displacement type having no retaining catches or inertial features. The pinion must rotate at reduced speed during the process of engagement with the flywheel ring, but during the initial engagement the pinion and armature shaft assembly must mesh by moving axially towards the gear ring. The starting sequence must be initiated by the control system and repeat engagement facilities must be provided should the starter pinion fail to engage with the engine flywheel ring. When the engine fires, the starter motor pinion must be withdrawn from the flywheel ring automatically by means initiated by a directly driven tachogenerator or centrifugal speed switch. Flexible drives are not permitted. Battery charging, voltage generators, alternators and pressure switches on the engine lubricating system or water pump outlet, as a means of de-energizing the starter motor, are not permitted.

Alternative forms of manual starting: Any other form of manual starting, crank handle, pneumatic, hydraulic, etc. shall be submitted for approval to the Engineer.

The starter motor in combination with each battery power supply shall have a design capability to rotate the engine for at least 10 cycles of not less than 15 seconds cranking and not more than 6 seconds rest.

Compression-Ignition Engine Drive Controllers

All switching equipment for manual use in connecting or disconnecting or starting or stopping the engine shall be externally operable.

A manually operated isolating switch shall be mounted within the controller enclosure.

Fuses for protection for both the AC and DC circuits shall be provided and shall conform to BSS 88 as amended.

Automatic starting shall be initiated by an external monitoring device and the starting components will be arranged to crank for a maximum period of 15 seconds and dwell for a period of no more than 6 seconds. Both time periods shall be adjustable and set to suit engine and site conditions.

A presentable counter arranged to count each cranking period shall be provided and shall be capable of being pre-set for up to 9 counts, but shall normally be pre-set for 6 counts. If the engine has not started after pre-set number of counts, the cranking must be stopped and the pump failure indication and alarm must be initiated. Only actual cyclic counters are acceptable. A timer set for the overall calculated time for the pre-set number of starts is not acceptable.

The components shall be arranged to connect each of the two batteries to the engine starter motor on alternate cranking cycles and so designed that the first cycle of a first attempted start shall alternate between one battery and the other.

A suitable voltage relay shall be connected across the load side of the main fuses and electrically separate contacts on this relay shall be wired out to clearly identified terminals for initiating the power failure alarm.

An AC voltmeter shall be provided to indicate the input voltage to the controller.

A DC voltmeter shall be provided to indicate the terminal voltage of each battery.

A DC ammeter shall be provided to indicate the charging rate of each battery.

Electrically separate contacts wired out to clearly identified terminals are to be provided for the following conditions to be monitored:

- Power failure (battery charger electrical supply)
- Pump failure
- Pump running
- Low oil pressure
- Indication in the form of duplicate indicating lamps shall be provided to show the following:
 - Pump failure
 - Pump running
 - Low oil pressure
- A reset push button shall be provided to reset the controller.

The controller shall latch on to a starting signal until the reset push button is pressed.

One "emergency start" push button shall be provided for each battery and the circuitry shall be arranged so that each push button will bypass the automatic starting circuit and will energize its associated starter motor solenoid. It shall be possible to depress both push buttons and apply power from both batteries simultaneously to the starter motor.

An adjustable voltage sensitive device shall be provided to sense the potential generated by the tachogenerator mentioned in the specification.

Manual isolating and/or selector switches in the battery to engine starter motor circuits are not permitted.

A separate test button shall be provided to initiate the automatic starting sequence.

Controllers mounted on the engine bedplate shall be supported by a substantial frame securely bolted to the engine bedplate and the controllers shall be secured to this frame by means of approved resilient mountings. Plug-in components such as fuses, relays, p.c. boards, etc., in controllers which are mounted on the engine bedplates shall be provided with suitable spring clips or securing facilities to prevent unplugging due to vibration.

Batteries shall be mounted and securely clamped on stands or stillages and located in a readily accessible position where the likelihood of contamination by oil, fuel, damp, pump set cooling water or being damaged by vibration, is unlikely. The battery should be installed as close to the starter motor as possible to minimize voltage drop between the battery and starter motor terminals. The batteries shall be mounted on a wooden base.

Heavy current solenoid operated contactors for connecting the battery to the engine starter motor shall be located on the engine or bedplate immediately adjacent to the engine starter motor or batteries.

All DC electrical components shall be capable of functioning effectively at the reduced voltage levels that exist during cranking. Relays shall not chatter on drop-out and solid state circuits shall not "switch" under these low voltage conditions.

The battery voltage shall be as specified by the engine manufacturers.

The control circuit shall be arranged to operate across the full battery voltage. Connections for any reduced voltages shall not be taken by tapping-off cells in the battery.

5 Main Electrical Control Panel

The electric control panel to be supplied and installed shall comply with the Local Authorities regulations, codes. This panel and electrical installation shall adhere to all relevant regulations, codes, by-laws and laws as set out in above specification and applicable to the installation. The electric control panel shall be of the indoor floor standing type and shall be vermin and insect proof, drip proof and dust proof to at least Class IP 55. Unless otherwise specified the control panel shall be equipped with a lockable hinged door(s) and lockable facia panel and a bolted removable back plate. The panel shall be finished with a powder coated finish or baked enamel system with the interior of the panel in a brilliant white colour and the rest of the panel

in a fire red colour. It shall have a top cable entry removable gland plate. Power and control cables shall be grouped together.

The panel shall be designed and manufactured to automatically control the whole system as set out above and shall easily house at least the following equipment: (with a 30% spare space allowed)

Main isolating switch, with label to indicate to switch off in case of emergency, on the fascia panel.

Suitable circuit breakers for pumps and control circuit with correct fault current rating, on back plate with faces protruding through fascia panel.

Suitable contactor for jockey pump and star delta starting arrangement for main electrical driven pump.

Suitable thermal overloads for pumps.

All control equipment necessary for the complete automatic control of system (i.e. relays, selector switches, push buttons, indicator lights, etc.), on fascia panel and back plate.

Voltmeter with selector switch to monitor voltages between each current phase and neutral and between phases (min 65 mm), on fascia panel

Ammeter with selector switch to monitor each phase (min 65 mm), on fascia panel.

Indicator lights for all fault, on/off and automatic conditions, on fascia panel.

Alarm for major faults conditions, on top of control board.

Water storage tank level monitoring indication and devices

Alarm accept and reset buttons, on fascia panel.

24 Volt low voltage circuit for low water level and high level float switch in tank and engine starting and control circuit.

Lightning arrestors/surge suppressors on all lines and neutral, on back plate.

Remote alarm start and stop system wired back to fire station control room.

Labels, with black lettering on white background, shall be securely fitted to indicate the name and function of the components and other relevant information e.g. "stop", "start", "Pump 1" etc. The minimum letter size shall be 5 mm.

The Contractor shall ensure before manufacturing of control panel that the fault current rating of panel is within the limits of this particular installation.

The electric control panel shall be tested and inspected before leaving the manufacturer.

Before any ordering, manufacturing, supplying and/or installation commences, the complete offered system shall be checked and reviewed by the Engineer in writing. Full details and 3 sets of drawings showing wiring diagram, component lists, panel dimensions and layout shall be supplied to the Engineer for this purpose.

The electrical installation shall be carried out in accordance with the latest edition of the Local Authorities regulations and codes.

In addition to the components mentioned in the above and this specification, at least the following shall be incorporated in the control circuit on the hinged front panel.

Adequate sized led type indicators at a visible position in the distribution board (min 20Ø).

One set for each pump indicating:

Pump off	Red
Pump running	Green
Pump tripped	Orange-flickering (including alarm)
Pump automatic	Yellow
Pump manual	Yellow
Water low	Orange-flickering (including alarm)
Water overflow	Orange-flickering (including alarm)
Power supply adequate	Red

Meters

1 x Volts	0 - 400 Volt (min 65 mm)
3 x Amps	Amps as required (min 65 mm)

Selector switches for:

Pump: manual, off or automatic selection for each pump.

Volt meter between phases and phases and neutral and off selection.

Push buttons for : (min 20 Ø diam)

Alarm accept. (black)

Alarm reset button. (black)

Indicator and alarm test buttons. (yellow)

Pump start and stop. (green; red)

Proper labels indicating functions of components and other relevant information e.g. voltage, pump 1 etc. (min 3 mm high characters).

An audible alarm of the flashing strobe type shall be mounted outside the pump room panel for fault condition and pump running signalling. The alarm shall be of a kind and so situated that it produces a sound level of at least 110 dBA at a distance of more than 1 m.

In all cases the malfunction indicators shall only be activated in the event of a fault condition, and stay in operation until reset manually at the switchboard, while auto resetting protection equipment shall keep the pump in working order (except for thermal overload). Flickering and/or flashing emergency lights/indicators refer to malfunction conditions, while a constant signal serves for monitoring purposes.

Provision shall be made for test button(s) activating all signals, in order to test functioning; (alarm and monitoring circuits).

Remote fault and status signals for all equipment shall be provided on this control panel to be relayed back to the fire detection system.

It shall be the responsibility of the subcontractor to ensure that the interfacing between the electrical supply and their DB is allowed for in their bill of rates. Where the contractor does not have a competent electrician on staff, they shall at their own cost appoint a suitable subcontractor to carry out the termination.

6 Division of Work schedule

The following work related to this Contract shall be provided by others to the Contractor's requirements.

Principal Building contractor

- All openings in the structure, brick walls, bulkheads and partitions.
- Building-in of pipe sleeves.
- All plinths.

Electrical Contractor

- A 3 phase power supply to maintenance isolators for the false alarm (jockey) pumps inside the Plant Room and ICV chamber
- General lighting and power in Plant Room and ICV chamber
- Fire detection interface modules for flow switches, alarm signals, and fault signals.

7 Detail Design Information

Fire Pump Systems

FIRE PUMP - FIRE HYDRANT AND HOSE REEL PROTECTION		
Required Delivery Flow rate:	25 litres/second	
Required Downstream Pressure:	430 kPa	
Dedicated Fire Water Storage:	61 m³ effective capacity	
Number of Pumps	1 Jockeys & 1 Main Pumps (One Electrical driven)	
JOCKEY PUMP		
Number of pumps:	1	
Pump Capacity / pump:	Closed Head:	+/- 1150 kPa T.B.C
	Flow and Pressure not to exceed:	+/- 0.44ℓ/sec @ 900 kPa T.B.C
Type of Pumps:	Vertical Multi-stage	
MAIN ELECTRICAL DRIVEN PUMP		

Number of pumps:	1	
Pump Capacity / pump:	Closed Head:	+/- 1100 kPa T.B.C
	Duty Point:	25 ℓ/sec @ 950 kPa
	Maximum Flow rate:	27 ℓ/sec @ 650 kPa
Type of Pumps:	End-Suction Electrical Driven	
MEMBRANE VESSELS FOR JOCKEY PUMPS		
Number:	1 off 200 litres	
Test Pressure:	1000 kPa T.B.C	
SURGE ANTICIPATOR AND RELIEF VALVE		
Number:	1	
Relief Pressure Setting:	1000 kPa T.B.C	
Relief Flow rate:	25 ℓ/sec T.B.C	
ELECTRICAL POWER REQUIREMENTS		
Normal Power:	22 kW, 400 Volt, 50 Hz, 3 phase + neutral, fault rating to be confirmed by Elect. Eng., 90 Amp D Curve Breaker neutral and earth. To Be Confirmed	
Standby Power:	Battery only	

In diversity there is beauty and there is strength.

MAYA ANGELOU

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Sidwadweni Bulk Water Supply Scheme - CP and AC Mitigation Technical Specification for Tender Purposes – CONTRACT 1.

REPORT No. PER0250 Rev 1

Client: OR Tambo District Municipality / Zutari (Pty) Ltd / Beacon Consulting Engineers.

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CLIENT : **Zutari (Pty) Ltd / Beacon Consulting Engineers / OR
Tambo District Municipality**

CONTACT PERSON : **Gcobani Tshayana / Mr Trevor Duncan / Petronella
Taljaard**

PROJECT : **Sidwadweni Bulk Water Supply Scheme Rising Main – CP
and AC Mitigation Technical Specification – CONTRACT 1.**

PROJECT NO : **PEP0225**

REPORT NO : **PER0250 Rev 1**

REPORT: : **Martyn Sherratt (Pr Eng)** _____

REVIEWED BY : **Dr Chris Ringas** _____

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1. Introduction and Background

The scope of work involves the supply and installation of Cathodic Protection (CP) and AC Mitigation for the Sidwadweni Regional Bulk Water Supply Scheme Rising Main. This document provides the Technical Specification for CP & AC Mitigation for CONTRACT 1, which is the first 580m of the Rising Main to AV2.

The pipeline for Contract 1 is 580m long with diameter DN 350 and wall thickness 5mm. The pipe material is Grade X52 and will be constructed with bell and spigot ends. The internal lining will be cement mortar and the external coating is still to be finalised. The bell and spigot ends will be welded on site by the main contractor, thus providing electrical continuity. The main aim of the Sidwadweni Regional Water Supply Scheme (SRWSS) project is to improve the drinking water supply to Mhlontlo Local Municipality. The project has the following components:

- Low-lift pumping main (HDPE PE100 PN 12.5) pipe connecting the abstraction works with the Tsitsa WTW.
- A high-lift pump station.
- A 6360m DN 350 steel rising main from the Tsitsa WTW that follows mostly along existing gravel roads at terminates at the proposed Nkudu Command Reservoir.
- Nduku Command reservoir near the existing Nduku village with new access road.
- A mPVC pipeline to convey water from the Nduku Command reservoir to an existing control chamber.

The pipeline route crosses the ESKOM Qumbu-Ugie 132kV Overhead HVAC powerline as well as 22 kV low-voltage overhead village reticulation powerlines at numerous positions along the route.

A sacrificial anode cathodic protection system (SACP) will be used to protect the pipeline. From a design perspective the magnesium anodes can perform a dual CP and AC function, i.e., provide CP to the pipeline and provide a path to earth for the induced AC. The CP and ACM systems will be combined into one system using the magnesium anodes plus other AC mitigation interventions (GCM, VLD

etc.). This specification must be read in conjunction with the BOQ and CP/AC Drawings.

2 Quality Control Plan and ITP's

The successful tenderer will be required to submit a QCP, Method Statements and ITP's two weeks after Contract Award which must be approved by the Engineer prior to the start of construction. The QCP must contain hold points for critical activities such as excavation, cable to pipe connections etc. Further work should not proceed until the Engineer has witnessed the particular "Hold Point".

3 Cathodic Protection

3.1 7.7Kg Hi-Potential Magnesium Anode Groundbeds

A Sacrificial Anode Cathodic Protection (SACP) system will be utilised to provide protection to the pipeline. The SACP system will use shallow vertical magnesium anodes to confer protection to the pipeline. The anodes used will be 766mm long x 195mm diameter 7.7kg Bagged Hi-Potential Magnesium Anodes (-1.75 V), with a gypsum, bentonite and sodium sulphate mixture around the anode contained in a cotton bag (75% Gypsum; 20% Bentonite; 5% Sodium Sulphate).

The anodes will be distributed in 1 x SACP groundbeds consisting of 12 parallel vertical anodes, 5m apart from each other and 3 to 5m from the pipe centre line (preferably 5m depending on the servitude width). The anodes will be connected to a header cable using splicing kits which will be connected directly to the structure at both ends of the groundbed. The SACP anode groundbed will be located as shown in the Table 1 below.

Table 1: SACP Groundbed Location.

SACP GB	Longitude	Latitude	Ave Resistivity per GB Section (Ω m)	Start & End Chainage (m)	No of Anodes	Distance between GB (m)
GB1 - Start	28,7243023340	-31,2122373817	98	440	12	440m from Start.
GB1 - End	28,7241694936	-31,2125460579		495		

The 7.7Kg Hi-Potential Magnesium Anode specifications are given in Table 2 below:

Table 2: Hi-Pot Mg Anode Composition.

Elements	Composition (% weight)
Al	0.01% max
Mn	0.5-1.3%
Zn	Absent
Si	Absent
Cu	0.02% max
Ni	0.001% max
Fe	0.03% max
Other Impurities	0.3%
Mg	Balance
Potential vs CSE	-1.75V
Capacity (A.h/kg)	1200

3.2 Monitoring Test Posts

CP monitoring Test Points will be installed as follows:

- One Mega BHTP will be installed as follows:
 - At the start of the steel section (Abstraction Works- Ch 0.0, near AV0).

- This Mega BHTP will have IR Free Card/PRE/Coupon to allow for more accurate readings.
- This Mega BHTP will also have a GCM and a VLD for ACM.
- Two Valve Chamber Test Posts will be installed at the following VC on the Rising Main:
 - AV1 (Kp 440m)
 - AV2 (Kp 580m).

BHTP must be placed on a concrete foundation at least 900x900x100 THK as shown in the relevant drawings, containing steel mesh with a concrete strength of 25 MPa. For both type ducts using 40 mm HDPE piping must be provided for the cables. The top of the foundation must be 300 mm below natural ground level. After placing of the test post on the foundation, mass concrete must be poured around the periphery of the test post.

A Direct Current (DC) Coupon and a long-life copper/copper-sulphate reference electrodes shall be installed at all BHTP located along the rising main. The cable from the coupon shall be brought up and terminated at the IR Free Card located inside the BHTP. The Test Post types are shown in the Table 3 below. The Engineer will provide the contractor with exact locations prior to the start of construction.

Table 3: Test Post Type and location.

Chainage (m)	Description
0.0	Start AV0
7.97	SV1
440	AV1
580	AV2

3.3 Continuity Bonding

Continuity bonding for CONTRACT 1 will be required as follows:

- All flanges, VJ flexible couplings, Restrained Flange Adaptors, Flanged Pipe with Puddle Flanges outside the valve chambers AV0, SV1, AV1 and AV2

must be continuity bonded using 2 x 10 mm² PVC/PVC black single core lugged copper cables connected to studs on either side of the flange adaptor.

- Continuity bonding will also be required at valve chamber AV0, SV1, AV1 and AV2, to be installed outside the chamber at pipe depth, and buried after installation. Two 10 mm² PVC/PVC Black cable will be used to connect to the pipeline. The cables will be inserted inside 20 mm HDPE piping, which must be attached to the wall using saddle clamps.
- Cable attachment to be done using 2 x M8 Studs attached to the pipe on either side of the valve chambers at the 12H00 position using capacitive discharge stud welding.
- 2 x 10 mm² PVC/PVC black single core lugged copper cables to be used to connect to the studs on each pipeline at the valve chamber using M8 washers and M8 Nylock nuts.
- Coating repair shall be done in accordance with the following specifications:
 - Zutari General Corrosion Protection, Specification Number: SPE-JJ-0003.
 - Zutari General Corrosion Protection, Specification Number: SPE-JJ-0003: Amendments to Specification.
 - “OR Similar Approved Specifications”.

3.4 Reference Electrode and Coupon.

A long-life copper/copper-sulphate reference electrode must be installed 300 mm away from the pipe surface, at the 3 o'clock position and connected back to the IR Free Card. The reference electrode must have 15 m of cable. A steel coupon, 32 mm in diameter, with 15 m of cable must also be installed next to the Permanent Reference Electrode.

Technical details of the Permanent Reference Electrode and Coupon, including manufacturer name, must be supplied by bidders with their tender submission.

3.5 Cabling

Copper-cored cables will be single or double insulated and rated for voltages up to 600 V/1000 V and shall possess stranded copper conductors in accordance with SANS 1507 or ASTM B-8.

Cable details are provided in Table 4 below. No cable markers will be required from a security perspective. Cable warning tape will be inserted above all cables at a depth of 600 mm below surface. Refer to relevant drawings for installation of cables.

Table 4: Cable details for CP.

Description	Number	Cores	X-Section	Type / Colour
VCTP to Pipe inside VC	1	1	10	DI / BLACK
VC Continuity Bonding	2	1	10	DI / BLACK
Reference electrode (PRE)	1	1	6	DI / BLUE
DC Coupon to Bunker/BHTP	1	1	6	DI / WHITE
AC from GCM to VLD	2	1	16	SI / Y/G
7.7kg Mg Anode Cable to Header Cable	1	1	10	DI / RED
Header Cable at SACP Groundbeds	1	1	10	DI / RED

3.6 Cable Connections to Pipeline

All cable connections to the pipeline shall be done using capacitive discharge welding (Stud Welding). Stud Welding to be done as follows:

- Coating to be removed at top of the pipelines (12H00 Position).
- Surface to be brushed with a steel wire brush (including surrounding coating (300mmx300mm)).
- Area to be roughened using angle grinder fitted with flapper disk abrasion cleaner pad.

- All traces of existing coating (mastic etc.) or any other matter shall be removed from the surface.
- For 10 mm² PVC/PVC Copper Cable attachments remove 200mm x 150mm area of coating, area large enough for attaching Magnets on either side.
- Attach one magnet on either side making sure it is securely fastened.
- Insert stud into the chuck and make sure it is secured.
- Place chuck on weld area, hold firmly. Execute weld by squeezing trigger of chuck. Install two Studs per pipe.
- Remove electromagnets from pipe.
- Visually inspect the weld for uniform splatter. Tap weld lightly with hammer/rubber mallet.
- Remove 15 mm of insulation/sheathing from ends of cables. Crimp Lug to end of cables.
- Cable Lug to terminate on stud using 2 x M8 Washers and 1 x Loc-Tight M8 Nut (Washer-Lug-Washer-Loc-Tight Nut).
- Ensure there is some slack in cable.
- Photographic records of all installations to be done by the contractor.

The cable connections to the pipeline must be witnessed by the Engineer, prior to the coating being made good, so this activity is a Hold Point on the relevant ITP.

3.7 Cable connections and splicing

Magnesium Anodes are to be connected to the header cable by splicing/cable jointing kits. A suitable crimping tool shall be used. The connections shall be waterproofed with epoxy splicing kits. Sufficient time will be allowed for the epoxy to set (according to manufacturer's recommendations) before the cables are buried. The cable insulation will be roughened with 160 grit sandpaper before the connections are made and the epoxy is poured into the mould.

3.8 Temporary Cathodic Protection during construction.

During construction there may be sections of pipeline which may be isolated from the rest of the pipeline or pipe sections where the permanent CP system has not been installed. Temporary protection will be achieved using 7.7Kg Hi-Potential Mg

Anodes (c/w 10m of 10mm² PVC/PVC red cable) and must be requested by the contractor and approved by the Engineer. The Contract rates will be used for temporary CP anodes (if required).

These will be additional and will form part of the final CP system. These anodes will not be removed. Temporary CP will be finalised once the construction program has been received and determined by the Engineer.

3.9 CP Drawings

The following CP Drawings form part of the CP Installation:

PES-PEP0225-CP-001	-	CP Coupon Detail.
PES-PEP0225-CP-002	-	Mega Big Headed Test Post Detail (BHTP).
PES-PEP0225-CP-003	-	Continuity Bonding at Valve Chambers.
PES-PEP0225-CP-004	-	Valve Chamber Test Post Detail.
PES-PEP0225-CP-005	-	SACP Groundbed Detail.
PES-PEP0225-CP-006	-	IR Free Card.
PES-PEP0225-CP-007	-	Monitoring BHTP Test Post Installation Detail.
PES-PEP0225-CP-008	-	Temporary CP Installation.

4 AC Mitigation

4.1 Introduction

The results show that the touch voltages on the pipelines can reach hazardous levels during both steady state and fault conditions on the nearby power lines. The recommended AC mitigation measures for Contract 1 up to AV2 (Ch 580m) along the steel pipe include:

The requirements of the AC mitigation system for Contract 1 are detailed below:

- i. The pipe section requiring AC Mitigation measures is the section of pipeline from Ch 0 m to Ch 580m.
- ii. At valve chambers within the AC mitigation zone (AV0, SV1, AV1 & AV2) internal gradient control mats must be installed. The gradient control mats are the floor and wall re-bar (to be made electrically continuous) or steel mesh encased in the concrete base (or screed) if the re-bar cannot be accessed. The GCM is to be connected to the pipeline using suitably rated VLD's. A connector plate must be connected to the re-bar (or steel mesh) in the base of the chamber for cable attachment to the VLD. For this project wall and floor re-bar will be utilised as the GCM.
- iii. 16mm² PVC Copper cable (Y/G) will be used to connect the connector plate to the VLD. 16mm² PVC/PVC copper cable (BLACK) will be used to connect the pipeline to the VLD and IR-Free Link Panel.
- iv. At the start of the pipeline (Ch 0.0 m) a monitoring BHTP will be installed. A GCM must be installed around the BHTP. The GCM will be 200mm x 200mm x 6mm steel mesh encased in concrete and connected to the pipeline via a suitably rated VLD, mounted inside the BHTP enclosure. The GCM will extend 1.2m around the BHTP.
- v. A VLD must be installed across the IF kit at the new WTW and the Nduku Command reservoir.

- vi. The technical specification contained within Appendix E describes each component of the AC mitigation system. A bill of quantities and relevant drawings have been developed and issued separately.
- vii. Numerous safety hazards exist when working under overhead HVAC power lines. It is the responsibility of the main pipeline contractor to ensure that safe, site-specific working procedures are developed and implemented on site. An example of safe working procedures will be provided by the main contractor.

4.2 Gradient Control Measures at Pipeline Appurtenances

To protect personnel inside valve chambers during transient conditions (such as faults and lightning), internal gradient control mats need to be installed inside all valve chambers along the steel sections of the pipeline in the AC Mitigation Zone (Ch 0.0m to Ch 580m). The following valve chambers require internal GCM:

- AV0 (Ch 0.00 m)
- SV1 (Ch 7.97 m)
- AV1 (Ch 440 m)
- AV2 (Ch 580 m)

The gradient control mats must be connected to the pipeline using a voltage limiting device (VLD)). The specific requirements for the gradient control mats are detailed below.

4.2.1 Internal Gradient Control Mats at Valve Chambers

Gradient control mats (GCM) need to be installed inside all valve chambers along the steel sections of the pipeline in the AC Mitigation zone (Ch 0.0 m to Ch 580 m). This is achieved by making the structural wall and floor re-bar of the chamber electrically continuous:

Wall and floor re-bar continuity will be carried out by the main contractor responsible for construction of the valve chambers. Electrical continuity will be achieved as follows:

- Continuity of the floor reinforcing is established by installing two steel flat bars (3mm thick, 30 mm wide carbon steel with lengths cut to suit) at right angles to one another.
- Each piece of flat bar is spot welded to each piece of re-bar that it traverses.
- A connector plate made from carbon steel must be installed underneath the pipe 6 o'clock position to allow for cable connections. The connector plate is welded to the relevant piece of steel flat bar before the concrete is poured and must protrude from the floor by at least 80 mm. The connector plate can be shifted laterally by up to 500 mm to accommodate cable connections if required. No steel connector plate required for the VC wall re-bar.
- Continuity of the wall reinforcing is established with a continuity ring installed 300 mm above the pipe overtop (12 o'clock) position and spot welded to each vertical bar. Steel flat bar (3mm thick, 30 mm wide carbon steel with lengths cut to suit) is used for the continuity ring, which must wrap around all sides of the chamber. The different pieces of flat bar on each wall must be welded to each other at the chamber corners.
- To ensure floor to wall re-bar continuity at least four (one on each side of VC) of the vertical re-bars must be securely bonded (by spot welding) to one of the floor re-bars.
- The steel connector plate must be installed in the valve chamber to ensure minimum cable lengths when connecting to the VLD ($\leq 1.5\text{m}$).
- After cable connections are completed, the connector plates will be coated using an appropriate technique to prevent corrosion.
- At scour and overflow valve chambers the rebar in the wet compartment does not need to be made electrically continuous.
- At air valve chambers where precast concrete rings are used for chamber construction, only the floor rebar is made electrically continuous and only one connector plate is required.

If the reinforcing (re-bar) cannot be accessed or welded, the alternative installation requirements for the internal gradient control mats are as follows:

- Install a weld mesh cut-out on the chamber floor, comprising 200 x 200 x 6 mm diameter steel weld mesh, not galvanized,
- The weld mesh shall cover the full surface area of the valve chamber floor,

- Where required, weld mesh sections shall overlap by at least 100 mm and shall be connected with at least two crimped ferrule connections,
- Two cables welded to the weld mesh to allow for connections to the VLD,
- Cover the weld mesh with a thin (5 to 10 cm thick) screed layer, sloped as required for water dispersion,

4.2.2 Gradient Control Mats at Mega Big Head Test Posts (Ch 0.0 m).

All test posts in the AC mitigation zone require the installation of gradient control mats, as per the following specification:

- A 200 x 200 mm weld mesh of 6 mm diameter steel wire, not galvanized, extending 1.2 m beyond the concrete bunker/test post enclosure.
- All weld mesh overlaps shall be 100 mm minimum and joined at two places using crimped ferrules or spot welds.
- The weld mesh is to be completely encased in a 100 mm thick concrete layer.
- The weld mesh can either be installed at surface level or a depth of 500 mm below normal ground level (NGL).
- The weld mesh must be connected to the pipeline through a voltage limiting device (VLD) as specified in Section 4.3 using two separate cable connections.
- The VLD can be installed inside the BHTP as shown in the relevant drawing (PES-PEP0225-AC-003).

4.3 Voltage Limiting Devices (VLDs) for Gradient Mat Connections

Gradient control mats are to be connected to the pipeline using a voltage limiting device (VLDs) installed in an IP68 enclosure. The devices must be low voltage, steady state surge protection devices such as a metal oxide varistor (MOV) or gas discharge tube (GDT).

A DIN rail with terminal blocks must be mounted on the valve chamber wall just below the VLD enclosure to aid with the cable terminations for gradient control mats at valve chambers if the VLD does not have sufficient connections. The internal gradient control mats at valve chambers and external gradient control mat

at test posts (BHTP) can be connected to the pipeline using the same VLD. The VLDs must meet the specifications listed in Table 5 below.

Table 5: Voltage Limiting Device (VLD) Specification.

Item	VLD Specification
Class II impulse current rating *	20 kA, 8/20 μ s
Front of wave spark over voltage*	≤ 500 V, 1.2/50 μ s
Response time	≤ 100 ns
a.c. short circuit withstand**	10 kA rms, 1 sec, 50 Hz (10 independent pulses)
Housing dielectric withstand*	5.8 kV
AC clamping voltage	75 V rms ($\pm 10\%$)
DC breakdown voltage	100 V ($\pm 10\%$)
DC leakage (blocked)	≤ 1 mA
Environmental rating of enclosure	IP68
Ambient temperature	-15° C to 60° C
Air clearance and creepage distances *	10 mm, 40 mm resp.
Protection against direct contact ***	No direct contact

* according to SANS 61643-1 requirement

** this requirement must be met for at least 10 pulses using derating curves

*** as per IEC 60529 test finger

4.4 AC Cables

16 mm² single core, multi-strand PVC insulated copper cables (Yellow/Green) must be used to connect VLDs to the gradient mats and pipeline.

All cabling is to be kept to a minimum length and all connections are to be achieved using an appropriate welding technique to ensure the bond is of a low resistance. All connections must be doubled up to ensure redundancy. All cabling used to connect to the pipeline must be black in colour. Yellow/green cabling is used for connections to the gradient control mats.

The cable to weld mesh connections shall comprise a suitably sized ferrule crimping the cable to the weld mesh, silver soldering the joint area and covering the joint area using self-vulcanizing butyl rubber tape. The weld mesh around the joint must be sanded down to remove any rust and/or dirt prior to the connection being performed.

4.5 Insulating Flange Kits

Insulating flange (IF) kits are used to electrically isolate sections of pipe either side of a flange face. At any connection to a Water Tank/Reservoir, an IF kit will be required to ensure the tank and its earthing system do not drain the protective current intended for the pipeline.

The mitigation measures required at the IF kits are detailed below:

- At the IF kit installed at the new WTW and Nkudu Command reservoir, a VLD must be installed across the IF kit (in parallel to the spark gap).
- This should be done by the pipeline contractor.

If the IF kits are located aboveground, then the VLD must be installed on a stainless-steel frame installed near the IF kit to minimize cable lengths.

4.6 AC Mitigation Drawings

The following CP Drawings form part of the CP Installation:

PES-PEP0225-AC-001	-	Internal Gradient Control Mat (GCM) at Valve Chambers – Using Re-Bar.
PES-PEP0225-AC-002	-	Internal Gradient Control Mat (GCM) at Valve Chambers – Using Steel Mesh.
PES-PEP0225-AC-003	-	Gradient Control Mat at BHTP No 1

5.0 Safe Working Procedures in HV/EHV Power Line Servitudes

The safe working procedures applicable during pipeline construction inside HVAC power line servitudes are covered and adapted from the Eskom *Guideline on the Electrical Coordination of Pipelines and Power Lines*.

Prior to any work commencing the appointed CP Contractor must report to the Main Contractors Electrical Safety Officer (ESO) to obtain guidelines for working under HVAC Power lines.

**ENVIRONMENTAL MANAGEMENT PROGRAMME:
PROPOSED SIDWADWENI REGIONAL BULK WATER
SUPPLY SCHEME**

REPORT NO: ZUTARI-2212-AE-04

DATE: 31 March 2025

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1. SCOPE (CLAUSE 1)

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

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

2. INTERPRETATIONS (CLAUSE 2)

2.1 APPLICABLE EDITION OF STANDARDS (SUBCLAUSE 2.2)

Add the following to the end of Subclause 2.1:

“These specifications shall be read in conjunction with any amendments to them. Any references to these specifications shall refer to these specifications as amended (if applicable).”

Add at the beginning of Subclause 2.2:

“Unless a specific edition is specified (see the List of Standardised Specifications),”

2.2 DEFINITIONS (SUBCLAUSE 2.3)

Replace the opening sentence (that begins with “For the purpose of”) with the following:

“For the purposes of this specification, the definitions given in the Conditions of Contract, in any preambles to these specifications and those definitions that follow shall apply:”

Add the following definitions to Subclause 2.3(a):

Conditions of Contract and General Conditions. The Conditions of Contract specified for use with this Contract, as detailed in the Contract Data.

Site. This term shall be as defined in the Conditions of Contract but may also consist of multiple places or Sites.

SABS. Except for references to the Bureau itself, or to the (official) SABS mark, the term ‘SABS’ shall mean ‘SANS’.

Replace the definitions for ‘Fixed charge’ and ‘Time-related charge’ under Subclause 2.3(c) 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 for a schedule item, the amount of which varies in accordance with the time for the completion of the item, adjusted in accordance with the provisions of the Contract.

Remove the definition for ‘Value-related charge’ from Subclause 2.3(c).

2.3 ABBREVIATIONS (SUBCLAUSE 2.4)

Add the following abbreviations to Subclause 2.4(a):

“CKS : SABS Co-ordinating Specification”

“TMH1 : Technical Methods for Highways 1”

Add the following abbreviation under Subclause 2.4(b):

“MAMDD : Modified AASHTO maximum dry density.”

2.4 ITEMS IN SCHEDULE OF QUANTITIES (SUBCLAUSE 2.8)

2.4.1 Principle (Subclause 2.8.1)

In the fourth line, after the words "standardized specification", add:

"or in the measurement and payment clause of the standard specification, particular specification and project specification and any amendments thereto,".

At the end of this Subclause add the following paragraphs:

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

- (a) the form and nature of the Site and its surroundings, including subsurface conditions,
- (b) the hydrological and climatic conditions,
- (c) the extent and nature of work and materials necessary for the execution and completion of the Works,
- (d) the means of access to the Site and the accommodation he may require,
- (e) the location and nature of the site for the purpose of providing adequate security,

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

The Contractor shall be deemed to have based his tender on the technical data given in the Documents and, if in the performance of the Contract any circumstances shall differ from the said technical data, which difference causes delay or additional cost, the Contractor shall be entitled to make a claim in accordance with the *Contractor's Claim(s)* clause in the Conditions of Contract.

The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the Works, and of the rates and prices stated in the priced Schedules of Quantities, or in the specification, which rates and prices shall (except in so far as otherwise provided in the Contract) collectively cover full payment for the discharge of all his obligations under the Contract, and all matters and things necessary for the proper completion of the Works."

3. MATERIALS (CLAUSE 3)

3.1 QUALITY (SUBCLAUSE 3.1)

Add the following to the end of this Subclause:

"No used or recycled material may be used in the Works unless required in terms of the specification.

Where a material to be used in this Contract is specified to comply with the requirements of a SANS Standard Specification, and such material is available with the official SABS mark, the material used shall bear the official mark.

Samples of concrete aggregates are to be delivered to an approved laboratory.

Where proprietary products are specified, the Contractor may propose equal alternatives for approval by the Engineer. Alternative materials or equipment proposed by the Contractor shall be tested. The test, as well as the materials or equipment, shall be approved by the Engineer prior to any such materials or equipment being built into the Works, and all costs involved in testing shall be deemed to be included in the rates tendered."

3.2 ORDERING OF MATERIALS (NEW SUBCLAUSE 3.3)

The quantities set out in the Schedules 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 purpose, 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 purpose.

4. PLANT (CLAUSE 4)

4.1 SILENCING OF PLANT (SUBCLAUSE 4.1)

Replace the contents of this Subclause 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, 1993 (Act No 85 of 1993) as amended.

The Contractor shall at all times and at his 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."

4.2 CONTRACTOR'S OFFICES, STORES AND SERVICES (SUBCLAUSE 4.2)

Add the following before the first paragraph of this Subclause:

"4.2.1 General

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 his camp 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.

Neither housing nor shelters are available for the Contractor's Employees, and the Contractor shall make his own arrangements to house his Employees off site and transport them to the Site. Only night-watchmen may be on the Site after hours.

No water may be abstracted from water bodies for the purposes of construction without the approval of the Engineer.

The Contractor's camp shall be kept neat and clean at all times and all surplus or rejected material shall be removed from the Site.

The Contractor shall provide facilities for the storage and handling of hazardous substances and liquid pollutants."

In the second paragraph, delete the words: "and first-aid services".

Add the following to the end of Subclause 4.2:

"4.2.2 Latrine facilities

The Contractor shall provide and maintain on the Site adequate and suitable sanitary services and a supply of potable water for his employees engaged on the Contract.

The Contractor shall provide on the Site and in close proximity to the actual locations where the work is being executed, one toilet per 10 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 suitable sanitary services shall be of the chemical type or better and shall be readily accessible to workers at all areas of the site.

The Contractor shall make all the necessary arrangements with the relevant local authority, or a commercial organisation approved by the local authority, for the disposal of the contents of the toilets on a regular basis

4.2.3 Medical facilities and safety equipment

The Contractor shall provide and maintain on the Site adequate first aid services. The first aid services shall include, inter alia, a First Aid cabinet fully equipped and maintained with at least the minimum contents as listed in the Annexure (Regulation 3) to the General Safety Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993), to deal with accidents and ailments which are likely to occur during the construction period.

The Contractor shall provide personal safety equipment and facilities as required by Regulation 2 of the General Safety Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993)."

5. CONSTRUCTION (CLAUSE 5)

5.1 SURVEY (SUBCLAUSE 5.1)

5.1.1 Setting out of the Works (Subclause 5.1.1)

Add the following to the end of this Subclause:

"Before commencing any construction, the Contractor shall check the relative positions and levels of all reference pegs, benchmarks and line pegs, and inform the Engineer of any discrepancy.

The Contractor shall be responsible for the true and proper setting out of the Works and for the correctness of the position, levels, dimensions and alignment of all parts of the Works and for the provisions of all necessary instruments, appliances and labour in connection therewith.

The Contractor shall carefully protect and preserve all benchmarks, sight-rails, pegs and other things used in setting out the Works. For any new work the Contractor shall establish his own reference points from which the work can be set out.

The checking of any setting-out or of any line or level by the Engineer shall not relieve the Contractor of his responsibility for the correctness thereof.

If at any time during the progress of the Works, any error appears or arises in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required to do so by the Engineer, shall at his own expense rectify such error to the satisfaction of the Engineer, but if such error is based on incorrect data supplied in writing by the Engineer, or if there is any delay in providing the particulars required, which delays progress on the Contractor's critical path, the Contractor shall, in respect of that delay and the cost of such rectification, be entitled to make a claim in accordance with the *Contractor's Claim(s)* clause in the Conditions of Contract."

5.1.2 Preservation and replacement of survey beacons and pegs subject to the Land Survey Act (Subclause 5.1.2)

In the second sentence of this Subclause, delete the words: "in the vicinity of boundaries". In that same sentence, replace the words: "under the direction of" with: "in consultation and liaison with".

Add the following to the end of the second sentence of this Subclause:

"The Contractor and the Engineer shall record on the said list, their concurrence or disagreement (as the case may be) regarding the completeness and accuracy of the details recorded therein."

Replace the third sentence of this Subclause with the following:

"At the completion of the Contract, the Contractor shall expose 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 for the checking of the positions of all such pegs and the replacement of those that the Land Surveyor's check reveals have become disturbed or damaged. The Contractor shall, as a precedent to the issuing of a Taking-Over Certificate or Certificate of Practical Completion (as applicable), 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 all checking, replacement and certification as aforesaid shall be entirely for the Contractor's account. This, with the provision 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 to the satisfaction of the Engineer, were disturbed, damaged or destroyed by others beyond his control."

5.1.3 As-built survey (New Subclause 5.1.3)

The Contractor shall supply the Engineer with as-built survey data for the entire Works (including invert and cover levels, coordinates of manholes and points of intersection, valve chambers, etc). A Taking-Over Certificate or Certificate of Practical Completion (as applicable) will not be issued until the as-built survey information had been approved by the Engineer.

5.2 WATCHING, BARRICADING, LIGHTING AND TRAFFIC CROSSINGS (SUBCLAUSE 5.2)

Add the following at the end of this Subclause:

"The Contractor shall, in addition to the requirements of Subclause 5.1.6 of SANS 1200 D, carry out and maintain such Temporary Works, and provide all temporary road signs, as are necessary to maintain and safeguard the normal flow of public and private vehicular and pedestrian traffic.

All temporary signs shall be of the type and size required for rural roads, as applicable, as specified in the "Southern African Development Community Road Traffic Signs Manual and Chapter 13, [Roadwork Signing] of the South African Road Traffic Signs Manual".

5.3 PROTECTION OF STRUCTURES (SUBCLAUSE 5.3)

Replace the words "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 after the words "(Act No. 27 of 1956)", insert the words "as amended".

5.4 PROTECTION OF OVERHEAD AND UNDERGROUND SERVICES (SUBCLAUSE 5.4)

Replace this Subclause heading with "Location and Protection of Existing Services".

Replace the contents of this subclause with the following:

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 shown on any plans, or 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 his 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 he intends to work. Neither the Employer nor the Engineer offers 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 further requirements of Subclauses 4.4 and 5.1.2.2 of SANS 1200 D shall 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 and competent Contractor to be present or potentially present on the Site.

All services, the positions of which have been determined as aforesaid at the 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 when any such service is encountered or discovered on the Site.

Whilst he 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 cognizance 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.

The Contractor shall also be liable for consequential damage in regard to (a) and (b), whether caused directly by the Contractor's operations or by the lack of proper protection.

No separate payment will be made to the Contractor in respect of his costs of providing, holding available on the Site and utilising the said detecting and testing equipment, nor for any costs incurred in preparing and submitting to the Engineer the Drawings as aforesaid. These costs shall be deemed included in the Contractor's other tendered rates and prices included in the Contract.

Payment to the Contractor 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 for in the respective sections of the specifications pertaining to the type of work involved.

5.4.2 Protection during construction

The Contractor shall take all reasonable precautions and arrange his 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 therefrom to the public and/or workmen, all in accordance with the requirements of the prevailing legislation and related regulations.

Unless otherwise instructed by the Engineer, no services shall be left exposed after its exact position has been determined and all excavations carried out for the purpose of exposing underground services shall be promptly backfilled and compacted. In roadways, the requirements of Subclause 5.9 of SANS 1200 DB should be observed. In other areas compaction is to be to 90% modified AASHTO density.

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.

5.4.4 Existing fences, boundary walls and structures

Where work is carried out in the proximity of buildings, bridges, buried services, tanks, pipes, walls or other structures, the Contractor is reminded of his obligation to take all necessary precautions required in terms of the regulations framed under the Occupational Health and Safety Act (Act N° 85 of 1993) to ensure the safety of structures and services that are at risk.

Before commencing work in an area, the Contractor shall make sketches as directed by, and to the satisfaction of the Engineer, and, if so directed, take photos of the fences, walls and structures within the working width, in order that the standard after completion of the Works can be compared with the original standard, and shall submit the sketches and photos to the Engineer.

If the Engineer issues a written instruction to remove existing fences, walls or other structures or parts thereof, the Contractor shall dismantle and recover the various components and store them in a security area. As soon as possible after completion of the work in the area, the Contractor shall, if so directed, re-erect the fences, walls or other structures to a standard at least equal to the original, using the recovered material as far as possible and, if necessary, new material of a type and quality equivalent to the original."

5.5 DEALING WITH WATER ON WORKS (SUBCLAUSE 5.5)

Replace the contents of this Subclause with the following:

"All water, whether from rain, pipeline failures, flooding, special water hazards or subsurface water and infiltration, etc., shall be dealt with in such a way as to ensure the safety of the Works.

It is required that adequate preventive, protection and control measures are taken and maintained by the Contractor for 24 hours per day, 7 days a week, throughout the period during which the facilities are required, to ensure that the Works are protected from damage due to water from any source and under any circumstance, whether abnormal or not.

The Contractor shall ensure that the water level outside all water retaining structures is at all times kept below the floor of the particular structure until the structure is filled with water, to prevent structural damage or floating.

The Contractor shall design, construct, operate and maintain all drains and other Temporary Works necessary for the dewatering and flood protection of the permanent Works. All methods of dewatering and flood protection shall be submitted to the Engineer for approval, which approval shall not relieve the Contractor of their obligations or responsibilities in regard to dealing with water.

In the event of these measures failing to protect the works, action shall be taken immediately by the Contractor to protect the Works from further damage, the cost of which shall be carried by the Contractor.

The Contractor shall be responsible for and shall repair at their own expense, any damage to the foundations, structures or any part of the Works caused by water that he is required to deal with, or failure of any part of the measures he has taken to protect the Works.

Once dewatering and protection measures have served their purpose, all Temporary Works shall be removed, and affected areas backfilled or levelled (as applicable) such that the operation of the Works not be affected in any way, and the Site restored to its original condition.

Further requirements may be added in the project specification."

5.6 POLLUTION (SUBCLAUSE 5.6)

Add at the end of this Subclause:

"The Contractor shall comply with the Construction Environmental Management Plan included in the project specification."

5.7 SAFETY (SUBCLAUSE 5.7)

Replace the contents of this Subclause with the following:

5.7.1 Occupational Health and Safety

The Contractor is to observe the provisions of the Occupational Health and Safety Act 85 of 1993, and the latest version of the related Construction Regulations (together hereinafter referred to as the Act), as well as the OHS requirements in the project specification.

Working on underground pipelines presents hazardous conditions and the Contractor's attention is drawn to the Act - General Safety Regulations and in particular the Regulation for working in confined spaces. The Contractor shall, in terms of the Act, address these hazards in his Health and Safety Plan.

All work and particularly work carried out in the proximity of buildings, bridges, tanks or other structures shall be carried out in conformance with the regulations framed under the Act, and the Minerals Act, Act 50 of 1991, including shoring where necessary, to ensure the safety of structures that are at risk.

The Contractor shall give notice to the Provincial Director, in terms of the Act, prior to the commencement of work on Site.

Pursuant to the provisions of the Conditions of Contract, and without in any way limiting the Contractor's obligations thereunder, 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 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;
- (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;
- (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;
- (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;
- (e) Full compliance with all other requirements pertaining to safety as may be specified in the Contract.

The Employer and the Engineer shall be entitled, although not obliged, to 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 and/or Engineer's representative may reasonably require.

Where any such investigations reveal, or where it comes to the Engineer'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 relevant Suspension of Work clauses in the Conditions of Contract, be entitled to suspend progress of part or all of the Works until such time as the Contractor has demonstrated to the satisfaction of the Engineer, that such breach has been rectified, which breach will be just cause for the suspension, and thus the responsibility of the Contractor as contemplated in this clause.

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 to complete the Works within the specified time for completion, irrespective of the suspension.

Persistent and repeated breach by the Contractor of the requirements of the Act and/or this clause shall constitute further grounds for the Engineer to act in terms of the *Termination by Employer* clause in the Conditions of Contract.

5.7.2 Construction hazards

Besides any other potentially hazardous conditions on Site, the possibility of high water pressures shall be taken into account when working with live water mains."

5.8 GROUND AND ACCESS TO WORKS (SUBCLAUSE 5.8)

Add at the end of this Subclause:

"The Contractor shall, during construction of the Works:

- a) improve and maintain to a standard that will ensure the safe execution of the Works, any existing access roads or roads built under this Contract, and tracks required by him for the Works,
- b) keep all roads and access tracks used by him watered to minimise dust. The frequency of the watering shall be at least daily when roads and tracks are used by the Contractor, unless it is sufficiently damp after rain.
- c) not operate outside the "working width" or construction area as defined on the drawings, and he will be held wholly responsible for any damage or nuisance caused by himself, his plant, vehicles or staff throughout the period of the Contract.

Immediately on completion of each section of the Works, the Contractor shall:

- i) reinstate all private roads used by him, other than those under (ii) below, to at least their original condition,
- ii) scarify all roads constructed by him for construction purposes, and which are not required by the property owner or the Employer,

On completion of operations the Contractor shall restore the ground surface, wherever it may have been disturbed, to its original condition by filling in all ruts with material similar to the material within the rut and levelling the ground and, where necessary, planting grass and shrubs as may be required. Any boundary fences which have been removed or damaged by his operations and activities shall be repaired and/or reinstated at the Contractor's expense. Ground restoration must include proper placement of topsoil profile.

The relevant provisions of the Construction Environmental Management Plan, included in the project specification, shall also apply."

5.9 DRAWINGS AND DETAILS (NEW SUBCLAUSE 5.9)

Tender drawings shall not be used for construction purposes. Construction drawings and additional detailed information will be made available to the Contractor as and when required by him.

The originals of all Drawings and Specifications prepared by or on behalf of the Engineer shall remain in his custody and references herein to delivery to the Contractor of Drawings or Specifications shall relate to true electronic copies thereof.

The Contractor shall, to the extent provided in the Contract, receive electronic copies of each such Drawing and Specification and on his own accord and cost produce hard copies as he shall reasonably require.

One hard copy of all documents constituting the Contract shall be kept on the Site and be available for perusal by the Engineer or any person authorised by him.

The Contractor shall, in accordance with the Engineer's instructions, maintain a register on the Site of all Drawings and revisions thereof in the chronological order in which they are delivered to him.

5.10 PROVISION OF SECURITY MEASURES (NEW SUBCLAUSE 5.10)

The Contractor shall ensure safety of and protect the Works from theft and vandalism. The Contractor shall be responsible for the safety and security of his personnel, materials on Site and the Works in general at all times. The Contractor shall therefore acquaint himself with the situation in the area with regard to safety and security (liaising with the local police as necessary) and shall provide all security measures deemed necessary to comply with the requirements under this clause in the Contract.

The Contractor shall make use of a professional service provider who is registered and compliant with the Private Security Industry Regulatory Authority (PSIRA). All security personnel provided by the service provider must also be registered with PSIRA. Upon appointment of the service provider the Contractor shall provide proof of the above mentioned PSIRA registration. The Contractor shall ensure that the service provider has the necessary insurances in place to cover the service provider against any negligence on the part of the service provider.

Further requirements may be added in the project specification.

6. TOLERANCES (CLAUSE 6)

6.1 USE OF TOLERANCES (NEW SUBCLAUSE 6.4)

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 'authorised' 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 'authorised' 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.

7. TESTING (CLAUSE 7)

7.1 PRINCIPLES (CLAUSE 7.1)

7.1.1 Checking (Subclause 7.1.1)

Add the following at the end of this Subclause:

"Every completed layer or section of the Works shall be subject to check testing by the Contractor, at his own cost. Once the Contractor has satisfied himself with the standard of his works, he shall provide the Engineer with the results of his check testing indicating that the work is to specification. In order to minimize delays due to testing, the Contractor shall give the Engineer at least 24 hours' notice of when any portion of the Works will be completed to his satisfaction, so that the Engineer can arrange for his acceptance control testing to be done.

Failure by the Contractor to notify the Engineer or to provide the required information or, where specified, to perform the required test, will be grounds to exempt the Employer from payment for the associated work and for all subsequent work which would be affected by the failure of the work to be tested.

All pipeline infrastructure will be tested as per project specifications.

The Engineer will be under no obligation to the Contractor to perform acceptance tests. If the Engineer elects not to perform a particular test after notification by the Contractor, he will issue the Contractor with a written instruction to proceed with the relevant works without the acceptance test being performed.

Nothing contained in this Clause will relieve the Contractor of his responsibilities under the specification or in any way limit the tests which the Engineer may call for or perform in terms of the specification."

7.1.2 Standard of Finished Work not to Specification (Subclause 7.1.2)

Add the following at the end of this Subclause:

"In addition, the costs of check testing by the Engineer, including tests carried out by commercial laboratories after remedial work by the Contractor, shall be borne by the Contractor."

7.2 APPROVED LABORATORIES (CLAUSE 7.2)

Replace the contents of Subclause 7.2 with the following:

"Unless otherwise specified in the relevant specification or elsewhere in the Project Specifications, 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;
- (d) Any other laboratory that the Engineer approves in his absolute discretion;
- (e) Concrete testing and technical analysis shall be carried out by the Structural Engineering/Concrete Laboratory at the University of Cape Town, or similar approved by the Engineer.

If required, the Engineer will employ the services of a commercial laboratory in order to carry out acceptance testing. All acceptance testing carried out by a commercial laboratory shall be paid for by the Contractor. The costs of such tests shall be deemed to be included in the relevant rates.

The Contractor shall make due allowance for testing procedures in his construction programme."

8. MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 MEASUREMENT (SUBCLAUSE 8.1)

8.1.1 Method of Measurement, All Sections of the Schedule (Subclause 8.1.1)

Delete the words "and South West Africa".

8.1.2 Preliminary and General Item or Section (Subclause 8.1.2)

8.1.2.1 Contents (Subclause 8.1.2.1)

Replace the last sentence of Subclause 8.1.2.1(b) with the following:

"Separate items will be scheduled to cover the fixed charge and time-related components of the Contractor's preliminary and general costs."

For Subclause 8.1.2.1(c), replace the words "the substantial completion certificate" with the words "a Taking-Over Certificate or Certificate of Practical Completion (as applicable)".

Add the following to the end of Subclause 8.1.2.1(c):

"Notwithstanding the above, should a Taking-Over Certificate or Certificate of Practical Completion (as applicable) be issued with a list of outstanding work and defects, those preliminary and general items and responsibilities necessary to complete the outstanding work and remedy the defects, in the opinion of the Engineer, shall not cease or be removed but shall remain and continue at the Contractor's own cost until the work is complete and defects remedied to the satisfaction of the Engineer."

Remove the phrases "same section of the" and "prime cost items," from Subclause 8.1.2.1(d).

8.1.2.2 Tendered sums (Subclause 8.1.2.2)

Replace the contents of this Subclause with the following:

"Except only where specific provision is made in the Specifications and/or the Schedules of Quantities for separate compensation for any of these items, what is covered by the Contractor's tendered sums is specified in 8.3 and 8.4, and shall collectively cover his direct costs plus overheads, and include his profit and all costs and expenses that he requires for the item(s) specified, as well as for all general risks, liabilities and obligations set forth or implied in the documents on which the tender is based, and further, all expenses of a general nature not specifically related to any item or items of the permanent or temporary work."

8.2 PAYMENT (SUBCLAUSE 8.2)

8.2.1 Fixed-charge and value-related items (Subclause 8.2.1)

Replace the contents of subclause PSA 8.2.1 with the following:

"Payment of fixed charges in respect of item 8.3.1 will be made as follows:

- (a) EIGHTY PER CENT (80%) of the sum tendered will be paid when the facilities have been provided and approved;
- (b) The remaining TWENTY PER CENT (20%) will be paid when the works have been completed, the facilities have been removed and the site of the Contractor's establishment has been cleared and cleaned as specified by the Engineer.

No adjustment will be made to the sum tendered in respect of item 8.3.1 should the value of the works finally executed or the time for completion vary in any way from that specified in the tender

Should the Contractor fail to provide, within a reasonable amount of time as determined by the Engineer, all the services and facilities or meet all the responsibilities, obligations and liabilities required of him in respect of any fixed-charge items, the Engineer may suspend progress of part or all of the Works until such time as they are fully provided/met.

NOTE: An approved extension of time will not qualify the Contractor to receive any additional payment for fixed charge items, nor receive any payment for that portion of these items which have become regarded as 'time-related' items."

8.2.2 Time-Related Items (Subclause 8.2.2)

Replace the contents of this Subclause with the following:

"Payment for time-related items scheduled as lump sums or at monthly rates (if applicable), will be effected as follows, only after the relevant fixed-charge item has been provided/implemented, and certified for payment:

Subject to the provisions of 8.2.3 and 8.2.4, for lump sum items, payment of monthly incremental amounts (calculated by the division of the remainder of the tendered sums by the realistic number of remaining months, as determined by the Engineer, for the completion of the relevant items) will be authorized in each of the subsequent progress certificates until the sum tendered has been paid, subject to full compliance. Should any item be provided/implemented later than required, the tendered sum will be reduced pro rata to the extent of lateness.

For items scheduled at monthly rates, also subject to the provisions of 8.2.3 and 8.2.4, payment at the monthly rate will be authorized in each of the subsequent progress certificates, until realistic completion of the relevant item or need for it, all as determined by the Engineer, or the due completion thereof, whichever is the shorter time, also subject to full compliance.

NOTE: Unless an extension of time is approved without costs, an approved extension of time may qualify the Contractor to receive payment for each relevant time-related item at a unit rate determined from the sum tendered for such item and the period for the completion of the item."

8.2.3 Withholding of Payment for Time-related Items (Subclause 8.2.4)

Replace this Subclause heading with "Omitting Payment for Time-related Items".

Replace the contents of this Subclause (8.2.4.1 through 8.2.4.3 inclusive) with the following:

"Should the Contractor fail to provide all or part of the services and facilities or meet all or part of the responsibilities, obligations and liabilities required of him in a particular period in respect of any time-related item, all or part of the relevant incremental amount for that item will be omitted and the total amount of the contract reduced accordingly. Should the Contractor not remedy the failure within a reasonable amount of time as determined by the Engineer, the Engineer may suspend progress of part or all of the Works until the failure has been resolved.

Notwithstanding how payment for time-related items are calculated in 8.2.2 above, the incremental amount omitted for each relevant time-related item shall be at a unit rate determined from the sum tendered for such item and the period for the completion of the item, 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."

8.3 SCHEDULED FIXED-CHARGE AND VALUE-RELATED ITEMS (SUBCLAUSE 8.3)

Remove the words "and value-related" from the heading of this subclause.

Delete Subclauses 8.3.2, 8.3.3 and 8.3.4, and substitute with the following:

8.3.2 Establishment of Facilities on the Site

8.3.2.1 Facilities for Engineer..... Unit: Sum

The sum shall cover all costs for providing, establishing and commissioning on the Site all facilities specified for the Engineer, adequately equipped to allow the work to commence and to proceed to completion as required in terms of the Contract. This includes for, but is not limited to, meeting all the requirements specified in SANS 1200 AB, excluding the time-related costs scheduled separately under 8.4.2.1.

8.3.2.2 Facilities for Contractor Unit: Sum

Facilities for the Contractor will not be measured and paid for separately, but all (excluding the River Diversion Facility which is scheduled separately, see 8.3.10), consolidated into two items, one item covering all fixed-charge requirements (this scheduled item) and the other covering all time-related requirements (scheduled under 8.4.2.2).

The sum for this item shall cover the cost of providing, establishing and commissioning on the Site all facilities for the Contractor which are adequately equipped to allow the work to commence and to proceed to completion as required in terms of the Contract.

These facilities for the Contractor include offices, storage sheds, workshops, laboratories, living accommodation, ablution, latrine and medical facilities, tools and equipment (including safety equipment), water supplies, electric power and communications, sewage, rubbish disposal, dealing with water on the Works (see 5.5) except for areas scheduled separately under 8.3.7, access (see 5.8), plant (designated plant or plant for designated operations or plant for use during stated periods; applicable only to specifically identified plant), fencing off the Contractor's camp (see 4.2) and all other facilities the Contractor may require.

8.3.3 Environmental Management Unit: Sum

The sum tendered shall cover all costs of whatsoever nature, excluding the time-related costs scheduled separately under 8.4, of complying with all specified environmental management (and related) requirements.

8.3.4 Health and Safety Unit: Sum

The sum tendered shall cover all costs of whatsoever nature, excluding the time-related costs scheduled separately under 8.4 or costs already included for in facilities for Engineer and Contractor, of complying with all specified health and safety (and related) requirements.

8.3.5 Provision of Security Measures Unit: Sum

The sum tendered shall cover all costs of whatsoever nature, excluding the time-related costs scheduled separately under 8.4, of complying with the requirements of 5.10.

8.3.6 Accommodating Other Contractors Unit: Sum

The sum tendered shall cover all costs of whatsoever nature, excluding the time-related costs scheduled separately under 8.4, associated with accommodating other contractors on or adjacent the Site, as outlined in the project specification.

8.3.7 Dealing with water in areas scheduled Unit: Sum

Dealing with water on the Works shall be included for in the sums tendered for facilities for the Contractor (see 8.3.2.2), and for the river diversion facility (see 8.3.10), as applicable, except for areas scheduled separately under this subclause.

The sum tendered for areas scheduled separately shall cover all costs, excluding the time-related costs scheduled separately under 8.4, for dealing with water (see 5.5) in the scheduled areas.

8.3.8 Quality Management Unit: Sum

The sum tendered shall cover all costs of whatsoever nature, excluding the time-related costs scheduled separately under 8.4 or costs already included for in other rates, of complying with all quality management and quality assurance related requirements specified.

8.3.9 Removal of site establishment Unit: Sum

The sum shall cover the cost of any demolition as may be necessary, and the complete removal from the surface of the Site, all scheduled fixed-charge items (excluding the River Diversion Facility which is scheduled separately, see 8.3.11), and shall provide for the making good and the restoring of the Site to at least as good a condition as it was handed over, all to the satisfaction of the Engineer.

In addition, the sum shall cover the cost of the work specified in 5.8 and the cost of complying with the *Clearance of Site* clause in the Conditions of Contract.

8.3.10 Provision of River Diversion Facility Unit: Sum

The provision of the river diversion works and associated dewatering facilities will be measured and paid for as a sum. The sum shall include for the design, construction and commissioning of the river diversion works and related equipment, inclusive of all necessary cut-off walls, drainage channels, excavation for foundations (other than for the permanent works) through all materials, supply of materials from approved sources, and any other requirements for the satisfactory construction. The sum shall further include for the provision and installation of adequate pumping equipment, including piping, power, temporary platforms and any other suitable equipment necessary to ensure that the area and excavations for the abstraction works remain dewatered as required for construction purposes, irrespective of the source of the water that needs to be removed.

The sum shall further include for meeting all the requirements specified in Spec RD (River Diversion), excluding the time-related costs scheduled separately under 8.4.11.

8.3.11 Removal of River Diversion Facility Unit: Sum

The sum shall cover the cost of the complete removal of the river diversion facility from the Site, including all related materials and equipment, and the making good and the restoring of the Site to at least the condition it was in when it was handed over, all to the satisfaction of the Engineer.

In addition, the sum shall cover the cost of complying with the *Clearance of Site* clause in the Conditions of Contract.

8.3.13 Other fixed-charge obligations Unit: Sum

The sum shall cover the fixed costs of all other obligations that are required for the proper execution of the Works in accordance with the requirements of the specification and the Conditions of Contract, and that are not specifically covered elsewhere in 8.3."

8.3.1 Other fixed-charge obligations Unit: Sum

The sum shall cover the fixed costs of all other obligations that are required for the proper execution of the Works in accordance with the requirements of the specification and the Conditions of Contract, and that are not specifically covered elsewhere in 8.3."

8.4 SCHEDULED TIME-RELATED ITEMS (SUBCLAUSE 8.4)

Delete Subclauses 8.4.2, 8.4.3, 8.4.4 and 8.4.5, and substitute with the following:

"8.4.2 Operation and Maintenance of Facilities on Site, for Duration of Construction, except where otherwise stated

8.4.2.1 Facilities for Engineer..... Unit: Sum

The sum shall cover all costs in connection with facilities for the Engineer for the periods stated for site rentals, repairs to and depreciation of buildings, furniture, tools and equipment, the storage and distribution of fuels and lubricants, water, electricity, sewage, rubbish disposal, internet, communications, time lapse cameras, plant consumables, access, sanitation, and the wages of staff operating and maintaining these facilities in accordance with the contract. This includes for, but is not limited to, meeting all the requirements specified in SANS 1200 AB, excluding fixed-charge requirements scheduled separately under 8.3.2.1.

8.4.2.2 Facilities for Contractor Unit: Sum

Facilities for the Contractor will not be measured and paid for separately, but all (excluding the River Diversion Facility which is scheduled separately) consolidated into two items, one item covering all fixed-charge requirements (scheduled under 8.3.2.2) and the other covering all time-related requirements (this scheduled item).

The sum for this item shall cover the Contractor's costs for the periods stated for site rentals, repairs to and depreciation of buildings, furniture, tools and equipment, the storage and distribution of fuels and lubricants, water, electricity, sewage, rubbish disposal, internet, communications, plant consumables, access, sanitation, and the wages of staff operating and maintaining these facilities in accordance with the contract.

These facilities for the Contractor include, but are not limited to, offices, storage sheds, workshops, laboratories, living accommodation, ablution, latrine and medical facilities, tools and equipment (including safety equipment, water supplies, electric power and communications, sewage, rubbish

disposal, dealing with water on the Works (see 5.5) except for areas scheduled separately under 8.4.7, access (see 5.8), plant (designated plant or plant for designated operations or plant for use during stated periods; applicable only to specifically identified plant), fencing off the Contractor's camp (see 4.2) and all other facilities the Contractor may require.

8.4.3 Environmental Management Unit: Sum

The sum tendered shall cover all time-related costs of whatsoever nature of complying with all specified environmental management (and related) requirements.

8.4.4 Health and Safety..... Unit: Sum

The sum tendered shall cover all time-related costs of whatsoever nature, excluding costs already included for in facilities for Engineer and Contractor of complying with all specified health and safety and related requirements.

8.4.5 Provision of Security Measures..... Unit: Sum

The sum tendered shall cover all time-related costs for complying with the requirements of 5.10.

8.4.6 Accommodating Other Contractors..... Unit: Sum

The sum tendered shall cover all time-related costs associated with accommodating other contractors on or adjacent the Site, as outlined in the project specification.

8.4.7 Dealing with water in areas scheduled Unit: Sum

Dealing with water on the Works shall be included for in the sums tendered for facilities for the Contractor (see 8.4.2.2) and for the river diversion facility (see 8.4.11), as applicable, except for areas scheduled separately under this subclause.

The sum tendered for areas scheduled separately shall cover all time-related costs for dealing with water (see 5.5) in the scheduled areas.

8.4.8 Quality Management Unit: Sum

The sum tendered shall cover all time-related costs of whatsoever nature, excluding costs already included for in other rates, of complying with all quality management and quality assurance related requirements specified.

8.4.9 Supervision for Duration of Construction Unit: Sum

The sum shall cover the costs of on-site supervision and such local administration as the Contractor considers necessary for the proper completion of the Works, and shall cover the cost of the salaries, wages and allowances paid to the site agent, salaried general and/or section foremen (where applicable), site surveyors, timekeepers, assistants and other site supervisory staff, and of transport incurred in connection with such staff.

8.4.10 Company and Head Office Overhead Costs for the Duration of the ContractUnit: Sum

The sum shall cover the Contractor's company and head office overhead costs.

8.4.11 River Diversion Maintenance and DewateringUnit: Sum

The sum tendered shall cover all costs for maintaining and dewatering of the river diversion facility and construction area protected by the facility. The sum shall further include for meeting all the requirements specified in Spec RD (River Diversion), excluding the fixed-charge requirements scheduled separately under 8.3.10 and 8.3.11.

8.4.12 Provision of an SMME manager Unit: Sum

The sum shall cover the time-related costs of all obligations that are required for the Contractor to provide an SMME manager in accordance with the requirements of the specification and the Conditions of Contract, and that are not specifically covered elsewhere in 8.4."

8.4.13 Other Time-related Obligations Unit: Sum

The sum shall cover the time-related costs of all other obligations that are required for the proper execution of the Works in accordance with the requirements of the specification and the Conditions of Contract, and that are not specifically covered elsewhere in 8.4."

8.5 SUMS STATED PROVISIONALLY BY ENGINEER (SUBCLAUSE 8.5)

Delete the contents of Subclause 8.5, and substitute with the following:

- "a) For work to be executed (including plant, materials or services to be supplied) by the Contractor, and valued in terms of the Variations (and Adjustments as applicable) clauses in the Conditions of Contract.
1. Description of work, etc. Unit: Prov Sum
- b) For work to be executed by a subcontractor, and/or for goods, materials, plant and/or services to be supplied to the Site.
1. Description of work, etc. Unit: Prov Sum
2. Overheads, charges and profit on item (b)(1) above Unit: %
3. Specified Contractor's activities (if any) associated with the two items (b)(1) and (b)(2) above, which are not already included for in other rates.
- i) Description of work, etc. Unit: Prov Sum or Sum or % on item (b)(1)

Provisional Sums are allowances made by the Engineer for items and/or operations that are not fully defined at the time of Tender but are to be included in the Contract and accounted for in the Contractor's programme. Provisional Sums shall only be used in accordance with the Engineer's instructions.

The Engineer will state in the schedule the provisional sum amount he requires in order to complete that which is stated in (a), (b)(1) and, if applicable, (b)(3), and specified more fully, if practicable, in the project specification and on the drawings.

Where provisional sums are scheduled, they shall be dealt with in terms of (a) where not followed in the schedule by a percentage for (b)(2), or dealt with in terms of (b)(1) where followed in the schedule by a percentage for (b)(2). Any percentage rate stated in the Appendix to Tender or fixed percent stated in the Conditions of Contract (as applicable) shall not be applicable to provisional sums dealt with in terms of (a), as they are to be valued in terms of the variation procedure.

The sum paid to the Contractor in (b)(1) shall be the actual amounts paid (or due to be paid) by the Contractor, exclusive of VAT.

The rate for (b)(2) shall cover the Contractor's profit, head office and Site overhead costs, correspondence, preparing quotes, liaising with suppliers and subcontractors, taking responsibility for subcontractors and ensuring subcontractor compliance with the Contract, supplying invoices, vouchers, delivery notes, receipts, taking delivery on Site, offloading and getting in, unpacking, storing and checking against invoices and delivery notes (as applicable), checking the quantity and condition of all materials and goods on taking delivery, and alerting the Engineer and supplier upon taking delivery, of any issues. Any materials and goods subsequently found missing or damaged shall be replaced at the Contractor's expense. Where not already included for in other rates and prices, the rate for (b)(2) shall also cover costs and expenses for all general risks, liabilities and obligations set forth or implied in the documents on which the tender is based.

Any amount paid to the Contractor in (b)(2) shall be a percentage of the actual amount of the provisional sum used in (b)(1). As such, where the Engineer decides not to proceed with or use a scheduled provisional sum in terms of (b)(1), no amount will be paid to the Contractor for work done in terms of (b)(2). As such, the Contractor performs work required in terms of (b)(2) at his own risk, without the guarantee that the provisional sum will actually be used, and no claims related to provisional sums not being used shall be entertained.

The rate for (b)(3) shall cover all costs associated with the work described against item (b)(3) in the schedule, and shall only be used for work to be executed by the Contractor not covered by (b)(1) and (b)(2). Where the unit of measure for (b)(3) is a percentage, it shall be a percentage of the actual amount of the provisional sum used in (b)(1). As such and as described for (b)(2), no amount will be paid to the Contractor for work done in terms of (b)(3) where a provisional sum is not used.

Where the unit of measure for (b)(3) is a provisional sum, it shall be evaluated in terms of (a)(1). Where the unit of measure for (b)(3) is a sum, it shall be paid in full if all work described against item (b)(3) is complete or, if not fully complete, the Engineer shall evaluate what portion of the work has been completed and only that portion shall be due to the Contractor.

8.6 PRIME COST ITEMS (SUBCLAUSE 8.6)

Delete the heading and contents of this Subclause (as prime cost items are covered by 8.5.b) and replace with the following:

“8.6 PROVISIONAL ITEMS

The Engineer may schedule provisional items to cover instances, work or activities (as applicable) that are provisional but are to be included in the Contract. Provisional work and activities shall only be carried out if instructed by the Engineer. Where the unit of measure is ‘days’, it shall be calendar days excluding special non-working days.

- a) All costs related to the provisional delay due to the late issuing of the instruction for the Contractor to Commence Carrying out the Works, as contemplated in Clause 5.3.4 of the Contract Data (Provisional) Unit : Days

The rate tendered shall include for all applicable preliminary and general costs in terms of 8.1.2 as relevant, and all compensation as contemplated in terms of Clause 5.12.3 of the GCC.

- b) All costs related to the instances, work or activities described (provisional) Unit : As scheduled

The rate tendered shall cover all costs of whatsoever nature, including but not limited to all applicable preliminary and general costs in terms of 8.1.2, related to that which is described in the schedule.”

8.7 DAYWORK (SUBCLAUSE 8.7)

Deleted the contents of this Subclause and substitute with the following:

“Provisional items for Daywork are scheduled as follows:

- a) Labour at hourly or daily rates for foremen, skilled, semi-skilled and unskilled labourers, electrical foremen, cable joiners, and other labour, all as scheduled.
- b) Material as a Provisional Sum with a percentage allowance on the net cost.
- c) The Contractor's own plant, at hourly or daily rates as scheduled.
- d) Hired plant as a Provisional Sum with a percentage allowance on the net cost.

The unit rates for labour and Contractor's own plant, and the percentage allowances for addition to the net cost of materials and hired plant, shall cover overhead charges and profit, site supervision and site staff, insurances, use and maintenance of tools and equipment, holidays with pay, travelling allowances and travelling costs (transport of men by Contractor's transport or transport hired or paid for by the Contractor), lodging allowances and any other emoluments and allowances payable to the workmen, as well as cover meeting the requirements of the *Daywork(s)* clause in the Conditions of Contract. The rates for the Contractor's own plant used for Daywork shall further cover the full and final cost of the use of such plant, including plant operators, consumable stores, fuel and maintenance, servicing, etc.

Only the net working hours will be measured under Daywork, and it will be held that the Contractor has made provision in his rates for possible interruptions and standing time. Hired plant for dayworks shall be used exclusively for dayworks and shall be hired for as short a period as practical. Hiring plant for longer than practical or necessary will not be accepted.”

8.8 TEMPORARY WORKS (SUBCLAUSE 8.8)**8.8.1 Main Access Road to Works (Subclause 8.8.1)**

Add the following to the end of this Subclause:

“The Contractor will be held to have satisfied himself with regard to the accessibility of the site and the standard of access available via the existing main roads, minor roads and tracks. The tendered sum shall cover the cost of the upgrading or constructing where necessary, existing access, including new access roads as required by the Contractor.

The tendered sum shall further include for the cost of maintenance to the standard specified throughout the construction period, watering as specified in 5.6 above, temporary repair of all existing access roads, new access roads required by the Contractor, and tracks, and the reinstatement/scarifying of the roads as specified in 5.8 above.”

8.8.2 Dealing with traffic (Subclause 8.8.2)

Add the following to this Subclause:

"The tendered sum for dealing with traffic shall include for the maintenance of access, protection at level crossings, and other requirements of Subclause 5.2 above."

8.8.3 Protection of.....structure until construction in vicinity is completed (Subclause 8.8.3)

Add the following to this Subclause:

- " (a) Name of existing structure stated..... Unit : Sum
(b) Etc. for other structures..... Unit : Sum

The tendered sum(s) shall include full compensation for all the costs for protecting the existing structures until the construction in the vicinity is completed. Payment will be made in two equal instalments, the first when the protection measures are in place, and the second when the protection measures have been removed."

8.8.4 Cost of Survey in Terms of the Land Survey Act (Subclause 8.8.5)

Replace the contents of this Subclause with the following:

"The cost of the Contractor's responsibility for the setting out of the Works in terms of 5.1.1 and the preservation and replacement of beacons and pegs subject to the Land Survey Act in terms of 5.1.2 will be held to be covered by the sums tendered for Other Fixed-charge Obligations under 8.3 and Other Time-related Obligations under 8.4. Any costs incurred by the Employer or his representative in connection with the replacement of beacons or pegs for which the Contractor is responsible in terms of Subclause 5.1.2 will be recoverable from the Contractor by deduction from the monthly Interim Payment Certificate."

8.8.5 Special Water Control in Terms of Project Specification (Subclause 8.8.6) Unit: Sum

Delete the heading and contents of this subclause.

All water shall be dealt with as per 5.5 and included for, unless otherwise indicated, in the rates for facilities for the Contractor.

Add the following new subclauses to 8:

8.9 MISCELLANEOUS ITEMS (SUBCLAUSE 8.9)

8.9.1 As-built Survey (New Subclause 8.9.1) Unit: Sum

The sum(s) tendered for the relevant item(s) in Schedules of Quantities shall cover all costs associated with providing the Engineer with the required as-built information of the Works in terms of 5.1.3.

8.9.2 Wayleaves (New Subclause 8.9.2) Unit: Sum

The tendered sum(s) shall include full compensation to the Contractor for all the costs involved in obtaining all the necessary wayleaves as specified in the project specification.

8.9.3 Miscellaneous Items (New Subclause 8.9.3) Unit: As Scheduled

An item which, in the payment clause column of the Bill of Quantities, refers to this clause, will be measured in the unit scheduled.

The sum or rate for such item shall cover the cost of all materials, labour and plant required to execute and complete the work as specified, described in the Bill of Quantities or shown on the drawing(s).

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1. SCOPE (CLAUSE 1)

Add the following paragraph at the end of this Subclause:

This specification covers the minimum required facilities that the Contractor is to provide for use on Site by the Engineer and his guests. These required facilities include, but are not limited to, nameboards, office buildings, furniture, parking, protective clothing, regulation of electrical supply, plant, plant consumables, assistants, site instruction books and various services (such as water, electricity, sewage and rubbish disposal).

NOTE: The standards referred to in the specification are listed in Appendix A.

2. INTERPRETATIONS (CLAUSE 2)

2.1 DEFINITIONS (SUBCLAUSE 2.3)

Delete the first two lines and substitute the following:

"For the purposes of this specification the definitions given in SANS 1200 A and the following definitions, shall apply."

2.2 FACILITIES (NEW SUBCLAUSE 2.4)

2.2.1 Facilities for the Engineer (New Subclause 2.4.1)

Facilities for the Engineer shall meet all requirements outlined in this specification (SANS 1200 AB), and shall include, without being limited to, nameboards, office buildings, furniture, parking, protective clothing, regulation of electrical supply, plant (including telephones, computers, internet, printers, survey equipment, time lapse cameras, etc.), plant consumables, assistants, site instruction books and various services (such as water, electricity, sewage and rubbish disposal).

3. MATERIALS (CLAUSE 3)

3.1 NAMEBOARDS (SUBCLAUSE 3.1)

Replace the first sentence of this Subclause with the following:

"The Contractor shall supply and erect at approved sites, before commencing with construction of the Works, three nameboards. The nameboards shall comply as regards size, painting, decorating and detail, with the recommendations for the standard board of the Consulting Engineers South Africa."

Add the following at the end of this Subclause:

"The nameboards shall conform to the standard layout and design as formulated by the Employer (details available from the Engineer). The wording for the name board shall be as ordered at the Commencement of Works. Before ordering or manufacturing the required nameboards, the Contractor shall obtain the Engineer's written approval in respect of all names and wording to appear on the nameboards."

3.2 OFFICE BUILDING(S) (SUBCLAUSE 3.2)

Replace the contents of this Subclause with the following:

"The Contractor shall provide and have ready when commencing with work on Site, and thereafter maintain and service for the duration of construction, the following:

A suite of three "Kwikspace" or similar approved modular offices with a floor area of at least 14 m² per office.

Each office shall, individually, include/contain:

- a. one trestle table, 2 m long x 1 m wide x 0,9 m high, with a smooth top;
- b. one high stool;

- c. one table or desk having a top of size at least 1,5 m x 0,7 m of suitable height (0.7 m to 0.8 m), with at least one lockable drawer;
- d. two sturdy office chairs;
- e. "Barhold" or similar wall mounted rack with 6 clamps suitable for hanging A0 sized drawings;
- f. either a lockable upright steel cabinet with three shelves or a steel filing cabinet with four drawers;
- g. shelving with a total length of 3 m and of nominal width 300 mm;
- h. two opening windows and total glazed area of at least 1.5 m²;
- i. adequate blinds covering all glazed areas;
- j. adequate lighting;
- k. two wall-mounted 3-pin 16A double socket electrical outlets;
- l. an air conditioning unit (capable of heating and cooling) of at least 12 000 BTU/h capacity (note: the aircon will not be required to run off generator power provided that the contractor also supply and power from the generator a fan (min 50 watts) per aircon unit specified);
- m. adequate multiplugs, adapters and extension cables necessary for connecting all appliances (and office equipment listed elsewhere) to mains power simultaneously, while still having two available 3-pin 16A sockets.

Two ablution rooms each with a floor area of at least 3 m², cleaned daily. The facilities provided shall conform to the local health authority requirements as applicable, and the Contractor shall pay all sanitary fees and charges. Each ablution room shall include/contain:

- a. a communal hand washbasin area with mirror;
- b. a liquid soap dispenser with adequate supply of liquid soap;
- c. a urinal cubicle and a private flush toilet cubicle (each separate from the other), both of the chemical type or better;
- d. an adequate supply of toilet paper;
- e. two opening windows with frosted glazing (obscure);
- f. adequate ventilation (extractor fan required);
- g. adequate lighting.

One kitchen area with a floor area of at least 6 m². The kitchen shall be cleaned daily, and shall include/contain:

- a. a kitchen sink with hot and cold water;
- b. adequate counter space for kitchen appliances (excluding fridge) listed below;
- c. adequate shelving/cupboards for nominal groceries, dishwashing products and the crockery and cutlery listed further below;
- d. a drying rack;
- e. one refrigerator of at least 200 litre capacity;
- f. one kettle of at least 2 litre capacity;
- g. one microwave of at least 20 litre capacity;
- h. one tea set comprising eighteen cups and saucers, eighteen teaspoons, two teapots, two sugar bowls and two milk jugs;
- i. two plastic serving trays;
- j. one paper towel stand with adequate supply of paper rolls;
- k. a dishwashing liquid dispenser, with adequate supply of dishwashing soap and dish-cleaning utensils;
- l. adequate lighting;

- m. four wall-mounted 16A double socket electrical outlets ;
- n. adequate multiplugs, adapters and extension cables necessary for connecting all kitchen appliances to mains power simultaneously, while still having two available 3-pin 16A sockets.

One conference room for conducting meetings, with floor area of at least 6 m x 7 m in plan. The conference room shall include/contain:

- a. one large meeting table to seat sixteen people, with a table top height of between 0.7 m to 0.8 m (4x identical tables may be pushed and secured together to form the sixteen-seater table);
- b. sixteen chairs;
- c. one A0 sized drawing table;
- d. four wall-mounted 16A double socket electrical outlets ;
- e. one 5m extension cable, for the exclusive use of the Engineer and his staff or guests at the meeting table;
- f. adequate multiplugs, adapters and extension cables necessary for connecting any equipment that is to be installed in the conference room (such as printers and WiFi specified elsewhere) to mains power simultaneously, while still having two available 3-pin 16A sockets;
- g. two air conditioning units (capable of heating and cooling) of at least 12 000 BTU/h capacity each;
- h. a personal, sturdy, portable folding table with height of between 65 and 75 cm, a length of between 60 and 80 cm and width of between 40 and 60 cm ("Lifetime Personal Table", "Bushtec Personal Adjustable Table", or other similar approved);
- i. a sturdy, plastic, folding chair.

A rain gauge, for the exclusive use of the Engineer, positioned in a place approved by the Engineer.

The buildings (i.e. offices, ablutions, kitchen(s), conference room(s), etc.) shall have ceiling heights of at least 2.4 m (unless otherwise approved), shall be weatherproof and shall be provided with a ceiling and a lining to the walls, or equivalent insulation to provide comfortable working conditions. All floors shall either be wooden boarded floors that are at least 150 mm above the ground or floors covered with linoleum.

All windows shall be fitted with burglar proofing over the entire glazed area and with fly screens over the window openings. Each room, office and cubicle shall have an adequate door with a secure lock.

The buildings shall be fitted with wall-mounted fire extinguishers and safety signs in accordance with SANS 10400-T, but with no less than one 5kg Carbon Dioxide fire extinguisher mounted in the kitchen area and one 4.5kg dry chemical powder fire extinguishers mounted in the conference room, unless not all offices and ablution rooms have quick access to the conference room, in which case each office and ablution shall be fitted with a 4.5kg dry chemical powder fire extinguisher.

The Contractor shall further provide and pay for all necessary services required by these buildings, including providing water, electricity, sewage, rubbish disposal, etc.

The rain gauge provided shall only be emptied by the Engineer unless he approves one of the Contractor's staff to empty the gauge. Unless otherwise agreed, the Contractor shall accompany the Engineer to take and agree on the rainfall measurements and witness emptying of the gauge daily. Should the Contractor or his staff tamper with or empty the rain gauge without prior approval of the Engineer, the measurement for the preceding or following period will be taken to be zero, whichever period is most appropriate in the opinion of the Engineer.

The buildings, their furnishings and the rain gauge specified shall be for the exclusive use of the Engineer and his/her staff. After the Engineer has issued the Taking-Over Certificate or Certificate of Practical Completion (as applicable) and after the Contractor has completed, to the satisfaction of the Engineer, all outstanding work and defects listed therein, ownership of the buildings and their furnishings shall revert to the Contractor who shall promptly remove them."

3.3 PARKING FOR VEHICLES (NEW SUBCLAUSE 3.3)

The Contractor shall provide and have ready when commencing with work on Site, and thereafter maintain, for the duration of construction, ten parking spaces. The parking spaces shall be for the exclusive use of the Engineer, his staff and their guests, and shall include a pathway to the Engineer's office.

Five of the ten parking spaces shall include carports, constructed so that the vehicles parked thereunder are appropriately protected against the sun and rain. The remaining five parking spaces shall be uncovered.

Each parking space shall have a floor area of at least 20 m² in plan and shall be positioned so as to provide easy and convenient access to the Engineer's office. All parking space floors and the pathway to the Engineer's office shall be covered with a layer of crushed stone to alleviate dusty and muddy conditions.

After the Engineer has issued the Taking-Over Certificate or Certificate of Practical Completion (as applicable) and after the Contractor has completed, to the satisfaction of the Engineer, all outstanding work and defects listed therein, the Contractor shall promptly remove the parking spaces and pathways from Site."

3.4 PROTECTIVE CLOTHING (NEW SUBCLAUSE 3.4)

The Contractor shall provide and have ready when commencing with work on site, and thereafter maintain and replace (as necessary) for the duration of construction, the following:

- a. eight sets of safety helmets;
- b. eight sets of safety shoes (of sizes as required);
- c. eight sets of gumboots (of sizes as required);
- d. eight hi-vis vests (of sizes as required).

This protective clothing and equipment shall be for the exclusive use of the Engineer, the Engineer's site staff and their visitors.

3.5 ELECTRICITY SUPPLY FOR THE ENGINEER (NEW SUBCLAUSE 3.5)

The Contractor shall provide and pay for electricity required by these buildings, including adequate backup generation during periods of failure of mains supply. The electrical supply shall be adequate to power all facilities, lights, appliances, office equipment (listed elsewhere) and aircons simultaneously. The changeover from mains power to backup generation shall be seamless for the Engineer and his staff (i.e. backup generation shall power the same electrical outlets as the mains power, thus not requiring the Engineer to switch plugs at changeover). The Contractor shall be responsible for ensuring that these services are available and reliable during normal working hours.

All electricity supply to the Engineer's office(s), whether provided by the Contractor by way of a reticulated supply from a local authority or other authorised electricity supply, or by way of on-site generators, shall be regulated by the Contractor to within limits such as to prevent damage due to fluctuations in the electrical current supply that may occur to any electrical plant and equipment provided by the Contractor or the Engineer.

The Contractor shall be liable for and pay all costs incurred for the repair or replacement of any electrical equipment damaged due to poor regulation of electrical supply. Reliance by the Contractor on the regulation of the electrical supply by the supplier or on current regulators fitted to generators shall not absolve the Contractor of his liabilities in terms of this Subclause and, where appropriate, the Contractor shall provide and install at his own cost, all such electrical current-regulating equipment as is necessary to prevent damage to the said equipment.

4. PLANT (CLAUSE 4)

4.1 TELEPHONE (SUBCLAUSE 4.1)

Not required.

4.2 INTERNET (NEW SUBCLAUSE 4.2)

The Contractor shall provide and have ready when commencing with work on Site, and thereafter maintain for the duration of construction, an uncapped, unthrottled and unshaped internet data facility at the Engineers offices. The data facility shall:

- a. have data-transfer speeds of at least 50 Mbps download and 25 Mbps upload,
- b. be provided with a password protected WiFi network (WiFi 4 or later standard),
- c. have a WiFi range covering, at minimum, the Engineer's offices, the conference room, and 10m beyond these, and in which range the WiFi connection must be stable at a speed of at least 50Mbps to all devices supplied by the Contractor.

The Contractor shall insure the internet connection equipment against loss or damage from whatever cause arising and shall ensure that all internet accounts are promptly paid on the due dates for payment. In addition, the Contractor shall indemnify the Employer and the Engineer and his staff against all claims for loss, breakage or theft of such equipment. The Contractor shall further, at his own cost, ensure the prompt repair of the equipment provided under this clause, when reasonably required by the Engineer.

The Contractor shall settle the accounts for all costs related to the above.

4.3 PRINTERS (NEW SUBCLAUSE 4.3)

The Contractor shall provide and have ready when commencing with work on Site, and thereafter maintain and service for the duration of construction, the following:

One new A3 multi-function printer. The printer shall:

- a. be capable of printing, photocopying and scanning size A3 and A4 documents in full colour;
- b. be WiFi enabled, connected to the WiFi network provided for the Engineer's offices and set up for printing and scanning over the WiFi network;
- c. be internet enabled and capable of (and set up for) scanning directly to email;
- d. have a USB interface (and be supplied with the required cable) for connecting directly to a computer for printing and scanning over the USB interface;
- e. be provided on a suitable table, supplied with the required cables and installed in the conference room;
- f. be compatible with all laptop computers provided to the Engineer by the Contractor, and shall come with all the necessary software and drivers which the Contractor shall install on each laptop computer provided under the Contract;
- g. be provided with an adequate supply of paper (both A3 and A4 sizes) and ink cartridges (black and colour);
- h. be of the Hewlett-Packard OfficeJet colour printer series or equivalent compatible, unless otherwise approved by the Engineer;

One new A4 laser printer. The printer shall:

- a. be of the laser type and use a toner cartridge;
- b. be capable of printing A4 black and white documents;
- c. be WiFi enabled, connected to the WiFi network provided for the Engineer's offices and set up for printing over the WiFi network;
- d. also have a USB interface (and be supplied with the required cable) for connecting directly to a computer for printing over the USB interface;
- e. be provided on a suitable table, supplied with the required cables and installed in the conference room;
- f. be provided with an adequate supply of A4 paper and laser cartridges (black toner);

- g. be of the Hewlett-Packard LaserJet printer series or equivalent compatible, unless otherwise approved by the Engineer;

The Contractor shall ensure that all printers are compatible with the laptop computers and WiFi connections provided to the Engineer by the Contractor. All printers shall be supplied with the necessary software and drivers to perform the requirements listed, which shall be installed and set up by the Contractor on each of the laptop computer provided under the Contract.

The Contractor shall provide all paper, ink cartridges and other printer consumables required by the Engineer. All printers provided shall be kept fully serviceable at all times by the Contractor. Contractor shall have any defective equipment repaired or replaced at his own cost within 12 hours after notification by the Engineer's staff.

After the Engineer has issued the Taking-Over Certificate or Certificate of Practical Completion (as applicable) and after the Contractor has completed, to the satisfaction of the Engineer, all outstanding work and defects listed therein, ownership of the printers and their accessories shall revert to the Employer."

4.4 MEDICAL FACILITIES AND SAFETY EQUIPMENT (NEW SUBCLAUSE 4.4)

The Contractor shall make the first aid services and such personal safety equipment and facilities as are required in terms of SANS 1200 A, available to the Engineer and his site staff.

4.5 SURVEY EQUIPMENT (NEW SUBCLAUSE 4.5)

The Contractor shall provide and have ready when commencing with work on Site, and thereafter maintain and service for the duration of construction, the following survey equipment:

- a. One tachometer capable of reading to twenty seconds of arc plus tripod
- b. One total station, complete with all accessories
- c. One automatic reading Engineer's level plus tripod
- d. One levelling staff (5m long, 1cm graduations)
- e. One staff angle bubble
- f. One metal change-point for levelling
- g. Six ranging rods
- h. One separate plumb-bob
- i. One spirit level (one metre long)
- j. One hammer (2kg) with steel or wooden pegs as necessary
- k. Two canvas carry bags
- l. One 100m Stilon or similar approved measuring tape
- m. Two 5,0m (or longer) retractable steel tape

The Contractor shall provide proof, at the start of the Contract, that the tacheometer, Engineer's level and total station have recently been serviced by an acceptable institution and shall, throughout the period of construction, service and maintain all survey equipment. He shall keep the equipment continuously insured against any loss, damage, or breakage, and he shall indemnify the Employer and the Engineer against all claims for loss, breakage or theft of such equipment.

The Contractor shall have any defective equipment repaired or replaced at his own cost within 12 hours after notification by the Engineer's staff.

Where required by the Engineer, the Contractor shall at his own cost, promptly arrange for the recalibration of survey equipment provided.

The tacheometer and total station may be shared by arrangement between the Contractor and the Engineer, but the other instruments shall be provided for the exclusive use of the Engineer. The Contractor shall maintain the equipment in good working order and keep it clean until the completion of the Works.

After the Engineer has issued the Taking-Over Certificate or Certificate of Practical Completion (as applicable) and after the Contractor has completed, to the satisfaction of the Engineer, all outstanding work and defects listed therein, the survey equipment, as listed above, shall revert to the Contractor.

4.6 COMPUTER FACILITIES (NEW SUBCLAUSE 4.6)

The Contractor shall provide and have ready when commencing with work on Site, and thereafter maintain and service for the duration of construction, two new laptop computers, together with the software and peripherals specified, for the exclusive use of the Graduate engineer staff to be employed for this project.

Each laptop computer shall comply with the following minimum specifications:

- a. Processor: Intel Core i5 or AMD Ryzen 5 or similar approved processor, with a minimum of 4 physical cores, based on an architecture with release date no older than 2 years (taken from the Commencement Date).
- b. Graphics: Discrete graphics; Nvidia GeForce, Nvidia Quadro, AMD Radeon, AMD Vega or similar approved (integrated graphics alone are not adequate);
- c. Display: FHD (1080p) from 14 inch to 16 inch in size;
- d. Storage: 512GB Solid State Drive (SSD);
- e. Memory: 16 GB RAM;
- f. Networking: Ethernet, WiFi 4 (or later standard) and Bluetooth;
- g. Ports:
 - 1x USB Type C port, unless the laptop computer is charged/powered through a USB Type C port, in which case 2x USB Type C ports are required;
 - 3x USB Type A ports (a 3-port USB 3.0 hub may be provided where there are only 1 or 2 USB Type A ports);
- h. Other:
 - Integrated Webcam ;
 - Kensington or similar anti-theft slot;

Each laptop computer shall further be supplied with the following software and peripherals:

- a. A Logitech or Microsoft or similar approved wireless mouse with spare batteries;
- b. A suitable laptop backpack;
- c. A 23" or larger FHD (1080p) monitor with suitable display ports and cables (connectivity interface) for connecting to the supplied laptop computer;
- d. A Kensington or similar notebook lock, compatible with the supplied laptop computer;
- e. An edition of the latest Microsoft Windows operating system suitable for business/professional use ('Starter', 'Home' or similar Windows editions are not acceptable);
- f. Microsoft Office 365 subscription, 'Business Standard' or similar equivalent edition;
- g. The latest version of PDF XChange Pro or similar approved.

All computer hardware shall be provided complete with the requisite connecting cables, power cables, interfacing devices and software necessary for their efficient operation as an integral system.

A two USB external portable DVD drive with cables shall be provided and maintained for the exclusive use of the Engineer and his staff.

All software and drivers shall be properly installed and working on each laptop computer, and the Contractor shall provide evidence showing that the software is original and not counterfeit.

All computer equipment provided shall be kept fully serviceable at all times by the Contractor. The Contractor shall have any defective equipment or installed software repaired or replaced at his own cost within 12 hours after notification by the Engineer's staff.

After the Engineer has issued the Taking-Over Certificate or Certificate of Practical Completion (as applicable) and after the Contractor has completed, to the satisfaction of the Engineer, all outstanding work and defects listed therein, ownership of the computer equipment shall revert to the Employer."

4.7 TIME LAPSE CAMERAS (NEW SUBCLAUSE 4.7)

The Contractor shall provide and have ready when commencing with work on Site, and thereafter maintain and service for the duration of construction, two high dynamic range time-lapse cameras.

The cameras shall be Brinno TLC200 Pro's or similar approved, and each shall be supplied complete with:

- a. mounting brackets,
- b. IP56 weather-proof housing,
- c. external battery power or dedicated power to fully operate for the duration of the contract,
- d. wireless communication capability – Wi-Fi enabled,
- e. internal memory capability to store all footage for the duration of the contract (minimum 32GB), and
- f. a suitable temporary structure on which to mount the cameras (as necessary).

The Contractor shall install the cameras in locations and at angles approved by the Engineer. Unless otherwise agreed, each camera shall be installed at a height of at least 9m above the ground and shall be able to observe all construction under the Contract for the full duration of construction.

The Contractor shall erect suitable temporary structures on which to mount the cameras, unless suitable fixed structures are available and approved by the Engineer. The Contractor shall relocate each camera and move or erect a temporary structure (as necessary) at the request of the Engineer, but no more than 4 times per camera during construction. Relocation will typically be on account of the current position being inadequate to observe all construction activities or a more suitable position becoming available (i.e. moving a camera for mounting onto the tower crane once the crane has been erected).

The cameras shall each capture 1 photo per hour during working hours. The Contractor shall be responsible for ensuring correct operation of the cameras and logging of all footage which shall be saved on an external storage device daily. The digital footage shall be made available to the Engineer, daily, by means of a web-based interface and a physical storage back-up device on site for the Resident Engineer.

In the event that a camera is found to have malfunctioned it shall be replaced by the Contractor at his/her own expense. The Contractor shall be given a day to replace the camera and ensure full operation of the time-lapse footage is restored.

The cameras, waterproof housings, storage, etc. shall remain the property of the Employer. After the Engineer has issued the Taking-Over Certificate or Certificate of Practical Completion (as applicable) and after the Contractor has completed, to the satisfaction of the Engineer, all outstanding work and defects listed therein, the cameras, waterproof housings, storage, etc. shall be taken down and handed over to the Employer in good working order. Temporary structures erected for mounting the camera to shall also be removed.

4.8 IPAD (NEW SUBCLAUSE 4.8)

"The Contractor shall provide and have ready when commencing with work on Site, and thereafter maintain and service for the duration of construction, two new iPads, together with the accessories, for the exclusive use of the Engineer and his staff.

Each device shall have the following minimum specifications:

- a. a screen/display size of at least 10 inches;
- b. 64GB or larger built-in storage;

- c. the device shall be a generation/model with a release date no older than 2 years (taken from the Commencement Date).

Each device shall, at minimum, be supplied with the following accessories:

- a. a compatible charger and charging cable at least 1m in length.
- a. a suitable, fitting cover/case for protection against accidental drops, replaced annually for the duration of construction;
- b. 2 suitable screen protectors, with an additional 2 supplied annually for the duration of construction.

The devices and accessories shall be continuously insured against theft or damage. The Contractor shall settle the accounts for all costs related to the above, ensuring that accounts are paid promptly on their due dates.

After the Engineer has issued the Taking-Over Certificate or Certificate of Practical Completion (as applicable) and after the Contractor has completed, to the satisfaction of the Engineer, all outstanding work and defects listed therein, ownership of the devices and accessories shall revert to the Employer."

5. CONSTRUCTION (CLAUSE 5)

5.1 NAMEBOARDS (SUBCLAUSE 5.1)

Replace the contents of this Subclause with the following:

"The position of all nameboards will be subject to the Engineer's approval and must in no way obstruct sight lines for road, rail or pedestrian traffic. All arrangements regarding permission and approval from the controlling authority as far as locations are concerned, are the Contractor's responsibility. The Contractor shall keep the nameboards in good state of repair for the duration of the Contract and he shall remove them once the Defects Notification Period(s) expire and before the Performance Certificate is issued."

5.2 ENGINEER'S OFFICE(S) (SUBCLAUSE 5.2)

Replace the contents of this Subclause with the following:

"Throughout the Contract period, the Contractor shall provide proper maintenance of the offices, ablutions, kitchen(s) and conference room(s), parking area(s) and their approaches, and shall keep them clean, hygienic and sanitary.

5.3 KEY PERSONNEL (SUBCLAUSE 5.3)

Add at the end of this Subclause:

"The Contractor shall inform the Engineer of the person to whom he has assigned duties with respect to the Site(s) in terms of the Occupational Health and Safety Act and the person(s) who are in possession of a valid certificate of competency in first aid. The Contractor shall promptly give copies of the minutes of the monthly site safety meetings to the Engineer."

5.4 TELEPHONE (SUBCLAUSE 5.4)

Delete the last sentence.

5.5 SURVEY ASSISTANTS (SUBCLAUSE 5.5)

Delete the first sentence and substitute with the following:

"The Contractor shall make available to the Engineer two suitably educated labourers for use on and about the Site for survey and other work directed by the Engineer at all reasonable times."

5.6 SITE INSTRUCTION BOOK (NEW SUBCLAUSE 5.6)

Unless the Engineer supplies and chooses to make use of his own Site Instruction book, or the terms of contractual communication exclude the use of a Site Instruction book, the Contractor shall supply a carbon

triplicate book as a Site Instruction book, which shall be used and replaced throughout the construction period.

The Site Instruction book shall be kept on Site and shall be accessible to both the Contractor and the Engineer at all times. It shall be used:

- a. by the Engineer for the purpose of writing day-to-day instructions, issuing of construction drawings and confirming any verbal information or instructions given to the Contractor.
- b. by the Contractor for providing the Engineer with any information regarding the construction of the Works which may be requested.

One copy of each site note issued shall remain in the book.

6. TOLERANCES (CLAUSE 6)

No amendments.

7. TESTING (CLAUSE 7)

No amendments.

8. MEASUREMENT AND PAYMENT (CLAUSE 8)

Delete the contents of Clause 8 and substitute with the following:

"Facilities for the Engineer will not be measured and paid for separately, but all consolidated into two items, one item covering all fixed-charge requirements and the other covering all time-related requirements. The fixed-charge item will be scheduled under SANS 1200 A as Subclause 8.3.2.1 and the time-related item will be scheduled under SANS 1200 A as Subclause 8.4.2.1. The terms Clauses 8 SANS 1200 A shall apply.

In the case where a Taking-Over Certificate or Certificate of Practical Completion (as applicable) is issued with a list of outstanding work and defects, the items and responsibilities specified herein that are necessary to complete the outstanding work and remedy the defects, in the opinion of the Engineer, shall not cease or be removed but shall remain and continue at the Contractor's own cost until the work is complete and defects remedied to the satisfaction of the Engineer."

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1. SCOPE (CLAUSE 1)

No Amendments.

2. INTERPRETATIONS (CLAUSE 2)

No Amendments.

3. MATERIALS (CLAUSE 3)**3.1 DISPOSAL OF MATERIAL (SUBCLAUSE 3.1)**

Delete the contents of this Subclause and substitute the following:

"Material, that is not re-usable, obtained from clearing and grubbing and from the demolition of structures shall be disposed of at areas off site identified by the Contractor and approved by the Engineer.

Fencing wire shall be neatly wound into rolls or coils and all such wire, together with all re-usable material from structures, etc., shall be stacked at designated points."

4. PLANT (CLAUSE 4)

No Amendments.

5. CONSTRUCTION (CLAUSE 5)**5.1 AREAS TO BE CLEARED AND GRUBBED (SUBCLAUSE 5.1)**

Add the following to the end of this Subclause:

"Unless otherwise ordered by the Engineer, pipeline routes shall be cleared to a distance of 3,5 m on both sides of the pipeline centre line. Route pegs or markers shall not be destroyed or damaged during clearing operations.

The following applies to other clearing widths:

- a) The width to be cleared for roads shall not exceed 0,5 m beyond the road footprint, including the toe of fill and top of cut.
- b) The area to be cleared for the Works and stock pile areas shall not exceed the specified dimensions by a margin of 0,5 m measured from the perimeter."

5.2 RECLEARING OF VEGETATION (SUBCLAUSE 5.5)

Add the following to the end of this Subclause:

"When areas have to be re-cleared on the written instructions of the Engineer, such re-clearing shall be carried out at the Contractor's own cost and the Contractor is therefore advised not to clear the areas too soon."

6. TOLERANCES (CLAUSE 6)

No Amendments.

7. TESTING (CLAUSE 7)

No Amendments.

8. MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 BASIC PRINCIPLES (SUB-CLAUSE 8.1)

Add the following to the end of this Subclause:

"The Contractor shall survey the site after completion of Site Clearance and agree with the Engineer the levels to be used for earthworks quantity calculations."

8.2 SCHEDULED ITEMS (SUB-CLAUSE 8.2)

8.2.1 Remove topsoil to nominal depth of 150 mm and stockpile/spoil (Subclause 8.2.10)

Add the following at the end of the Subclause:

"The rate tendered for topsoil shall also cover the cost of stabilizing and protecting the stockpiles of topsoil or spoil at the designated spoil site(s) until required for use elsewhere."

8.2.2 Demolish and remove structures/buildings and dismantle steelwork, etc. (Subclause 8.2.8)

Replace the second paragraph with the following:

"The rate shall cover the cost of excavating around the structure, demolishing the structure, disposal of excavated material and rubble to a site provided by the Contractor including all haul, backfilling of the hole with sand in layers of 300 mm and compaction to 100% of modified AASHTO. Separate items will be listed for different structure/building sizes."

8.2.3 Take down and re-erect existing fences (New Subclause 8.2.11).....Unit: m

The rate shall cover the cost of taking down the fences, coiling wire, sorting, stacking and guarding all materials, the cost of loading, transporting and off-loading such materials, the cost of re-erecting the fence in its original position using the dismantled material but with new tying wire, the cost of temporary bracing of the fencing sections not taken down and the cost of appurtenant materials that may be required to restore the fence to its original condition before dismantling.

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1 SCOPE (CLAUSE 1)

No Amendments.

2 INTERPRETATIONS (CLAUSE 2)

2.1 SUPPORTING SPECIFICATIONS (SUBCLAUSE 2.1)

Replace Subclause 2.1.2 with the following:

"Any of the other SANS 1200 specifications may form part of the Contract documents."

2.2 DEFINITIONS (SUBCLAUSE 2.3)

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 new 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 commercial sources, excavations or borrow pits. In roads it includes the earthworks up to the underside of the selected subgrade level.

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."

3 MATERIALS (CLAUSE 3)

3.1 CLASSIFICATION FOR EXCAVATION PURPOSES (SUBCLAUSE 3.1)

3.1.1 Method of classifying (Subclause 3.1.1)

Add the following to the end of the Subclause:

"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."

3.1.2 Classes of excavation (Subclause 3.1.2)

Replace the first sentence with the following:

"Notwithstanding the excavation of material classifications that follow, the materials excavated, other than hard rock and boulder excavation, will not be classified for the purposes of measurement and payment. The unit rate for excavation shall cover the cost of excavation in all materials with the only extra-over items payable being those for excavation in hard rock and boulder excavation."

4 PLANT (CLAUSE 4)**4.1 DETECTORS (SUBCLAUSE 4.4)**

Replace the contents of this Subclause 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 SANS 1200 A and Subclause 5.1.2 of SANS 1200 D, at his own cost, provide and use detecting equipment which is suitable for the detection of underground cables and pipes."

5 CONSTRUCTION (CLAUSE 5)**5.1 PRECAUTIONS (SUBCLAUSE 5.1)****5.1.1 Safety (Subclause 5.1.1)****5.1.1.1 Barricading and lighting (Subclause 5.1.1.1)**

Replace "Machinery and Occupational Safety Act, 1983 (Act 6 of 1983)" with "Occupational Health and Safety Act, 1993 (Act 85 of 1993)."

5.1.1.2 Safeguarding of excavations (Subclause 5.1.1.2)

Replace "Machinery and Occupational Safety Act" with "Occupational Health and Safety Act, 1993 (Act 85 of 1993)."

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."

5.1.1.3 Explosives (Subclause 5.1.1.3)

Replace the contents of this Subclause with the following:

"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 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 Project Specifications or given on any drawing.
- i) The design level shall be achieved using grade 15 MPa/19 mass concrete to fill areas where excessive overbreak occurred. The cost to fill overbreak areas with mass concrete shall be borne by the Contractor and he shall not be able to claim any delays as a result of filling overbreak.

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."

5.1.2 Existing services (Subclause 5.1.2)

5.1.2.1 Detection, location and exposure (Subclause 5.1.2.2)

Replace the contents of this Subclause with the following:

"The exposure by the Contractor of underground services, as required in terms of Subclause 5.4 of SANS 1200 A 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: 93% Mod AASHTO density; and
- (b) In all other areas: 90% 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 Subclause 5.9 of SANS 1200 DB.

Payment in respect of exposing the services by means of hand excavation as described above, will be made in accordance with Subclause 8.3.8.1.

Payment in respect of reinstating layerworks in roadways will be made in accordance with Subclause 8.3.6.1 of SANS 1200 DB."

5.1.2.2 Protection of cables (Subclause 5.1.2.3)

Replace the contents of this Subclause with the following:

"Further to the requirements of Subclause 5.4.2 of SANS 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 subclause 5.4.2 of SANS 1200 A, 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."

5.1.2.3 Negligence (Subclause 5.1.2.4)

Delete this Subclause and its heading.

5.1.3 Stormwater and groundwater (Subclause 5.1.3)

Add the following to the end of the Subclause:

"The Contractor shall, where applicable and at the earliest practicable opportunity, install the permanent drainage specified or shown on the Drawings and shall also provide the temporary drainage required to protect the works."

5.1.4 Road traffic control (Subclause 5.1.6)

In the 4th line, amend "South African road traffic signs manual 1)" to read:

"Southern African Development Community: Road Traffic Signs Manual 1) and Chapter 13: [Roadworks Signing] of the South African Road Traffic Signs Manual".

Amend the footnote to read:

"1) Published by the Department of Transport, Pretoria."

Delete the second sentence of Subclause 5.1.6.

5.2 METHODS AND PROCEDURES (SUBCLAUSE 5.2)

5.2.1 Site Preparation (Subclause 5.2.1)

5.2.1.1 Conservation of topsoil (Subclause 5.2.1.2)

Replace the contents of this Subclause with the following:

"When so scheduled and when there is suitable topsoil within the limits of the area to be cleared, the Contractor shall remove and conserve topsoil. The Contractor will not be required to remove topsoil from any area in which the average depth of soil is less than 150 mm."

5.2.2 Excavation (Subclause 5.2.2)

5.2.2.1 Excavation for general earthworks and for structures (Subclause 5.2.2.1)

Add the following paragraph to the end of paragraph (b):

"When the nature of the material precludes the above procedure or where structural concrete (i.e. reinforced concrete and concrete for any structural element) is to be cast in excavations, additional excavations shall be carried out to provide working space for the erection of formwork. Payment will be made for excavating and backfilling a working width of 600 mm, but the Contractor may excavate and backfill 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 sand fill from commercial sources compacted to 100% of modified AASHTO density or approved gravel compacted to 93% of modified AASHTO density or to the density of the surrounding material, whichever is the higher density. The cost of the remedial measures shall be for the Contractor's account.

Where backfilling is required below structures, either due to over-excavation or where ordered by the Engineer, such backfill shall be mass concrete of Grade 15 MPa/19 mm or no-fines concrete, as directed by the Engineer. Backfilling with 5% cement stabilized sand (typically equates to 75kg cement per m³ of backfill) compacted to 100% MOD AASHTO in 150mm layers may be appropriate for use under certain structures, if approved by the Engineer or where indicated on the drawings. The cement stabilized sand to be thoroughly mixed in the presence of the Engineer. The cost of backfilling due to over-excavation shall be for the Contractor's account.

Where the sides of excavations against which non-structural concrete is to be cast have been over-excavated or have collapsed partially, the Contractor shall retrim the excavations if necessary and, unless other remedial measures are agreed to by the Engineer, shall cast the concrete, 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."

5.2.2.2 Disposal (Subclause 5.2.2.3)

Replace the second sentence of this Subclause with the following:

"The Contractor shall provide all 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.

Payment to the Contractor in respect of locating and making arrangements for suitable spoil sites and spoiling material at such sites will be made in accordance with the provisions of 8.3.15."

5.2.2.3 Selection and stockpiling (New Subclause 5.2.2.4)

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 to which the said approval or designation relates, nor that all material in the borrow pit or source should be used for the

particular purpose. The Contractor shall select suitable material from that borrow pit or source, discard unsuitable material and reserve material for other purposes as necessary.

The Contractor shall organise and carry out his operations in such a manner as will prevent the contamination of suitable embankment and backfill material with unsuitable materials. Any excavated material which becomes, in the Engineer's opinion, unsuitable for use in embankments 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 stockpiled for later use. Granular (silty sand), clay (sandy clay) and rock shall be stockpiled separately. The additional costs for stockpiling material shall be paid to the Contractor in accordance with the provisions of 8.3.14.

5.2.2.4 Recording of original ground profiles (New Subclause 5.2.2.5)

The Contractor shall inform the Engineer, in writing, at least 28 days before commencing any work which will result in a change in the topography of the site, whether such work be for the permanent works or for temporary works which the Contractor intends to execute for his own convenience. Thereupon, before commencing the work, the Contractor shall undertake cross-sections of the original ground profiles at structures and a centreline survey of the pipeline or another approved method to determine the ground profiles of the entire area to be worked. In addition all rock and/or foundation levels shall be recorded as the work proceeds.

The information so obtained shall be permanently recorded on a drawing or drawings which shall each be signed by both the Contractor and the Engineer. The Contractor shall then provide the Engineer with a reproducible copy of each drawing to serve as a permanent record both for the purpose of redesign, determining the quantities of excavation and earthworks carried out in the construction of the permanent works and the extent to which temporary works shall be removed or temporary excavations shall be refilled upon completion of the Works."

5.2.3 Placing and compaction (Subclause 5.2.3)

5.2.3.1 Embankments (Subclause 5.2.3.1)

In Subclause 5.2.3.1, in the second last paragraph, replace "90%" with "93%" and "98%" with "100%" respectively.

5.2.3.2 Backfilling of trenches and backfilling or filling against structures (Subclause 5.2.3.2)

In Subclause 5.2.3.2 after the second last paragraph add the following:

"Each layer shall be compacted at OMC to a density of at least 93% MAMDD in the case of cohesive soils or 100% in the case of non-cohesive soils."

5.2.4 Transport for earthworks (Subclause 5.2.5)

Replace the contents of this Subclause with the following:

"The transport of all materials, irrespective of the distance and source, shall be deemed to be free-haul, the cost of which is included in the Contractor's tendered rates and prices for importation or disposal of materials.

No separate compensation shall apply for the transportation of materials."

6 TOLERANCES (CLAUSE 6)

6.1 POSITION, DIMENSIONS, LEVELS, ETC. (SUBCLAUSE 6.1)

Amend the Permissible Deviation under Degree of Accuracy II for 6.1 (a) (4) with the title "Level" from +- 15 to ±10.

7 TESTING (CLAUSE 7)

7.1 TAKING AND TESTING OF SAMPLES (SUBCLAUSE 7.2)

Replace the contents of this Subclause with the following:

"The Contractor shall carry out sufficient tests on a regular basis as agreed between him 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 Engineer may likewise carry out such tests.

Testing by the Engineer will not relieve the Contractor of his obligations to provide materials and workmanship in accordance with the specifications.

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."

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 BASIC PRINCIPLES (SUBCLAUSE 8.1)

Replace the first sentence of Subclause 8.1.1 with the following:

"The basic principles of measurement and payment for all earthworks are that the rates tendered for excavation shall cover the cost of excavating at the Site and the re-use of the excavated material in backfilling, forming embankments, terraces, etc, or (where ordered) the replacement of excavated material with material from commercial sources for backfilling, and the cost of disposal of any surplus and unsuitable excavated material within the freehaul distance."

8.2 SCHEDULED ITEMS (SUBCLAUSE 8.3)

8.2.1 Site preparation (Subclause 8.3.1)

Replace the contents of Subclause 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 is required, the provisions and scheduled items of SANS 1200 C shall apply."

8.2.2 Bulk excavation (Subclause 8.3.2)

Replace the contents of this Subclause with the following:

"(a) Excavate in all materials and use for embankment or backfill, as ordered..... Unit: m³

The unit of measurement shall be the cubic metre measured in place in accordance with 8.2.

Separate items will be scheduled for embankments and backfills for different parts of the works.

The tendered rates shall cover the cost of complying with all the precautions required in terms of 5.1 in addition to the cost of excavating in all materials, basic selecting, loading, transporting, off-loading, spreading or backfilling, watering, compacting, final grading, complying with the

requirements for tolerances, providing for testing, finishing and tidying, all in accordance with the specifications.

- (b) Excavate in all materials and dispose of Unit: m³

The unit of measurement shall be the cubic metre of material excavated, measured in place in accordance with 8.2.

The tendered rates shall cover the cost of complying with all the precautions required in terms of 5.1 in addition to the cost of excavating in all materials and disposing of these materials, the cost of complying with the requirements of 5.2.2.3, basic selecting, loading, transporting, off-loading at the spoil site, maintaining and finishing the spoil site and for all other incidental costs to excavate and dispose of the material, all in accordance with the specifications.

- (c) Excavate in all materials and dispose of, and backfill with material from commercial sources (clean sand unless otherwise indicated) Unit: m³

The unit of measurement shall be the cubic metre of material excavated on Site which is replaced with material from commercial sources, measured in place in accordance with 8.2. Separate items will be scheduled for different parts of the works and for importation from different sources.

The tendered rates shall cover the cost of complying with all the precautions required in terms of 5.1 in addition to the cost of excavating in all materials and disposing of these materials, the cost of complying with the requirements of 5.2.2.3, basic selecting, loading, transporting, off-loading at the spoil site, maintaining and finishing the spoil site and for all other incidental costs to excavate and dispose of the material, all in accordance with the specifications.

The tendered rate shall also include for the costs of finding a commercial source of suitable material, for making arrangements with the owner of the source, for procuring the material, selection, for the payment of all requisite royalties, charges or damages, for transporting the material to the site regardless of the distance involved, for spreading or backfilling, watering, compacting, complying with the requirements for tolerances, providing for testing, finishing and tidying, all in accordance with the specifications. No payment will be made for the removal of overburden or stockpiling at the commercial source.

- (d) Extra over subitems 8.3.2(a), 8.3.2(b) and 8.3.2(c) for:

- (1) Not applicable (VOID)
- (2) Hard rock excavation
 - (i) By means of explosives Unit: m³
 - (ii) Without explosives Unit: m³
- (3) Boulder excavation, Class A
 - (i) By means of explosives Unit: m³
 - (ii) Without explosives Unit: m³
- (4) Boulder excavation, Class B
 - (i) By means of explosives Unit: m³
 - (ii) Without explosives Unit: m³

The rate shall cover the additional cost of the operations enumerated in 8.3.2(a), 8.3.2(b) and 8.3.2(c) above for any portion of the excavation that is classified as hard rock, boulder excavation class A or boulder excavation class B as applicable.

The rate for subitems (i) shall be applicable to methods which use explosives (blasting) for the excavation of hard rock.

The rate for subitems (ii) shall be applicable to non-explosive methods for the removal of hard rock (e.g. using chemicals, machine mounted hydraulic hammers/breakers or other approval method).

No extra-over payment will be made for excavation in material classified in terms of 3.1.2 as intermediate excavation. (See Drawing D-2.)

The tendered rate for excavation shall include the cost of recording the original ground profiles as per clause 5.2.2.5."

8.2.3 Restricted excavation (Subclause 8.3.3)

Replace the words "in 1 m increments" at the end of the first sentence of Subclause (a) with "in the increments indicated in the Schedule of Quantities".

Replace "in 5.2.2.1 – 5.2.2.3 (inclusive)" at the end of Subclause (a) with "in subclauses 5.2.2.1 to 5.2.2.5 (inclusive)".

Replace the contents of this Subclause (b) with the following:

(b) Extra over subitems 8.3.2(a), 8.3.2(b) and 8.3.2(c) for:

- | | | |
|-----|--|----------------------|
| (1) | Not applicable (VOID) | |
| (2) | Hard rock excavation (without explosives) | Unit: m ³ |
| (3) | Boulder excavation, Class A (without explosives) | Unit: m ³ |
| (4) | Boulder excavation, Class B (without explosives) | Unit: m ³ |

The rate shall cover the additional cost of the operations enumerated in 8.3.3(a) for any portion of the excavation that is classified as hard rock, boulder excavation class A or boulder excavation class B as applicable. The rate shall be applicable to non-explosive methods for the removal of hard rock (e.g. using chemicals, machine mounted hydraulic hammers/breakers or other approval method).

No extra-over payment will be made for excavation in material classified in terms of 3.1.2 as intermediate excavation. (See Drawing D-2.)

The tendered rate for excavation shall include the cost of recording the original ground profiles as per clause 5.2.2.5."

Add the following Sub-Items:

(c) Excavate for restricted foundations, footings and pipe trenches in all materials and dispose of, and backfill with material from commercial sources (clean sand unless otherwise indicated)..... Unit: m³

The unit of measurement shall be the cubic metre of material excavated on Site, which is replaced with material from commercial sources, measured in place in accordance with 8.2. Separate items will be scheduled for separate structures, for importation from different sources and, in the case of pipe trenches, to different depths in the increments indicated in the Schedule of Quantities.

All restricted excavations will be measured by volume. The volume of short pipe trenches will be computed from the minimum base width of the trench (see SANS 1200 DB). The rate shall cover the cost of complying with all the precautions required in terms of 5.1 in addition to the cost of excavating in all materials and disposing of these materials, for basic selecting, loading, transporting, off-loading at the spoil site, maintaining, and finishing the spoil site and for all other incidental costs to excavate and dispose of the material, all in accordance with the specifications.

The tendered rate shall also include for the costs of finding a commercial source of suitable material, for making arrangements with the owner of the source, for procuring the material, selection, for the payment of all requisite royalties, charges or damages, for transporting the material to the site regardless of the distance involved, for spreading or backfilling, watering, compacting, complying with the requirements for tolerances, providing for testing, finishing and tidying, and as more fully specified in Subclauses

5.2.2.1 to 5.2.2.4 (inclusive) and 5.2.3. No payment will be made for the removal of overburden or stockpiling at the commercial source.

- d) Excavate for conservancy tanks in all materials and use for backfill or berm or dispose as ordered.....

The provisions of subclause 8.3.3 of SANS 1200 D, 8.3.3(a) and 8.3.3 (d) shall as applicable apply.

The rate shall further cover the cost of preparing the bottom of the excavations as specified in SANS 1200LD 5.1.1, as well as for selective stockpiling of excavated material (refer SANS 1200LD 8.3.3(f)).

- e) Extra over sub-item 8.3.3 (a) - (d)

- 1) Hand excavation Unit: m³

This item shall apply to hand excavation ordered by the Engineer or when the Engineer considers that, owing to circumstances, excavation by mechanical excavators is not practicable. It shall not apply to hand excavation for trimming or finishing an excavation made by mechanical means and shall also not apply to hand excavation for exposing existing services.

The tendered rate shall include full compensation for the additional cost of excavating by means of hand tools.

- 2) Soilcrete backfill where directed by the Engineer.....Unit: m³

The unit of measurement shall be the cubic metre of soilcrete placed on the Employer's Agent instructions in accordance with Sub-clause SANS 1200DB 3.5(d), measured in place according to the authorised dimensions."

- f) Excavate unsuitable material from bottom of conservancy tank excavations and replace with selected material complying with SANS 1200D 3.2.4

- (i) Using material from conservancy tank excavations.....Unit: m³

- (ii) Using Material from other excavations on site.....Unit: m³

- (iii) Using Material from commercial sources.....Unit: m³

The rate tendered shall cover the cost of excavating unsuitable material from the bottom of the tank excavations to the extent ordered by the Employer's Agent, the disposal of the excavated material at a site located by the Contractor and subsequent replacement of the material with selected material, as well as for watering, compacting and trimming of the backfill surfaces. The rate tendered shall further differentiate between the various sources of selected material."

- g) Backfill Conservancy tank using selected material complying with SANS 1200D 3.2.4

- (i) Material from other excavations on site.....Unit: m³

- (ii) Material from commercial sources.....Unit: m³

The quantity measured for payment shall be the volume of the tank excavations calculated from the nett outline of a tank plus 300mm side allowance along its entire perimeter and depth of excavation, less the total outside volume of the tank itself.

The rate tendered shall cover the cost of acquiring the material, loading, haulage (in the case of (ii) above irrespective of distance), offloading, placing, watering and compacting the backfill, as well as for additional material required due to any over excavation. (Backfill of a tank using selected material generated by its excavation shall be deemed to be covered by subclause 8.3.3 (c)."

8.2.4 Importing of materials (Subclause 8.3.4)

Replace the heading of 8.3.4(a) with the following heading, without changing the unit of measure:

"Importation of additional material from commercial sources or from borrow pits and use for fill"

Replace the content of 8.3.4(a) with the following:

"Importation of material used for fill will only be the measure of imported material which does not replace excavated material and thus cannot be measured under 8.3.2(c) or 8.3.3(d). Imported material which replaces disposed of excavated material will not be paid for separately under this Subclause but shall be included for in the rates provided under 8.3.2(c) and 8.3.3(d).

The unit of measurement shall be the cubic metre of material imported, measured in place once compacted in accordance with 8.2. Separate items will be scheduled for different parts of the Works and for importation from different sources.

The tendered rate for importation of material for fill as described in this Subclause shall cover the cost of complying with any relevant precautions of 5.1 in addition to the cost of finding a commercial source of suitable material, for making arrangements with the owner of the source, for procuring the material, selection, for the payment of all requisite royalties, charges or damages, for transporting the material to the site regardless of the distance involved, for spreading or filling, watering, compacting, complying with the requirements for tolerances, providing for testing, finishing and tidying, all in accordance with the specifications. No payment will be made for the removal of overburden or stockpiling at the commercial source."

8.2.5 Overhaul (Subclause 8.3.6)

Delete this Subclause.

The transport of all materials, irrespective of the distance and source, shall be deemed to be free-haul as defined in 5.2.5.

8.2.6 Existing services (Subclause 8.3.8)

8.2.6.1 Location (Subclause 8.3.8.1)

Replace the contents of this Subclause with the following:

"Hand excavation for locating and exposing existing services:

- | | | |
|-----|--------------------------|----------------------|
| (a) | In roadways | Unit: m ³ |
| (b) | In all other areas | Unit: m ³ |

The unit of measurement shall be the cubic metre of material excavated, measured in place according to the authorised or actual dimensions of the excavation, whichever is the lesser.

The tendered rates shall cover the cost of excavating in all materials by means of hand tools within authorised dimensions and at locations approved by the Engineer in accordance with the requirements of Subclause 5.4.1 of SANS 1200 A for all precautionary measures necessary to protect the services from damage during excavation and backfilling, and for subsequent backfilling and compacting. Compaction of material in all areas except in roadways shall be to 90% of the modified AASHTO density.

The tendered rate for hand excavation in roadways shall include compensation for compacting excavated or selected backfill material to 93% of modified AASHTO density. Reinstating layerworks and surfacing shall be measured and paid for in terms of SANS 1200 DB.

The tendered rates shall also include for keeping excavations safe, for dealing with surface and subsurface water, for removing surplus excavated material from the site, for transporting all material within the free-haul distance, and for supplying adequate supervision during both excavation and backfilling operations.

Overhaul, if applicable, will be measured and paid for in terms of SANS 1200 DB."

8.2.7 Topsoiling (Subclause 8.3.10)

Change the unit to "m³" and replace the contents of this Subclause with the following:

"The unit of measurement shall be the cubic metre and the quantity shall be calculated from the authorised dimensions.

The tendered rate shall include loading of the topsoil from stockpiles, transporting it for the free-haul distance, and off-loading, spreading, shaping and lightly compacting the topsoil."

8.2.8 Road traffic signs and markings (Subclause 8.3.12)

Replace the word "Separate" in the first sentence of Item 8.3.12 with the following:

"Where the Engineer requires the provision of road traffic signs and/or road markings and/or any other measures additional to those to be provided by the Contractor in accordance with 5.1.6, separate".

8.2.9 Extra over items 8.3.2(a) and 8.3.3(a) for temporary stockpiling (New Subclause 8.3.14)

Unit: m³ 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 or backfill. Measurements shall be taken in place in compacted embankment or backfill as the case may be.

The tendered rate shall include for the costs, additional to those provided for in 8.3.2(a) and 8.3.3(a), of off-loading, forming and maintaining the stockpile for as long as is required, reloading and transporting.

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 his own volition, nor for materials necessarily stockpiled by the Contractor in consequence of the sequence of operations adopted by him in the course of executing the works, whether such stockpiling was avoidable or otherwise.

8.2.10 Extra over for stabilizing backfill with 5% cement (New Subclause 8.3.15) Unit: m³

The unit of measurement shall be the cubic metre of backfill material stabilized, measured in place according to the authorised dimensions after compaction, which was stabilized as shown on the drawings or on the Engineer's instructions. The tendered rate shall include full compensation for any work additional to that priced for in 8.3.2 and 8.3.3 (as applicable) to stabilize the backfill material with 5% cement and compacting the stabilised material to the required modified AASHTO density (100% unless otherwise stated).

8.2.11 Backfilling with topsoil material from stockpile (New Subclause 8.3.16) Unit: m³

The unit of measurement shall be the cubic metre of backfill material, measured in place according to the authorised dimensions after compaction, undertaken on the Engineer's instructions or as shown on the drawings. The tendered rate shall cover the cost of excavating from topsoil stockpiles formed, loading, hauling, backfilling, compacting the topsoil material to the required modified AASHTO density (90% unless otherwise stated) and shaping.

9 DRAWINGS

9.1 CLASSES OF EXCAVATION (FIGURE D-1)

Replace Figure D-1 with the following figure:

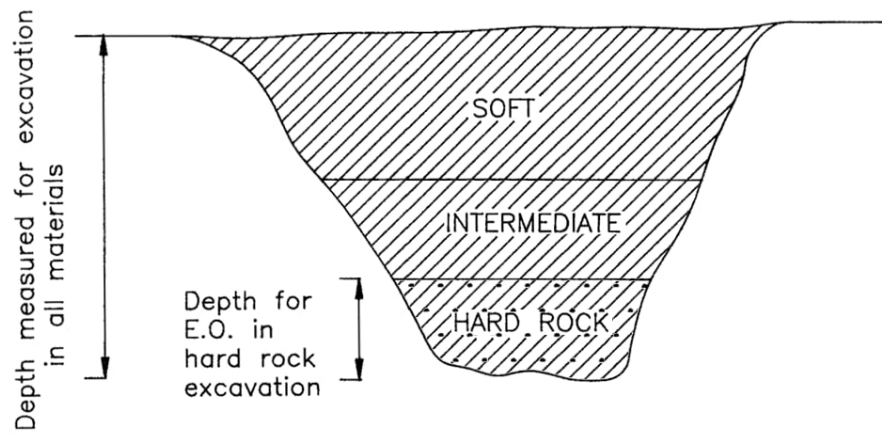


Fig. D-1 – Classes of Excavation: Measurement and Payment

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1 SCOPE (CLAUSE 1)

No amendments.

2 INTERPRETATIONS (CLAUSE 2)

No amendments.

3 MATERIALS (CLAUSE 3)

3.1 CLASSES OF EXCAVATION (SUBCLAUSE 3.1)

Delete the contents of Clause 3.1 and replace with the following:

"The classification shall be as described in Subclause 3.1 of SANS 1200 D".

3.2 BACKFILL MATERIAL (SUBCLAUSE 3.5)

In the third line of 3.5(a), delete "150mm" and substitute "100mm".

Delete the contents of Clause 3.5(b) and replace with the following:

"Materials used in the reinstatement of trenches beneath or within a new roadway, up to underside of the road layers, shall be subbase quality gravel material conforming to SANS 1200 ME compacted in 150mm layers to 98% of Modified AASHTO maximum density. The area subject to loads from road traffic shall be held to apply for a width of 150mm beyond the back of kerb.

For services along the edge of roads beyond the back of kerb or edging strip, the selected fill material shall have a PI not exceeding 6 and a minimum CBR 7 at 90% of modified AASHTO maximum density."

Add the following to the end of Subclause 3.5:

"c) Where shown on the drawings or as directed by the Engineer, backfill shall be stabilised with 5% cement by mass. The aggregate for soilcrete shall be mixed with 5% cement and shall consist of approved soil or gravel containing stones not bigger than 38 mm and with a plasticity index not exceeding 10.

The dry materials shall first be mixed in a concrete mixer after which sufficient water is to be added to produce the stiffest consistency available for placing and compacting with vibrators.

The soil shall be mixed with 5% cement and shall be compacted in layers of 100 mm thick to 90% of modified AASHTO density.

d) The aggregate for soilcrete shall be mixed with 5% cement and shall consist of approved soil or gravel containing stones not bigger than 38 mm and with a plasticity index not exceeding 10.

The soil or gravel shall be mixed in a concrete mixer with the cement and enough water to acquire a consistency that allows the mixture to be placed with vibrators to fill all voids between the pipe and the sides of the trench. Shuttering shall be used where necessary."

3.3 MATERIALS FOR REINSTATEMENT OF ROADS AND PAVED AREAS (SUBCLAUSE 3.6)

Add the following to the start of this Subclause:

"The materials used in the reinstatement of existing road layers shall comply with the following properties, unless otherwise shown on the Drawings.

- a) Subbase: PI maximum 10.

- CBR at least 45% at 95% of MAMDD.
- b) Base: PI maximum 6.
CBR at least 80% at 98% of MAMDD.
- c) Surfacing: Asphalt surfacing as specified in 3.6.4.
- d) Gravel wearing course: PI maximum 14 but not less than 10.
The size of the aggregate shall not exceed 40 mm.
CBR at least 45% at 95% of MAMDD."

3.4 SELECTION (SUBCLAUSE 3.7)

Replace the words "if he so wishes" in the first line of the second paragraph with the words "at his own cost".

Add the following to Subclause 3.7:

"Notwithstanding anything to the contrary stated in this subclause, the Contractor shall, where so ordered, selectively stockpile topsoil, material complying with 3.5, as well as road materials for re-use in terms of 5.9."

4 PLANT (CLAUSE 4)

4.1 EXCAVATION EQUIPMENT (SUBCLAUSE 4.1)

In the first line delete "The Contractor" and substitute: "In sections deemed to be excavated by mechanical means, the Contractor".

Add to the end of the Subclause:

"Should any portion of a pipe trench exceed the specified depth, the Contractor will be held responsible for any additional costs which may arise as a result of such over-excavation. Concrete filling or imported compacted fill may be ordered by the Engineer to make good any over-excavation."

4.2 RESTRICTION ON USE OF PLANT (NEW SUBCLAUSE 4.4)

Where the Contractor finds it impractical to use mechanical plant for excavation or to complete portions of the work due to restrictions caused by difficult access or the presence of existing structures, pipelines or services shown on tender drawings, the Contractor will be deemed to have satisfied himself as to the alternative requirements when entering rates against the appropriate items in the Bill of Quantities as no claim for extra payment based on the inability to use plant in such circumstances will be considered.

5 CONSTRUCTION (CLAUSE 5)

5.1 PRECAUTIONS (SUBCLAUSE 5.1)

5.1.1 Stormwater, seepage and dewatering of excavations (Subclause 5.1.2)

5.1.1.1 Throughout the Works (Subclause 5.1.2.1)

Add the following to the end this Subclause:

"The provisions of this subclause shall apply to all trench and valve chamber excavations. Sections of pipelines and valve chambers will be laid below the water table and ground water will be encountered during excavation. The Contractor shall dewater the excavations to such an extent as to draw the water table down to at least 100 mm below the top of the crushed stone layer, or bottom of the blinding layer, and keep it there until the backfill is complete.

The cost of dealing with water in trenches for pipes and excavations for valve chambers shall not be paid for separately but deemed to be included in the rates provided under SANS 1200 A for dealing with water for the whole of the Site."

5.1.1.2 Special water hazards (Subclause 5.1.2.2)

Add the following to the end this Subclause:

"The Engineer may direct the Contractor to implement subsoil drainage measures at certain sections of the pipe trench where ground water seepage is considered significant. Such drainage measures shall consist of a free draining granular material placed underneath or alongside the pipe, or in separate drainage trenches."

5.1.1.3 Sloping ground (Subclause 5.1.2.3)

Delete the subclause and substitute with the following:

"The Contractor shall be responsible throughout the duration of the Contract, inclusive of the Defects Liability Period, for the provision of all soil erosion preventative measures necessary to protect the trenches, pipeline(s) and land utilized by the Contractor during the Contract from any adverse effects of soil erosion, settlement, scour, etc., resulting from the construction of the Works.

Protection measures for sloping ground shall be implemented in accordance with the percentage grade of the natural existing slope or artificial slope created as shown on the Drawings including the minimum dimensions and maximum spacings of the applicable protection.

Payment will be made for the construction of sloping ground protections provided construction thereof has been either ordered or approved by the Engineer prior to the commencement of such construction."

5.1.2 Accommodation of traffic and access to properties (Subclause 5.1.3)

Replace the semicolon and the word "and" at the end of Subclause 5.1.3(a)(4)(ii) with a full stop.

Replace Subclause 5.1.3(b) with the following:

"(b) The Contractor shall provide and maintain pedestrian and vehicular access to properties affected by the works, the Contractor shall construct and maintain to the satisfaction of the Engineer, such temporary access roads around, and/or steel or timber bridges over excavations in roads, pavements, entrances or accesses to properties.

Temporary pedestrian access bridges shall be at least 1,2 m wide and temporary access bridges for vehicles shall be at least 3,6 m wide. All temporary access bridges shall be fitted with handrails as well as protective mesh fencing on both sides.

On completion of the work, the Contractor shall dismantle and remove all such temporary constructions and reinstate these areas to their former condition.

Except only where the Engineer has included in the Schedule of Quantities, particular payment items specifically therefor, the Contractor will not be paid directly for the construction and maintenance of temporary access roads and/or the provision and maintenance of bridges as aforementioned, and the costs thereof shall be deemed included in the Contractor's tendered rates for excavation."

5.1.3 Existing services that intersect or adjoin trenches (Subclause 5.1.4)

Delete the Subclause and replace with the following:

"The requirements of Subclause 5.1.2 of SANS 1200 D shall apply."

5.1.4 Stability of Trench Excavations (New Subclause 5.1.5)

The precautions for excavations as specified in Clause 5.1.1 of Section 1200 D and 1200 DA shall also apply to all trench excavations.

The Contractor shall take all the steps necessary to ensure that no person is required or allowed to work in a trench or any other unsupported overhanging excavation which is more than 1,5m deep, and any excavation which has not been adequately supported, shored or braced if there is any danger whatsoever of the sides of the excavation collapsing. The support, shoring or bracing to be designed and constructed by the Contractor, shall be strong and sturdy enough to support the sides of the excavation in question.

5.1.5 Removal of existing pipelines (New Subclause 5.1.6)

Where existing pipes have to be removed, an excavation shall be carefully opened by machine down to 300 mm above the pipes after which the whole pipe shall be fully exposed by means of hand excavation. The excavation width shall comply with 8.2.3.

The pipes shall be removed from the trench in a manner approved by the Engineer and brought to the surface for inspection by the Engineer.

Pipes that are declared suitable for reuse and pipes declared unfit for reuse shall be dealt with in an applicable manner described in the specifications, or on the Drawings or on the Engineer's instructions, as relevant.

5.1.6 Working areas (New Subclause 5.1.7)

The construction of the Works shall be restricted to the "working areas" indicated on the drawings. The Contractor requires written permission from the Engineer should he wish to work outside the specified "working areas".

5.2 MINIMUM BASE WIDTHS (SUBCLAUSE 5.2)

For Subclause 5.2, delete all instances of the word "External" and replace with "Nominal."

Delete Subclause 5.2(b) and substitute the following:

"b) The base width for unbedded flexible continuous piping of nominal diameter not exceeding 125mm laid at a depth not exceeding 1,5m, shall be equal to the nominal diameter of the pipe, plus a side allowance of 200mm on either side.

c) Should any ducts or services be placed in the same trench as a pipe, there shall be a minimum clear space of 300 mm between the pipework and the ducts/services, unless otherwise specified or shown on drawings."

5.3 EXCAVATION (SUBCLAUSE 5.4)

Add to the Subclause:

"All pipelines shall be laid to the invert levels and gradients shown on the drawings. Except where otherwise specified, trenches shall be of such a depth that the minimum cover over the pipes shall be 1200 mm (as measured from the original ground level to the top of the pipe barrel).

All excavated material shall be kept within the working area and designated sites as indicated on the drawings and shall be so deposited as not to interfere with or endanger the Works (for example, by causing the sides of the excavation to collapse), other property, or traffic.

The toe of the stockpile shall be trimmed well back from the edge of the trench so as to leave a minimum 1,5 m clearance between the edge of the stockpile and the edge of the trench. The Contractor shall keep this strip clear of excavated material at all times and take all necessary steps to prevent mixing with material set aside for backfill.

The Engineer may, in terms of 5.6.3 and 5.6.4, order the Contractor to remove any material which he considers liable to endanger or interfere with the Works, private property, traffic, or pedestrians, and to place such material at some other approved position. If the necessity for such removal is, in the opinion of the Engineer, a result of some default on the part of the Contractor, the cost thereof shall be borne by the

Contractor, otherwise the cost will be borne by the Employer at a sum pre-agreed with the Engineer or measured as Daywork, whichever is the more appropriate in the opinion of the Engineer.

The maximum allowable length of open trench with no pipe shall not exceed 100m on any single construction front. The total length of open trench on all construction fronts shall not exceed 300 metres (without approval of the Engineer).

For the sections with high water tables, the Contractor shall dewater the ground, excavate and support the trench and lay, bed and backfill the pipe up to the original ground level, including removal of the trench support and stopping dewatering. A detailed method statement covering the complete operation shall be submitted to the Engineer for approval.

The Contractor shall complete all backfilling, trimming, levelling and cleaning up of the Site as work proceeds.

Unless otherwise ordered or approved by the Engineer, furrows and subsurface drainage shall be reinstated to match dimensions and standards they were before being disturbed by the Contractor's activities. The work shall be carried out as soon as the pipeline (or appurtenant works) has been laid, tested and backfilled."

5.4 TRENCH BOTTOM (SUBCLAUSE 5.5)

5.4.1 Jointing Holes (New Subclause 5.5.1)

Jointing holes shall be cut of sufficient length and depth to allow for the proper making or bolting of pipe joints and to ensure that joint collars or sleeves do not rest on the trench bottoms. After the pipework has been inspected, tested and approved by the Engineer, the jointing holes shall be refilled with selected soft material free from stone (bedding materials as specified) and then rammed to provide a continuous uniform support for the pipework.

No specific payment will be made for forming and refilling holes, the cost of which is deemed to be included in the tendered rates.

5.4.2 Unstable trench bottom (New Subclause 5.5.2)

The Engineer may, upon consideration of the condition of the trench bottom, particularly with regard to the properties of the soil materials, order the use of a crushed stone layer in order to provide a stable platform for placing of the pipe bedding and laying the pipe in certain sections of the trenches.

The stone layer detail shall be in accordance with the Drawings.

If no detail is available, the stone layer shall consist of 19 mm single-sized crushed stone and shall have a minimum specified thickness of 300 mm over the specified minimum base width. The stone layer shall be completely wrapped within a geotextile filter blanket which shall comply with the requirements of SANS 1200 DK, and shall have overlaps of at least 300 mm.

5.5 BACKFILLING (SUBCLAUSE 5.6)

5.5.1 General (Subclause 5.6.1)

Add to the Subclause:

"Notwithstanding the requirements of this Subclause and 5.6.6, no pipe joint nor pipe fitting shall be covered by either blanket or backfill material prior to the successful completion of the visual inspection and pressure testing of the relevant section of the pipeline."

5.5.2 Material for Backfilling (Subclause 5.6.2)

Delete the second paragraph and substitute the following:

"Hard rock material shall not be used for, or incorporated into, the backfill above the bedding layers without the Engineer's approval."

Add the following to the end of this Subclause:

"The final 150mm of the trench shall be backfilled with topsoil which was previously stockpiled. Care must be taken to ensure that the trench is slightly overfilled so that it does not become a rivulet in wet weather."

5.5.3 Disposal of Soft Excavation Material (Subclause 5.6.3)

Delete the contents of this Subclause and add the following:

"Except where, in the opinion of the Engineer, the excavated material is unsuitable for disposal in one or the other of the following methods, surplus material may be spread evenly over the area cleared and grubbed provided it does not raise the original ground level by more than a maximum height of 100mm, or it may be disposed of in a dumping area approved by the Engineer.

Material disposed of in approved disposal areas shall be spread in such a manner that it will not cause water to dam up, and shall be levelled, trimmed and lightly compacted to neat lines and levels."

5.5.4 Disposal of Intermediate and Hard Rock Material (Subclause 5.6.4)

After the words "the surplus shall", insert the following " , as directed by the Engineer, ".

5.5.5 Transport for Earthworks for Trenches (Subclause 5.6.8)

Delete the contents of this Subclause and substitute the following:

"The requirements of Subclause 5.2.5 of SANS 1200 D shall apply."

5.5.6 Backfilling around structures (New Subclause 5.6.9)

Backfilling around a structure shall not be commenced before it has been approved by the Engineer.

Granular material shall be used as backfill material around structures as shown on the drawings and shall be placed in layers not exceeding 150 mm compacted thickness, each layer being thoroughly compacted to 100% of modified AASHTO density as instructed by the Engineer before the succeeding layer is placed. Unsuitable or surplus excavated material shall be spoiled off site.

5.6 COMPACTION (SUBCLAUSE 5.7)

5.6.1 Areas not Subject to Traffic Loads (Subclause 5.7.1)

Add to the end of this Subclause:

"All non-cohesive material shall be compacted to 100% MOD AASHTO density."

5.6.2 Areas Subject to Traffic Loads (Subclause 5.7.2)

Delete "98%" and substitute with "100%".

Add the following to the end of this Subclause:

"All pipe trenches that fall within the road reserves shall be regarded as areas subject to traffic loads. Where no road reserve is registered, a 3m offset from the outer edge of the road will be regarded as an area subject to traffic loads."

5.7 REINSTATEMENT OF SURFACES (SUBCLAUSE 5.9)

5.7.1 Width to be Reinstated (Subclause 5.9.1)

Replace Subclause 5.9.1.1 with the following:

"The reinstatement of surfaces over the full extent of the top of the actual excavation shall comply with the applicable of the requirements given in 5.9.2-5.9.5 (inclusive), unless otherwise shown on the Drawings."

5.7.2 Bitumen Roads: Sub-Base and Base (Subclause 5.9.4)

Add to the Subclause:

"The rates shall include for the costs of reinstating all surfaces and inclusive of all layers to their original condition before the commencement of construction."

5.7.3 Bitumen Roads: Surfacing (Subclause 5.9.5)

5.7.3.1 General (Subclause 5.9.5.1)

Add to the Subclause:

"The rates shall cover the costs of reinstating all surfaces, kerbing and drainage channels to their original condition before the commencement of construction."

5.8 TRENCH WALL STABILITY (NEW SUBCLAUSE 5.10)

Notwithstanding the requirements of 5.4 above, the Contractor shall take responsibility for the length of trench open at any time and if collapse of the side walls occurs for any reason, the responsibility will be the Contractor's and he will reinstate and make good at his own cost.

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)

Replace the contents of Subclause 7.1 with the following:

"The Contractor shall carry out density tests as specified in TMH1: Standard Methods of Testing Road Construction Materials, 1986, in the positions indicated by the Engineer, to determine the compaction of the backfill material in the trenches and the material used for reinstating the road construction layers. No single test result which is below the specified density, will be accepted.

In the case of trenches in areas subject to traffic loads, the Contractor shall bear the cost of all density tests carried out except in the following case. Where the test results in areas subject to traffic loads are equal to or exceed the specified density, the Employer will bear the cost of that number of those tests ordered by the Engineer in excess of one test per 20 m³ of compacted material, based on the total volume of backfill and reinstated road layers, which volume is to include the replacement of any over excavation.

In the case of trenches not in areas subject to traffic loads, the Contractor shall undertake one density test per 20 m of installed pipe on the trench bottom and for each layer backfilled. The Contractor shall bear the cost of these density tests. The Contractor shall also bear the cost of additional density tests ordered by the Engineer where the test results of these additional tests are below the specified density.

If the density is found, in any case, to be below the specified value, the Engineer may order the re-compaction of the backfill and retesting, both at the Contractor's expense."

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 BASIC PRINCIPLES (SUBCLAUSE 8.1)

In the third line of Subclause 8.1.1, replace "along the route of the pipeline" with "as specified in 5.6.3".

Replace the contents of subclause 8.2.4 with the following:

"No separate items will be measured for shoring. Refer in this regard to item 5.1.1.2 of SANS 1200 D."

In Subclause 8.1.2(c), amend the last sentence to read:

"The ground surface will be that existing after any bulk excavation has been carried out and before any embankment has been constructed, unless a portion of the embankment has to be constructed in order to achieve an acceptable cover over a pipe that is to be installed, in which case, measurement will be made from the level of embankment that produces an acceptable minimum cover over the pipe."

Add the following to the end of Subclause 8.1.3:

"No additional payment will be made for excavating and backfilling of jointing (fox) holes as the cost of that work will be deemed to be included in the rates for trenching."

8.2 COMPUTATION OF QUANTITIES (SUBCLAUSE 8.2)

Replace the contents of Subclause 8.2.3 with the following:

"Wherever volumetric measurement is required, the volume will be computed according to the depths indicated on the drawings, or to the bottom of the specified bedding cradle, whichever is the greater, and the minimum width determined from the applicable side allowance set out in 5.2 (see drawing DB-4 also) plus the nominal width of the pipe. No allowance shall be made for the extra thickness of the collars or couplings."

Add the following to the end of this subclause:

"8.2.5 If payment in terms of item 8.8.4 of SANS 1200 A has been made to expose an existing service and the excavation involved falls within a proposed trench, the quantity measured for trench excavation shall be reduced accordingly."

8.3 SCHEDULED ITEMS (SUBCLAUSE 8.3)

8.3.1 Site clearance and (if specified) removal of topsoil (Subclause 8.3.1)

In Subclause 8.3.1(c), replace the words "(depth stated)" with the words:

"to a minimum depth of 150mm".

Add the following to the end of 8.3.1(c):

"The topsoil stockpile material shall be stabilized by watering or other approved means."

8.3.2 Excavation (Subclause 8.3.2)

In Subclause 8.3.2(a), replace the sentence that starts with "Items will be provided for" with the following:

"Items will either be provided for various trench widths as specified and/or detailed on the Drawings, or for various pipe diameters in steps not greater than those specified in 5.2, unless otherwise scheduled. Additionally, items will be provided for various depths in increments as specified in the Schedule of Quantities measured to the bottom of the bedding layer. (see Drawings DB-2, DB-3 and DB-4)"

Add the following to the end of Subclause 8.3.2(a):

The rate shall also cover the cost of working within areas considered restricted that are not explicitly indicated as such on Drawings and scheduled separately under 8.3.2(b)(5).

(b) Extra over item (a) above for: (Subclause 8.3.2(b))

In Subclause 8.3.2(b), replace both "1) intermediate excavation" and the corresponding unit of measure with "1) Not applicable (VOID)". No extra-over payment will be made for excavation in material classified as intermediate excavation.

Omit the phrase "intermediate or" from the first paragraph of Subclause 8.3.2(b).

Replace subclause 8.3.2(b), subitem (2) with the following:

"(2) Hard rock excavation:

- (i) By means of explosives Unit: m³
(ii) Without explosives Unit: m³

The rate shall cover the additional cost of the operations enumerated in 8.3.2(a), above for any portion of the excavation that is classified as hard rock.

The rate for subitem (i) shall be applicable to methods which use explosives (blasting) for the excavation of hard rock.

The rate for subitem (ii) shall be applicable to non-explosive methods for the removal of hard rock (e.g. using chemicals, machine mounted hydraulic hammers/breakers or other approval method).

No extra-over payment will be made for excavation in material classified in terms of 3.1.2 as intermediate excavation.

The tendered rate for excavation shall include the cost of recording the original ground profiles as per clause 5.2.2.5."

Add the following after Subclause 8.3.2(b) (2):

"No payments will be made under 8.3.2(b)(1) and 8.3.2(b)(2) in respect of any materials measured and paid for under 8.3.2(b)(3) below."

"3) Hand excavation and backfill by hand where ordered by the Engineer

- a) Soft and intermediate material Unit : m³
b) Hard rock material Unit : m³

The unit of measurement shall be the cubic metre of material, measured in place according to the authorised dimensions, which was excavated by hand on the specific prior written instructions of the Engineer; provided always that the Engineer's said instruction shall have stated that measurement and payment for such hand excavation will be in accordance with this item.

The tendered rate shall include full compensation for the additional cost, effort and time resulting from excavating in the respective materials using hand methods only.

The Engineer shall not be obliged to authorise payment under this item in respect of any hand excavation carried out (whether ordered in writing or otherwise), which hand excavation was in any case necessary to achieve compliance by the Contractor with his obligations under the Contract to:

- i) utilise construction appropriate to the nature of the specific parts of the works; and/or
ii) protect existing structures and/or services; and/or
iii) comply with all prevailing legislation and regulations.

4) Stabilizing backfill with 5% cement where directed by the Engineer Unit : m³

The unit of measurement shall be an extra over to the backfilling measured elsewhere (i.e. 8.3.2(a)), measured as the cubic metre of backfill material that is stabilized, measured in place after compaction according to the authorised dimensions, which was stabilized on the Engineer's instructions in accordance with 3.5(c).

The tendered rate shall include full compensation for stabilizing backfill material as specified in 3.5(c), including but not limited to supplying cement, selecting and mixing the material, backfilling and compacting the stabilised material to 90% of modified AASHTO density.

5) Working within a restricted working area Unit : m

Extra-over payment will only apply for work in restricted working areas explicitly indicated as such on the Drawings and scheduled accordingly in the Bill of Quantities. Where not indicated and scheduled, no extra-

over payment shall apply, and the rates tendered under 8.3.2(a) shall be deemed to include any anticipated working area constraints.

Restricted working areas shall be categorised as follows:

- a) 5 – 10 m (state pipe identifier and chainage range(s), if necessary)
 - i. Up to 1.5 m depths
 - ii. Over 1.5 m and up to 2.5 m depths
 - iii. Over 2.5 m and up to 3.5 m depths
 - iv. Etc.
- b) 10 – 15 m (state pipe identifier and chainage range(s), if necessary)
 - i. Up to 1.5 m depths
 - ii. Over 1.5 m and up to 2.5 m depths
 - iii. Over 2.5 m and up to 3.5 m depths
 - iv. Etc,
- c) 15 – 25 m (state pipe identifier and chainage range(s), if necessary)
 - i. Up to 1.5 m depths
 - ii. Over 1.5 m and up to 2.5 m depths
 - iii. Over 2.5 m and up to 3.5 m depths
 - iv. Etc.

The extra-over rates shall cover the costs associated with the method of excavation employed, including all bracing, shoring, battering and the like required to ensure safe trench and working conditions, as well as any extra costs involved in handling and transportation of backfilling, compacting and disposing of surplus material.

6) Soilcrete backfill where orderedUnit : m³

The unit of measurement shall be the cubic metre of soilcrete placed on the Engineer's instructions in accordance with subclause 3.5(d), measured in place according to the authorised dimensions.

The tendered rate shall include full compensation for supplying the cement and for selecting, mixing and placing the soilcrete as well as for the cost of shuttering if required.

7) Steep SlopesUnit : m

The tendered rate shall include full compensation for all additional costs associated with excavation for pipe alignments of steepness range specified in the pricing schedule."

(8) Boulder excavation, Class A

- (i) By means of explosives Unit: m³
- (ii) Without explosives Unit: m³

The rate shall cover the additional cost of the operations enumerated in 8.3.2(a), above for any portion of the excavation that is classified as boulder excavation class A.

The rate for subitems (i) shall be applicable to methods which use explosives (blasting) for the excavation of hard rock.

The rate for subitems (ii) shall be applicable to non-explosive methods for the removal of hard rock (e.g. using chemicals, machine mounted hydraulic hammers/breakers or other approval method).

The tendered rate for excavation shall include the cost of recording the original ground profiles as per clause 5.2.2.5."

(9) Boulder excavation, Class B

- (i) By means of explosives Unit: m³
- (ii) Without explosives Unit: m³

The rate shall cover the additional cost of the operations enumerated in 8.3.2(a), above for any portion of the excavation that is classified as boulder excavation class B.

The rate for subitems (i) shall be applicable to methods which use explosives (blasting) for the excavation of hard rock.

The rate for subitems (ii) shall be applicable to non-explosive methods for the removal of hard rock (e.g. using chemicals, machine mounted hydraulic hammers/breakers or other approval method).

The tendered rate for excavation shall include the cost of recording the original ground profiles as per clause 5.2.2.5."

Add the following after Subclause 8.3.2(c):

- "d) Excavate in all materials for stormwater inlet and outlet structures and for manholes, catchpits, valve chambers and the like, irrespective of depth, and backfill around these structures:.. Unit : m³

The unit of measurement shall be the cubic metre of material excavated, measured in place according to the authorised dimensions, and excluding the volume of material excavated and paid for under subitem (a).

The tendered rate shall include for the costs of excavating in all materials, backfilling, compacting, trimming and tidying the final surface around the structure, disposing of surplus and unsuitable materials within the free-haul distance and, where applicable, selecting and keeping separate, excavated material suitable for use as backfill.

- e) Excavate open drains in all materials: Unit : m³

The tendered rates shall include full compensation for excavating in all materials within the dimensions specified or authorised by the Engineer and to the specified lines and profiles, for the disposal of surplus and unsuitable excavated material where applicable, and in the case of item (d), for backfilling with suitable approved material compacted to 90% of modified AASHTO density around the structures.

- f) Extra over items (d) and (e) for excavating in:

- 1) Hard rock material Unit : m³
- Measurement and payment shall be in accordance with the provisions of Subclause 8.3.2(b) of SANS 1200 D."

8.3.3 Excavation Ancillaries (Subclause 8.3.3)

8.3.3.1 Compaction in road reserves (Subclause 8.3.3.3) Unit : m³

Replace the heading of the subclause with "Compaction in Road Crossings" and the contents of the subclause with the following:

This item shall only apply to the compaction of materials in areas subject to road traffic loads as defined in 3.5.

The volume will be computed from the length of trench falling within the defined area, the width as shown on the Drawings and the depth from the top of the bedding to the designated level of the underside of the required selected layer, finished verge level etc. as scheduled on the Drawings. The rate tendered shall cover the cost of the additional compactive effort as specified.

Payment for this work will be additional to that covered by 8.3.2(a)."

8.3.3.2 Overhaul (Subclause 8.3.3.4)

Delete the contents of this Subclause and replace with the following:

"All haul will be regarded as free haul as per Subclause 8.3.6 of SANS 1200 D."

8.3.4 Particular Items (Subclause 8.3.4)

Replace the heading and contents of Subclause 8.3.4(a) with the following:

"a) Shoring. Payment for this subclause shall be for shoring of trenches where specified or ordered.

Shoring of other excavations shall be dealt with under SANS 1200 D.

The length measured for the payment of trenches will be that of the centre-line of the trench regardless of whether supports are placed on one or on both sides of the trench.

The rate shall cover the cost of supply, placing, maintenance and removal of timbering and other support measures together with any cost that results from the inconvenience of working in the supported excavation, the cost of any risks inherent in the operation and the surrounding geotechnical conditions.

Any shoring required due to the working width being restricted, if working width limitations have been specified, shall be deemed to be covered under the rates tendered for the items specified in 8.3.2 (5)."

8.3.5 Existing Services that Intersect or Adjoin a Pipe Trench (Subclause 8.3.5)

At the end of the Subclause 8.3.5(b), replace the full stop with a semi colon and add the following:

- "v) all work involved in locating the service by hand excavation;
- vi) notifying and attending upon the proprietor of the service;
- vii) supporting and protecting the service while the pipeline is installed, inspected, tested and backfilled."

8.3.6 Finishing (Subclause 8.3.6)

8.3.6.1 Reinstate road surfaces complete with all courses (Subclause 8.3.6.1)

Before the words "and subsequently of reinstatement" in the final paragraph, insert the following:

"importation of material from commercial sources if required by the Engineer to restore each road course to its original state or better, "

Add the following to the end of this Subclause:

"Where the trench crosses asphalt road surfaces, the rate shall include for neatly sawcutting the existing asphalt surfacing."

8.3.6.2 Reinstate other items (New Subclause 8.3.6.2)

Other items to be reinstated and their unit of measure shall be as scheduled. The rate shall cover all relevant costs described in 8.3.6.1 and any further costs associated with and necessary to complete the work scheduled.

8.3.7 Temporary stockpiling of wet material from trench excavations (New Subclause 8.3.8)

The excavation and stockpiling of material which is too wet to be placed in a stockpile, will be measured by the volume, based on the specified trench width, depth and length, which the Engineer orders to be removed.

The rate shall cover the cost of all operations required to handle, transport to a suitable site and spread to allow the material to dry sufficiently, as well as any costs for disruptions, delays and associated overhead costs resulting from drying out the material.

Should the material which is replaced in the trench become too wet again to achieve necessary compaction, due to the fact that the Contractor made insufficient provision for the handling and removal of groundwater in accordance with Subclause 5.5 of SANS 1200 A, the Contractor shall replace the material at his own cost with material which is, in the opinion of the Engineer, suitable.

8.3.8 Reinstatement of existing stormwater infrastructure (New Subclause 8.3.9)

The reinstatement of furrows and subsurface drainage will be measured separately by length.

Sections of the furrows and canals which are measured in accordance with 8.3.5 will not be measured under this item.

The rates shall cover the cost of reconstructing the furrows and subsurface drainage to the dimensions and standards of the existing, including the provision of all plant, labour and materials required to complete the work.

8.3.9 Stone bedding layer and geotextile filter blanket (New Subclause 8.3.10)

Where the use of a layer of stone in the trench bottom has been authorised by the Engineer, it will be measured by volume calculated according to the length multiplied by the specified thickness and specified minimum base width.

The rate shall exclude the cost of all additional excavation and preparation of the trench bottom to accommodate the layer of stone, the removal of unsuitable material, but cover the supply and placing of a layer of stone at least the specified thickness over at least the specified width and all related activities in order to produce a stable platform.

The geotextile filter blanket shall cover each stone layer as specified and shall be measured by area as:

Area = 2 x (specified thickness + minimum base width) x net length.

The rate shall include the cost of supply, placing and losses as a result of overlaps and over excavated trench widths.

8.3.10 Survey and protection of surrounding structures before blasting (New Subclause 8.3.11)

The rates shall cover the cost of examining and measuring up any buildings, houses or structures that encroach within the pipeline servitude and establishing and recording, together with the owners thereof, the general condition and/or damage that may exist before commencement of blasting operations, including the cost of providing a photographic record, the costs of reduced working width, and the costs of any special working methods required to protect the structure throughout the course of the nearby construction work.

This shall include, where required, but is not necessarily limited to, the use of shoring or lateral trench support and the placing of barriers to demarcate restricted working area in the vicinity of the structure.

8.3.11 Reinstatement of existing stormwater infrastructure (New Subclause 8.3.12)

The rates shall cover the cost of examining and measuring up the construction and condition of existing stormwater infrastructure items listed in the Bill of Quantities that require to be removed to successfully carry out the works. The rate shall further cover all costs necessary to reinstate the altered item(s) to the same original condition or better.

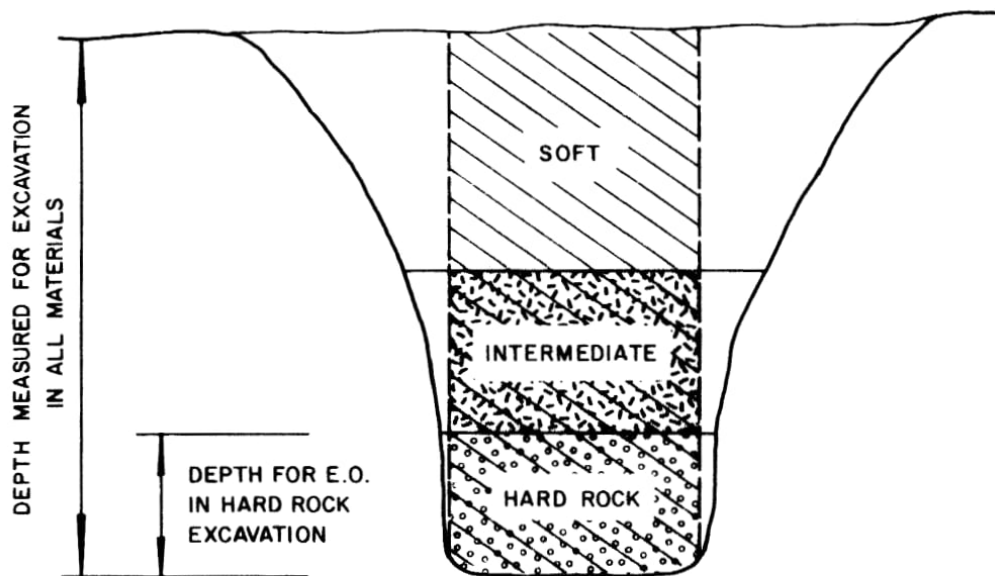
9 DRAWINGS

9.1 EXCAVATION MEASUREMENT (FIGURE DB-2)

For Note c), replace the phrase "Intermediate excavation and rock excavation are" with "Rock excavation is"

9.2 CLASSES OF EXCAVATION (FIGURE DB-5)

Replace Figure DB-5 with the following figure:



Drawing DB - 5 - Classes of Excavation: : Measurement and Payment

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1. SCOPE (CLAUSE 1)

Replace the first paragraph of this Clause with the following:

“This specification covers the construction of gabions, stone pitching and rip-rap for the protection of earthworks against erosion. It covers gabion walls and aprons used as retaining walls, channel linings, and the like. It also covers rock rip-rap, used as channel linings, and light to heavy stone pitching, with and without mortar.”

2. INTERPRETATIONS (CLAUSE 2)

2.1 DEFINITIONS (Subclause 2.3)

Add the following to the end of this Subclause:

“2.3.10 Rip-rap:

Rock of specified quality and grading placed in layers of specified thickness as erosion protection.”

3. MATERIALS (CLAUSE 3)

3.1 Gabions (Subclause 3.1)

3.1.1 Stone (Subclause 3.1.1)

Add the following after the heading of Subclause 3.1.1.1:

“Stone for gabions must be obtained from commercial sources and be approved by the Engineer. Such stone shall be clean and free of foreign matter and, blend in with the environment.”

3.1.2 Gabion Cages (Subclause 3.1.2)

Add the following at the end of this Subclause:

“The wire netting for gabions and mattresses shall comply with the requirements of SANS 1580 and shall consist of a hexagonal double twist mesh (Type 80 for gabions and Type 60 for mattresses) with 2,7 mm wire and 3,4 mm selvedge wire for gabions and 2,2 mm mesh wire and 2,7 mm selvedge wire for mattresses, all galvanized to Class A according to EN 10244-2 with an extruded grey PVC coating of mean wall thickness of 0,5 mm, complete with partitions at 1,0 m centres.

The properties and tolerances of the steel wire shall further, as a minimum, comply with the following:

Wire for mattresses				
Use	Units	For lacing	For mesh	For selvedge
Galvan + PVC	Ø mm	2,2 / 3,2	2,2 / 3,2	2,7 / 3,7
Wire tolerance *	Ø mm	±0,08	±0,08	±0,08
Quantity of Galfan **	g/m ²	230	230	245
Tensile strength ***	N/mm ²	350 – 575		

* To SANS 675 / ** To EN 102442-2, Table 2, Class A / *** To SANS 1580 and SANS 675

Wire for boxes				
Use	Units	For lacing	For mesh	For selvedge
Galvan + PVC	Ø mm	2,2 / 3,2	2,7 / 3,7	3,4 / 4,4
Wire tolerance *	Ø mm	±0,08	±0,08	±0,1
Quantity of Galfan **	g/m ²	230	245	265
Tensile strength ***	N/mm ²	350 – 575		

* To SANS 675 / ** To EN 102442-2, Table 2, Class A / *** To SANS 1580 and SANS 675

”

3.1.3 Geotextile (Subclause 3.1.3)

Add at the end of the Subclause:

“The geotextile used under and on the sides of the gabions and mattresses shall consist of continuous filament double needle punched geotextile.

Gabion AG 200 or similar approved shall be used underneath and on the sides of gabions and mattresses.

Gabion AG 400 or similar approved shall be used where rock protection (rip-rap) is placed.

The geotextile blanket used beneath the reno mattresses shall have a mass of at least 210g/m² and a minimum strength of 10kN/m in all directions (“Kaymat U24” or equal approved), with overlaps of at least 300mm.”

3.1.4 Tensioning frames for gabion baskets (New Subclause 3.1.6)

The Contractor shall supply one set of tensioning frames for gabion baskets.

3.2 PITCHING (SUBCLAUSE 3.2)

3.2.1 Stone (Subclause 3.2.1)

In Table 2, amend the “Extra heavy” “Thickness of pitching” value (column 2, third row from the top) from “300” to “600”.

3.3 RIP-RAP (NEW SUBCLAUSE 3.3)

3.3.1 Stone (New Subclause 3.3.1)

Stone for rip-rap must be obtained from commercial sources and be approved by the Engineer. Such stone shall be clean and free of foreign matter and, blend in with the environment. The stone size shall be as shown in the table below:

STONE SIZES FOR RIP-RAP

RANGE OF STONE SIZE (IN TERMS OF D ₅₀ STONE SIZE)	FRACTION OF TOTAL WEIGHT SMALLER THAN THE GIVEN SIZE (%)
1.50 - 2.00 D ₅₀	100
1.30 - 1.80 D ₅₀	85
1.00 - 1.50 D ₅₀	60
0.30 - 0.50 D ₅₀	15

THE D₅₀ STONE SIZE FOR RIP-RAP SHALL BE AS SPECIFIED ON THE DRAWINGS.

3.3.2 Filter Layers (New Subclause 3.3.2)

Where specified on the Drawings, or ordered by the Engineer, filter layers shall be provided between the bottom of the rip-rap layer and the surface that it is intended to protect. The filter material shall be sand, gravel or crushed stone, as appropriate to meet the grading requirements shown on the Drawings, and as approved by the Engineer.

4. PLANT (CLAUSE 4)

No amendments.

5. CONSTRUCTION (CLAUSE 5)

5.1 GABION CAGES (SUBCLAUSE 5.1)

5.1.1 Gabion and mattress installation training (New Subclause 5.1.3)

The Contractor shall arrange with a representative from the supplier of the gabions for all workers involved with the installation of gabions and mattress to receive on-site training, which will be provided by the representative from the gabion supplier. Attendance will be compulsory.

In addition to the above, the Contractor shall ensure that sufficient pliers, nippers, Spenax (or similar) tools as well as closing tools are available for use by his labour force.

5.1.2 Construction of trial gabion section (New Subclause 5.1.4)

A 3 m trial length of 1,0 x 1,0 m gabion baskets shall be constructed at the Site to the satisfaction of the Engineer and a representative from the supplier. The approved trial section will be used as the benchmark for future work and photographs of the trial section will be kept on Site, to ensure that the quality of work is comparable with the benchmark. The Engineer reserves the right to reject work that does not meet the benchmark and such work will be dismantled by the Contractor and re-done.

5.2 PITCHING (SUBCLAUSE 5.3)

5.2.1 General (Subclause 5.3.1)

Add the following at the before the last paragraph of this subclause:

"The excavated footing trench shall be backfilled with class 20/19 concrete to the proposed top level of the pitching."

5.2.2 Grouted pitching (Subclause 5.3.3)

Replace the words "(see table 4)" in the second line of the third paragraph with "(see table 2)".

Add the following to the end of this Subclause

"The exposed stone surfaces shall be cleaned of excess mortar within 1 day of being grouted."

5.3 RIP-RAP (NEW SUBCLAUSE 5.4)

5.3.1 Placing of rip-rap (New Subclause 5.4.1)

Rip-rap shall be placed in layers of the thicknesses specified on the Drawings so as to minimise the spaces between the rocks and to obtain a relatively even surface to the top of the rip-rap layer, with no rock protruding more than 150 mm above the general surface level.

6. TOLERANCES (CLAUSE 6)

In the first sentence, replace the two instances of "Degree of Accuracy II" with "Degree of Accuracy I".

7. TESTS (CLAUSE 7)

7.1 Taking and testing of samples (SUBCLAUSE 7.1)

Delete the contents of Subclause 7.1 and replace with the following:

"The Contractor shall carry out sufficient tests to satisfy himself as to the consistency of the materials used for and placed in gabion cages or used for pitching or rip-rap. The stone supplied for the contract shall conform to the test procedures and parameters stated under 7.3. Stone from doleritic sources shall also satisfy the durability test described in 7.4. The cost of the tests will be deemed to be included in the rates for gabions and mattresses and stone pitching."

8. MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 PRINCIPLES (SUBCLAUSE 8.1)

Delete the contents of this Subclause and replace with the following:

8.1.1 Computation of quantities for excavation

The relevant principles and computation of quantities set out in 8.1 and 8.2 of SABS 1200 DA, shall apply to excavations.

8.1.2 Tensioning frames for gabion baskets

The cost of providing tensioning frames for installing gabion baskets shall be deemed to be included in the tendered rate for gabions.

8.1.3 Installation training for gabions and mattresses

The cost of attending the compulsory on-site training session will be deemed to be included in the tendered rates supplying and installing gabions and mattresses.

8.1.4 Construction of trial gabion structure

The cost of constructing the trial gabion section will be deemed to be included in the tendered rate for supplying and installing gabions."

8.2 Scheduled items (Subclause 8.2)

8.2.1 Surface preparation for bedding of gabions (Subclause 8.2.1)

Replace both units of measurement with " m³"

8.2.2 Pitching (Subclause 8.2.5)

Replace the unit of measurement with "Unit: m³"

Delete the following from the second paragraph: "excavating footing trenches to a vertical depth not exceeding 1 m and backfilling and compacting".

Add the following to the end of the second paragraph:

"The excavation and backfill of footing trenches will be measured for payment under 8.2.8."

Replace the contents of Note 1 with "VOID".

8.2.3 Excavation and concrete backfill of footing trenches for pitching (New Subclause 8.2.8).

..... Unit: m³

The rates tendered shall cover the cost of excavating footing trenches over the lengths, widths and depths ordered as if in soft and intermediate material, trimming trenches, compacting inverts, class 20/19 concrete

backfill, as well as the cost of loading, transporting within the free haul distance and disposal of excess excavation material as directed.

The volume will be computed from the dimensions ordered. No payment will be made for over-excavation or resultant additional concrete backfill.”

8.2.4 Rip-rap (New Subclause 8.2.9) Unit: m³

The rate for rip-rap shall cover the cost of supplying and placing the rip-rap in a uniform layer of specified thickness to the satisfaction of the Engineer.

8.2.5 Geotextile beneath rip-rap (New Subclause 8.2.10) Unit: m²

The area measured will be the area of the rip-rap layers ordered or shown on the Drawings to be underlain by geotextile. The rate shall cover the cost of supplying geotextile of the specified grade, cutting, waste, placing, joining, overlapping, and fastening the geotextile in position.

8.2.15 Sand layer on top of geotextile layer (New Subclause 8.2.11) Unit: m²

The area measured will be the area of the geotextile covered by the sand layer as ordered or shown on the Drawings.

8.2.16 Filter layers beneath rip-rap (New Subclause 8.2.12) Unit: m²

The area measured will be the area of each filter layer of specified grading and thickness ordered, or shown on the Drawings, to be placed beneath the rip-rap layer.

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1 SCOPE (CLAUSE 1)

No Amendments.

2 INTERPRETATIONS (CLAUSE 2)

No Amendments.

3 MATERIALS (CLAUSE 3)

3.1 CLASSIFICATION FOR PLACING PURPOSES (SUBCLAUSE 3.2)

3.1.1 Selected layer (Subclause 3.2.3)

Replace the contents of this Subclause with the following:

"The following requirements shall apply in respect of the selected layer:

- a) Maximum particle size: 60% of compacted layer thickness
- b) Unstabilized selected layer:
 - 1) Upper selected layer
 - Minimum CBR at 93% of modified AASHTO density: 15
 - Maximum PI: 12 (the Engineer has the right to alter this requirement to 3 x the grading modulus + 10)
 - NOTE: These requirements for the upper selected layer also apply where only one unstabilized selected layer is specified.
 - 2) Lower selected layer
 - Minimum CBR at 90% of modified AASHTO density: 7
 - Maximum PI: 12 (the Engineer has the right to alter this requirement to 3 x the grading modulus + 10)
- c) For stabilized selected layer:
 - Minimum grading modulus of natural material: 0,75
 - UCS of stabilized material 300 kPa - 500 kPa at 93% of modified AASHTO density
 - Maximum PI for stabilized material: 10"

4 PLANT (CLAUSE 4)

No Amendments.

5 CONSTRUCTION (CLAUSE 5)

5.1 METHODS AND PROCEDURES (SUBCLAUSE 5.2)

5.1.1 Cut and borrow (Subclause 5.2.2)

5.1.1.1 Catchwater mounds and channels and mitre banks and channels (Subclause 5.2.2.6)

Add the following to the end of this Subclause:

"Catchwater mounds and mitre banks shall be compacted to a minimum density of 90% of modified AASHTO density."

5.1.2 Treatment of the road-bed (Subclause 5.2.3)

5.1.2.1 Removal of unsuitable ground (Subclause 5.2.3.2)

Replace the second sentence of paragraph (a) with the following:

"The excavated spaces shall then be backfilled with approved imported material or material from other excavations compacted to the required density."

Add the following sentence to paragraph (b):

"Unsuitable excavated material will be paid for as cut to spoil."

5.1.2.2 Treatment of road-bed (Subclause 5.2.3.3)

Add the following paragraph to the end of this Subclause:

"(c) Three-pass roller compaction

Any portion of the road-bed that is shown on the Drawings or is specified or is directed by the Engineer to be given three-pass roller compaction because of its inadequate natural density, shall be prepared by shaping where necessary and compacting with a roller, complying with the requirements specified below.

Compaction shall comprise three complete coverages by the wheels of the specified roller over every portion of the area that is being compacted. While it is not the intention that the Contractor should apply water to the road-bed for this type of compaction, and while no rigid moisture control will be exercised during compaction, the Contractor shall nevertheless satisfy the Engineer that everything is being done to take full advantage of favourable soil moisture conditions during the rainy season, and that such compaction is as far as possible carried out when the road-bed is neither excessively dry nor excessively wet.

The Engineer has the authority to decide when conditions are favourable for compaction and where such compaction is to be carried out at any particular time, and he has the right to instruct the Contractor to water the road-bed at the Contractor's expense when, in the opinion of the Engineer, the Contractor failed, neglected or refused to comply with these requirements.

The rollers to be used for roller-pass compaction shall conform to the following requirements:

Grid roller: The grid roller shall have a mass of not less than 13,5 t when ballasted, shall be loaded to this mass if required, and shall be moved at a speed of not less than 12 km/h.

Vibratory roller: The vibratory roller shall be capable of exerting a combined static and dynamic force of not less than 120 kN/m width for every metre of loose-layer thickness at an operating frequency not exceeding 25 Hz and shall move at a speed not exceeding 4 km/h."

5.1.3 Fill (Subclause 5.2.4)

5.1.3.1 Finishing (Subclause 5.2.4.3)

Replace the second sentence of Subclause 5.2.4.3(e) with the following:

"The thickness of the topsoil shall be as directed by the Engineer."

5.1.3.2 Selected layer (Subclause 5.2.5)

Replace the contents of this Subclause with the following:

"Except with regard to density, the requirements of 5.2.4 shall apply. The degree of compaction shall be:
Selected layer: 93% of modified AASHTO density."

5.1.3.3 Gravel surfacing (Subclause 5.2.6)

Replace the third sentence of this Subclause with the following:

"The relevant requirements of 5.2.4.2 shall apply, except that the material shall be compacted to 93% of modified AASHTO density."

5.1.3.4 Transport (Subclause 5.2.8)

Replace the contents of this Subclause with the following:

"The provisions of Subclause 5.2.5 of SANS 1200 D shall apply."

6 TOLERANCES (CLAUSE 6)

No Amendments.

7 TESTING (CLAUSE 7)

7.1 ROUTINE INSPECTION AND TESTING (SUBCLAUSE 7.3)

Replace the contents of Subclause 7.3.2, including Table 2, with the following:

"The dry density requirements for a particular lot of selected layer or wearing course shall be deemed to be satisfied if the average density and the results of individual tests meet the requirements specified in Table 2 below. Refer to SANS 1200 D, Subclause 7.2 for the requirements for fill.

TABLE 2 - DENSITIES

Layer	Specified density (% of modified AASHTO density)	Number of tests per lot	Average density %	Minimum density for any single test, %
Upper selected or selected layer and gravel wearing course	93	3 and 4	93,1	89,4
		5	93,4	89,2
		6	93,6	89,0
Fill (sand)	100	3 and 4	100,6	96,7
		5	100,8	96,5
		6	101,0	96,2

"

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 COMPUTATION OF QUANTITIES (SUBCLAUSE 8.2)

8.1.1 Volume Measured only Once (Subclause 8.2.1)

Replace the contents of this Subclause with the following:

"The provisions of Subclause 8.2.1 of SANS 1200 D shall apply."

8.1.2 Non-geometric Shaped Volumes (Subclause 8.2.2)

Replace the contents of this Subclause with the following:

"The provisions of Subclause 8.2.2 of SANS 1200 D shall apply."

8.1.3 Volumes Removed in Site Clearance and Topsoil (Subclause 8.2.3)

Replace the contents of this Subclause with the following:

"The provisions of Subclause 8.2.2 of SANS 1200 D shall apply."

8.1.4 Verifying quantities (Subclause 8.2.5)

Replace the first sentence with the following:

"Before any earthworks are commenced but after completion of any site preparation, the Engineer will, upon a written request from the Contractor, provide cross-sections for the purpose of measurement of earthworks quantities."

8.2 SCHEDULED ITEMS (SUBCLAUSE 8.3)

8.2.1 Treatment of road-bed (Subclause 8.3.3)

Add the following to the end of paragraph a), after the paragraph which ends with "material if required.":

"The unit of measurement shall be the cubic metre of material recompacted as specified and the volume shall be determined from levelled cross-sections on which are superimposed the levels to which the road-bed is to be constructed. When material is imported to make up the required volume, such material will be paid for as cut or borrow to fill as relevant."

In the heading of Subclause 8.3.3.b), delete the words "intermediate or".

Add the following to the end of Subclause 8.3.3:

"c) Three-pass roller compaction:

- 1) Grid roller Unit: m²
- 2) Vibratory roller Unit: m²

The units of measurement shall be the square metre of road-bed compacted as specified in 5.2.3.3(c) for the areas designated by the Engineer.

The tendered rates shall include full compensation for shaping the areas, providing the rollers and compacting the road-bed by means of three roller passes over the entire area."

8.2.2 Cut to fill, borrow to fill (Subclause 8.3.4)

Replace the contents of this subclause with the following:

"a) Cut to fill compacted to 93% of modified AASHTO maximum density..... Unit: m³

b) Borrow to fill from commercial or off site sources located by the Contractor compacted to 93% of modified AASHTO maximum density..... Unit: m³

The unit of measurement shall be the cubic metre of fill and the volume will be calculated in accordance with the authorised dimensions of the embankment and levelled cross-sections.

The tendered rates shall include full compensation for excavating the material as if in soft and intermediate material, for selecting, loading, transporting for the free-haul distance, off-loading, watering, mixing, and compacting the material as specified, trimming, and testing the fill. Borrow to fill in this item relates to material from designated borrow areas (provided by the Employer) or material from stockpile.

Where it is required that material is obtained from commercial sources, payment for procuring the material will be made under 8.3.17."

8.2.3 Selected layer compacted to 93% of modified AASHTO maximum density (Subclause 8.3.5)

Replace the heading and contents of this Subclause with the following:

"Selected Layer

a) Selected layers using material cut from the site and compacted to:

i) 93% of modified AASHTO maximum densityUnit: m³

ii) 95% of modified AASHTO maximum densityUnit: m³

The rate tendered shall cover the cost of excavating as if in soft and intermediate material, selecting, loading, transporting, placing, watering, compacting to percentage of modified AASHTO maximum density specified, trimming and testing the selected layer. No additional payment will be made for difficult work or hand operations in confined areas.

b) Selected layers using material from commercial or off site sources located by the Contractor, compacted to:

i) 93% of modified AASHTO maximum density Unit: m³

ii) 95% of modified AASHTO maximum density Unit: m³

The rate tendered shall cover the cost of acquiring the material from commercial or off-site sources located by the Contractor, any excavation and selection required, loading, transporting to the point of use irrespective of distance, temporary stockpiling if necessary, placing, watering, compacting to percentage of modified AASHTO maximum density specified, trimming and testing the selected layer. No additional payment will be made for difficult work or hand operations in confined areas."

8.2.4 Extra over items 8.3.4 and 8.3.5 for excavating and breaking down material in (Subclause 8.3.6)

Replace this Subclause heading with the following:

"Extra over items 8.3.4, 8.3.5 and 8.3.16 for excavating and breaking down material in"

Replace both "a) Intermediate excavation" and the corresponding unit of measure with "a) Not applicable (VOID)". No extra-over payment will be made for excavation and breaking down material in intermediate excavation.

Replace the words "items 8.3.4 and 8.3.5" in the final paragraph with the words "items 8.3.4, 8.3.5 and 8.3.16".

8.2.5 Cut to spoil or stockpile from (Subclause 8.3.7)

Replace this Subclause heading with the following:

"Cut to spoil from"

Replace "a) Soft excavation" with "a) Soft and intermediate excavation".

Replace both “b) Intermediate excavation” and the corresponding unit of measure with “b) Not applicable (VOID)”.

Add the following to the end of the Subclause:

“Separate items will be scheduled for cut to spoil or cut to stockpile. The rate tendered shall further cover the cost of complying with the requirements of Clause 5.2.3.2 irrespective of the depth or extent of the material ordered to be removed, or whether the order to remove unsuitable material is given after the completion of the any initial cut operation, with the exception of unsuitable material ordered to be removed from the completed cut surface of channel cross drains and road side channels which will be measured for payment under Subclause 8.3.17 of SANS 1200 D.

The tendered rate shall further, in the case of cut to spoil, include full compensation for transporting the material regardless of the distance involved and for all other incidental costs to dispose of the spoil material.”

8.2.6 Overbreak of excavation in: (Subclause 8.3.9)

Replace both “a) Intermediate excavation” and the corresponding unit of measure with “a) Not applicable (VOID)”. No extra-over payment will be made for overbreak of excavation in intermediate excavation.

8.2.7 Extra-over Items 8.3.2, 8.3.4 or 8.3.5 for temporary stockpiling of material (Subclause 8.3.11)

Add the following to the end of the subclause:

The temporary stockpiling of material from commercial sources or borrow pits located by the Contractor will not be measured for payment.”

8.2.8 Overhaul (Subclause 8.3.12)

Delete this Subclause.

No overhaul will be paid on material from commercial sources or borrow pits selected by the Contractor for the purposes of this Contract and all the costs for transporting such material shall be included in the applicable tendered rates and amounts.

8.2.9 Surface finishes (Subclause 8.3.13)

For Subclause 8.3.13(a), change the unit to “m³”.

8.2.10 Gravel surface layer (Subclause 8.3.16)

Replace the contents of this Subclause with the following:

“The unit of measurement shall be the cubic metre of gravel surface layer and the quantity will be determined from the authorised dimensions of the compacted layer.

The tendered rate shall include full compensation for excavating the material as if in soft and intermediate material, for loading and transporting the material for the free-haul distance, off-loading, spreading, breaking down, watering, mixing and compacting the material.”

8.2.11 Extra over items 8.3.4 and 8.3.16 replacing unsuitable material with material from commercial sources (New Subclause 8.3.17) Unit: m³

Unsuitable material shall only be replaced when ordered by the Engineer. The tendered rate shall include full compensation for the additional costs of disposing of unsuitable material, finding a suitable source of commercial material, for procuring the commercial material and paying all royalties or other charges to the owner of the source and for transporting the commercial material to the point of use regardless of the distance hauled.

Items 8.3.6, 8.3.12 and 8.3.14 do not apply to material obtained from commercial sources.

8.2.12 Final finishing and cleaning up of the site of the works (New Subclause 8.3.18) Unit: Sum

The tendered sum shall include full compensation for the clearing, disposal of material, finishing, tidying and all other work required to finish and clean up the Site of the works and affected areas by removing excess earth, stones, boulders, debris and other waste material, by clearing stormwater inlets and outlets and pipe barrels, by clearing the surfacing of all dirt, mud and foreign material, and by neatly finishing off all junctions, intersections and kerbing.

8.2.13 Tie in with existing road edge (New Subclause 8.3.19) Unit: m

The tendered rate shall include full compensation for removal and disposal of existing concrete backing, protecting the existing paving when excavating the road box adjacent to it and tying the new layerworks to the existing.

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1. SCOPE (CLAUSE 1)

No amendments.

2. INTERPRETATIONS (CLAUSE 2)

2.1 DEFINITIONS (SUBCLAUSE 2.3)

2.1.1 General (Subclause 2.3(a))

Add the following under Subclause 2.3(a) "General":

"Construction joint:

A joint required on account of constraints or convenience in the method of construction.

Unforeseen joint:

A joint formed during concreting when plant failure, inclement weather, or some unforeseen event has enforced a halt in the placing of concrete and has thus created a situation in which a construction joint has to be made in a location that was neither designated nor approved before the commencement of concreting.

Extender:

Material which, when mixed with Portland cement, has a cementing property and is used as a portion of the cement in a concrete mix for economic reasons or for the chemical or physical properties (or both) that it gives to the concrete mix.

Cementitious binder:

Common cement that complies with the requirements of SANS 50197-1&2, and blends of certain types of common cement and cement extenders that comply with the requirements of SANS 55167-1&2, SANS 50450-1&2 and SANS 53263-1&2 where applicable.

Water/cement ratio:

Ratio (by mass) of the water to the cementitious binder in a concrete mix.

Immediate protection of concrete:

The prevention of moisture loss from the concrete from the time of compaction until full wet curing is possible.

Scabbling:

Removing all laitance and exposing the aggregate over 100% of the area using mechanized plant such as scabblers, abrasive blasters or other approved method.

Scabble:

Scabble shall be synonymous with scabbling.

2.2 EXPLANATION OF TERMS (SUBCLAUSE 2.4)

2.2.1 Strength concrete (Subclause 2.4.2)

Add the following:

"Grade 35 MPa/19 mm means strength concrete Grade 35 MPa with 19 mm stone."

2.2.2 Joints (Subclause 2.4.3)

Replace contents of this Subclause with the following:

"The location of joints is controlled by design requirements and construction limitations. "Designated joints" will only be those joints whose locations are shown on the drawings. The terms "constructional joints", "movement joints", "contraction joints" and "expansion joints" are used to identify various types of designated joints. All other joints required by the Contractor, including unforeseen joints as defined in 2.3(a) and those resulting from construction constraints, whether approved by the Engineer or not, will not be considered as designated joints (i.e. they will be considered as "non-designated" joints). All non-designated joints (except for unforeseen joints) need to be approved by the Engineer, in writing, before commencing with construction thereof."

3. MATERIALS (CLAUSE 3)**3.1 CEMENT (SUBCLAUSE 3.2)****3.1.1 Alternative types of cement (Subclause 3.2.2)**

Replace the contents of this Subclause with the following:

"Only CEM I 52.5 or CEM I 42.5 (Portland cements), CEM II A 52.5 or CEM II A 42.5 in accordance with SANS 50197-1 may be used. Further blending with a suitable extender shall be as per 5.5.1 and 5.5.11.

If the Contractor wishes to use any other type/blend of cement, he shall obtain the Engineer's prior written approval. The tendered rates, however, shall be based on the use of the above-mentioned cements/blends only.

The test results conducted to evaluate the conformity of cement in terms of SANS 50197-1, Clause 9, shall be made available to the Engineer at least 28 days before the materials are used for concrete."

3.1.2 Storage of cement (Subclause 3.2.3)

Add the following:

"Cementitious binder shall be used in the order in which it is received. Cementitious binder shall not be stored for longer than 8 weeks without the Engineer's permission.

Any cement that contains lumps that cannot easily be crumbled to powder between the fingers, may not be used."

3.2 WATER (SUBCLAUSE 3.3)

Add the following

"Where potable water is not used as mixing water for concrete, the water shall comply with BS EN1008:2002 *Mixing Water for Concrete*.

Final effluent shall not be used for curing concrete."

3.3 AGGREGATES (SUBCLAUSE 3.4)**3.3.1 Applicable specification (Subclause 3.4.1)**

Add the following:

"The nominal stone size specified in the concrete grade (e.g. 35 MPa/26 mm) shall mean stone conforming to the grading specified in SANS 1083 for the nearest equivalent size, i.e. 26 mm means stone that complies with SANS 1083 for 26.5 mm size.

The fineness modulus of the sand delivered to the mixer shall lie between 1,7 and 2,8 and the standard deviation of fineness moduli of samples of sand that is delivered to the mixer during one shift shall be not more than 0,10."

3.3.2 Storage of aggregates (Subclause 3.4.3)

Add the following:

"When aggregates of different chloride content are stored on the Site, their use in the various classes of concrete shall be strictly controlled."

3.3.3 Types of aggregates for watertight concrete (New Subclause 3.4.4)

Unless unavailable in the region, coarse aggregates for watertight concrete shall be granites from a commercial source with a known low-alkali content.

3.4 ADMIXTURES (SUBCLAUSE 3.5)**3.4.1 Air-entraining agents (Subclause 3.5.2)**

Replace the contents of this Subclause with the following:

"No air-entraining agents will be permitted."

3.5 REINFORCEMENT (SUBCLAUSE 3.6)

Add the following:

“All reinforcing steel shall have a certified post-consumer recycled content greater than 90% by mass.”

3.6 WATERSTOPS (NEW SUBCLAUSE 3.9)

Waterstops shall be of approved manufacture and of the pattern and the material widths scheduled on the drawings. They shall conform to Specifications CKS 388 or 389, for natural rubber or PVC respectively.

All intersections between waterstops shall be prepared by mitring and welding/vulcanising intersection pieces in the factory in accordance with the manufacturer's instructions and to approval of the Engineer. Only straight lengths of waterstop may be field welded, using appropriate jigs and tools.

Where required, waterstops shall have eyelets so that they may be tied securely to the adjacent reinforcement. “Rearguard”-type waterstops shall have flanges or cleats that grip effectively. Where the Contractor proposes alternative products/brands, the widths, profiles, flanges and cleats shall be similar to the specified products and are subject to the approval of the Engineer.

Floor placed waterstops shall always be welded continuous to vertical wall waterstops at points of intersections.

3.7 JOINT FILLERS (NEW SUBCLAUSE 3.10)

Fillers for movement joints shall be closed cell expanded cross-linked polyethylene with properties equivalent to products manufactured by Sondor for this purpose. The filler shall have the following minimum densities:

- a) Water retaining / water excluding structures: 110kg/m³
- b) All other applications: 35kg/m³

All fillers shall be pre-cut to suit the application with a tear out strip for forming the specified recess for the bondbreaker and sealant.

3.8 ALKALI-AGGREGATE REACTION (NEW SUBCLAUSE 3.11)

Reference is made to “Fulton’s Concrete Technology, Ninth Edition, Chapter 10, Alkali-silica reaction.”

Coarse aggregates for watertight concrete shall be as per 3.4.4. The following shall apply in other regions as well as to strength concrete with other coarse aggregates.

In accordance with this reference, the Contractor shall provide the Engineer with the following (with the concrete mix design submission):

- Type of coarse aggregate
- Source of coarse aggregate
- Recent SANS 6245:2006 test results (accelerated mortar prism method) for the coarse aggregate
- Certificates from cement (and extender) supplier stating the certified active alkali content(s)
- Total active alkali content of the various mix designs, adhering to the maximum values stated below (including calculations)

Result of SANS 6245 Coarse aggregate test (@12 days)	Description	Limit on total active alkali content of mix (kg/m ³)
Linear Expansion < 0.10%	Aggregate innocuous	N/A
0.10% < Linear Expansion < 0.20%	Slowly reactive/ inconclusive	2.8
Linear expansion > 0.20%	Deleteriously reactive, rapidly expansive	2.1

Over and above the table above, aggregates from the Witwatersrand Supergroup shall have a limit of 2.0kg/m³ active alkalis in the mix design.

The Engineer may instruct a petrographic analysis of the coarse aggregate for new/unknown coarse aggregates in addition to the tests above.

All costs of the testing described above shall be deemed included in the cost of the rates for concrete.

Note: The equivalent sodium oxide content is measured as $\text{Na}_2\text{O} + 0.658\text{K}_2\text{O}$. For cement it is expressed as a percentage by mass, for concrete it is expressed in kg/m^3 .

4. PLANT (CLAUSE 4)

4.1 MIXING PLANT (SUBCLAUSE 4.3)

4.1.1 General requirements for mixing plant (Subclause 4.3.1)

Add the following:

“Standby mixers of adequate capacity and with an independent power unit shall be maintained on the site for immediate use in the event of breakdown of the regular mixers or failure of the power supply.

In addition, The Contractor shall have the following minimum plant available and in sound working order:

- a) Two concrete mixers, each of sufficient capacity to complete a section of the wall between horizontal construction joints within 4 hours and without interruption.
- b) Two weigh-batchers to supply the mixers.
- c) Four concrete vibrators, at least one of which shall be powered by an internal combustion engine.
- d) One air compressor.
- e) Suitable and adequate Plant to transport and raise concrete and other material and equipment from ground level to the top of the structure at all stages of construction.
- f) Elevated storage tanks of adequate capacity to ensure that sufficient water will be available before commencement of every major concrete-placing operation.

If the Plant used for placing concrete for the structure is electrically or mechanically powered, the Contractor shall also provide some other approved, non-electrically-powered standby means for placing concrete at an adequate rate in the event of a power or mechanical failure of the main Plant.

When the Contractor elects to place a crane inside the walls of the structure during the construction period, he shall communicate with the Engineer in good time to ensure that the design and layout of the panels that form the roof slab and floor allow for such positioning of the crane. When sections of the roof and floor have to be redesigned to accommodate the crane, the redesign cost shall be borne by the Contractor.”

4.2 FORMWORK (SUBCLAUSE 4.5)

4.2.1 Design (Subclause 4.5.1)

Add the following:

“All formwork or scaffolding required for any part of the Works shall be designed by the Contractor, and before commencing with the erection of any formwork or scaffolding, the Contractor shall submit the methods he proposes to use to the Engineer for approval. The Engineer has the authority to order alterations to the design or the sizes of any part of the formwork or scaffolding. The Contractor shall check the safety and suitability of all such alterations. The fact that the Engineer has approved or altered any part of the formwork or scaffolding shall not be construed as relieving the Contractor of his responsibility with regard to the strength and stability of the formwork or scaffolding.

Furthermore, in accordance with the Construction Regulations under Section 43 of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993), the Contractor shall appoint a competent person to design, inspect and approve the erected temporary works on Site. Written approval (signed-off) of the design, inspections and approval of the temporary works by competent person shall be submitted to the Engineer for record-keeping purposes throughout the various stages.”

4.2.2 Finish (Subclause 4.5.2)

Add the following:

"All exposed concrete edges and external angles in concrete work shall have 20 mm x 20 mm chamfers unless otherwise specified or ordered, with the following exceptions:

- a) edges to which bolt-on frames for grid flooring are to be fixed,
- b) the sides of staircase risers,
- c) and staircase treads.

Edges to which bolt-on frames for grid flooring are to be fixed shall be finished neatly and uniformly with a rubbing stone to remove protrusions and slightly round the edge.

The sides of staircase risers (vertical edges) shall be edged with an 8 mm round fillet (forming this round edge by neatly applying a silicone bead inside the shutters prior to casting is acceptable).

Staircase treads will, unless otherwise specified, be topped with a 25mm granolithic screed. The screed shall receive an 8 mm round edge."

4.2.3 Ties (Subclause 4.5.3)

Add the following:

"No plugs, bolts, ties or clamps of any description used to hold the formwork will be allowed through the walls of water retaining structures, unless expressly approved by the Engineer.

Only approved tie-rods consisting of solid rods (that remain embedded in the concrete) and with removable ends shall be used to hold the formwork of the walls. The removable tie-rod ends shall facilitate removal without damage to the concrete, and no permanently embedded parts of such tie-rods shall have less than 50 mm of cover to the finished concrete surface.

The cavities left in the concrete when the tie-rod end cones are removed shall be soundly caulked/ grouted up with a cement mortar to which an approved shrinkage-reducing agent has been added, and shall be neatly finished to a smooth surface uniform with that of the surrounding concrete.

The cost of supplying special tie-rods as well as the filling of cavities left by the tie-rod cones shall be included in the rates tendered for formwork under the appropriate pay items.

Under no circumstances shall formwork be secured to reinforcing bars."

4.3 WATER-BATH (NEW SUBCLAUSE 4.6)

A temperature-controlled water-bath with a capacity to cure two hundred cubes shall be provided and maintained on site. The water-bath shall be located under cover.

5. CONSTRUCTION (CLAUSE 5)

5.1 REINFORCEMENT (SUBCLAUSE 5.1)

5.1.1 Fixing (Subclause 5.1.2)

Add the following:

"Welding of reinforcing steel will not be permitted.

The Contractor shall make provision for the Engineer to inspect reinforcing once it has been fixed in place, with cover blocks secured and construction joints prepared. Formwork that prevents arm-length access to any reinforcing or construction joints for checking shall not be erected until the Engineer is satisfied that preparations at that stage meet specification."

5.1.2 Cover (Subclause 5.1.3)

In Subclause 5.1.3(a) amend the words "or stirrup" to read: ", secondary reinforcement, tie, stirrup, tying-wire knots or wire ends".

Add the following:

"Tying wire may not encroach on the specified minimum cover by more than a single strand thickness.

The distance between pipes, ducts, conduits or sleeves in the concrete and the reinforcing steel shall nowhere be less than

- 40 mm,

- 5 mm plus the maximum size of the coarse aggregate, or
- the cover specified on the drawings,

whichever is the largest.

The Contractor shall make provision for the Engineer to inspect cover once all formwork has been erected and secured, joints prepared and items that are to be cast in are fixed in place. Where poor lighting between formwork prevents the Engineer from adequately completing the inspection, the Contractor shall make available, for the Engineer's use, a portable light (flashlight) of sufficient brightness to complete the inspection."

5.2 FORMWORK (SUBCLAUSE 5.2)

5.2.1 Classification of finishes (Subclause 5.2.1)

Replace the phrase "are classified as follows and will be so scheduled:" at the end of the first paragraph with the following:

"are classified below unless otherwise classified on the drawings, and will be so scheduled. Except where otherwise specified, formwork for formed concrete surfaces against which backfill will be placed shall be rough and formwork for all other formed surfaces shall be smooth."

In Subclause 5.2.1(b) amend the words "to Degree of Accuracy II as defined in terms of Clause 6" to read: "to the Degree of Accuracy specified in 6.2".

5.2.2 Preparation for formwork (Subclause 5.2.2)

Add the following:

"Construction joints shall be approved by the Engineer."

5.2.3 Removal of formwork (Subclause 5.2.5)

Replace TABLE 2 in Subclause 5.2.5.2 with the following table:

1	2	3	4	5	6	7	8	9	10
Formwork to Structural Member	Strength Class of Cement								
	CEM-1			CEM-II-A (or blend of CEM-I with less than 20% FA/GGCS /GGBS)			CEM-II-B, CEM-III (or blend of CEM-I and more than 20% FA/GGCS /GGBS)		
	Minimum time (24 hour periods) before removal of formwork								
	Weather								
	Hot or Normal	Cool	Cold	Hot or Normal	Cool	Cold	Hot or Normal	Cool	Cold
Beam sides, walls and unloaded columns	1	1.25	1.5	1.5	2	3	3	4	5
Slabs with props left underneath	2	3	4	4	5.5	7	6	8	10
Beam soffits with props left underneath and ribs with a ribbed floor construction	3	4	5	5	7	10	10	13.5	17
Slab props including cantilevers	5	7	9	10	13.5	17	10	13.5	17
Beam props including cantilevers	7	9.5	12	14	17.5	21	14	17.5	21

Add the following to the end of Subclause 5.2.5.3:

"This shall include evidence that curing and protection as per 5.5.8 is strictly adhered to."

Add the following to the end of Subclause 5.2.5:

- “5.2.5.6 The Contractor shall make provision for the continued support of beams and slabs while the formwork is being removed and/or for back propping of beams and slabs.
- 5.2.5.7 Where walls/beams have top slabs attached, the contractor shall keep the wall/beam propped until such a time as the top slab has attained its design strength. Back-propping of such structures shall be discussed and agreed with the Engineer at the time of programme approval.
- 5.2.5.8 Any deviation from the table above or the agreed upon programme for back-propping, shall not be permitted without the Engineer’s acceptance in writing.”

5.3 HOLES, CHASES AND FIXING BLOCKS (SUBCLAUSE 5.3)

Add the following:

“Cover blocks shall be made of mortar to achieve a strength class (and equivalent durability) of the concrete of the element they are placed in. They shall be placed and grouped at a spacing so as to avoid crushing from any applied construction and self-weight loads.

The holes or cavities left by ferrule heads in the concrete of water-retaining and water-excluding structures shall be filled with an approved non-shrink grout applied strictly in accordance with the manufacturer’s specifications.

Plastic cover blocks will not be permitted in water-retaining and water-excluding structures.”

5.4 PIPES AND CONDUITS (SUBCLAUSE 5.4)

Add the following:

“All pipes passing through concrete elements (floors, walls, slabs, etc.) shall be cast into the concrete elements simultaneously with the casting of the element. Openings for pipes shall only be left in concrete elements when so directed or approved by the Engineer or when shown on the drawings. Pipes shall be installed in such openings in accordance with the details shown on the drawings.”

5.5 CONCRETE (SUBCLAUSE 5.5)

5.5.1 Quality (Subclause 5.5.1)

5.5.1.1 Chloride content (Subclause 5.5.1.4)

Add the following to this Subclause:

“With reference to Table 4, efflorescence will not be acceptable on any exposed concrete surface.”

5.5.1.2 Durability (Subclause 5.5.1.5)

Replace this Subclause with the following:

“The exposure conditions of the watertight concrete are classified as **“severe”**.

The maximum allowable water:binder ratio for watertight concrete shall be **0.50**.

The maximum allowable water:binder ratio for all other strength concrete shall be **0.60**.”

5.5.1.3 Strength concrete (Subclause 5.5.1.7)

Add the following to this Subclause:

“With the exception of mixes weaker than 15 MPa, all concrete for the Works shall be considered to be strength concrete. Watertight concrete shall also comply with requirements as stated in 5.5.11.

The concrete mixes shall be designed by an approved laboratory.

a) Design of concrete mixes:

The proportions of the various sizes of aggregate, binder and water shall be such as to produce a dense concrete of adequate workability for the particular circumstances under which the concrete will be transported, placed and compacted. Approved plasticizing additives may be used to ensure adequate workability in preference to varying the proportions of water and cementitious binder.

All exposed concrete shall be of the same colour. No change in materials or processes shall be made without the Contractor first satisfying the Engineer that no change in colour will result.

Where extenders are proposed by the Contractor for building surface beds and trafficable slabs, a maximum of 15% cement replacement with a suitable extender will be allowed.

b) Trial Mixes:

The Contractor shall for each class of concrete required for the Works, have trial mixes designed within the limits specified herein for 28 day and 7 day strengths and he shall have cubes made and tested by an approved laboratory at his own expense. The test results of cubes made from trial mixes shall be used to determine the proportions for the "Designed Mixes" to be used in the Works.

Details of the mixes as designed shall in all cases be submitted to the Engineer for approval, 30 days before concreting is carried out and no concrete shall be placed in structures before such approval in writing has been obtained. The proportions of cement, aggregates and water for each mix as approved shall not be changed except with approval of the Engineer.

The Engineer must receive for any particular concrete mix:-

- Proportions of each design tested
- Strength of each cube tested
- Density of each cube tested
- The Contractor's nomination of the design he proposes."

5.5.2 Mixing (Subclause 5.5.3)

5.5.2.1 Ready-mixed concrete (Subclause 5.5.3.2)

Add the following to this Subclause:

"If the Contractor elects to use ready-mixed concrete in the Works he shall provide a qualified technical assistant who shall check the quality of materials used, the accuracy and effectiveness of the water gauges and all relevant parts of the batching and mixing equipment, the moisture content of the aggregates, the quantities batched, the time of departure of each batch and all other matters which may affect the quality of timely arrival of the concrete.

The technical assistant shall commence work at the batching plant sufficiently in advance of the batching of the first mix to carry out all the required checks and shall remain at the plant throughout the period in which concrete for the Works is being batched.

The technical assistant shall maintain a continuous record of all the tests and checks carried out by him. The record shall be available for the Engineer's inspection at all times and a copy of the record for each day shall be given to the Engineer the following morning."

5.5.3 Placing (Subclause 5.5.5)

Add the following to the end of this Subclause:

- "5.5.5.10 Concreting of circular walls (without vertical joints) between horizontal construction joints shall be carried out in both directions from a point on the wall in order to close the gap with fresh concrete.
- 5.5.5.11 Pumping of concrete shall not be permitted unless approved by the Engineer. For such approval, the Engineer may require shrinkage tests of the concrete to meet the criteria in 5.5.11. The rates for concrete will be deemed to include such testing costs.
- 5.5.5.12 Should excessive cracking of pumped-concrete occur, the Engineer may instruct the Contractor to revert to conventionally placed concrete. All costs associated with changes in mix design, site placing equipment, and any remedial repairs to concrete will be at the Contractor's expense.
- 5.5.5.13 Structural concrete shall not be cast directly against the side of any excavation without the use of formwork unless prior approval has been obtained in writing from the Engineer.
- 5.5.5.14 Concrete used in pipe trenches for encasement may be cast directly against the side of the excavation. Concrete for thrust/anchor blocks shall be cast directly against the side of the excavation."
- 5.5.5.15 Blinding layers shall be cast on the same day that earthworks excavation (Restricted as per Subclause 8.3.3 of SANS 1200 D and Extra excavation as per Subclause 8.3.5 of SANS 1200 D) have been completed."

5.5.4 Construction joints (Subclause 5.5.7)

Add the following to the beginning of this Subclause 5.5.7.1

"The position and pattern of all joints (designated or non-designated) shall be subject to the Engineer's approval.

The construction joints in water-retaining and water-excluding structures (designated or non-designated) shall be made strictly in accordance with the details shown on the drawings. Where alternative joint details are proposed by the Contractor, these are subject to the Engineer's approval.

For construction joints at kickers, all additional costs for concrete, formwork preparation, etc. will be deemed to be included in the rates tendered for concrete in walls and formwork. Kickers shall be cast monolithically with the floor/slab concrete and the Contractor shall ensure that kickers are thoroughly compacted, immediately protected, and cured using suitable techniques, as specified.

Walls shall be cast in lifts of a height that permits each lift to be poured without interruption in one continuous operation during normal working hours.

It is the Contractor's responsibility to ensure that construction joints for water-retaining and water-excluding structures are watertight. The Contractor's proposed method for ensuring the watertightness of such joints shall be submitted to the Engineer for his approval.

The joints between screeds and concrete floors shall be regarded as construction joints and the surface of the floor shall be prepared as described for construction joints."

For Subclause 5.5.7.3(b), replace the words "sand-blasted or chipped with a light hammer" with the word "scabbled".

5.5.5 Curing and protection (Subclause 5.5.8)

Add the following:

"Curing shall be conducted for a minimum of 7 days. The method of curing shall be approved by the Engineer for the various elements.

Concrete will not be paid for unless immediately protected and properly cured and proof of curing is continuously visible on Site. The cost of immediate protection and curing shall be deemed to be included in the rates for concrete.

The contractor is to pay special attention to both the immediate protection (see definition in 2.3) and long term curing of the concrete for the various elements. Where deemed necessary by the Engineer, the Contractor shall submit a Method Statement for approval outlining in detail the various measures that the Contractor will undertake to ensure effective immediate protection and long-term curing of the concrete.

Curing compounds will not be accepted as a stand-alone system for the immediate protection of concrete. Only resin-based curing compounds complying with ASTM C309 Type 1 or 2 Class B will be accepted where approved by the Engineer.

Where accepted, the curing compound approved by the Engineer shall be applied immediately as formwork is progressively stripped or, in the case of unformed surfaces, after a minimum of 48 hours of immediate protection. It shall preferably be applied by spraying and the rate of application shall be strictly in accordance with the manufacturer's recommendations. A method of monitoring the area to which curing compound has been applied and the application rate shall be as approved by the Engineer and rigidly applied by the Contractor.

Surfaces of joint rebates, where elastomeric sealant is to be applied, shall be protected from contamination by curing compound by the use of masking tape."

5.5.6 Adverse weather conditions (Subclause 5.5.9)

Add the following to Subclause 5.5.9.2:

"If concrete is to be cast during times of high ambient temperature or hot drying winds, the Contractor shall be responsible for taking the necessary steps to keep the placement temperature as low as possible. Such steps include the spraying of the coarse aggregate with water, the painting of silos with reflecting aluminium paint, the insulation of tanks and pipelines, and the protection of concrete ingredients against the direct rays of the sun. The area of the pour shall be shaded before and during concreting and the concrete shall be shaded from the time of mixing until eight hours after placing.

Windbreaks shall be erected if necessary."

5.5.7 Concrete surfaces (Subclause 5.5.10)

Add the following to Subclause 5.5.10.2:

“Under no circumstances shall cement mortar be added while floating concrete.”

Add the following to the end of Subclause 5.5.10:

“5.5.10.4 Where the surfaces of the concrete are to be additionally hardened or protected, the positions of such surfaces and the method to be used will be shown on the drawings and will be scheduled. Materials or products with a ferrous content will not be allowed.”

5.5.8 Watertight concrete (Subclause 5.5.11)

Add the following:

“The mix designs for watertight concrete must be aimed at ensuring concrete durability and must therefore be guided by the need to:

- Minimise the permeability of the concrete; and
- Maximise the chemical resistance of the concrete to aggressive agents in the environment.
- Reduce the heat of hydration and thermal gradient of thick sections (greater than 400mm thick) at early-age.

The following parameters shall be adhered to:

Parameter	Limit
Maximum shrinkage strain (12 day accelerated shrinkage test):	300 µm/m
Maximum water:binder ratio:	See 5.5.1.5
Minimum cementitious binder content:	300kg/m ³
Maximum cementitious binder content:	360kg/m ³
Maximum water content:	180kg/m ³
Maximum alkali content:	See 3.11
Maximum thermal coefficient of expansion for concrete:	10x10 ⁻⁶ /°C
Minimum coarse aggregate fraction (as a percentage of total (coarse + fine) aggregates):	0.55
Type of extender required:	Ground Granulated Corex Slag (GGCS), Ground Granulated Blast-furnace Slag (GGBS), OR Fly Ash (FA)
Minimum and maximum range of extender replacement (as a percentage of total binder content)	40% - 50% (GGCS) 40% - 50% (GGBS) 20% - 30% (FA)

Nominal coarse aggregates size shall be 26mm, but can be blended with smaller size aggregates if required, and approved by the Engineer.

Where extenders are used/specified, Table 2 (as amended) shall apply, and the immediate protection during casting and the curing of concrete should be given special attention by the contractor. Where extenders specified may not be locally available, the Contractor should take into account all the costs required to import and batch the specified extender in the rates for concrete (8.4.3).

The following structures (in its entirety) shall be considered water-retaining/water-excluding shall be constructed using watertight concrete unless shown otherwise on the drawings:

- **Reservoirs, abstraction works and intermediate pump stations**
- **Clearwell (including motive water tank and potable water reserve)**
- **Flocculation and sedimentation complex, including all connected channels and sumps**
- **Filter backwash bund**

- **Lagoon diversion chambers**
- **Lagoon inlet and outlet structures**
- **Residue holding tank**
- **Lime mixing tanks**
- **Isolation valve chambers**
- **Inlet flow meter chamber**
- **Any other element(s) of a structure retaining water**

The following elements of structures shall be considered water-excluding and shall be constructed using watertight concrete:

- **Raft foundations / base slabs below ground level**
- **Retaining walls fixed to raft foundations / base slabs**
- **Footings / thickenings in raft foundations / base slabs**
- **Any other element(s) of a structure excluding water (including ground water assumed to be at top of final ground level)**

5.5.9 Grouting (Subclause 5.5.13)

Add the following:

“Unless otherwise approved by the Engineer, proprietary grouting materials shall be obtained ready-mixed in sealed pockets as supplied by the manufacturers.”

5.5.10 Defects (Subclause 5.5.14)

Add to the end of Subclause 5.5.14.1:

“All defects shall be repaired as soon as possible after the formwork has been removed and the Engineer has inspected the concrete. A statement of the method to be used for each repair shall be submitted to the Engineer for his approval before any work is carried out. Such methods should deal separately with methods for the various depths of defects as follows:

- a) Repair of shallow surface irregularities (e.g. blowholes or minor grout loss)
- b) Repair of 5mm to 50mm deep irregularities with polymer modified repair mortars
- c) Repair of deeper defects by means of formed micro-concretes

Each method should deal in detail with surface preparation, dealing with minimum product application depths (sawcutting and roughening of saw-cut edges etc.), the use of bonding agents and/or other proprietary product where specified by the applicator, product window periods and curing of the repair products.

The Engineer may prohibit the further placing of concrete in the particular area concerned until he is satisfied that the repair has been satisfactorily executed.”

5.5.11 Creating box-outs for and casting in of items (New Subclause 5.5.16)

- a) Where an item (i.e. pipe, special, etc.) is to be cast/grouted into a concrete member/element at a later stage (such as for items supplied by others), the Contractor shall provide a box out hole in the concrete element. When constructing such holes, the reinforcement bars shall not be cut but shall run through the hole/opening.

Once the concrete element has been cast and the box out hole made, all formwork and boxing remaining in the holes shall be removed. Any alterations required to the position and shape of the holes shall then be made. This shall be followed by preparing the surface as specified in 5.5.7.3(c), including thoroughly scabbling the sides of the holes to obtain a satisfactory surface to which the new concrete/grout will bind to.

- b) When the item is ready to be cast in, the reinforcement shall then be cut (with the approval of the Engineer) and/or bent out to suit the item being cast in. Cutting of reinforcing shall be kept to an absolute minimum. After positioning of the item, the remaining reinforcement shall be bent back in position (i.e. after flanges or similar protruding components have been passed through the reinforcing).

Cover of concrete over reinforcing as detailed in 5.1.3 shall be adhered to, including cover between reinforcing and the item installed (unless otherwise directed or approved by the Engineer).

- c) The surface of the existing concrete shall be kept continuously wet for 24 hours before a layer of mortar slurry and the new concrete/grout are placed. Right before casting, all standing water shall be removed and the surface shall be covered with a layer of mortar slurry (or other approved method), as thick as practical, made of the same mix as the concrete in which the items are to be cast. Under no circumstances shall the mortar slurry be allowed to dry out prior to casting.

If watertightness is a requirement where the item is cast into the concrete element, the Contractor shall ensure watertightness by using an approved method (unless one is already specified by the Engineer) such as tape wrapping the pipes (i.e. with a SikaSwell sealant and profile) prior to casting in. The cost of such waterproofing method will be deemed to be included in the rates tendered for items 8.7 and 8.13, as applicable.

Formwork shall be constructed and the item secured in position to prevent movement from the required position during casting. The Engineer shall be called on to inspect the work for compliance at agreed milestones and, at minimum, while there is still sufficient access to inspect the work before the final formwork is positioned and casting commences.

The concrete/grout shall be mixed and placed as dry as possible to obtain a dense, watertight concrete. The concrete/grout shall be carefully worked around item, including the puddle flange (if any) and the pipe barrel or body of the special (as applicable), and shall be vibrated in layers so as to obviate a falling away from the item's surface of the concrete already placed. The whole shall, when set, form a dense, homogeneous, and waterproof mass."

5.5.12 "No-fines" concrete (New Subclause 5.5.17)

A nominal aggregate size of 19 mm shall be used in the manufacture of "no-fines" concrete. Each size of aggregate shall be a single size aggregate graded in accordance with SANS 1083.

The concrete shall be mixed in the following proportions:

Cement	:	50 kg
Aggregate	:	0,30 m ³
Water	:	20 ℓ

Cement shall be measured by mass or in full pockets of 50 kg each and aggregate shall be measured by volume in approved measuring boxes or barrows. The aggregate shall be moist or wetted before the cement is added. Where drum mixers are used, about 20% of the water shall be poured into the drum before the aggregate and cement are loaded. The mixing time in the drum shall be about 45 to 50 seconds.

The quantity of water added shall be just sufficient to form a smooth grout which will adhere to and completely coat each and every particle of aggregate, and which is just wet enough to ensure that, at points of contact of aggregate, the grout will run together to form a small fillet to bond the aggregate together. The mix shall contain no more than 20 litres of water for every 50 kg of cement. Mixing shall be done in an approved batch-type mechanical mixer, but small quantities may be hand-mixed.

No-fines concrete shall be placed in accordance with the procedure approved by the Engineer. It shall be placed in its final position, on an approved geotextile bidim, within 15 minutes of having been mixed. The concrete shall be worked sufficiently to ensure that it will completely fill the space to be concreted and that adjacent aggregate particles are in contact with one another. Excessive tamping or ramming shall be avoided and under no circumstances shall the concrete be vibrated.

All no-fines concrete shall be protected from the elements and loss of moisture. Protection against loss of moisture shall be accomplished by one or more of the following methods:

- Retaining formwork in place
- Covering exposed surfaces with sacking or other approved material kept continuously wet
- Covering exposed surfaces with plastic sheeting

Between 24 h and 48 h after the no fines layer has been laid it shall be covered with a 1:4 cement:sand mortar skim layer 20 mm thick. The mix shall be comparatively dry to ensure that it does not penetrate and block the cavities in the no-fines concrete. The surface shall be steel floated to form a plane surface.

The mortar skim shall be cured in the same manner as concrete for a period of not less than 2 days.

5.5.13 Precast paving slabs (New Subclause 5.5.18)

The paving slabs shall comply with the requirements of SANS 541, shall be as scheduled and with patterned surface, or equal approved. Samples of the types which the Contractor proposes to use shall be submitted for approval prior to construction.

The area to be paved shall be compacted to 95% of MAMDD (Mod AASHTO maximum dry density), trimmed and then treated with an approved weedkiller, with care being taken to avoid contaminating surrounding areas. The paving slabs shall be laid on a sand bed approximately 25 mm thick, which shall be graded to the required levels and slopes as approved by the Engineer.

The joints between the slabs shall be 2 mm to 6 mm wide and shall be grouted with cement mortar. Gaps in the pattern of slabs shall be filled with Grade 15 MPa/20 mm concrete and given a wood floated finish.

5.5.14 Grouting in of equipment (New Subclause 5.5.19)

- a) The Contractor shall form pockets to the details shown on the drawings to accommodate holding down bolts for equipment provided by the Contractor or by the Mechanical and Electrical Contractor. The holding down bolts will be provided and positioned by the Mechanical and Electrical Contractor for his equipment.
- b) After casting of the concrete all shuttering shall be removed and the inside of the bolt holes and the surface on which any machine base is to be placed shall be cleaned and scabbled to remove all defective concrete, laitance, dirt, oil, grease and loose material.
- c) Upon completion of the positioning and alignment of equipment (the Mechanical and Electrical Contractor will position his own equipment), and when instructed by the Engineer, the Contractor shall in collaboration with the Mechanical and Electrical Contractor, grout up pockets and baseplates by filling pockets and voids under the baseplates with an approved non-shrink grout.

5.5.15 Backfilling of excess excavations (New Subclause 5.5.20)

Wherever the Contractor has over-excavated below the specified founding levels, such over-excavation shall be backfilled to bring the founding surface to the correct level by placing and compacting no-fines concrete or mass concrete of Grade 15 MPa/19 mm, as directed by the Engineer.

Backfilling with 5% cement stabilized sand compacted to 100% MAMDD in 150mm layers may be appropriate for use under certain structures, if approved by the Engineer. The cement stabilized sand to be thoroughly mixed in the presence of the Engineer.

5.5.16 Applied loads (New Subclause 5.5.21)

No loads (e.g. crushed stone covering or any other) shall be placed on the roof of the structure before the concrete has attained its design strength, unless approved supports are provided.

5.5.17 Soilcrete (New Subclause 5.5.22)

Soilcrete shall consist of an approved soil or gravel mixed with 5 % by mass of Portland Cement and only sufficient water to give it a consistency that will permit the soilcrete to be placed, using vibrators. The material used for soilcrete shall be sandy granular material of the following specifications:

Minimum Grading Modulus:	1.2
Maximum Plasticity Index:	10%
Maximum particle size:	38mm

Detrimental percentages of silt and clay shall be avoided

The soilcrete shall be mixed on site using suitable concrete mixers and the water and cement contents shall be carefully controlled. It shall be placed and thoroughly compacted by means of concrete vibrators so that all voids are filled.

5.5.18 Holding down bolts (New Subclause 5.5.23)

Where holding down bolts (HD bolts) are to be cast into concrete or grouted into pockets and where they are not specified and measured with the items they are fastening, these bolts shall be Class 8.8 and shall be manufactured from stainless steel Grade 316L (unless otherwise specified), shall be fitted with insulating washers and shall have a nickel-based anti-seize compound applied along the full length of fastener threads before the nut is applied.

5.5.19 Sterilization of water retaining structures (New Subclause 5.5.24)

Before a water-retaining structure is sterilized, the structure shall have been tested for watertightness as set out in 7.2.5, and the pipelines serving the structure shall have been sterilized. The inside of the structure shall then be thoroughly cleaned out and washed down with clean water. Thereafter the roof soffit, beams, columns and walls shall be thoroughly sprayed down, using pressurised equipment, and the floors shall be scrubbed with a calcium hypochlorite solution of concentration 0,15 g/L, as specified in Subclause 5.10 of SANS 1200 L.

On completion of the sterilization, the sterilizing solution shall be run to waste before the water-retaining structure is filled.

Should additional work be required inside the structure after a watertightness test has been completed, the structure shall be resterilised at the Contractor's expense.

5.5.20 Granolithic screeds (New Subclause 5.5.25)

Where the type of screed required is not stated, the screed shall comply with this granolithic screed specification unless it is applied to a roof top, in which case it shall comply with the roof screed specification in Specification PD.

5.5.25.1 Mix design

Only CEM I 52.5 or CEM I 42.5 (Portland cements), CEM II A 52.5 or CEM II A 42.5 in accordance with SANS 50197-1 may be used. Where extenders are proposed by the Contractor, a maximum of 15% fly ash, or 30% GGBS/GGCS will be allowed.

The maximum allowable water:binder ratio for granolithic screed shall be 0.50 and the minimum 28-day cube strength shall be 35MPa.

The coarse aggregate shall consist of granite or other approved aggregate. For screeds with a nominal thickness of up to 40mm, the coarse aggregate shall pass through a 10mm sieve but be retained on a 5mm sieve. For screeds with average thickness greater than 40mm, the nominal size of the coarse aggregate should be increased to one-quarter the thickness of the topping, subject to a maximum of 19mm.

The mix design must be submitted to the engineer for approval.

5.5.25.2 Preparation of base concrete

Before placing any granolithic screeds, the base concrete (substrate) shall be scabbled to remove all laitance and expose the aggregate over 100% of the area to be screeded using mechanized plant such as scabblers or abrasive blasters. After scabbling, the surface shall be thoroughly cleaned from dust and debris by scrubbing and/or high pressure wash, followed by soaking the surface with water for at least 24 hours. The Engineer shall be called to inspect all prepared surfaces prior to placing the screed.

5.5.25.3 Placing

Remove all surface water and apply a 1:1 cement/clean sand grout with just enough water to provide the consistency of a slurry. The grout is to be vigorously brushed into the scabbled surface with brooms (which have bristles long and flexible enough to reach down into all the irregularities of the concrete surface).

On completion of brushing the grout into the scabbled surface, the surplus grout must be brushed off to leave only a thin grout coating (without pools of grout in depressions) and the screed must be placed while this grout coating is still visibly wet. Under no circumstances should the grout be allowed to dry out before placing the screed as this will cause debonding. This will typically require grouting over small areas at a time, just ahead of laying the screed.

Where a screed to fall is required but no fall (i.e. 1:100) is given for the area, the screed shall be laid to fall (slope) as indicated below.

- Where the screed only falls in one direction, the fall shall be 1:100.
- Where the screed consists of multiple sections sloping in various directions, the section(s) with the most gradual slope shall have a fall of 1:100. All other sections shall have slopes steeper than 1:100 to fall in the direction shown and tie into adjacent sections.

Where a screed is required and a fall is given for the area comprising of multiple sections sloping in various directions, the fall given shall be the minimum fall (fall for the most gradually sloped section) and some sections will require steeper falls to tie into adjacent sections.

Granolithic screeds applied to stairs shall be 25mm thick and level, unless otherwise indicated. The thickness of all other granolithic screeds shall be 30mm at the thinnest point (unless otherwise indicated).

The granolithic screed must be laid and compacted in one layer and care must be taken to obtain maximum compaction. All laitance on the surface of the fresh screed must be struck off prior to mechanical trowelling. Over-trowelling, causing an excessive cement-water paste to come to the surface, must be strictly avoided. Under no circumstances should cement or a dry cement-sand mixture be sprinkled directly onto the surface of a finish in order to absorb bleed water or laitance. Surface water should not be trowelled back into the finish and, similarly, water should not be applied between trowelling operations, since this may cause surface weakness.

The granolithic screed shall have exposed corners and edges rounded ($r=8$ mm), and shall be finished with a steel trowel to Degree of Accuracy I, or in the case of receiving a surface finish application, in strict accordance with the manufacturer's specification and approved by the Engineer. Where granolithic screeds are applied to stairs, a portion of each tread shall be reeded (finished with a non-slip pattern) to the satisfaction of the Engineer.

5.5.25.4 Curing

Granolithic screeds shall be protected from damage and cured in accordance with the requirements of 5.5.8.

5.5.25.5 Joints

The granolithic screed shall be divided into panels with joints that align/coincide with joints in the base concrete (including joints at columns, walls, etc.). Additional joints are to be made in the screed if, when matching the base concrete joints, the screed panel size will exceed 9m^2 . These additional joints shall be made such that joints are no more than 3m apart, equally spaced and the length:width ratio of the panels adheres to a 1,5:1 limit. The Contractor shall have his proposed additional joint locations approved by the Engineer prior to commencing with the screeding work.

Unless detailed otherwise, screed joints that align with the base concrete joints shall be full-depth and of the same width as those in the base concrete. Joints that do not align with the base concrete joints shall be formed by cutting grooves 3mm wide by 25mm deep into the screed within 8 hours of placing the screed and sealed as specified on the drawings.

All joints shall be straight, neat and of workmanlike appearance. All joints shall be sealed as shown on the drawings.

When placing granolithic screed against an adjacent band of granolithic screed, the edge of the latter shall be prepared by wire brushing and brushing with grout. Under no circumstances shall the brushed grout be allowed to dry out prior to placing screed.

5.5.25.6 General

Screeds found to be delaminating shall not be accepted.

The interface between the screed and substrate, if visible (i.e. sides of walkways or stairs that have received a screed and do not abut the structure), shall be finished flush and made neat either by rubbing down or by another suitable method approved by the Engineer. Fairing coats are not acceptable.

5.5.21 Concrete protection and proprietary floor finishes (New Subclause 5.5.26)

Concrete protection and proprietary floor finishing products shall be applied where specified on the drawings or in the Bill of Quantities. The Contractor shall ensure that the substrate and preparation thereof meet the requirements of the product being applied (if applicable), and the Engineer shall be called to inspect all prepared substrates prior to applying/installing the finish. A trial panel (including skirting if applicable) shall be prepared in advance by the Contractor for the Engineer's approval.

All installations of proprietary products shall be carried out by supplier-approved applicators and in strict accordance with the manufacturer's specifications. The finish (including joints) shall be

level, plum, uniform, straight and of a neat and workmanlike appearance. The supplier's technical representative shall carry out regular inspections to ensure that their specifications are adhered to during installation. Any thicknesses specified shall be the dry film thickness. Although some of the more common finishes are specified below, other finishes may be specified elsewhere.

Where aluminium straight edge trim (flooring trim) is specified as a stop end for the finish, the underside of the trim shall be lightly sanded, and the entire underside adhered securely to the substrate with Sikadur-30 (or similar approved) epoxy paste prior to applying the finishing products. The finishing products shall be applied over the appropriate section of the aluminium trim and worked into holes in that section provided for the product to bond to. The exposed edges of the aluminium trim shall be masked and protected during construction and shall have a clean and 'new' appearance once construction is complete. Any visible gaps between the aluminium trim and the substrate to which it is affixed due to undulations in the substrate shall be filled with Sikafloor-161 (or similar approved epoxy primer and mortar) and neatly finished.

a) Epoxy Finish:

Unless otherwise indicated, epoxy finishes for an area are to be applied after completing the Works in that area.

Epoxy finishes shall be completed in strict accordance with the manufacturer's method statements and product data sheet instructions. Although Sika products are specified below, similar alternatives may be approved by the Engineer. A 10-year guarantee shall be given, in writing, on epoxy finishes.

Prior to applying finishes, edges and trim shall be masked off for neatness and areas adjacent to where the coatings are to be applied shall be protected from coating splatter, tearing, etc. (areas defaced by coatings are not acceptable and will be remedied at the Contractor's cost).

Concrete expansion joints are to be extended through the epoxy finish and sealed with Sikaflex Pro-3. If day joints are required and unavoidable, the Contractor shall have his proposed joint locations approved by the Engineer prior to commencing with work.

Unless otherwise indicated, where epoxy finishes abut other elements, where they cross over elements/interfaces and where there is a change from one finish to another, these interfaces shall be neatly finished off and fully sealed by applying a bead of Sikaflex Pro-3 at the interface (except for where cove skirting is used). For example, this would include applying a bead in corners where walls/plinths/columns meet the floor, where the finish abuts a support or other equipment, etc.

Type 1: Epoxy-cement seal finish:

The epoxy-cement seal finish shall consist of a 2mm thick layer of Sikagard 720 EpoCem. Where a thicker layer is specified, each coat will not exceed 2mm thickness.

Type 2: Epoxy chemical resistant finish:

The epoxy chemical resistant finish shall consist of 2 brushed coats of Sikafloor 161 (as a primer) and least 2x coats of Sikagard-63N (min. 0.25mm thick).

Type 3: Epoxy finish:

The epoxy finish shall consist of 2 brushed coats of Sikafloor-161 (for priming and to provide a levelled surface) followed by a 3mm thick (min.) Sikafloor-263 SL ZA wearing course (combined with Sikafloor Quartsand SS2). The finished colour shall be RAL 7038 unless otherwise indicated. All edges of the floor finish that do not terminate up against an element (i.e. do not terminate up against a wall, column, plinth, etc.) shall be edged with a 3mm aluminium straight edge trim (Kirk ASE030 or similar approved), installed in accordance with the specification provided at the start of this Subclause.

Type 4: Epoxy broadcast finish:

The epoxy floor broadcast finish shall be at minimum 4mm thick and shall consist of 1-2 brushed coats of Sikafloor-161 (for priming and to provide a levelled surface), followed by a Sikafloor-263 SL ZA base coat (combined with Sikafloor Quartsand SS2), followed by a broadcast layer of 0.4-0.7mm quartz sand and finished with a Sikafloor-264 ZA seal coat. The finished colour shall be RAL 7038 unless otherwise indicated. All edges of the finish that do not terminate up against an element (i.e. do not terminate up against a

wall, column, plinth, etc.) shall be edged with a 3mm aluminium straight edge trim (Kirk ASE030 or similar approved), installed in accordance with the specification provided at the start of this Subclause.

Type 5: Epoxy cove skirting:

The epoxy cove skirting shall have a 25mm radius cove and be 100mm high. The top edge shall be neatly finished with a 6mm aluminium straight edge trim (Kirk ASE060 or similar approved) as a stop end.

The skirting shall be formed with Sikafloor-161 mortar bulked up with clean sand and overcoated with Sikafloor-263 SL ZA or Sikafloor-264 ZA (as applicable to match the adjacent finish type and colour). The interface between the floor and the cove skirting shall be seamless.

The thickness of the completed cove skirting shall be 7mm at the top edge and at least 4mm at the bottom edge, and the bottom of the skirting shall tie in level with the finished floor (they shall meet without a step). This will require the concrete substrate near the bottom edge of the cove to be cut back slightly (no more than 5mm) before constructing the cove.

Any gaps between the substrate and aluminium trim due to the substrate not having a flat surface shall be filled with an approved mortar and finished to match the finish of the wall (not to be finished to appear similar to the aluminium trim).

Type 6: Epoxy seal coat finish:

The epoxy seal coat finish shall consist of 1x brushed coat of Sikafloor Garage (as a primer) and at least 2x seal coats of Sikafloor Garage. The finished colour shall be RAL 7035 unless otherwise indicated. Sikafloor-161 or similar approved repair mortar and primer shall be used to repair any minor damages to the substrate prior to applying the seal coat finish.

Type 7: Epoxy roller coat finish:

The epoxy roller coat finish shall consist of 1x brushed coat of Sikafloor Garage (as a primer) and at least 2x seal coats of Sikafloor-264 ZA. The finished colour shall be RAL 7038 unless otherwise indicated. For coating vertical surfaces, Sika Extender T shall be added to the seal coats.

Type 8: Epoxy non-slip roller coat finish:

The epoxy non-slip roller coat finish shall consist of 1x brushed coat of Sikafloor Garage (as a primer) and 1x coat of Sikafloor-264 ZA with Sika Extender T and 0.1-0.5mm quartz sand. The finished colour shall be RAL 7038 unless otherwise indicated.

b) Polyurethane Finish:

Unless otherwise indicated, polyurethane finishes for an area are to be applied after completing the Civil Works but before commencing with M&E Works for that area.

Polyurethane finishes shall be completed in accordance with the manufacturer's method statements and product data sheet instructions. The polyurethane finish shall also include retaining/anchor groove openings (along joints, around openings and around the perimeter of all application areas to prevent curling or lifting of the products), and free edge grooves (for terminating the products so as to maintain the minimum product thickness as the product cannot be feathered at the edges).

Although Sika products are specified, similar alternatives may be approved. The finished colour shall be RAL 7037 unless otherwise indicated.

Prior to applying finishes, edges shall be masked off for neatness and areas adjacent to where the coatings are to be applied shall be protected from coating splatter, tearing, etc. (areas defaced by coatings are not acceptable and will be remedied at the Contractor's cost).

Concrete expansion joints are to be extended through the polyurethane finish. Joints shall be sealed with Sikaflex Pro-3. Additional joints through the polyurethane finish shall be incorporated when necessary to ensure that any area of polyurethane finish enclosed by

expansion joints does not exceed 16m². The Contractor shall have the locations of these additional joints approved by the Engineer prior to commencing with work.

Unless otherwise indicated, where polyurethane finishes abut other elements, where they cross over elements/interfaces and where there is a change from one finish to another, these interfaces shall be neatly finished off and fully sealed by applying a bead of Sikaflex Pro-3 at the interface (except for where cove skirting is used). For example, this would include applying a bead in corners where walls/plinths/columns meet the floor, where the finish abuts a support or other equipment, etc.

A 10-year guarantee shall be given, in writing, on polyurethane finishes.

Type 1: Polyurethane cement textured finish:

The polyurethane cement textured finish shall consist of a 6mm thick (min.) layer of Sikafloor-20 PurCem. All edges of the finish that do not terminate up against an element (i.e. do not terminate up against a wall, column, plinth, etc.) shall be edged with a 6mm aluminium straight edge trim (Kirk ASE060 or similar approved), installed in accordance with the specification provided at the start of this Subclause.

Type 2: Polyurethane cement smooth finish:

The polyurethane cement smooth finish shall consist of 1.5mm (min.) scratch coat of Sikafloor-21 PurCem followed by a 4.5mm thick (min.) layer of Sikafloor-21 PurCem. All edges of the finish that do not terminate up against an element (i.e. do not terminate up against a wall, column, plinth, etc.) shall be edged with a 6mm aluminium straight edge trim (Kirk ASE060 or similar approved), installed in accordance with the specification provided at the start of this Subclause.

Type 3: Polyurethane cement cove skirting:

The polyurethane cement cove skirting shall have a 25mm radius cover and be 100mm high with the top edge finished neatly at a right angle. The skirting shall be formed with Sikafloor-29 PurCem detailing mortar overcoated with 2 layers of Sikafloor-31 PurCem. The thickness of the completed cove skirting at the top and bottom edge shall match the thickness of the abutting floor finish, with the cove being thicker. The bottom of the finished cove shall tie in level with the finished floor (they shall meet without a step). Unless otherwise indicated, the interface between the top edge of the skirting and the substrate shall be neatly finished and fully sealed by applying a bead of Sikaflex Pro-3.

c) Quartz-encapsulated Resin Finish:

Unless otherwise indicated, quartz-encapsulated resin finishes for an area are to be applied after completing the Works in that area. The finished colour shall be light grey unless otherwise indicated.

Quartz-encapsulated resin finishes shall be completed in strict accordance with the manufacturer's method statements and product data sheet instructions. Although Flowcrete and Sika products are specified below, similar alternatives may be approved by the Engineer. A 10-year guarantee shall be given, in writing, on quartz-encapsulated resin finishes.

Prior to applying finishes, edges and trim shall be masked off for neatness and areas adjacent to where the coatings are to be applied shall be protected from coating splatter, tearing, etc. (areas defaced by coatings are not acceptable and will be remedied at the Contractor's cost).

Concrete expansion joints are to be extended through the resin finish and sealed with Sikaflex Pro-3. If day joints are required and unavoidable, the Contractor shall have his proposed joint locations approved by the Engineer prior to commencing with work.

Unless otherwise indicated, where quartz-encapsulated resin finishes abut other elements, where they cross over elements/interfaces and where there is a change from one finish to another, these interfaces shall be neatly finished off and fully sealed by applying a bead of Sikaflex Pro-3 at the interface (except for where cove skirting is used). For example, this would include applying a bead in corners where walls/plinths/columns meet the floor, where the finish abuts a support or other equipment, etc.

Type 1: Quartz-encapsulated resin finish:

The quartz-encapsulated resin finish shall be a 4mm thick Flowcrete Peran STB system with a power floated finish, and shall consist of various layers specified by the manufacturer including Flowprime, Scatter 3, Peran STB Slurry, STB Coloured Quartz, Peran STB Sealcoat and UV resistant Super Satin Sealer.

All edges of the finish that do not terminate up against an element (i.e. do not terminate up against a wall, column, plinth, etc.) shall be edged with a 3mm aluminium straight edge trim (Kirk ASE030 or similar approved), installed in accordance with the specification provided at the start of this Subclause.

Type 2: Quartz-encapsulated resin cove skirting:

The quartz-encapsulated resin cove skirting shall be Flowcrete Peran STB cove skirting to match the adjacent flooring system. The interface between the floor and cove shall be seamless.

The skirting shall have a 25mm radius cove and be 100mm high. The top edge shall be neatly finished with a 6mm aluminium straight edge trim (Kirk ASE060 or similar approved) as a stop end.

The skirting shall comprise of Flowtex F1 Coveing resin (natural) as a primer, followed by forming the cove with Flowtex F1 coving resin mixed with STB Coloured Quartz. The coving shall then be completed with topcoats and seal coats as recommended by the floor finish manufacturer such that the skirting matches the adjacent Flowcrete Peran STB system floor.

The thickness of the completed cove skirting shall be 7mm at the top edge and 4mm at the bottom edge, and the bottom of the skirting shall tie in level with the finished floor (they shall meet without a step). If required by the manufacturer, the concrete substrate near the bottom edge of the cove shall be cut back slightly (no more than 5mm) before constructing the cove to ensure the minimum required thickness is maintained.

Any gaps between the substrate and aluminium trim due to the substrate not having a flat surface shall be filled with an approved mortar and finished to match the finish of the wall (not to be finished to appear similar to the aluminium trim).

d) HDPE anchor-knob sheeting:

A protective lining to soffit and walls shall be manufactured from 3mm thick HDPE with anchor knobs which will be cast into concrete. The HDPE anchor-knob sheeting shall be fit-for-purpose with a proven history in the environment into which it is to be placed. The lining shall be sealed or fusion welded to be watertight at all joints in strict accordance with the manufacturer's specifications. A trial panel shall be prepared by the Contractor for Engineer's approval.

e) Calcium Aluminate Cement lining:

A Calcium Aluminate Cement lining is to be applied to the concrete surface post-cast (or to existing concrete), in strict accordance with the manufacturer's specifications. A trial panel shall be prepared by the Contractor for Engineer's approval.

5.5.22 Construction of weir crests (New Subclause 5.5.27)

Weir crests shall be constructed to the tolerances provided in 6.2.1 and finished surfaces shall have a smooth finish. Rounded/chamfered/flat weir crests shall be constructed monolithically with the final wall cast (i.e. from the below designated joint level, or approved non-designated joint level, up to top of concrete weir level). Contractor shall, prior to casting, provide a method statement for construction of each weir type for approval by the Engineer. Creating the weir profile with a cement mortar (or any other proprietary product) will not be accepted, nor will delamination of the concrete surface be accepted.

6. TOLERANCES (CLAUSE 6)

6.1 PERMISSIBLE DEVIATIONS (SUBCLAUSE 6.2)

6.1.1 General (Subclause 6.2.1)

Replace the last sentence of this Subclause with the following:

"If no degree of accuracy is specified, the following shall apply:

Degree of Accuracy I shall apply to the following structures/components of the Works, as well as further accuracy requirement where so stated:

- a) Top of weirs, including all weir crest surfaces
- b) All precast units

Degree of Accuracy II shall apply to all other structures/components of the Works, unless specified otherwise on the drawings.

Every specified permissible deviation is binding in itself. The cumulative effect of permissible deviations will not be considered. The maximum permissible vertical deviation is subject to the other permissible deviations."

6.1.2 Specified PDs (Subclause 6.2.3)

Replace Subclause 6.2.3(a)(3) with the following:

	Permissible deviation		
	Degree of accuracy		
	III	II	I
	mm	mm	mm
"Cover to reinforcement (see (e) below)	-0+10	-0+10	-0+10

"

Replace Subclause 6.2.3(d)(5) with the following:

	Permissible deviation		
	Degree of accuracy		
	III	II	I
	mm	mm	mm
"Verticality, per metre of height.....	5	3	2
subject to a maximum of	50	30	10

"

7. TESTS (CLAUSE 7)

7.1 FACILITIES AND FREQUENCY OF SAMPLING (SUBCLAUSE 7.1)

7.1.1 Facilities (Subclause 7.1.1)

Add the following:

"Site sampling methods storage shall be in accordance with SANS 5861-3:2006.

The cost of all testing, including the cost of sampling, storage and transport of samples shall be included in the rates tendered for concrete work."

7.1.2 Frequency of sampling (Subclause 7.1.2)

Add the following to Subclause 7.1.2.1:

"One sample shall consist of three concrete test cubes.

For each sample taken the position in the structure shall be recorded where the batch represented by that sample is placed.”

7.2 TESTING (SUBCLAUSE 7.2)

7.2.1 Watertightness test (New Subclause 7.2.5)

7.2.1.1 General

The Works will not be certified Practically Complete until the structures and concrete roofs have been proved by testing to be watertight to the satisfaction of the Engineer. If required by the Engineer, the structure shall be retested during and before the expiry of the Defects Liability Period.

7.2.1.2 Water-retaining structures

Watertightness testing shall be undertaken on all water-retaining structures, with each component tested independently of adjacent components. i.e. if two water-retaining components share a wall then they shall not be watertightness tested at the same time.

Any openings in the structure, including those allowed for equipment to be provided at a later stage by the Mechanical and Electrical Contractor, shall be fitted with temporary watertight closures. The closures shall be fabricated from steel plate of thickness determined by the Contractor, but with a minimum of 5 mm. The closures shall be provided with suitable seals and shall be held in place by props or anchor bolts.

Water for testing shall be provided by the Contractor and he shall be responsible for providing all necessary equipment that may be required for filling the structures. Potable water shall be used for all structures, and tendered rates are to include the supply and use of potable water.

Should earth-backfilling of the structure be required, watertightness testing shall be conducted prior to backfilling to facilitate the detection of leaks.

The structure shall be filled with water at a uniform rate not exceeding 2,0 m in 24 hours until the top water level has been reached. The top water level is stated on the drawings and if unclear, should be provided by Engineer. Structures should not be allowed to overflow/overflow. The water level will then be carefully noted and recorded by the Engineer in relation to a fixed bench-mark, and shall be maintained by the addition of further water for a stabilizing period to permit complete absorption of water by the concrete.

The stabilizing period should be 21 days. After the stabilizing period, the level of the liquid surface shall be recorded at 24 hour intervals for a test period of 7 days. During this 7-day test period the total permissible drop in level, after allowing for evaporation, shall not exceed 1/500 the of the average water depth of the full tank, or 10 mm, whichever is less.

The evaporation shall be measured by the mean drop in level caused by the evaporation of the water in three flat containers floating in the water being recorded.

In the event of appreciable leakage being evident at any stage of the filling or testing or in the event of the Engineer considering the final degree of watertightness to be unsatisfactory, the Contractor when ordered by the Engineer shall discontinue such filling or testing and shall, at his own expense, take approved steps immediately to rectify the leakage, until a satisfactory test is obtained, which shall prove to the Engineer that a sufficient degree of watertightness has been obtained. The costs of retesting the structure for watertightness shall be borne by the Contractor.

The Contractor shall empty the structure once the structure has passed the watertightness test. On successful completion of the watertightness test, the Contractor shall remove the temporary watertight closures, along with any anchor bolts, and shall grout the holes allowed for the anchor bolts with a non-shrink grout approved by the Engineer.

The costs of emptying a water-retaining structure which cannot be drained shall be borne by the Contractor. The water shall be discharged in a manner approved by the Engineer and shall be such that the employer can utilize the water if he so desires. The water shall not be used as a medium for additives to effect remedial work or to stop leaks.

7.2.1.3 Concrete roofs

All concrete roofs (whether receiving a waterproof finish or constructed from watertight concrete) shall be watertightness tested. Testing shall be done after applying the waterproof finish (if applicable) by ponding the roof with at least 25mm of water for 24 hours. For domed or sloped slabs where ponding is not practical, each section of the roof shall be continuously hosed or irrigated using a sprinkler system whereby every part of the

rooftop remains drenched for 24 hours. The slab or roof will be considered satisfactory if no leaks or damp patches are visible from the underside during or following the tests.

7.2.2 Grouting tests (New Subclause 7.2.6)

The Contractor shall, where so ordered, carry out a site test for each grouting procedure and each grouting gang to be used. The tests shall be carried out on a dummy bedplate similar in configuration to that which is to be grouted, but not exceeding 1 m² in area unless otherwise ordered. When the dummy bedplate is dismantled, the underside shall show a minimum grout contact area of 80% with reasonably even distribution of the grout over the surface grouted except that, in the case of expanding grout, the minimum grout contact area shall be 95%. The test shall show evidence of good workmanship and materials and the results shall be to the satisfaction of the Engineer.

The Contractor shall, when so ordered, make standard test cubes from various grout mixtures and also subject them to compression tests to determine whether the specified strength has been achieved. Test procedures shall comply with the relevant requirements of 7.2.1 to 7.2.3.

7.3 ACCEPTANCE CRITERIA FOR STRENGTH CONCRETE (SUBCLAUSE 7.3)

Add the following:

"Test results obtained from the supplier of ready-mixed concrete will not be accepted for evaluation in terms of 7.3, but samples for testing shall be taken of such concrete at the point of placing."

8. MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 MEASUREMENT AND RATES (SUBCLAUSE 8.1)

8.1.1 Formwork (Subclause 8.1.1)

Delete "and of fillets or splays over 20 mm x 20 mm" from the first line of Subclause 8.1.1.2.

Add the following to Subclause 8.1.1.2:

"Splays, chamfers and fillets up to and including 40 mm x 40 mm will not be measured separately and will be deemed to be included in the formwork costs."

Add the following to the end of Subclause 8.1.1.3:

"f) For back shuttering or formwork to top of revealed sloping or conical surfaces which will only be measured to surfaces of 35° and up to 80° to the horizontal."

Add the following to the end of Subclause 8.1.1:

"8.1.1.7 For construction joints at kickers (in accordance with 5.5.7), all additional costs for formwork to edges up to 300mm (vertical kickers) will be deemed to be included in the rates tendered for vertical formwork to sides of walls and will not be measured separately in narrow widths.

8.1.1.8 No formwork will be measured to edges of blinding layers and no-fines concrete under structures and the cost thereof (if needed) will be deemed to be included in the rates tendered for concrete in blinding layers or no-fines concrete as applicable.

8.1.1.9 Formwork to horizontal surfaces in enclosed structures/chambers such as valve chambers, manholes or sumps shall either be removed through the manhole cover opening or the contractor may use permanent formwork at his own cost as no claims in this regard will be considered.

8.1.1.10 Larger splays, chamfers or fillets over 40mm will be measured by length in accordance with 8.2.5"

8.1.2 Reinforcement (Subclause 8.1.2)

Replace the contents of this Subclause 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 kilogram of fabric reinforcement in place, and the quantity, in kilograms, shall be calculated from the net area covered by the mesh, excluding overlaps.

The tendered rate shall include full compensation for the supply, delivery, cutting, bending, welding, placing and fixing of the steel reinforcement, including all tying wire, stools, supports and waste."

8.1.3 Concrete (Subclause 8.1.3)

Delete ", or the plan size of the excavation where additional excavation is provided to facilitate erection of forms" from Subclause 8.1.3.1(c).

Add the words "(including requirements for trial mixes)" after the words "design of the mix" in line 1 of Subclause 8.1.3.3.a).

Delete the words "(made with ordinary Portland cement unless otherwise scheduled)" in line 2 of Subclause 8.1.3.3.a).

Add the words ", non-designated joints" after the words "stop-ends" in line 3 of Subclause 8.1.3.3.a).

Add the following to the end of Subclause 8.1.3.3:

" e) The rates for concrete shall also cover other concrete-related requirements specified but which are not scheduled separately."

8.2 SCHEDULED REINFORCEMENT ITEMS (SUBCLAUSE 8.3)

8.2.1 High-Tensile Welded Mesh (Subclause 8.3.2)

Replace "Unit: m²" with "Unit: kg"

8.3 SCHEDULED CONCRETE ITEMS (SUBCLAUSE 8.4)

8.3.1 Strength concrete, grade (Subclause 8.4.3)

Replace the contents of this Subclause with the following:

"The grade and positions or elements in the Works will be stated. The type of cement and blended extender (if applicable) shall be as specified herein, or on drawings or Bill of Quantities

In the case of structural floor screeds, the unit of measurement shall be the square metre and the average thickness and proportions will be stated."

8.3.2 Unformed surface finishes (Subclause 8.4.4)

Replace "Unit: m²" with "Unit: m² or m"

8.4 JOINTS (SUBCLAUSE 8.5)

Add the following:

"Only designated joints as shown on the drawings will be measured for payment according to the length or square meter of each type of joint constructed (see 2.4.3). The rate shall cover the cost of all materials, labour and plant required to construct each type of joint scheduled, complete as specified on the drawings, and shall further include for the cost of all shuttering, preparation of concrete (as specified in 5.5.7), etc..

Non-designated joints (2.4.3) shall not be paid for separately and shall be assumed to be included in the various rates for concrete, reinforcing and formwork (this includes preparation of concrete to form construction joints in flume walls, as specified in the drawings)."

8.5 GROUTING (SUBCLAUSE 8.7)

Replace the last sentence of Subclause 8.7 with the following:

The rate shall further include all formwork necessary to complete the work.

Add the following to Subclause 8.7 (a):

"Grouting in of equipment (such as base plates for machines) provided by the Contractor or by the Mechanical and Electrical Contractor will be measured by the volume of grout used.

The rate shall cover the cost of meeting the requirements of 5.5.19, and the supply and floating in of grout under the plates to ensure solid and complete filling of the gap."

Replace Subclause 8.7(b) and it's heading with the following:

"b) HD bolts Unit: No.

Separate items will be scheduled for different diameters, lengths, and types. The quantity measured will be the number of bolts grouted in. No deduction will be made for bolts and packers protruding into the grout space."

Add the following to the end of Subclause 8.7:

"c) Grouting around pipes, etc......Unit: m³

If so scheduled, grouting around pipes and other mechanical equipment in boxouts or voids in concrete members will be measured by the volume of grout necessary to fill the voids and pockets between the outside surface of the pipe or mechanical equipment and the surface of the concrete wall/slab. The rate shall cover the cost of meeting the requirements of 5.5.16(c) and shall include all formwork necessary to complete the work. Grouting shall be watertight."

8.6 HD BOLTS AND MISCELLANEOUS METAL WORK (SUBCLAUSE 8.8)

Replace Subclause 8.8 and its heading with the following:

"8.8 HD bolts (cast in and/or supply)Unit: t or No.

a) Supply and casting in of HD bolts. The rate shall cover the cost of supplying, delivering and casting into concrete HD bolts as specified, and all cleaning, preparation, and finishing. The rate shall also cover the cost of meeting the requirements of 5.5.23, and all items and operations necessary to ensure that the bolts are effectively and rigidly held in position during casting, complete with sleeved pockets, all as detailed on the drawings.

b) Casting in of HD bolts. The rate shall cover the cost of taking delivery of HD bolts supplied by others, casting into concrete as specified, and all cleaning, preparation, and finishing. The rate shall also cover the cost of meeting the requirements of 5.5.23, and all items and operations necessary to ensure that the bolts are effectively and rigidly held in position during casting, complete with sleeved pockets, all as detailed on the drawings.

HD bolts that are already included in other rates (such as SANS 1200 H Subclause 8.3.1), will not also be measured here."

8.7 IMPERVIOUS DPC MEMBRANE UNDER CONCRETE SLABS (NEW SUBCLAUSE 8.9)

The impervious DPC membrane under concrete slabs (375 micron unless specified otherwise on the drawings or in the Bill of Quantities) consisting of DPC/DPM/PVC sheets as indicated on the drawings will be measured by the surface area covered (laps and wastage are not measured). The rate shall cover the cost of the supply, laying, jointing of sheets as recommended by the supplier and final trimming of outer edges.

8.8 NO-FINES CONCRETE (NEW SUBCLAUSE 8.10)

No-fines concrete will be measured by area (unit of measurement shall be square meter) to the thickness as shown on the drawings or as scheduled. The provisions of Subclause 8.1.3 of SANS 1200 G shall apply *mutatis mutandis* and the rate shall include for the geotextile bidim, and steel-floated 20 mm mortar skim complete.

8.9 SPECIALIST CRYSTALLIZING ADDITIVES TO CONCRETE (NEW SUBCLAUSE 8.11)

The unit of measurement shall be the cubic meter (extra-over) of concrete for the addition of a concrete crystallising waterproofing additive (Xypex C500NF or similar approved) to exact manufactures specifications.

8.10 GRANOLITHIC SCREEDING (NEW SUBCLAUSE 8.12)

Granolithic screeding will be measured as the square metre of screeds constructed (in plan view) to the average thickness as specified. The unit rate shall cover the cost of all materials, labour and equipment for the supply and application of the specified material, complete as specified in 5.5.25. Where a screed to fall is specified, the average thickness shall be stated. Repairs to unsatisfactory work will not be paid for. The rate shall also include the required float finish.

8.11 CASTING ITEMS IN CONCRETE (NEW SUBCLAUSE 8.13)

Casting items in concrete members (where so scheduled separately) will be measured by number for each type or range of items. The rate shall cover all costs related to fixing in position, formwork and casting in the item, including meeting the requirements of 5.5.16(b), 5.5.16(c) and 5.4. Where not scheduled separately, the rate for the applicable item shall include casting the item in concrete.

If the Contractor chooses (subject to the Engineer's approval) to box out a hole and cast the item in subsequently, instead of casting the item into the concrete member simultaneously to casting of the concrete member, this rate shall also cover these activities and the requirements of 5.5.16(a).

8.12 CREATING BOXOUTS IN CONCRETE FOR OTHERS TO CAST ITEMS IN (NEW SUBCLAUSE 8.14)

Box-outs created in accordance with 5.5.16(a) for items to be cast in concrete by others will be measured by number separately for each type of item or range of items.

The rate shall cover the cost of creating the box-out, maintaining continuous reinforcing, removing all formwork and boxing remaining in the holes, and thoroughly scabbling the sides of the holes so as to obtain a satisfactory bond surface for the new concrete, as described in 5.5.16(a). As this rate already includes for creating box-outs, no additional payment will be made under 8.2.6.

8.13 PRECAST PAVING SLABS (NEW SUBCLAUSE 8.15)

Precast paving slabs will be measured by the area paved.

The rate shall cover the cost of compacting the area, application of weed-killer, supplying, laying and bedding the slabs, grouting the joints and filling any gaps, all as specified.

8.14 MISCELLANEOUS/MINOR REINFORCED CONCRETE/BRICK STRUCTURES (NEW SUBCLAUSE 8.16)

Where minor reinforced concrete and brick structures have been scheduled in the Bill of Quantities, the sum tendered for each item shall cover the cost of all material (including handrailing, banded grating, flooring, ladders where applicable, weir plates and handstops), plant and labour involved in constructing the said item (including 0,12 t of high tensile steel per m³ of concrete where the amount of reinforcement is not indicated on the drawings) according to the drawings and relevant specifications. Unless otherwise stated in the Bill of Quantities, the sum tendered shall also cover the cost of all excavation and backfilling, and if applicable, watertightness testing.

8.15 BREAKING INTO AND BUILDING ON TO EXISTING STRUCTURES (NEW SUBCLAUSE 8.17)

Where it is necessary for the Contractor to break into and/or build into or onto an existing structure, such an activity shall be measured and paid by the sum.

The sums tendered shall cover the cost of dealing with the water (and/or any other contents) in the existing structure (where applicable), breaking away existing concrete, penetration of exposed concrete surfaces, supply and application of a wet to dry epoxy, liaison with the Engineer and the Employer to facilitate the work as specified and all materials or activities not measured elsewhere to complete the construction as specified including joining materials, supply and epoxying in of dowel bars etc.

Where it is required to break into existing structures in order to build in new pipes, the rate tendered shall cover the cost of ensuring that a watertight seal is achieved.

8.16 EMPTYING OF EXISTING STRUCTURES (NEW SUBCLAUSE 8.18)

The unit of measurement shall be the cubic meter of water/sludge/sand/grit removed, as well as any applicable transport and disposal costs. The following broad categories will be specified:

- (a) Pumping of water/sludge to adjacent or nearby structure/location as instructed as specified.
- (b) Manual removal of sludge/sand/grit to specified location.

For (b) above, "manual" implies removal by hand unless otherwise specified. If the location is specified off-site in the Bill of Quantities or by the Engineer, then the rate supplied by the Contractor will include haulage and any disposal permit costs. Hazardous waste needs to be disposed of appropriately at an appropriate disposal facility.

8.17 CLEANING OF EXISTING STRUCTURES (NEW SUBCLAUSE 8.19)

The unit of measurement shall be the square meter of surface to be cleaned. The minimum pressure rating of the water-jet (if applicable) will be stated in the Bill of Quantities. The surface must be accepted by the Engineer as cleaned of any dirt, grease, stains and other contaminants to an acceptable standard.

8.18 DOWELS (NEW SUBCLAUSE 8.20)

Separate items will be scheduled for each reinforcing diameter.

The unit of measurement shall be the number of dowels installed with a suitable epoxy anchor grout designed for reinforcing bars (Fischer FIS EM Injection Mortar, Sika Anchorfix II, Hilti HIT-RE 500, or similar approved) to exact manufacturer's specifications to a minimum embedment depth as indicated below:

Size	Minimum Embedment Depth (mm)
R/Y10	150
R/Y12	150
R/Y16	200
Y20	300
Y25	400

Where dowels are required, the holes are to be drilled with a masonry/percussion drill-bit not capable of cutting through reinforcing.

The tendered rate shall include full compensation for drilling to the required depths (including any costs associated with avoiding reinforcing in the base member and filling of unused holes with an approved mortar), supplying the epoxy anchor grout and installation of the dowels in the epoxy anchor-grout. The reinforcing bars shall be measured as per 8.1.2.

8.19 WATERTIGHTNESS TESTING (NEW SUBCLAUSE 8.21)

Watertightness tests shall be paid by a lump sum separately for each structure, or by number for components of structures successfully passing the test as scheduled. The sum or number shall cover the cost of all water, labour, equipment and materials to carry out the tests, as specified in 7.2.5, including all that is required for the installation of temporary watertight closures and associated props/anchors for openings. It shall also include the rectifying of faults and re-testing to achieve a test result to the satisfaction of the Engineer. No extra payment will be made for re-testing during the Defects Liability Period if leaks in the structure have been observed, thus leading to the Engineer's instruction to undertake the re-testing.

8.20 STERILIZATION OF WATER RETAINING STRUCTURES (NEW SUBCLAUSE 8.22)

The tendered sum shall include full compensation for sterilizing the structure as specified.

8.21 CONCRETE PROTECTION AND PROPRIETARY FLOOR FINISHES (NEW SUBCLAUSE 8.23)

The unit of measurement shall be the square metre of finish required, but with skirting measured per meter (see 5.5.26 for finishes). Separate items will be scheduled for each type of finish required. The tendered rates shall include full compensation for all labour, plant, equipment, material, transport, etc., substrate preparation and providing and installing all products necessary to complete the concrete protection/finish, inclusive of trim (e.g. aluminium edging), grooves, joints and sealing of interfaces.

Steel or timber skirting (excluding trim which is included in the rate for the finish) shall be measured and paid for elsewhere (steel skirting under SANS 1200 H and timber skirting under Specification PD).

8.22 PREPARATION OF BASE CONCRETE TO RECEIVE BENCHING (NEW SUBCLAUSE 8.24)

The unit of measurement shall be the square metre of base concrete to be prepared for receiving benching. The rate shall cover chipping/scabbling the base concrete to remove all laitance and expose the aggregate over 100% of the area to be benched using mechanized plant such as scabblers or abrasive blasters. The rate shall further include cleaning the surface from all dust and debris by scrubbing and/or high pressure wash, followed by soaking the surface with water for at least 24 hours.

8.23 APPLICATION OF AN EXPANSION/MOVEMENT JOINT BRIDGING FLEXIBLE WATERSTOP (NEW SUBCLAUSE 8.25)

Joint bridging flexible waterstops specified on the joint detail drawings (for example 'Joint W') are deemed to be included in the rate for joints (see 8.5) and shall not be measured here also.

The unit of measurement shall be the meter running length of proprietary product applied. The tendered rates shall include full compensation for:

Application of a 200mm wide Sika CombiFlex SG-10M (or similar approved), including all preparation and epoxy adhesive, joints, etc., by a supplier-approved applicator between concrete edges to provide a watertight seal to the exact manufacturer's specifications.

8.24 SWELLABLE WATERSTOP (NEW SUBCLAUSE 8.26)

Swellable waterstops specified on the joint detail drawings (for example 'Joint V') are deemed to be included in the rate for joints (see 8.5) and shall not be measured here also.

The unit of measurement shall be the meter running length of proprietary product applied. The tendered rate shall include full compensation for:

Application of SikaSwell S-2 sealant + P 2507H profile, or Xypex Kuniseal (or other similar approved products) by a supplier-approved applicator, including substrate preparation to provide a watertight seal to the exact manufacturer's specifications.

8.25 SHEAR LOAD CONNECTORS (NEW SUBCLAUSE 8.27)

Where shear load connectors have been scheduled in the Bill of Quantities, they will be measured in the unit scheduled.

The sum or rate for such item shall cover the cost of all materials, labour and plant required to execute and complete the work as specified, described in the Bill of Quantities or shown on the drawing(s).

8.26 MISCELLANEOUS WORK (NEW SUBCLAUSE 8.28)

Separate items will be scheduled for each type of miscellaneous work as described in the Bill of Quantities and shown on the drawings (with drawing number stated). The unit of measurement shall be as scheduled in the Bill of Quantities. The tendered rates shall include full compensation for providing all labour, plant, materials, equipment and transportation etc. required to carry out the work, for all proprietary work, for preparation and construction of the work scheduled in a workmanlike manner and for finishing-off and cleaning up when the work has been completed.

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1 SCOPE (CLAUSE 1)

No amendments.

2 INTERPRETATIONS (CLAUSE 2)

2.1 DEFINITIONS AND ABBREVIATION (SUBCLAUSE 2.3)

Add the following abbreviations to the end of this Subclause:

“HDG. Hot dip galvanized or hot dip galvanizing (steel), as applicable

SS. Stainless Steel

“Covered open grid flooring” and “covered grating” shall be taken to mean open grid flooring with a permanently attached solid top steel cover of the same material and finish as the grid flooring. Figure 2.3a illustrates covered open grid flooring (unbanded).

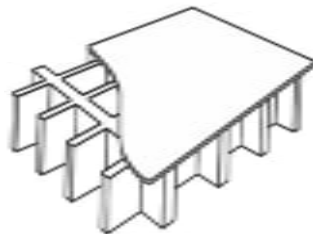


Figure 2.3a: An example of covered open grid flooring (unbanded), cover partially removed for illustration.“

3 MATERIALS (CLAUSE 3)

3.1 STRUCTURAL STEEL (SUBCLAUSE 3.1)

Add the following after the first sentence of Subclause 3.1.1:

“Steel shall be Grade S355JR for hot rolled steel sections. All members shall carry the Grade S355JR steel symbol to identify steel grade prior to manufacturing. Mill test certificates to be provided to the Engineer for all structural steel, prior to manufacture. Where stainless steel is specified, the grade of stainless steel shall be Grade 316L unless otherwise stated.”

3.2 BOLTS, NUTS AND WASHERS (SUBCLAUSE 3.6)

3.2.1 Bolts and nuts (other than friction-grip) (Subclause 3.6.1)

Add the following:

“All fasteners (i.e. bolts, nuts, washers, etc.) in the following categories shall be manufactured from Grade 316L stainless steel and shall have a nickel-based anti-seize compound applied along the full length of fastener threads before the nut is applied:

- Those within water-retaining structures, water-excluding structures or exposed to the rain
- Those with a diameter of 12 mm or less
- Those of any size used in conjunction with stainless steel items,
- All anchor fasteners of any size in concrete or brickwork, unless otherwise specified.

All other bolts, nuts and washers, not listed in the categories above, shall be hot-dip galvanized (HDG) to SANS 121, unless otherwise specified. HDG nuts shall be tapped before galvanizing, taking into consideration the extra clearance necessary to allow for the thickness of galvanizing on the bolts. If, after installation, there is any indication that galvanising has been stripped from either the nut or the bolt, both nut and bolt shall be removed and replaced.

All bolts for structural steel shall be Class 8.8 bolts, unless otherwise specified."

4 PLANT (CLAUSE 4)

No amendments.

5 CONSTRUCTION (CLAUSE 5)

5.1 DRAWINGS AND SHOP DETAILS (SUBCLAUSE 5.1)

5.1.1 Design drawings (Subclause 5.1.1)

Add the following:

"The Contractor shall be solely responsible for the final verification of all steelwork dimensions (including confirmation of all relevant dimensions on site) before preparing his shop drawings and manufacturing any steelwork components."

5.1.2 Contractor provides shop details (Subclause 5.1.2)

Add the following:

"The Contractor shall be responsible for the preparation, in accordance with SANS 10162:2011, of shop drawings and/or details, drawn using Tekla or similar approved software. The drawings (including all applicable .IFC and .TBP files) shall be submitted for approval at least two weeks prior to commencement of fabrication. The Engineer will check the drawings for conformity with design requirements and will return the drawings with additions and corrections, if any, within ten working days of having received them. Detailed checking of shop details for dimensional accuracy and installation fit, will not be done by the Engineer."

5.2 FABRICATION (SUBCLAUSE 5.2)

5.2.1 General (Subclause 5.2.1)

Add the following to the beginning of this Subclause:

"Before commencing with any manufacturing or construction of structural steelwork, the Contractor shall confirm all relevant dimensions on site. Any discrepancies should be brought to the attention of the Engineer immediately."

Add the following to the end of this Subclause:

"The main structural members shall be single full length."

5.2.2 Cutting (Subclause 5.2.3)

Add the following to the end of this Subclause:

"The edges of flame-cut plates shall be ground off and smoothed."

5.2.3 Holes for fasteners (Subclause 5.2.4)

Replace the contents of Subclause 5.2.4.2 with the following:

"Holes for fasteners shall be drilled."

Replace the contents of Subclause 5.2.4.5 with the following:

"Punching of holes shall only be permitted with the written approval of the Engineer."

5.2.4 Welding in fabrication (New Subclause 5.2.7)

All welders shall be coded welders.

Welding procedures and welder's performance qualifications shall conform to the requirements of AWS D1.1 (and/or SANS 15614-1). These documents/certificates must be submitted in writing to the Engineer and approved prior to the start of welding. Welding certificates are only valid for a period of 12 months. The

Contractor shall also submit, for review, an outline of the Quality Control measures that will be enforced by the Contractor to ensure that specified welding procedures are adhered to.

All welds shall be 6 mm or larger continuous fillet welds, unless otherwise specified or agreed by the Engineer.

Welds shall be continuous on all sides of any joint. Welds which are only accessible from one side shall be prepared so that the root run provides an acceptable profile and prevents the formation of crevices. Crevices shall not be accepted.

No staggered or intermittent welding is permitted. Approved splicing of members will be subject to non-destructive testing. In addition, the Engineer may at his discretion identify any welds for non-destructive testing. The cost of testing shall be borne by the Contractor.

No welding on site is permitted unless approved by the Engineer. Any site welder and site welding procedure will have to be re-qualified for site welding.

5.3 ASSEMBLY (SUBCLAUSE 5.3)

5.3.1 Welding (Subclause 5.3.4)

Add the following to the end of the first sentence:

“The requirements of 5.2.7 shall apply.”

5.3.2 Protective treatment (Subclause 5.3.9)

Replace the contents of this Subclause with the following:

“Corrosion protection for all structural steelwork shall be done in accordance with SANS 1200 HC.”

5.4 ERECTION (SUBCLAUSE 5.5)

5.4.1 Anchor holes (New Subclause 5.5.6)

Drill bits used for creating anchor holes in concrete shall be incapable of cutting through reinforcing steel. The Contractor shall be responsible for accommodating the actual reinforcing positioning and avoiding reinforcing when drilling anchor holes. Any unused or discarded holes shall be cleaned and filled completely with the same chemical anchor mortar approved for chemically anchoring the fasteners, unless an alternative product is approved. No additional payment shall be made for accommodating the reinforcing, including creating additional holes to achieve the required hole depths, filling unused holes, etc., which shall be included in the tendered price for steel items.

Anchor holes shall be prepared in strict accordance with the relevant chemical mortar/adhesive manufacturer's instructions. This typically includes allowing the substrate to cure beyond 28 days (as applicable), ensuring that the substrate is sound and moisture content below the maximum allowed, clean, free from contaminants such as dirt, oil, grease, rust, coatings, etc.

After creating and preparing the anchor holes but before anchoring the applicable fasteners, reinforcing or other objects (as applicable), the Contractor shall make provision for the Engineer to inspect the hole depth and preparation. Anchoring shall only take place after receiving the Engineer's approval and after the Contractor's representative overseeing the anchoring has demonstrated to the Engineer that the chemical mortar/adhesive manufacturer's installation method is well understood and can be applied consistently.

5.5 GROUTING OF SUPPORTS (SUBCLAUSE 5.6)

5.5.1 Holding-down bolts and grouting supports (New Subclause 5.6.5)

The Contractor shall supply detailed layouts of holding-down (HD) bolts, as well as a suitable steel template of each type of HD bolt layout which can be used to accurately position the bolts.

5.6 SUNDRY ITEMS (SUBCLAUSE 5.7)

5.6.1 Handrails (Subclause 5.7.1)

Replace the contents of this Subclause with the following:

"Handrails"

- 5.7.1.1 The terms "handrailing", "handrails" and "guard rails" shall all be synonymous. Handrails shall be of the type and shall be purpose made in the style and shapes given in the project specification and indicated on the drawings. Steel tubing shall comply with SABS 657: Part 1. The Contractor shall ensure, by making in-situ measurements before manufacture is started, that the handrails suit the situation in which they are to be installed. Handrails shall have a vertical height of at least 1 000 mm, measured from the top of the hand rail to the finished floor or surface. Where handrails terminate up against a wall or other barrier, the gap between the stanchion or closure bend (as applicable) and the barrier shall be less than 100 mm, unless the rails are fixed directly to the barrier (removable handrailing may not be fixed directly to the barrier).

Handrailing shall be supplied by one manufacturer and in one fully integrated style, complete with all the necessary fasteners, connections, corrosion protection, coatings, etc. Handrailing shall, unless otherwise annotated on drawings, be continuous, uninterrupted at changes in direction or angle, i.e. rails shall not terminate and restart at changes in direction or angle but be continuously connected and joined with bends and stanchions formed to suit the changes.

Notwithstanding the above, at the interface between fixed and removable handrailing, rails and kickplates (if applicable) shall be discontinuous, with rails and kickplates ending at stanchions (rather than rails ending with closer bends/returns) and the required c/c spacing for these interfacing stanchions shall be 135 mm.

Typically, the handrailing illustrated on drawings for each structure is exclusively for providing a high-level indication of where handrailing is necessary and for annotating (if applicable) the type required. The detailed handrailing requirements to be followed are provided on the general "Handrailing Details" drawing and in these specifications.

- 5.7.1.2 Unless otherwise indicated on the drawings or in the Bill of Quantities, the complete handrailing system (rails, stanchions, base plates, bends, kickplates, etc.) but excluding fasteners (which are specified elsewhere) shall be of stainless steel grade 304 material. The completed handrailing shall be of neat and workmanlike appearance, solidly and evenly supported, fastened in place, secure and tight under loading, true to line, level and plumb. Any gaps between stanchion base plates (stanchion feet) and concrete or brick surfaces shall be filled with non-shrink cementitious grout prior to final tightening of nuts. Where stanchion base plates are to be attached directly to metallic surfaces, Denso tape (or equivalent approved) shall be fitted under the stanchion feet to prevent direct contact.

Unless otherwise indicated, stanchions shall be top mounted (base mounted), suit the arrangement requirements and be of welded construction. Stanchions which are hollow shall be self-draining. When anchoring top mounted, removable, peg mounted or angle mounted stanchions, they shall (unless otherwise indicated) be installed with their centre line 100 mm from the edge of a slab or wall and centred atop beams. No stanchion shall be mounted with its centre closer than 300 mm to a concrete or brickwork joint.

All handrailing joints, excluding kickplate joints as they are to be bolted, shall be fully welded and smoothly finished without shoulders. Handrailing shall be free from sharp corners, edges and projections which may injure persons or damage clothing. Edges shall be rounded to a radius of at least 2 mm.

- 5.7.1.3 Handrail stanchion spheres (balls) shall be preformed with orientation to suit the situation in and the angle at which they will be installed. Incorrectly orientated stanchion spheres will not be

accepted. Stanchions shall be spaced at no greater than 1 200 mm centres for horizontal handrails and 1 000 mm centres for sloping handrails, unless otherwise indicated on the drawings. Stanchions for a particular run shall be evenly spaced after first positioning those required at ends and bends.

Railings shall be ended off with positively fixed closure bends/returns or by fixing directly to a wall or other barrier if appropriate and approved by the Engineer. At corners, short radius bends with stanchions on both ends shall be employed or, alternatively, stanchions specifically manufactured for such a position shall be employed.

- 5.7.1.4 At certain positions where it shall be necessary to have infrequent access to parts of the works which shall normally be equipped with handrails, the Engineer may instruct that handrails over these short sections be omitted in favour of self-closing handrailing gates or guard chains secured with eye bolts and carbine hooks. The eye bolts shall be fastened tightly to the stanchions and shall not rotate while in use.

- 5.7.1.5 Where kickplates are required, these shall be of the same material and receive the same coatings as the handrails (unless otherwise indicated) and provided along the full length of the handrailing system. Kickplates shall be at least 150 mm high unless otherwise indicated and fastened securely to the handrailing with M12 U-bolt fasteners. The top corners of kickplates shall be rounded to $r=16$ mm.

For horizontal top mounted, removable and peg mounted handrailing, the kickplate shall be installed on the outside face of the handrailing (face furthest from the walkway centre). For horizontal side mounted handrailing, the kickplate shall be installed on the inside face of the handrailing.

At corners, kickplates shall be bent neatly to suit the angle of the corner. Where kickplates meet, they shall overlap by 100 mm, separated by a 150 x 100 x 1.5 mm stiff solid neoprene (or similar approved) rubber strip and fastened together with 2 x M12 fasteners. These fasteners shall be orientated such that the bolt head ends of the fasteners point towards the centre of the walkway and ends with exposed threads point away from the walkway centre.

- 5.7.1.6 Should HDG handrailing be specified, the galvanizing shall be done in accordance with SANS 121 and SANS 10064, and all fabrication, sizing, modifying, drilling, cutting, welding and machining shall be carried out prior to HDG. Items modified after HDG shall be returned to the galvaniser for stripping of the zinc coating and re-galvanising. Other corrosion protection systems or coatings specified shall comply with the general corrosion protection specification provided with the contract document.

- 5.7.1.7 All fasteners associated with handrailing shall be of stainless steel grade 316. Fastener threads shall project (once tightened) above the nut by at least 1 but no more than 4 threads and the exposed fastener ends shall be free of sharp edges. The diameter of anchor fasteners shall not be less than M16 and other fasteners not less than M12 unless otherwise indicated. Washers shall be provided under the bolt head (as applicable) and nut.

Anchor fasteners for anchoring handrailing to concrete or brickwork shall be chemically anchored to the substrate with anchor depth of 140 mm using Sika Anchorfix-2+ or Hilti HIT-RE 500 (or equivalent approved). Anchor fasteners shall be delivered to Site in the correct lengths and already deburred, pickled and passivated, and no cutting of these fasteners will be permitted on Site. Holes shall be drilled to correct depths and cleaned in accordance with the anchor adhesive manufacturer's instructions. The Contractor shall have all holes inspected by the Engineer after completing preparations but before installing the adhesive and fasteners. Fasteners shall be tested in accordance with the requirements listed under Clause 7.

- 5.7.1.8 Unless otherwise indicated on the drawings or in the Bill of Quantities, handrailing for public spaces shall also comply with the requirements above with the exception of those indicated in 5.7.1.3, 5.7.1.4 and 5.7.1.5. In addition, handrailing for public spaces shall comply with the requirements of SANS 10104 and no opening in handrailing installed in public places shall allow the passage of a

ball of 100 mm diameter.

5.6.2 Ladders (Subclause 5.7.2)

Replace the contents of this Subclause with the following:

“Ladders:

5.7.2.1 Ladders shall be manufactured in accordance with the details and general arrangements shown on the drawings. Before commencing with any manufacturing or construction, the Contractor shall confirm and accommodate the actual dimensions and details measured on Site which may differ from those provided on drawings. Unless otherwise indicated, ladders and related ancillaries (threshold plates, grab bars, etc.) but excluding fasteners, shall be of stainless steel grade 304 material. Fasteners shall be of stainless steel grade 316 regardless of the ladder material specified.

5.7.2.2 All members shall be of solid structural sections (e.g. flat bar). Hollow sections are not acceptable for any part of the ladder.

All rungs in a flight shall be uniformly spaced at 250 mm centres (unless otherwise indicated) after positioning the rung nearest the upper platform (or threshold platform, as applicable) in the position shown on the drawings. A minimum clear space of 230 mm shall be provided behind the rungs, unless otherwise indicated on the drawings.

Anchoring supports (mounting brackets) shall be uniformly spaced at a distance not exceeding 2m. When mounted to concrete or brickwork, the gap between anchoring supports and the substrate to which they affix shall be no greater than 15 mm, and any gaps between them shall be filled with flowable non-shrink cementitious grout after the supports have been secured in place prior to final tightening of the nuts. Where ladders are mounted to steel surfaces, no gap shall be left between the surface and the anchoring support, and Denso Tape or approved equivalent shall be fitted under the anchoring support feet to completely seal the crevices between the two metallic surfaces.

Where the strings (also referred to as stringers) extend above an upper landing, they shall complement any handrailing at this level. Ladder-to-handrailing connections shall be bolted.

Generally, and unless otherwise indicated on drawings or in the BOQ, ladders of height greater than 5 m and up to 10 m shall be provided with cages. No part of the cage shall be more than 700 mm away from the plane of the rungs.

5.7.2.3 All joints shall be fully welded (leaving no crevices) and smoothly finished without shoulders. Ladders shall be free from sharp corners, edges and projections which may injure persons or damage clothing. Edges shall be rounded to a radius of at least 2 mm. Sharp edges, pits, inclusions, weld spatter, undercuts, indentations and other surface defects are not acceptable. Stainless steel ladders shall be pickled and passivated prior to installation.

If HDG ladders are specified, they shall be hot-dip galvanised after all fabrication has been completed. The unit shall be blasted and re-galvanised if it is welded, drilled or ground after galvanizing or if the zinc layer is damaged.

5.7.2.4 If a ladder as a single unit is excessively long, for ease of handling and transporting, the ladder may (at the discretion of the engineer) be divided into practical portable lengths and reassembled on Site. Should the ladder be divided, jointing fishplates will be required (500 x 65 x 10 for the stringer joints and 500 x 45 x 8 for caging joint) and shall be located on the outside of the ladder user area with 6 No M12 countersunk bolts on the inside of the same area (3 No equally spaced on both sides of the joint). Any costs for dividing the ladder shall not be paid for separately, but shall be taken to be included in the rate tendered for the ladder.

5.7.2.5 The Contractor shall make arrangements for the Engineer to inspect the fabricated ladders for compliance prior to installation. Only ladders that comply shall be installed.

5.7.2.6 Ladders shall be supplied complete with all the necessary fasteners, etc. for fixing. All fasteners

associated with ladders shall be of stainless steel grade 316. Fastener threads shall project (once tightened) above the nut by at least 1 but no more than 4 thread and the exposed fastener end shall be free of sharp edges. Unless otherwise indicated, the diameter of anchor fasteners shall not be less than M16 and other fasteners not less than M12. Washers shall be provided under bolt heads (as applicable) and nuts.

Unless otherwise indicated, fasteners for anchoring the ladder and ancillaries to concrete or brickwork shall be chemically anchored to the substrate with an anchor depth of 140 mm using Sika Anchorfix-2+ or Hilti HIT-RE 500 (or equivalent approved). Anchor fasteners shall be delivered to Site in the correct lengths and already deburred, pickled and passivated (as no cutting of these fasteners will be permitted on site). Holes shall be drilled to correct depths and cleaned in accordance with the anchor adhesive manufacturer's instructions. The Contractor shall have all holes inspected by the Engineer after completing preparations but before installing the adhesive and fasteners. Fasteners shall be tested in accordance with the requirements listed under Clause 7.

5.6.3 Open grid floors (Subclause 5.7.3)

Replace the contents of this Subclause with the following:

"Steel Open Grid Floors"

5.7.3.1 The term "grating" shall be synonymous with "grid flooring". Open grid flooring panels (whether or not they are covered with a vastrap or similar plate) shall be manufactured by an approved firm specializing in such work. Before commencing with any manufacturing or construction, the Contractor shall confirm and accommodate the actual dimensions and details measured on Site which may differ from those provided on drawings.

5.7.3.2 The grid flooring depth as well as the thickness and pitch (spacing) of both bearer bars and transverse bars shall be as specified on the drawing. Unless otherwise indicated, bearer bars shall run parallel to shorter span (bearer bars to run between closest supports).

Grid flooring shall be manufactured with transverse bars permanently locked to bearer bars (i.e. compressive pressure locked or welded or both, unless otherwise indicated). Grid flooring panels shall be banded around all edges, including edges of cut-outs and removable or hinged access covers. These bands shall be of equal height and thickness to the bearer bars and shall be fully welded to the flooring panel (leaving no crevices at joints).

5.7.3.3 The panels shall be supplied prefabricated with cut-outs given on the details and those necessary to accommodate the Contractor's equipment. Cut-outs made to accommodate equipment shall be neat and as small as practical and gaps between equipment and grid flooring shall not exceeding 100mm in extreme cases. Panels/off-cuts may not be welded together to create larger panels.

Unless otherwise specified, cutting of grating with top covers shall be done at angles and curves to suit the equipment. For grating without top covers, cutting shall generally be done parallel or perpendicular to bearer bars (as applicable), except for cut-outs made to accommodate circular objects or pipes larger than DN 300 where the cut-out shall instead be circular to prevent excessive gaps between the object and sides of the cut-out. Unless authorized to do so, the Contractor shall not cut or weld grid floor panels on Site.

5.7.3.4 The gap between the edge of grid flooring and the support frame or abutting structure (as applicable) shall be at least 2 mm and no greater than 10 mm on each side (or no greater than 20mm on one side when the panel is shifted up against the support frame/abutting structure on the opposite side). No gaps shall be left between adjacent panels.

Grid flooring shall be mounted firm and level (unless the surrounding floor has a fall, in which case the grating shall match this fall) orientated uniformly and shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.

Adjacent floor panels shall have vertical edge alignment of within 3 mm of each other. A least four fixing clip sets of the appropriate types (depending on the location being secured) shall be used to secure each panel to the supports and adjacent panels. No perceptible movement or rocking will be acceptable. Fixing clip sets shall be stainless steel grade 316 with M8 or larger fasteners, of standard types (i.e. M-Type, F-Type, G-Type, etc.) and approved by the grid flooring manufacturer.

Individual panel lengths (measured parallel to the bearer bars) shall be no greater than 2.4m. Unless otherwise approved, individual panels which are not supported along their entire perimeter shall be no less than 1m wide at the narrowest section (where the width is measured at right angles to the bearer bars), except for the final panel in a series of panels where a smaller width may be needed to close the remaining opening. Where narrower widths are specified or approved, each unsupported panel edge shall be fixed with clip sets to the adjacent flooring panel at 350mm centre or with a minimum of 2 clip sets, whichever is greater (these over and above the four fixing clip sets aforementioned).

- 5.7.3.5 Where vastrap plate flooring covers are required, they shall cover the entire top of the grid flooring panel (with the edges of the vastrap plate flush with the edges of the flooring panel) and shall be welded to the panel with 20 to 30mm welds at 300mm centres. Stainless steel grade 316 countersunk bolts shall be used with clip sets to secure flooring panels which are covered with vastrap plates to supports and to each other. Suitably positioned countersunk bolt holes shall be made in the vastrap plates prior to them being HDG (if HDG is applicable). The countersunk bolts shall not protrude above the vastrap plate beyond the height of the tread pattern.

- 5.7.3.6 The angle supports (also referred to as frames) indicated on drawings (including added flat bars where required) are to be installed continuously along the full perimeters of openings which are to be covered with flooring panels. Notwithstanding the above, where the support frame crosses a concrete or brickwork joint, the joint is to be extended through the angle frame.

Where two different angle support types (flooring details) are specified for supporting one area of flooring, the cast-in angle support type shall be used wherever possible, with the bolt-on angle support type only used where the cast-in angle support cannot be used.

Where a structural member is to pass through a flooring panel, adequately sized bolt-on angle supports shall be installed around and fastened to the circumference of the structural member to support the flooring panel, unless otherwise directed by the Engineer. All angle supports will not be paid for separately but shall be included in the rate tendered for the relevant flooring panels.

- 5.7.3.7 Additional support systems which exclude angle supports and top hat sections (thus I-beams and channels, etc. are additional supports) may be specified on drawings. Each support type, complete with end plates, flat bars, fasteners, etc. will be scheduled and paid for separately under 8.3.1. The grid flooring shall be fabricated to suit the additional supports.

Unless otherwise indicated, additional supports that cross from one side of an opening to the opposite side (i.e. a straight support beam) shall be orientated such that each runs parallel to the shorter span (i.e. for a channel, they shall run between the nearest channel walls).

Where a cut-out in the flooring larger than 480mm in width or diameter (irrespective of whether the cut-out bridges more than one panel) is necessary to accommodate an object(s) passing through the flooring (which objects are not designed to structurally support the flooring, i.e. pipes and equipment), these additional supports shall first be placed as close as practical on either side of the object. The remaining supports shall be evenly spaced with appropriate centres that fall within the spacing range indicated on the drawings (or at specific centres if so specified).

Notwithstanding the above, the additional supports shall be suitably positioned to prevent more than 50% of the bearer bars of a single panel being cut in the event of multiple cut-outs being required in the same panel. Where this is unavoidable, suitable alternative support designs shall be submitted by the Contractor to the Engineer for approval.

The gap between additional support ends and the substrates to which they affix shall be no greater than 10mm, and this gap shall be neatly filled with flowable non-shrink cementitious grout after the supports have been secured in place and prior to final tightening of nuts. Additional supports shall not be mounted over or with the centreline within 200mm of a concrete or brickwork joint.

- 5.7.3.8 The Contractor shall submit for approval all relevant details for additional cut-outs and supports to flooring which are not specified but are required by him to accommodate his equipment. These flooring modifications and supports shall ensure that, while under design load conditions, the deflection of any bearer bars does not exceed 1/200th of the clear span, or 10 mm, whichever is the lesser. Any approved modifications shall be done prior to HDG. Cut-outs and supports required by the Contractor will not be measured or paid for separately but shall be included in the rate tendered for the relevant flooring panels.
- 5.7.3.9 Unless otherwise indicated, all joints to be fully welded with no crevices. All steel items, excluding fasteners, handles, hinges and clip sets, shall be HDG unless otherwise indicated. HDG shall be done in accordance with SANS 121 and SANS 10064. All fabrication, sizing, modifying, drilling, cutting, welding and machining shall be carried out prior to HDG. Items modified after HDG shall be returned to the galvaniser for stripping of the zinc coating and re-galvanising.
- 5.7.3.10 All fasteners shall be of stainless steel grade 316, unless otherwise specified. Fasteners shall be delivered to Site in the correct lengths and already deburred, pickled and passivated (as no cutting of these fasteners will be permitted on Site). Anchor fasteners shall be chemically anchored into concrete or brickwork using Sika Anchorfix-2+ or Hilti HIT-RE 500 (or equivalent approved). The anchor holes required shall be drilled to correct depths and cleaned in accordance with the anchor adhesive manufacturer's instructions. The Contractor shall have all holes inspected by the Engineer after completing preparations but before installing the adhesive or fastener. SS316 washers shall be provided under both bolt head (where applicable) and nut. Unless otherwise approved, fastener threads shall project no less than 1 thread and no more than 8 threads from the head of the nuts when fixed. Fasteners shall be tested in accordance with the requirements listed under Clause 7.

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)

7.1 TEST CERTIFICATES (SUBCLAUSE 7.1)

Add the following:

"Test certificates pertaining to steel used for the various members shall be supplied by the Contractor to the Engineer when requested."

7.2 WELDING TESTING (NEW SUBCLAUSE 7.4)

All non-destructive testing procedures, techniques and acceptance criteria shall be in accordance with AWS D1.1 (and/or SANS 15614-1) and certificates of all testing shall be submitted to the Engineer. Personnel performing non-destructive testing (other than visual) shall be qualified in accordance with the stipulations of the code. All non-destructive examinations shall be carried out in accordance with written procedures approved by the Engineer .

Full penetration butt welds are to be radio graphically tested in accordance with AWS D1.1 (and/or SANS 15614-1). A minimum of 50% of full penetration welds shall be tested. If more than 5% of the examined welds show unsatisfactory results, then additional examinations covering all welds shall be performed. Fillet welds will be inspected and tested to AWS D1.1 (and/or SANS 15614-1) at the discretion of the Engineer. Ultrasonic and radiographic examinations shall not be made within the period of 24 hours after completion of welding.

All costs (time, travelling, testing etc.) incurred by non-destructive examinations (whether due to non-conformance of specifications, any latent defects in material and welding, or as requested by the Engineer) shall be borne by the Contractor.

7.3 TESTING OF CHEMICALLY ANCHORED FASTENERS (NEW SUBCLAUSE 7.5)

The Contractor shall demonstrate, using a torque wrench, that chemically anchored fasteners can be torqued to at least 75% of the chemical mortar/adhesive manufacturer's maximum tightening (maximum installation) torque. Typically, the maximum tightening torque is 40 Nm for M12 fasteners and 80 Nm for M16 fasteners.

The torque wrench is to have an accuracy of at least $\pm 10\%$ of the actual torque value, which may be demonstrated on Site to the Engineer by using the static weight or other agreed method.

To confirm that that anchor fasteners in a masonry substrate meet the chemical mortar/adhesive manufacturer's characteristic loads, the Engineer may also require that the Contractor perform pull-out tests. The tests will be conducted on a select number of chemically anchored fasteners, which number will be determined by the Engineer, generally based on extent and perceived quality of the installation, adherence to the specifications, etc. The Engineer shall identify the fasteners to be tested and the Contractor shall provide all equipment required and conduct the tests in the presence of the Engineer. The pull direction shall not be more than 5° off the axis of the bolt.

The pull-out test equipment will typically include an eye-nut for connecting to the anchored fastener, a pulling device (mechanical or hydraulic), a calibrated crane scale and a temporary support structure/jig.

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 BASIC PRINCIPLES (SUBCLAUSE 8.1)

Add the following to the end of this Subclause:

"8.1.3 The tendered price for steel items includes for the production of shop drawings/details, all procurement costs, supply, fabrication, corrosion protection and finishes as specified, inspections as per Subclause 7.2 of SANS 1200 HC, testing (unless scheduled separately), transportation and erection, all plant, labour, materials, fasteners (including holding-down bolts), etc. necessary for proper completion of structural steelwork, including casting in holding-down bolts (if applicable), fixing it to the concrete or brickwork, etc. as shown on drawings or as specified. These listed items will not be measured separately."

8.2 SCHEDULED ITEMS (SUBCLAUSE 8.3)

Delete Subclauses 8.3.1, 8.3.2, 8.3.3, 8.3.4, 8.3.5, 8.3.6 and 8.3.13 and substitute with the following:

"8.3.1 Structural steelUnit: t or No

The rate shall include for the production of shop drawings/details, all procurement costs, supply, fabrication, corrosion protection and finishes as specified, inspections as per Subclause 7.2 of SANS 1200 HC, testing (unless scheduled separately), transportation and erection, all plant, labour, materials, fasteners (including holding-down bolts), etc. necessary for proper completion of structural steelwork, including casting in holding-down bolts (if applicable), fixing it to the concrete or brickwork, etc. as shown on drawings or as specified.

The supply and fixing of roof sheeting, cladding and rainwater goods shall be scheduled separately."

8.2.1 Handrails (Subclause 8.3.7)

Replace the contents of this Subclause with the following:

Handrail assembly complete (drawing number stated/details given):

- a) Horizontal top mountedUnit: m
- b) Horizontal side mounted flushUnit: m
- c) Horizontal side mounted offsetUnit: m

- d) Horizontal removableUnit: m
- e) Sloping top mountedUnit: m
- f) Sloping angle mountedUnit: m
- g) Sloping side mounted flush.....Unit: m
- h) Step ladders top mounted.....Unit: m
- i) Step ladders side mounted flushUnit: m
- j) Bends Unit: No.
- k) End closures Unit: No.
- l) Sleeves for removable stanchions..... Unit: No.
- m) Kickplates.....Unit: m
- n) Handrailing for public places..... Unit: Sum or m
- o) Guard chains..... Unit: No

The per-meter rates (a) through (i), shall be per meter of handrailing assembly complete. The per-number rates (j) through (l) shall be extra over to the relevant per meter rate (a) through (i). The rate for bends shall be 1 No. per change in handrailing direction/angle (i.e. a bend in the handrailing shall typically incorporate a bend in both the hand rail and a knee rail, which shall together be measured as 1 bend). The per-meter rate for kickplates shall be per meter of kickplate assembly complete. The rate for handrailing in public places shall be for the complete assembly as indicated, or per meter of the type indicated. The per-number rate for guard chains shall be the number of each guard chain assembly complete, separated for different guard chain details and for each width (or range of widths) between substrates (stanchions/walls/stringers, as applicable) to which the guard chain eye and hook bolts will be affixed.

The tendered rates shall include for the production of shop drawings/details (where required), all procurement costs, supply, fabrication, corrosion protection (such as galvanizing and painting) as specified, inspections as per Subclause 7.2 of SANS 1200 HC, testing (unless scheduled separately), transportation and erection, all plant, labour and materials (including fasteners) necessary for proper completion of the handrails, kickplates, guard rails, etc., including grouting in/fixing to concrete, brickwork, steel substrates, etc. as shown on drawings and as specified.”

8.2.2 Ladders, complete and installed (Subclause 8.3.8)

In the heading, replace the word “length” with the word “height”.

Replace the contents of this Subclause with the following:

“Separate items will be scheduled for ladders of different types and heights (or height ranges). The height shall be measured as the vertical distance between the two levels which the ladder provides access between (i.e. the distance between the upper and lower levels connected by the ladder).

The rate for ladders shall include for the production of shop drawings/details, all procurement costs, supply, fabrication, corrosion protection (such as galvanizing and painting) as specified, inspections as per Subclause 7.2 of SANS 1200 HC, testing (unless scheduled separately), transportation and erection, all plant, labour and materials (including fasteners) necessary for proper completion of the ladders, including fixing it to the concrete, brickwork, etc. as shown on drawings or as specified.

The rate shall also include for all ladder ancillaries shown on the ladder drawings such as threshold plates, grab bars, etc.

8.2.3 Flooring, complete and installed with frames (Subclause 8.3.9)

Replace the contents of this Subclause with the following:

The rate shall cover the cost of supplying the specified or scheduled type of flooring complete with angle supports/frames (including added flat bars where required) and top hat sections as indicated on the drawings and the cost of all fixings, installing, fixing, grouting/casting in, etc. The rate shall further include for the production of shop drawings/details (where required), all procurement costs, fabrication, cutting, welding, banding, cut-outs, corrosion protection (including galvanizing, painting, etc.) as specified, inspections as per Subclause 7.2 of SANS 1200 HC, testing (unless scheduled separately), transportation and erection, all plant, labour and materials (including fasteners, clips, etc.) necessary for proper completion of the flooring and

support frames.

Any additional supports and cut-outs not specified but which are required by the Contractor to accommodate his equipment layout shall not be paid for separately, but shall be included for in the above rate for flooring.

Additional support systems specified (i.e. specified i-beams and channel sections) will be scheduled and paid for separately under 8.3.1, which rate shall also include for the required end connections, flat bars, fasteners, etc. Additional support systems exclude angle support/frames, etc. which are already included for under the rate for flooring.

8.2.4 Miscellaneous steel items (New Subclause 8.3.14)

- a) Items measured by area:
Description of or drawings reference to item Unit: square metre (m²)
- b) Items measured by length:
Description of or drawings reference to item Unit: metre (m)
- c) Items measured by number:
Description of or drawings reference to item Unit: No
- d) Items measured by mass:
Description of or drawings reference to item Unit: kg or ton

The unit of measurement shall be the square metre, linear meter, number or mass as applicable to each item. The tendered rates shall include full compensation for all labour, materials, fasteners (including holding-down bolts), plant, equipment, transport, etc, manufacturing or providing and installing each item complete as scheduled and shown on the Drawings, and shall include all corrosion protection, finishes and inspections as per Subclause 7.2 of SANS 1200 HC, testing (unless scheduled separately), where applicable.

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1 SCOPE (CLAUSE 1)

No Amendments.

2 INTERPRETATIONS (CLAUSE 2)

No Amendments.

3 MATERIALS (CLAUSE 3)

3.1 THICKNESS OF SHEETING (SUBCLAUSE 3.1)

Replace “The thickness of the sheeting” *with* “Unless specified elsewhere in Clause 3, or specified on the Drawings or in the Bill of Quantities, the thickness of the sheeting”.

3.2 STEEL SHEETING (SUBCLAUSE 3.2)

3.2.1 Galvanized Steel Sheeting (Subclause 3.2.1)

Replace “galvanizing shall comply with” *with* “galvanizing shall, unless otherwise specified, comply with”

3.2.2 Prepainted Galvanized Steel Sheeting (Subclause 3.2.1)

Replace “galvanizing shall comply with” *with* “galvanizing shall, unless otherwise specified, comply with”

3.2.3 Proprietary steel sheeting (New Subclause 3.2.4)

Proprietary steel roof sheeting and cladding specified on the drawings or in the Bill of Quantities shall be provided with a certificate verifying material compliance and be clearly marked on the reverse side at one-meter intervals indicating thickness, material quality, coating thickness and paint system. The proprietary roof sheeting and cladding provided shall have a successful record (of 5 years minimum) of use in similar applications locally. In addition, the proprietary roof sheeting and cladding shall comply with the following requirements:

- a) 0.53mm AZ200 Safintra SAFLOK 700 (or similar approved): 0.53mm thick Safintra SAFLOK concealed fix, standing seem, Aluminium-Zinc coated (AZ200), Grade G550 steel roofing (minimum yield strength 550 MPa), pre-painted both sides (and including touching-up cut and slit edges) with Colorplus modified polyester paint coating (“Chalk” colour if no colour is specified on the drawings), with an effective cover width of 700mm and rib height of 41mm, roll-formed to full required lengths (continuous lengths without lap), complete with SAFLOK interlocking clipping system fixed to purlins (through over-purlin insulation if applicable) with Safintra approved fasteners, all strictly in accordance with manufacturer’s specifications. The complete roofing system shall be provided with a 15-year guarantee, and shall be inspected and approved in writing by the supplier after installation.
- b) 0.53mm AZ200 Safintra NEWLOK (or similar approved): 0.53mm thick Safintra NEWLOK concealed fix, standing seem, Aluminium-Zinc coated (AZ200), Grade G550 steel roofing (minimum yield strength 550 MPa), pre-painted both sides (and including touching-up cut and slit edges) with Colorplus modified polyester paint coating (“Chalk” colour if no colour is specified on the drawings), with an effective cover width of 445mm and rib height of 50.8mm, roll-formed to full required lengths (continuous lengths without lap), complete with NEWLOK clips fixed to purlins (through over-purlin insulation if applicable) with Safintra approved fasteners, all strictly in accordance with manufacturer’s specifications. The complete roofing system shall be provided with a 15-year guarantee, and shall be inspected and approved in writing by the supplier after installation.

3.3 ALUMINIUM SHEETING (SUBCLAUSE 3.3)

3.3.1 Proprietary aluminium sheeting (New Subclause 3.3.3)

Proprietary aluminium roof sheeting and cladding specified on the drawings or in the Bill of Quantities shall be provided with a certificate verifying material compliance and be clearly marked on the reverse side at one-meter intervals indicating thickness, material quality, coating thickness and paint system. The proprietary roof sheeting and cladding provided shall have a successful record (of 5 years minimum) of use in similar applications locally. In addition, the proprietary roof sheeting and cladding shall comply with the following requirements:

- a) 0.8mm Aluminium Safintra SAFLOK 700 Color-Tech G4 (or similar approved): 0.80mm thick Safintra SAFLOK 700 Aluminium (Alloy 3004) interlocking concealed fix roofing, pre-painted both sides with Color-Tech G4 ("Marble White" colour unless stated otherwise on drawings), with an effective cover width of 700mm and rib height of 41mm, roll-formed to full required lengths (continuous lengths without lap), complete with SAFLOK 700 aluminium clips fixed to purlins (through over-purlin insulation if applicable) with Safintra approved stainless steel 316 wafer head fasteners, all strictly in accordance with manufacturer's specifications. The complete roofing system shall be provided with a 15-year guarantee, and shall be inspected and approved in writing by the supplier after installation.
- a) 0.8mm Aluminium Safintra SAFLOK 700 Color-Tech PVDF (or similar approved): 0.80mm thick Safintra SAFLOK 700 Aluminium (Alloy 3004) interlocking concealed fix roofing, pre-painted both sides with Color-Tech PVDF ("Marble White" colour unless stated otherwise on drawings), with an effective cover width of 700mm and rib height of 41mm, roll-formed to full required lengths (continuous lengths without lap), complete with 2k Polyurethane coated SAFLOK 700 aluminium clips fixed to purlins (through over-purlin insulation if applicable) with Safintra approved stainless steel 316 wafer head fasteners, all strictly in accordance with manufacturer's specifications. The complete roofing system shall be provided with a 15-year guarantee, and shall be inspected and approved in writing by the supplier after installation.
- b) 0.8mm Aluminium Safintra NEWLOK Color-Tech G4 (or similar approved): 0.80mm thick Safintra NEWLOK concealed fix, standing seem, Aluminium (Alloy 3004) roofing, pre-painted both sides with Color-Tech G4 ("Marble White" colour unless stated otherwise on drawings), with an effective cover width of 445mm and rib height of 50.8mm, roll-formed to full required lengths (continuous lengths without lap), complete with NEWLOK aluminium clips fixed to purlins (through over-purlin insulation if applicable) with Safintra approved stainless steel 316 wafer head fasteners, all strictly in accordance with manufacturer's specifications. The complete roofing system shall be provided with a 15-year guarantee, and shall be inspected and approved in writing by the supplier after installation.
- c) 0.8mm Aluminium Safintra NEWLOK Color-Tech PVDF (or similar approved): 0.80mm thick Safintra NEWLOK concealed fix, standing seem, Aluminium (Alloy 3004) roofing, pre-painted both sides with Color-Tech PVDF ("Marble White" colour unless stated otherwise on drawings), with an effective cover width of 445mm and rib height of 50.8mm, roll-formed to full required lengths (continuous lengths without lap), complete with 2k Polyurethane coated NEWLOK aluminium clips fixed to purlins (through over-purlin insulation if applicable) with Safintra approved stainless steel 316 wafer head fasteners, all strictly in accordance with manufacturer's specifications. The complete roofing system shall be provided with a 15-year guarantee, and shall be inspected and approved in writing by the supplier after installation.

3.4 FASTENERS (SUBCLAUSE 3.7)

3.4.1 General (Subclause 3.7.1)

Add the following to the end of this Subclause:

"Fasteners for cladding, sheeting, ridge capping, flashings, etc. shall be in strict accordance with the manufacturer's specifications, taking into account high wind loads and severe corrosion conditions with

proximity to the sea. Where the cladding, sheeting, ridge capping, flashings, etc. are stainless steel or aluminium, the fasteners shall be stainless steel grade 316 and otherwise in strict accordance with the manufacturer's specifications."

~~3.5~~ RAINWATER GOODS (SUBCLAUSE 3.8)

Add the following:

"Unless otherwise indicated on Drawings or Bill of Quantities, rainwater goods shall be hot dipped galvanized mild steel."

~~3.6~~ FLASHINGS AND RIDGE CAPPING (NEW SUBCLAUSE 3.11)

Flashings and ridge capping shall be manufactured from the same material and have the same corrosion protection and finish as the roof sheeting and cladding, and the thickness shall, unless otherwise specified on the Drawings or in the Bill of Quantities, be at least the thickness of the roof sheeting and cladding.

4 PLANT (CLAUSE 4)

No Amendments.

5 CONSTRUCTION (CLAUSE 5)

~~5.1~~ RESPONSIBILITY (SUBCLAUSE 5.1)

5.1.1 Installation Details (Subclause 5.1.4)

Replace the first sentence of this subclause with the following:

"The Contractor shall be solely responsible for ensuring that materials and installation of cladding, sheeting, ridge capping, flashings, etc. comply with the manufacturer's specifications, the project specifications, Engineer's drawings of the general arrangement and details and, subject to Engineer's approval, the Contractor's additional detail drawings."

~~5.2~~ INSTALLATION OF SHEETING (SUBCLAUSE 5.5)

Add the following to the end of this Subclause:

"Fitting and fixing shall be according to the manufacturer's specifications for the wind conditions on site."

~~5.3~~ FLASHINGS (SUBCLAUSE 5.6)

Add the following to the end of this Subclause:

"Fitting and fixing shall be according to the manufacturer's specifications for the wind conditions on site."

~~5.4~~ PROTRUSIONS THROUGH SHEETED SURFACES (SUBCLAUSE 5.7)

Add the following to the end of this Subclause:

"Fitting and fixing shall be according to the manufacturer's specifications for the wind conditions on site."

~~5.5~~ DETAIL DRAWINGS (NEW SUBCLAUSE 5.8)

The Contractor shall be responsible for preparing drawings of all sheeting/flashings/insulation details required (including details of the fasteners which he proposes to use). The drawings shall be submitted for approval at least two weeks prior to commencement of fabrication.

The Engineer shall require seven working days for the approval of the detail drawings submitted by the Contractor. No sheeting work shall be permitted to commence until such time as the detail drawings have been approved.

6 TOLERANCES (CLAUSE 6)

~~6.1~~ INSTALLATION (SUBCLAUSE 6.2)

6.1.1 Sheeting and cladding (Subclause 6.2.2)

Add the following:

“The maximum deviation from the theoretical position of sheeting/flashing lines shall be ± 5 mm.

The maximum deviation from the straightness of sheeting/flashing lines or abrupt change in same shall be 3 mm. the deviation shall be measured as the maximum deviation of the surface from any straight line of length 3 mm joining two points on the surface, determined by means of a straight edge, the ends of which are supported on identical blocks of suitable thickness placed over each of the points.”

7 TESTING (CLAUSE 7)

No Amendments.

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

~~8.1~~ SCHEDULED ITEMS (SUBCLAUSE 8.2)

8.1.1 Supply and install cladding and sheeting (Subclause 8.2.2)

Add the following:

“The rate tendered shall also cover the cost of corrosion protection and/or coloured finish (i.e painting) as specified, required clips, insulating tape and washers (if applicable), and all plant, labour and material necessary for proper completion of the work, as well as the provision of detailed drawings required in terms of 5.8.”

8.1.2 Supply and install ancillaries (Subclause 8.2.3)

Add the following:

“The rate tendered shall also cover the cost of corrosion protection and/or coloured finish (i.e. painting) as specified, required clips, insulating tape and washers (if applicable), and all plant, labour and material necessary for proper completion of the work, as well as the provision of detailed drawings required in terms of 5.8.”

8.1.3 Painting (Subclause 8.2.4)

Delete this Subclause.

Painting and corrosion protection of cladding, sheeting and ancillaries is already included for under their respective rates.

8.1.4 Supply and install insulation (New Subclause 8.2.6)

The unit of measurement shall be the square meter of area covered by the insulation (or insulation system) installed, with no deduction being made for protrusions or areas covered by overlaps.

The rate tendered shall cover the cost of the supply, delivery, installation and fixing of insulation as well as all the plant, labour and material necessary for proper completion of the work, including all straining wires and/or other supports.

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1 SCOPE (CLAUSE 1)

No amendments.

2 INTERPRETATIONS (CLAUSE 2)

2.1 DEFINITIONS AND ABBREVIATIONS (SUBCLAUSE 2.3)

Add the following to the end of this subclause:

“or hot dip galvanized (as applicable)”

3 MATERIALS (CLAUSE 3)

3.1 STAINLESS STEEL (NEW SUBCLAUSE 3.4)

All stainless steel shall be pickled and passivated after manufacture and all heat tint, weld splatter and impurities introduced by grinding, cutting etc. are to be removed. Passivation shall be in an approximate 15 percent solution by mass of nitric acid, at 60 degrees Celsius, for 20 to 30 minutes. Before passivation, the equipment shall be thoroughly cleaned and all traces of oil and other contaminants removed. The equipment shall be washed thoroughly after passivation.

Only descaled steel shall be used.

3.2 INSULATION (NEW SUBCLAUSE 3.5)

Where different metals are fastened together, such as mild steel and stainless steel, a non-porous insulator shall be inserted in the joint to prevent direct contact of the metals.

3.3 PROCUREMENT OF PAINT (NEW SUBCLAUSE 3.6)

The Contractor shall provide the Engineer with details of the paints he intends on using, including the manufacturer's data sheets for each product and shall only proceed with the purchase of the paints upon receipt of written approval from the Engineer.

All materials in a paint system shall be purchased from one supplier. The Contractor shall provide the paint supplier with a copy of the relevant sections of the Specification. The Contractor shall obtain a certificate from the paint supplier certifying that the materials to be supplied comply with the relevant Specification and are suitable for the intended purpose.

No variation in brand or material from those quoted in the tender documents and/or as approved by the Engineer shall be permitted without the approval of the Engineer in writing.

Any conflict between the manufacturer's data sheet and the Specification shall be referred to the Engineer for adjudication

4 PLANT (CLAUSE 4)

No amendments.

5 CONSTRUCTION (CLAUSE 5)

5.1 COATING SYSTEM (SUBCLAUSE 5.7)

Replace the contents of this Subclause with the following:

“The coating system shall be as indicated in the following table:

Structural/mild steel elements	Coating system
All structural steelwork	Duplex coating system, as per Subclause 5.12

“

5.2 APPLICATION OF PAINT COATINGS (SUBCLAUSE 5.8)

Add the following at the end of this Subclause:

“All paintwork shall be executed by tradesmen skilled in this class of work, and in strict accordance with the manufacturer’s recommendations as approved.

All surfaces which cannot be painted after erection shall be painted as specified herein before erection.”

5.3 APPLICATION OF METAL COATINGS (SUBCLAUSE 5.9)

Add the following at the end of this Subclause:

“Hot-dip galvanized material which is to remain unpainted shall be passivated as specified in SANS 121. Items to be painted after hot-dip galvanizing shall be air dried and not passivated.”

5.4 REPAIR OF DAMAGED COATINGS (SUBCLAUSE 5.10)

Add the following at the end of this Subclause:

“Unless otherwise approved by the Engineer, items modified after HDG shall be returned to the galvaniser for stripping of the zinc coating and re-galvanising.”

5.5 SURFACE PREPARATION (NEW SUBCLAUSE 5.11)

5.5.1 General (New Subclause 5.11.1)

All items to be corrosion protected shall be tested and inspected for compliance with the applicable Specifications before any cleaning of the surface is commenced.

All surfaces to be corrosion protected shall be degreased prior to any other method of surface preparation.

The area affected by weld heating shall be polished by means of plastic abrading pads until free of discolourations, and subsequently thoroughly degreased using a water rinseable detergent and allowed to dry.

5.6 DUPLEX COATING SYSTEM (NEW SUBCLAUSE 5.12)

A duplex system of coating shall consist of firstly hot-dip galvanizing the steel, followed by an organic coating.

Fabrication of items to receive a duplex system shall be in accordance with SANS 14713. HDG shall be done in accordance with SANS 121 and coatings shall be to the thicknesses detailed in the Standard.

After HDG, the items shall be air dried and not passivated as these items are to be painted.

Preparation and application of organic coatings on HDG shall be done in accordance with the Hot Dip Galvanizers Association of Southern Africa’s Code of Practice for Surface Preparation and Application of Organic Coatings.

The duplex system shall comply with the following:

- Hot-dip galvanized, as specified above, without passivation of the zinc coating.
- Application of one coat of an epoxy primer (two part; for hot-dip galvanized surfaces) with a dry film thickness (DFT) of 75 µm.
- Polyurethane enamel top coat (two part) with a DFT of 50 µm; done at the factory after suitable repair to the primer.

- d) Touch up repairs on site after erection.

Refer to 5.8 for application of paint coatings.

6 TOLERANCES (CLAUSE 6)

6.1 DRY FILM THICKNESS (SUBCLAUSE 6.5)

Delete the first two sentences of this Subclause.

6.1.1 Individual coatings (New Subclause 6.5.1)

At least 90% of all thicknesses measured shall comply with the minimum thickness of the system specification. Up to 10% of all readings may be below the specific minimum thickness, but no individual reading shall be less than 70% of the specified minimum thickness.

6.1.2 Total dry film thickness (New Subclause 6.5.2)

Not more than 10% of readings shall be less than the minimum specified and no reading shall be less than 90% of the specified minimum. For immersion conditions no reading shall exceed the mean specified thickness by greater than 60% of the minimum, unless a concession is granted by the Engineer.

7 TESTING (CLAUSE 7)

7.1 INSPECTION BY ENGINEER (SUBCLAUSE 7.2)

Replace the heading of Subclause 7.2 with "Inspections".

Replace the contents of Subclause 7.2 with the following:

"7.2.1 Inspection by Engineer"

Inspection by the Engineer (or his representative) will be carried out timeously. The inspector shall be given reasonable advance notice of the availability of steel for inspection.

The Contractor shall make arrangements for the inspector to inspect the items at the following stages:

- a) On completion of fabrication and before HDG.
- b) After HDG and before priming.
- c) After priming.
- d) After top coat but before dispatch to site.

7.2.2 Independent Inspectorate

The Contractor shall nominate an independent inspectorate to carry out any tests to verify compliance with the corrosion protection Specifications.

The inspectorate shall inspect the work to verify that at least the following are in accordance with the Specifications:

- a) Surface preparation prior to painting,
- b) Coating thicknesses,
- c) Holiday testing, and
- d) Paint quality, type and method of application.

The Contractor shall:

- i) Draw up a quality control programme together with the independent inspectorate,
- ii) Contact the inspectorate timeously to make arrangements for him to inspect the various items to be tested both prior to and after painting or HDG,
- iii) Submit copies of the quality control programme to the Engineer, and
- iv) Submit all the inspectorate's reports to the Engineer."

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 PRINCIPLES (SUBCLAUSE 8.1)

Replace Subclause 8.1 with the following:

"Unless otherwise indicated, corrosion protection shall not be measured and paid for separately, and rates and sums tendered for steel items under Subclause 8.3 of SANS 1200 H shall include all costs related to corrosion protection (inclusive of all costs related to 8.2 below).

Measurement and payment for items as detailed under 8.2 shall only be applicable for steel items not provided by the Contractor, unless otherwise indicated."

8.2 SCHEDULED ITEMS (SUBCLAUSE 8.2)

8.2.1 Inspection by the Engineer (New Subclause 8.2.5)

Where scheduled for a steel item, the unit of measure shall be as scheduled and the rate or sum shall cover all costs associated with 7.2.1.

8.2.2 Independent Inspectorate (New Subclause 8.2.6)

Where scheduled for a steel item, the unit of measure shall be as scheduled and the rate or sum shall cover all costs associated with 7.2.2.

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1 SCOPE (CLAUSE 1)

No amendments

2 INTERPRETATIONS (CLAUSE 2)

2.1 DEFINITION (SUBCLAUSE 2.3)

Amend the definition for “special” as follows:

“Special. Any pipe other than a straight section of pipe but including puddle pipes.

NOTE: Under this definition are included all sizes of specials such as bends, tees, crosses, angle branches, reducers, tapers and puddle pipes.”

Add the following definition:

“Maximum design pressure. The pressure rating or pressure class of the pipe material unless otherwise specified in the Project Specification, or shown on the drawings.”

2.2 ABBREVIATIONS (SUBCLAUSE 2.4)

Add the following to the list of abbreviations:

“MS	: Mild Steel
DN	: Nominal Diameter
GRP	: Glass fibre Reinforced Plastic (synonymous with FRP)
HDG	: Hot Dip Galvanised (steel substrate)
HDPE	: High-density Polyethylene
PVC-M	: Modified Poly Vinyl Chloride
PVC-U	: Unplasticised Poly Vinyl Chloride (synonymous with uPVC)
SS	: Stainless Steel”

3 MATERIALS (CLAUSE 3)

3.1 STEEL PIPES, FITTINGS AND SPECIALS (SUBCLAUSE 3.4)

Delete the contents of this clause and replace with the following: “Steel pipes shall comply with Particular Specification SPE-MP-7002 and its amendments. Steel specials shall comply with Particular Specification SPE-MP-7001 and its amendment.”

3.2 OTHER TYPES OF PIPES (SUBCLAUSE 3.7)

3.2.1 uPVC pipes (Subclause 3.7.1)

In the heading of this Subclause, replace “uPVC” with “PVC-U”.

Replace the contents of this Subclause with the following:

“PVC-U (also referred to as uPVC in this spec) pipes shall comply with the requirements of SANS 966. All PVC-U pipes shall be PN 12, or unless otherwise shown on the drawings.

Bends on PVC-U for DN 250 and smaller shall be manufactured from PVC-U. Bends on PVC pipes larger than DN 250 shall be manufactured from cast iron or ductile iron. All other specials on PVC-U pipes shall be manufactured from cast iron, ductile iron, and Grade 316L stainless steel, based on the detail of the special."

3.2.2 Polyethylene pipes (Subclause 3.7.2)

Replace the contents of this Subclause with the following:

"High density polyethylene (HDPE) pipes and specials shall all be of material PE100 and comply with the requirements of SANS ISO 4427.

Where HDPE pipes and specials are not manufactured by a SAPPMA member, the approval of the manufacturer shall be obtained from the Engineer prior to ordering any pipes or specials.

The Contractor shall provide the Engineer with the batch release test results from the raw material supplier for each pipe diameter and pressure class. The following shall be considered the minimum requirements: compound density, carbon black content, volatile content, oxidation induction time and melt mass flow rate.

The Contractor shall also submit samples taken from the manufactured pipes for testing at an independent test facility where the following shall be tested as the minimum requirements: compound density, carbon black content, carbon black dispersion, volatile content, oxidation induction time, melt mass flow rate and elongation at break. Test shall be performed on each pipe diameter and pressure class applicable to the contract."

3.2.3 Glass reinforced pipes (New Subclause 3.7.3)

3.2.3.1 General (New Subclause 3.7.3.1)

All GRP pipes, joints and fittings supplied under this specification shall, as a minimum, meet the requirements of the standards listed in Appendix A (as applicable).

3.2.3.2 Materials used in the manufacture of GRP pipes (New Subclause 3.7.3.2)

The manufacturer shall use only approved polyester resin systems for which he can provide documented performance in this particular application. The data shall have been acquired from a composite material of similar construction and composition as the product proposed for this project.

The reinforcing glass fibres to be used to manufacture the components shall be of the highest quality commercial grade of glass filaments suitably treated with binder and sizing compatible with impregnating resins.

Silica sand or other suitable materials may be used as fortifiers in the laminates. Fillers shall not be used in the inner liner or corrosion barrier.

Resin additives, such as pigments, dyes, and other colouring agents, if used, shall in no way be detrimental to the performance of the product nor shall they impair visual inspection of the finished product.

Elastomeric sealing rings shall be supplied by recognized, acceptable, quality manufacturers. The elastomeric compound used shall be compatible with the use environment.

3.2.3.3 Manufacture of GRP pipes (New Subclause 3.7.3.3)

The pipes shall be supplied in accordance with the diameters and tolerances specified in Clause 6. They shall be manufactured by a controlled, reproducible process using the materials specified to result in a corrosion resistant, composite structure to meet the operating conditions for the project. Stiffening ribs may be used to increase the overall pipe stiffness.

Flanges, bends, reducers, tees, wyes and other fittings shall, when installed, be capable of withstanding all operating conditions of the project. They may be contact moulded, filament wound or manufactured from mitred sections of pipe joined by glass fibre reinforced polyester overlays.

3.2.3.4 Product specifications (New Subclause 3.7.3.4)

The stiffness required is dependent on burial conditions and negative pressures (if they exist). Minimum stiffness requirements shall be determined for both parameters and the higher of the two shall be the minimum selected. Unless otherwise shown on drawings the specified stiffness class of all pipes shall be SN 5000.

Pressure classes shall be as stipulated in the Project Specification. The specified pressure classes shall be capable of withstanding surge pressures of up to 40% higher than the maximum allowable working pressures. When applicable the pipe shall be de-rated in terms of AWWA C950.

3.2.3.5 Product use (New Subclause 3.7.3.5)

The maximum allowable initial diametrical deflection shall be as follows (% of nominal diameter):

For pipe 300mm or greater: 3,0%

For pipe 250mm or less: 2,5%

The maximum allowable operating temperature of the pipes shall be 50 degrees C. The minimum allowable operating temperature of the pipes shall be -40 degrees C.

3.3 JOINTING MATERIALS (SUBCLAUSE 3.8)

3.3.1 Flexible Couplings (Subclause 3.8.2)

Replace the contents if this subclause with the following:

“Flexible couplings shall be in accordance with Particular Specification SPE-MP-7023 and its amendments.

All grinding off of welds shall conform accurately with the profile of the rolled section and so that no flats occur on surfaces that are supposed to be curved. The centre register (where present) shall be ground off on either side of the weld in such a manner that all sharp edges which would result in weakening of the protective coating are removed.

Flexible couplings shall be supplied complete with all necessary bolts, nuts and rubber jointing rings.”

3.3.2 Flanges and Accessories (Subclause 3.8.3)

Replace the contents of this subclause with the following: “Flanges for steel pipes and specials shall comply with the requirements of Particular Specifications SPE-MP-7001 and SPE-MP-7002 and their amendments. Each flanged pipe and fitting shall be supplied complete with one set of bolts, nuts, gaskets in compliance with the specifications.”

3.3.3 Loose flanges (Subclause 3.8.4)

Replace the contents of this subclause with the following: “Loose flanges supplied on this contract shall comply with the flange specifications included for steel pipes and specials in SPE-MP-7002 and SPE-MP-7001 respectively. The length of each bolt shall be such that the bolt threads project no less than 1 thread and no more than 8 threads above the head of the nut.

Backing ring flanges for HDPE pipes and fittings shall be in accordance with SANS 1123 and be manufactured from grade 316 stainless steel, unless otherwise shown on the drawings or specified in the Bill of Quantities.”

3.3.4 Joining pipes/fittings of the same material (New Subclause 3.8.8)

- a) HDPE pipes shall be joined by means of butt fusion welding. HDPE pipes of DN 110 and smaller can be joined with compression type fittings. Electro-fusion fittings will not be accepted unless approved by the Engineer.
- b) PVC-U / PVC-M pipes shall use push in joints. The pipe end shall be spigot and socket with integral socket and locked-in rubber ring seal.
- c) GRP pipes shall be field connected with glass reinforced plastic sleeve couplings that utilize elastomeric sealing rings as the sole means to maintain joint water-tightness. The joints shall meet the performance requirements of ASTM D4161.

3.3.5 Joining pipes/fittings of different materials (New Subclause 3.8.9)

- a) Unless otherwise specified on the drawings or in the Bill of Quantities, when connecting HDPE pipes to pipes or fittings of other materials, they shall be bolted together. The HDPE pipe shall have a stub and steel backing ring (SS316 backing ring unless otherwise specified) and the adjoining pipe or fitting of other material shall be flanged. Attempting to join plain-ended HDPE pipes to pipes and fittings of other materials will not be accepted.
- b) Unless otherwise specified on the drawings or in the Bill of Quantities, when connecting PVC-U/PVC-M pipes to pipes or fittings of other materials, this shall be done by means of a flange adapter. The PVC pipe shall be fitted with a ductile or cast iron flange adapter with socket end and the adjoining pipe or fitting of other material shall be flanged. An insulating flange shall be provided to prevent bi-metallic corrosion between the steel flange and the flange adaptor, and the flanges shall be bolted together.
- c) Unless otherwise specified on the drawings or in the Bill of Quantities, when connecting GRP pipes to:
 - i) plain-ended pipes or fittings of other materials, this shall be by means of flexible steel couplings (e.g. Arpol, Straub, etc.). Mechanical steel couplings (e.g. Viking Johnson, Klamflex etc.) shall only be used where approved by the pipe manufacturer as well as the Engineer.
 - ii) flanged pipes or fittings of other materials, they shall be bolted together. Both the GRP pipe and the adjoining pipe or fitting of other material shall be flanged.

3.4 CORROSION PROTECTION (SUBCLAUSE 3.9)

3.4.1 Steel Pipes (Subclause 3.9.2)

Replace the contents of this clause with the following: "Corrosion protection of steel pipes shall be in accordance with Particular Specification SPE-JJ-0003 and its amendments."

3.4.2 Flexible Couplings (Subclause 3.9.4)

Replace the contents of this clause with the following: "Corrosion protection of flexible couplings shall be in accordance with Particular Specification SPE-JJ-0003 and its amendments."

3.4.3 Joints, bolts, nuts and washers (Subclause 3.9.5)

Replace the contents of this Subclause with the following:

"All fasteners (i.e. nuts, bolts and washers, etc.) shall be of equal or better corrosion resistance than the items being fastened, and shall under no circumstance have corrosion resistant properties less than that provided by hot dip galvanising. For example, SS316 or better fasteners must be used to fasten together SS316 flanges, HDG or better fasteners must be used to fasten together HDG flanges. Plated fasteners will not be accepted.

Washers shall be fitted under both bolt head and nut. Bolts and nuts shall be treated with nickel anti-seize paste before assembly."

3.4.4 Corrosive soil (Subclause 3.9.6)

Replace the heading of this Subclause with the following:

“Buried pipework”

Replace the contents of this Subclause with the following:

“All buried steel, cast iron and ductile iron pipework fittings, joints and valves shall be wrapped in an approved petroleum-based paste and adhesive tape (“Denso tape” or equal approved) strictly in accordance with the System 10 of Particular Specification SPE-JJ-0003.”

3.5 VALVES (SUBCLAUSE 3.10)

Replace the contents of this Subclause with the following:

“Valves shall be of the types and sizes specified in the scope of work.

Valves shall comply with various Particular Specifications applicable to the different types of valves. Where no specifications are provided, valves shall comply with the following:

Diaphragm valves shall comply with the requirements of SANS 1808-13 and shall have the attributes as specified in the scope of work.

PVC-U gate valves shall comply with the requirements of SANS 1808-18 and shall have the attributes as specified in the scope of work.

Float valves (equilibrium type) shall comply with the requirements of SANS 1808-32 and shall have the attributes specified in the scope of work.

Automatic control valves shall comply with the requirements of SANS 1808-31 and shall have the attributes as specified in the scope of work.

Cast steel gate valves shall comply with the requirements of SANS 191 and shall have the attributes as specified in the scope of work.

Cast iron gate valves shall comply with the requirements of the relevant part of SANS 664 and shall have the attributes as specified in the scope of work.”

3.6 MANHOLES AND SURFACE BOXES (SUBCLAUSE 3.11)**3.6.1 Step irons (Subclause 3.11.4)**

Replace the contents of this Subclause with the following:

“Step irons shall be manufactured of copolymer polypropylene with a 12 mm diameter high tensile steel core. The step irons shall be installed in accordance with the manufacturer's specifications.”

3.6.2 Manhole covers and frames (Subclause 3.11.5)

Add the following to the end of Subclause 3.11.5.1:

“All manhole covers and frames shall be manufactured from ductile iron complying with the requirements of SANS 55 and be of the SECUREX type or similar approved.”

3.7 MARKING (NEW SUBCLAUSE 3.12)

All pipes, specials and valves arriving on site shall be marked clearly with the item number appearing in the Bill of Quantities. Furthermore, the nuts, bolts, washers and other ancillary equipment for each individual item shall be kept separate in a bag which shall also bear the respective reference number for that item. The cost of such marking will be held to have been included in the rates tendered for the items.

3.8 PROTECTION DURING STORAGE, HANDLING AND CONSTRUCTION (NEW SUBCLAUSE 3.13)

The Contractor shall satisfy the Engineer that the manufacturers' recommendations for good practice for the transporting, handling, stacking, storing and installing of pipes, pipe fittings, sealing rubbers etc. are being diligently followed. The Engineer's Representative shall be given the opportunity to inspect all materials immediately prior to installation and shall have the right to reject any materials which, in his opinion, have suffered damage which may impair the long term durability or strength of said items.

Pipes and specials shall be protected against damage during all stages of manufacture, delivery, storage and handling.

Until required, rubber rings and couplings in which there are rubber rings shall be stored undercover in a cool, dark place, away from grease, oil and harmful chemicals. If rubber rings are tied in bundles they shall be untied at least 2 days before being required to allow the rubber rings to recover from any tie marks and indentations.

4 PLANT (CLAUSE 4)

No amendments.

5 CONSTRUCTION (CLAUSE 5)

5.1 LAYING (SUBCLAUSE 5.1)

5.1.1 General (Subclause 5.1.1)

Add the following to the end of this Subclause:

"The pipelines shall be laid to the invert levels and gradients shown on the drawings.

Horizontal and vertical angular deviations at flexible couplings shall be limited to the maximum angle specified by the pipe manufacturers.

The Contractor shall protect all buried pipe fittings, valves and joints including fasteners against corrosion by wrapping them in accordance with subclause 3.9.6.

Curving of HDPE pipes to a radius not exceeding 20 x outside diameter of the pipe, or as permitted by the pipe manufacturer, shall be permitted in lieu of bends.

GRP pipes shall be installed in accordance with the Manufacturer's Installation Instructions and as approved by the Engineer. Field service representatives of the Manufacturer will be requested to be present periodically during the installation of the pipes, and particularly at the outset of installation. The extent of the presence of the field service representative will be covered in the pipe supply contract between the Manufacturer and Purchaser."

5.1.2 Damage (Subclause 5.1.2)

Add the following to the end of this Subclause:

"The following shall apply with respect to surface damage to HDPE pipes:

- a) All diameters: Any form of surface damage greater than 10% of the minimum wall thickness shall not be allowed.
- b) All diameters: Any surface damage located closer than 200 mm from the pipe ends shall not be allowed.
- c) \leq DN110: Surface damage shall not exceed 10% of the minimum wall thickness and shall not be greater than 75 mm in length. The distance between surface damages shall not be less than 300 mm and no

more than two (2) defects shall be permitted per 6 metre length of pipe (reduced number of defects pro rata per length).

- d) > DN110: Surface damage shall not exceed 5% of the minimum wall thickness and shall not be greater than 75 mm in length. The distance between surface damages shall not be less than 300 mm and no more than three (3) defects shall be permitted per 6 metre length of pipe (reduced number of defects pro rata per length).

Pipes not conforming to these criteria shall be rejected."

5.1.3 Depths and cover (Subclause 5.1.4)

Add the following to the end of Subclause 5.1.4.3:

"The minimum clearances at crossings between the barrels of proposed pipelines or between existing and proposed pipelines shall be 300 mm. The pipeline shall be laid horizontally at this level for a distance of at least 1,0 m on either side of the centreline of the service crossed. The Contractor shall inform the Engineer should he find that this minimum clearance cannot be achieved."

Add the following to the end of Subclause 5.1.4:

- "5.1.4.6 The pipelines shall be laid to the invert levels and gradients shown on the drawings and so that the minimum cover to the top of the pipe barrel from finished surface level is 1.0 m unless otherwise specified."

5.1.4 Setting out (New Subclause 5.1.5)

The Contractor shall clearly mark the pipeline route for the approval of the Engineer prior to commencing with and trench excavation. The requirements for marker posts shall apply.

5.1.5 Marker posts (New Subclause 5.1.6)

The Contractor shall supply and accurately place marker posts on the centreline of buried pipelines, or as instructed by the Engineer. Marker posts shall be placed at all points of intersection, chambers and at a maximum spacing of 250 m. Marker posts shall be placed only once the pipelines, or any sections thereof, have been successfully tested and the trenches backfilled.

The manufacture, installation and identification marks of marker posts shall comply with the drawings. Where no drawing exists, the Contractor shall propose marker posts that are suitable for the purpose, for approval of the Engineer.

The co-ordinates, level and centreline distance (as determined from the as-built survey and drawings) of each marker post shall be accurately determined and recorded by the Contractor. All details shall be given to the Engineer in writing.

5.2 JOINTING METHODS (SUBCLAUSE 5.2)

5.2.1 Welding (Steel Pipelines of Diameter 600 mm or greater) (Subclause 5.2.3)

Omit the words "of Diameter 600 mm or greater" from the Subclause heading.

Delete the contents of this subclause and replace with the following:

"All welded joints for steel pipes, fittings and specials shall be done in accordance with the particular specification SPE-CC-7003 and its amendments."

5.2.2 HDPE Welding (New Subclause 5.2.5)

The HDPE pipes and specials shall be joined by means of butt fusion using approved, butt welding equipment and fully accredited, trained plastic welders in accordance with the manufacturer's code of practice. The Contractor shall undertake the following steps prior to the commencement of welding on site:

- a) Provide a Welding Procedure Specification (WPS)
- b) Provide welding tables applicable specifically to pipe diameters and pressure classes to be welded and the welding equipment used.
- c) Provide a certificate of calibration for the welding machine to be used. The certificate shall bear the model number of the welding machine, the name and the address of the certifying agent, the date of the test and a statement as to the accuracy of the temperature and pressure gauges on the machine in question.
- d) A certificate of calibration dated more than 12-months from the Commencement Date is not acceptable.
- e) Provide certification that the welder/operator has successfully completed an approved training course in accordance with SANS 10269 and is qualified to weld the sizes and pressure classes of HDPE pipe to be used on this Contract. The certificate shall be issued within the previous 12 months from construction commencing on site.
- f) A test weld, on each pipe diameter and pressure class, is to be undertaken on site in the presence of the Engineer's Representative for approval prior to the commencement of welding the pipes. The test weld(s) shall also be submitted to an approved laboratory and be tested in accordance with SANS 6269. A minimum weld factor of 1.0 is required.

Under no circumstances will welding be permitted to commence prior to the provisions of the abovementioned certificates and the weld test, and the cost of delays resulting from failure to timeously undertake the abovementioned steps shall be borne by the Contractor.

Each joint is to be uniquely numbered and a record shall be kept detailing the date, pipe details, weather, welding conditions, initial bead height, welding times and final position of joint in the ground, a copy of which shall be forwarded to the Engineer.

To remove any residual dust and other fine contaminants on the heater plate, a dummy joint shall be made at the start of each day or when changing between pipe sizes.

Unless otherwise approved, the external and/or internal beads shall be removed using suitable debearing tools. The beads and joint shall be numbered/coded using an indelible marker pen to correspond with the joint details entered into the butt fusion machine data retrieval system.

During construction, the Engineers Representative shall order the cutting out of ad hoc joints for testing in accordance with SANS 6269 at an independent testing facility. A minimum of one joint per one hundred joints, with the same welding machine, shall be tested.

If it is necessary to cut pipes, the cut ends shall be turned using a field lathe. Filing of the coupling surfaces of pipes will not be permitted.

5.3 SETTING OF VALVES, SPECIALS, AND FITTINGS (SUBCLAUSE 5.3)

Replace the last paragraph of this Subclause with the following:

Valves requiring special adjustment after installation such as self-closing valves shall be commissioned by representatives of the valve manufacturers. Similarly, meters shall be commissioned by the respective suppliers after installation by the Contractor.

The mass of valves or water meters shall at no time be carried by the pipe, the flange or the coupling. Support stools shall be constructed as soon as practicable after the installation of valves and meters, and shall generally be constructed of steel, concrete or masonry work. Where fabricated steel stools are approved or specified, they shall comply with the requirements of SANS 10044-3 and shall be fabricated to the Engineer's approval. Supports shall be welded to the pipe only where specified and linings of pipes and specials shall be made good after welding.

Hydrostatic testing of individual sections of the pipeline shall only be carried out when all scour valves, air valves and control valves have been installed, except where otherwise instructed by the Engineer in writing.

Should line control valves or other equipment not be delivered timeously to enable the Contractor to lay continuously and to test the pipeline, the Engineer may order the Contractor to substitute specially made temporary flanged closure pieces. Such temporary closure pieces shall be supplied and installed by the Contractor to enable laying and testing to proceed. Subsequently after installation of the control valves, etc., they shall be removed and shall become the Contractor's property. These temporary closure pipes shall have the same face to face dimensions as the line control valves and shall be fitted with a suitably reinforced control diaphragm plate for sealing of the section of pipeline where it is fitted. Wall thickness and diameter of the closure pipes shall be the same as the pipeline. A 100 mm nominal bore valve-controlled by-pass shall be fitted externally around the diaphragm plate.

5.4 CONCRETE CASING (SUBCLAUSE 5.4)

Add the following to the start of this Subclause:

"The requirements under this Subclause shall only be used where the encasing of pipes in concrete is scheduled under 8.2.12 Concrete Casing."

5.5 ANCHOR/THRUST BLOCKS AND PEDESTALS (SUBCLAUSE 5.5)

Add the following to the end of this Subclause:

"Thrust blocks are required for all bends where flexible joints are used. These thrust blocks are not necessarily required for pipelines that are continuously welded or where locked joints are used.

Where locked joints are used in lieu of thrust blocks, the Contractor shall submit to the Engineer the relevant calculations of the anchored lengths for all relevant bends.

The concrete in the thrust blocks shall be at least Class 25 MPa/19 mm. The minimum cover to the steel shall be 50 mm. Where no reinforcement is shown allow 100 kg/m³ of concrete."

5.6 END CAPS (NEW SUBCLAUSE 5.11)

The Contractor shall, at the end of each day's work, fit end caps to the open ends of the pipeline under construction. The end caps shall be manufactured in such a manner that it can be fitted to seal off the pipeline to the extent that it is totally dust and water proof. The end cap must be able to withstand a pressure of 5 m head of water externally when fitted.

End caps shall be maintained during non-working periods.

5.7 FLEXIBLE CONNECTIONS AT STRUCTURES (NEW SUBCLAUSE 5.12)

In order to avoid damage to pipes due to differential movement where the pipes connect to chambers or other structures, all rigid pipes built and/or grouted into such structures shall be provided with flexible connections in accordance with SANS 1200 LD Drawing LD-2 (unless shown otherwise on the project-specific drawings).

Where PVC pipes connect to any structure a "Lyng" type PVC double socket (or where applicable, a bend) shall be fitted directly into the machined collar of the associated puddle pipe.

HDPE pipelines are considered flexible pipelines and shall connect via a restrained flanged special built into the structure.

5.8 CLEANING PIPE INTERNALS, VALVES AND FITTINGS (NEW SUBCLAUSE 5.13)

The Contractor shall ensure that all pipe work is installed internally free of any contaminants. All traces of dirty water, cuttings, dirt and other debris are to be removed from the inside of the pipe as it is installed.

The Contractor shall take note that flushing of the completed pipelines may not be allowed after construction has been completed and therefore clean house keeping practices will be required under all circumstances

during construction. The tendered rates for pipe laying shall include for the clean house keeping practices required.

Each section of the pipeline is to be internally inspected and passed by the Engineer once construction has been completed. If the pipework is not satisfactory, the Contractor shall re-clean the pipe at his own expense until the pipe is passed clean. The Engineer reserves the right to utilize cameras or any other means to inspect inaccessible areas.

All flanges, valves, fittings and equipment are to be installed in pipe work only after they have been thoroughly cleaned. Flange faces shall be checked for damage before being incorporated into the permanent works and any damage shall be reported to the Engineer.

5.9 PREVENTION OF FLOTATION OF PIPEWORK (NEW SUBCLAUSE 5.14)

The Contractor will take all necessary precautions to temporarily restrain pipework until it has been successfully tested and backfilled over to prevent the potential of flotation of the pipework by rising water tables in the soil. See also Subclause 5.5 of SANS 1200 A.

Pipes to be encased in concrete shall be prevented from flotation during concreting operations. Apart from this special case during concreting operations, the Contractor shall prevent the flotation of pipe work due to storm runoff or groundwater entering the trench before backfilling has been completed.

Methods adopted to prevent flotation shall not damage coatings or linings and shall be approved by the Engineer. Notwithstanding this the Contractor shall at his own expense repair all damage to pipework caused by flotation and/or by the methods adopted to prevent it.

6 TOLERANCES (CLAUSE 6)

6.1 CONTROL POINTS (SUBCLAUSE 6.2)

Amend the permissible deviation of ± 4 m in the second last line of this Subclause with ± 2 m.

6.2 ALIGNMENT (PLAN AND LEVEL) (SUBCLAUSE 6.3)

Amend the permissible deviation of ± 20 % in the third last line of this Subclause with ± 10 %.

6.3 TOLERANCES FOR GRP PIPES (NEW SUBCLAUSE 6.5)

Pipes shall be supplied in accordance with the required nominal diameters. Length shall be within ± 25 mm of the agreed standard length. The minimum average wall thickness shall be the agreed wall thickness for the pipe. The minimum single point thickness shall not be less than 87,5% of the stated thickness when measured in accordance with ASTM D3567.

All pipe ends shall be square to the pipe axis ± 6 mm or ± 0.5 % of the nominal diameter, whichever is the greater. The tolerance of the angle of a bend and the angle between the main and a leg of a wye or tee shall be ± 2 degrees. The tolerance on the laying length of a fitting shall be ± 50 mm.

7 TESTING (CLAUSE 7)

7.1 GENERAL (SUBCLAUSE 7.1)

Add the following to the start of this Subclause:

“Pipelines designed for potable use shall be hydraulically tested and disinfected using potable water.

The Contractor shall submit to the Engineer a detailed method statement describing the timing, methodology and scheduling of each hydrostatic pressure test to be undertaken. No test shall proceed before approval of such method statement by the Engineer. Under no circumstances will the Contractor be allowed to carry out

filling, testing and disinfecting of the pipeline without the supervision of the Engineer, neither shall the Contractor permit any other persons to carry out such said activities without the written permission of the Engineer.”

Add the following to the end of this Subclause:

“Over and above other tests specified, all pipelines shall be hydraulically tested. The pipelines shall be fitted with all valves, fittings and couplings required to complete the section before testing will be permitted. The Contractor shall construct temporary thrust blocks and provide temporary plugs, blank flanges and other isolating devices where required for testing at no extra cost to the Employer.

Before any tests are carried out, the test pressures and test points shall be confirmed with the Engineer. The Contractor shall provide all equipment required for the pressure testing of the pipeline.”

7.2 INITIAL TESTS ON WELDED STEEL PIPES (SUBCLAUSE 7.2)

Delete the contents of this subclause and replace with the following: “Welded steel pipes shall be tested in accordance with Particular Specification SPE-CC-7003 and its relevant amendments.”

7.3 STANDARD HYDRAULIC PIPE TEST (SUBCLAUSE 7.3)

7.3.1 Test pressure and time of test (Subclause 7.3.1)

Replace the last sentence of Subclause 7.3.1.1 with the following:

Where mixed types or classes of pipe occur, and where the pipeline traverses a wide range of altitudes, the pipeline shall be tested in reduced lengths necessary to comply with 7.3.1.2. Any temporary valves, blank flanges, thrust blocks or other isolating devices required shall be provided by the Contractor at no additional cost to the Employer.

Replace Subclause 7.3.1.2, 7.3.1.3 & 7.3.1.4 with the following:

“The field test pressure applied over any section of pipeline under test, taking differences in elevation along the pipeline into account, shall not be less than the maximum design pressure or exceed 1.25 times the maximum design pressure unless otherwise specified in the Project Specification, on the drawings or by the Engineer.

7.3.2 Permissible leakage rates (Subclause 7.3.3)

Add the following pipe materials to those listed in item b):

“HPDE, PVC-M, PVC-O”

7.3.3 Initial filling of pipeline (New Subclause 7.3.4)

Unless otherwise specified or approved in writing by the Engineer, filling of the pipeline for hydraulic testing shall be carried out at a velocity in the main pipeline not exceeding 0.5 m/s. Any damage to the pipeline caused by non-compliance with this clause shall be rectified at the Contractor's expense.

Water used for one filling of the pipeline for hydraulic testing, and in the case of potable pipelines, one filling for disinfection and one filling after draining, will be provided by the Employer to the Contractor, free of charge, at connection points stated in the Project Specification or instructed by the Engineer. Additional water supplied by the Employer owing to unsuccessful hydraulic testing and/or disinfection will be charged to the Contractor.

7.3.4 Disinfection of pipeline (New Subclause 7.3.5)

Pipelines designated for potable use shall be disinfected after the hydraulic testing has been successfully completed and approved by the Engineer. Water used for the hydraulic testing shall be drained and the pipeline filled, subject to 7.3.4, using potable water with a 1.0 mg/L chlorine solution until completely full. Once completely full, the pipeline shall be allowed to stand a minimum of 3 hours for disinfection unless

otherwise instructed by the Engineer and then drained completely. All valves and pipe ends shall be closed, and no drainage or leakage is permitted during the time for disinfection.

7.4 RESTRICTION ON LENGTH OF OPEN TRENCH (NEW SUBCLAUSE 7.5)

Unless agreed otherwise with the Engineer, pipes shall be tested in lengths not exceeding the maximum allowable length of open trench as contained SANS 1200 DB. Where additional temporary isolating devices are required for testing as a result, the Contractor shall provide these at no extra cost to the Employer.

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 SCHEDULED ITEMS (SUBCLAUSE 8.2)

8.1.1 Supply, lay and bed pipes complete with couplings (Subclause 8.2.1)

Delete "(See 8.2.4)" from the end of this Subclause.

Add the following to the end of this Subclause:

"The rates shall also cover the cost of any cutting and jointing (including nuts, bolts, washers, gaskets, etc.) required for temporary or permanent closure of pipes or for the creation of flexible connections at structures. The rates shall further cover the cost of marking of the items, complying with marker posts requirements, corrosion protection as specified, wrapping of flanges and couplings with "denso" tape or similar approved, supply and fitment of temporary end caps, cleaning the pipes, and all specified testing (including all cost associated with completing the tests including temporary thrust blocks, temporary isolating devices, etc.).

In the case of concrete pipes with an HDPE liner, the rate tendered shall also cover the cost of providing and testing the HDPE liner."

8.1.2 Extra-over 8.2.1 for the supplying, laying and bedding of specials complete with couplings (Subclause 8.2.2)

Add the following at the end of this Subclause:

"The contents of 8.2.3 apply."

8.1.3 Extra-over 8.2.1 for the supplying, fixing and bedding of valves (Subclause 8.2.3)

Add "complete with couplings" to the end of the heading for this Subclause.

Replace the contents of this Subclause with the following:

Specials and valves will be measured by the number of each type, class, and size.

The rates, which shall be extra-over the rates for 8.2.1, shall cover the cost of the design and provision of each special or valve, complete with specified couplings, supports, all nuts, bolts, gaskets, etc. and the cost of marking of the items, handling, inspecting, transporting, fixing, bedding, and testing of the special or valve, as applicable, and the cutting of the pipes and preparation of pipe ends.

The rates shall also cover the cost of machined collars on the specials (where shown on drawings) and the couplings/welds necessary to fit the special and valves to the associated pipeline. The rates shall further cover the cost of corrosion protection as specified, the repair of corrosion protection (as applicable), and the wrapping of flanges and couplings with "denso" tape or similar approved.

No extra payment over and above the rates will be made in respect of any additional cutting, turning, and jointing of pipes required for the location of valves, specials, etc., in the positions given on the drawings.

No extra over payment will be made for bends smaller than 5° for steel pipes, 5° for PVC, 5° HDPE or 5° GRP. The cost for bends or angular deviations at flexible couplings shall be deemed to be included in the tendered rate for 8.2.1.

Unless specific provision is made in the schedule, no separate payment will be made for the supply and fitting of any additional joints and jointing materials which may be required for the connection of shortened pipe lengths.

8.1.4 Extra-over 8.2.1 for encasing joints (Subclause 8.2.7)

Delete this Subclause and its heading.

The cost of encasing joints shall be included in the rates provided under 8.2.1, 8.2.2 and 8.2.3, where the cost of the specified corrosion protection and wrapping of flanges and couplings with “denso” tape (or similar approved) is included.

8.1.5 Temporary Valves, etc. (Subclause 8.2.10)

Delete this Subclause and its heading.

Payment for temporary valves, end caps, blank flanges, or other isolating devices required to complete installation and testing requirements shall be included in the rates provided under 8.2.1, 8.2.2 and 8.2.3,

8.1.6 Anchor/Thrust blocks and pedestals (Subclause 8.2.11)

Add the following to the end of the 2nd last paragraph of this Subclause:

“The rates given in b) above shall also include the cost of any excavation, trimming and backfill required.

In the final line of this Subclause, replace the words “and screeding of top surfaces.” with the following:

“concrete, screeding of top surfaces and any backfill required. Where reinforcement is not indicated on the drawings, an amount of 100 kg of high tensile steel per cubic metre of concrete shall be included for.

Temporary thrust blocks will not be paid for.”

8.1.7 Valve and hydrant chambers, etc. (Subclause 8.2.13)

Replace the words “complete units.” in the first sentence with the following:

“complete units, with depth increments as scheduled (if applicable). For the purpose of measurement and payment, the depth of a chamber is defined as the depth from the top of the cover to the invert level of the chamber (where the invert level for larger chambers is that of the main floor area and not the invert of a localized recess used for draining the chamber). For bell toby valve chambers, the crown of the pipe shall be taken as the chamber invert level.”

Replace the last paragraph of this Subclause with:

“The rate shall cover the cost of any additional excavation in all material (including disposal of surplus) and backfilling with suitable material (including importation of material if required). The rate shall further cover the cost of building the chambers, complete as shown on the relevant drawings, including castings, step irons, cover and frames (Type 2 A unless otherwise shown on the drawings), benching, vents, brickwork, concrete work, grids, other accessories, etc., and the building in of pipework and valves (but excluding supply of the main pipework and valves), along with all necessary materials, plant and labour.”

8.1.8 a) Manholes, b) Extra-over for manholes of depth exceeding 1,5 m (Subclause 8.2.14)

At the end of the first paragraph of Subclause 8.2.14(a), replace the words “of overall depth not exceeding 1,5 m.” with the following:

“of the incremental depths scheduled.”

Add the following to the end of Subclause 8.2.14(a):

“For the purpose of measurement and payment, the depth of a manhole, inspection chamber, etc, is defined as the depth from the top of the cover to the invert level of the manhole, inspection chamber, etc.

The rate shall cover the cost of any additional excavation in all material (including disposal of surplus) and backfilling with suitable material (including importation of material if required). The rate shall further cover the cost of building the manholes, complete as shown on the relevant drawings, including castings, step irons,

cover and frames (Type 2 A unless otherwise shown on the drawings), benching, vents, brickwork, concrete work, grids, other accessories, etc., and the building in of pipework and valves (but excluding supply of the main pipework and valves), along with all necessary materials, plant and labour.”

Delete the heading and contents of Subclause 8.2.14(b).

8.1.9 Special Wrapping in Corrosive Soil (Subclause 8.2.15)

Delete this Subclause and it's heading.

The cost of wrapping shall be included in the rates provided under 8.2.1, 8.2.2 and 8.2.3, where the cost of the specified corrosion protection and wrapping of flanges and couplings with “denso” tape (or similar approved) is included.

8.1.10 Miscellaneous (New Subclause 8.2.16)

The tendered sums or rates shall cover all costs required to execute and complete the work as specified and scheduled. This shall, for example, include full compensation for the supply of all materials, delivery to site, storage, all equipment and plant, labour, preparation, application, installation, testing, all temporary work and safety precautions, replacement of defective work, protection of completed work and clean-up after completion. Where this requires tying into an existing service, the rate shall further include managing the shutting-off/disconnection and turning-on/reconnection activities required to complete the work. The unit of measurement shall be as scheduled.

9 APPENDIX A. APPLICABLE STANDARDS

Add the following to the end of Appendix A

“AWWA C950, AWWA Standard for Fiberglass Pressure Pipe

ASTM D3517, Standard Specification for "Fiberglass" (Glass Fibre Reinforced Thermosetting-Resin) Pressure Pipe, in the case of pressure pipes

ASTM D3262 Standard Specification for "Fiberglass" (Glass Fibre Reinforced Thermosetting Resin) Sewer Pipe, in the case of gravity sewer pipes

ASTM D3754 Standard Specification for "Fiberglass" (Glass Fiber Reinforced Thermosetting Resin) Sewer and Industrial Pressure Pipe for pressurized sewer and industrial waste pipes

ASTM D4161 Standard Specification for "Fiberglass" (Glass Fiber Reinforced Thermosetting Resin) Pipe Joints Using Flexible Elastomeric Seals”

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1 SCOPE (CLAUSE 1)

Replace the contents of this Clause with the following:

“This specification covers the supply and installation of bedding (bedding cradle and selected fill blanket) for buried pipes carrying fluids under pressure or gravity.

Project-specific drawings (see definition) have been prepared to show the bedding details for various pipe types and installation conditions. As these project-specific drawings take precedence over the drawings which are included within the Standardised Specifications, these Standardised Specifications should be read in conjunction with the project-specific drawings.

NOTE:

The standards referred to in the specification are listed in Appendix A.”

2 INTERPRETATIONS (CLAUSE 2)

2.1 DEFINITIONS (SUBCLAUSE 2.3)

In the definition for “Main fill” delete “150 mm” in second line and substitute “300 mm”.

Add the following at the start of the definition for “Flexible pipe”:

“A pipe made of Steel, GRP, uPVC or HDPE, or otherwise “

Add the following at the start of the definition for “Rigid pipe”:

“A pipe made of concrete, or otherwise “

Add the following new definitions:

“Stiffness ratio. Modulus of soil reaction of the bedding material.”

“Project-specific drawings. Drawings other than those included within the Standardised Specifications. For example, drawings LB-1 and LB-2, etc. are not project-specific drawings.”

3 MATERIALS (CLAUSE 3)

3.1 SELECTED GRANULAR MATERIAL (SUBCLAUSE 3.1)

Add to the following to this Subclause:

“Unless otherwise specified, the selected granular material shall consist of sand and the maximum particle size shall be restricted to 5mm as detailed in Subclause 3.3 below.”

3.2 SELECTED FILL MATERIAL (SUBCLAUSE 3.2)

Replace the contents of this Subclause with the following:

“The material for selected fill shall be selected granular of a particular size as per 3.1, unless indicated otherwise on the project-specific drawings.”

3.3 BEDDING (SUBCLAUSE 3.3)

In the first line, replace “Class A, B, C or D” with “Class B”.

Add to this Subclause:

"Bedding (selected granular and selected fill material) for flexible pipes shall be fine sand or fine non-cohesive soil, carefully selected, with maximum particle size of 5 mm and which shall not cake nor form lumps when drying. Samples of bedding sand shall be submitted by the Contractor to the Engineer for approval well in advance of construction. Only after the Contractor has received written approval from the Engineer, may he/she proceed with placing sand as selected granular material.

No sharp-edged stones shall be allowed to come into contact with the flexible pipes or associated fittings. Joint holes (pockets) shall be provided in the trench bottom and bedding, at each pipe joint to facilitate inspection or welding where applicable, and no extra payment will be made for forming or filling the joint holes (pockets) with bedding sand.

The material shall be free of organic matter and shall have a compactibility factor of not more than 0,4. The material should be classified as silty to fine sand having a stiffness ratio of not less than 6,0 MPa. The origin of the materials should, preferably, be river transported since it is preferable that the larger grains be rounded and not sharp and angular.

The Contractor will be required to carry out his/her own quality control testing of the material to ensure that it meets the bedding sand requirements and complies with this specification at all times. At least one grading analysis shall be carried out for every 100 lineal metres of bedding placed. The results of these tests shall be forwarded to the Engineer within 24 hours of completion of the test. Should the material not comply with the specification, the Contractor shall remove and replace it with approved material at his/her own cost.

Depending on the actual material supplied by the Contractor, the moisture content may be critical to enable satisfactory placing and compaction and the Contractor will be deemed to have allowed in his tendered rate for any and all adjustments required to the moisture content of the bedding material at all times.

Items have been provided in the Bill of Quantities for the provision of approved bedding sand from approved Commercial or other approved off-site sources for bedding sand.

No extra payment will be made for forming or filling joint holes (pockets)."

3.4 SELECTION (SUBCLAUSE 3.4)

3.4.1 Suitable material available from trench excavation (Subclause 3.4.1)

Replace the words "(but is not required)" in the fourth and fifth lines with the words "(at his own cost)".

Add the following to this Subclause:

"If, in the opinion of the Engineer, bedding material can be produced from the excavated material, the Contractor shall, if so ordered by the Engineer, screen or otherwise treat (as scheduled) the excavated material in order to produce material suitable for bedding (see also Subclause 8.2.1 below)."

4 PLANT (CLAUSE 4)

No amendments.

5 CONSTRUCTION (CLAUSE 5)

5.1 GENERAL (SUBCLAUSE 5.1)

5.1.1 Trench (Subclause 5.1.1)**5.1.1.1 Bottom (Subclause 5.1.1.2)**

Add the following at the end of the first sentence:

“Where expansive clay is encountered in the trench bottom, the selected fill blanket shall comprise of selected granular material.”

5.1.2 Details of bedding (Subclause 5.1.2)

Replace the words “Pipes shall be bedded and protected in accordance with” with the following:

“Pipes shall be bedded and protected in accordance with the details shown on the project-specific drawings. Where no project-specific drawings are provided or where they do not cover certain pipe sizes or types, the pipes shall be bedded and protected in accordance with”

5.1.2.1 Stone drainage layer beneath bedding (New Subclause 5.1.2.1)

“In areas where waterlogged conditions exist or where ordered by the Engineer, special drainage may be required which consists of a single sized stone with a geofabric filter surround as specified in Subclause 5.5.2 of SANS 1200 DB. The excavation for these drains will be measured in cubic metres at the contract rate applying to unsuitable excavation below the bottom of the trench. The stone filling will be paid for per cubic metre and the geofabric filter will be paid for per square metre. All measurements in this connection will be to a width equal to the base widths and depths ordered.”

5.1.3 Compacting (Subclause 5.1.4)

Replace “90%” with: “93% (100% for sand)”.

Add the following to this Subclause:

“Steps will have to be taken by the Contractor to ensure that flexible pipes do not deform excessively in cross-section during and after construction and backfilling operations. The maximum deflection which will be acceptable at any stage during or after construction shall be the minimum of 2% of the pipe diameter horizontally or vertically, or the maximum deflection permitted by the pipe manufacturer. The Contractor will be required to provide the necessary apparatus and to monitor deflection during construction.

Pipe deformations will only be maintained within the specified tolerances by correct backfilling practice. No heavy compaction equipment will be permitted for compaction of any pipe bedding, only pneumatic or hand rammers being acceptable. To this end, and to achieve the 93% (100% for sand) compaction specified it is required that the bedding material be brought up evenly on either side of the pipe. The use of complete saturation of the material as a method of achieving the specified compaction may, subject to the Engineer's approval, be used. However, in this regard, Tenderers are advised that the presence of excessive quantities of water in the pipe trench could lead to flotation of the pipe.

Prior to the commencement of pipe laying the Contractor will be required to submit, to the Engineer, for his approval, his proposed methods of placing, and compacting methods which he proposes to implement in order to ensure compliance with the specification.”

5.1.4 Testing (New Subclause 5.1.5)

All pipe joints and pipe fittings shall be left exposed with a minimum of 300 mm clearance around the bottom of the pipe during hydraulic pressure testing of the pipe to facilitate inspection.

5.2 PLACING AND COMPACTING FLEXIBLE PIPES (SUBCLAUSE 5.3)

Delete the contents of Subclause 5.3.a Bedding cradle and substitute with the following:

“The pipes shall be bedded on a minimum 100 mm thick layer of compacted granular bedding material on which a 50 mm thick layer of uncompacted granular bedding material has been placed and spread. Loose granular bedding material lying next to the pipe shall be placed into the haunch area and compacted with

suitable hand tools (covered with rubber to prevent damage to the pipe coating), and additional selected granular material shall be added and compacted in layers up to the mid-point of the pipe diameter in the vertical plane. The remainder of the bedding i.e. the selected fill blanket, shall be placed in layers up the sides of the pipe, each layer being compacted until a level of 300 mm above the crown of the pipe is reached.

All joint (fox) holes shall be filled with bedding material."

For Subclause 5.3.b, delete "200 mm" from title.

5.3 CONCRETE CASING TO PIPES (SUBCLAUSE 5.4)

Replace the contents of this Subclause with the following:

"The requirements under this Subclause shall only be used where the encasing of pipes in concrete is scheduled under 8.2.4 Encasing of Pipes in Concrete.

Where the Engineer requires pipes to be encased in concrete, a class 25 MPa/19 mm for unreinforced, 30 MPa/19 mm for reinforced or such other class as is scheduled, shall be used. The work shall be done as follows:

- a) Concrete casing shall be discontinuous at flexible couplings in the pipeline.
- b) The pipe trench for the concrete encased pipeline shall be excavated to the depth below the bottom surface of the pipe, as ordered or shown on the drawings, and to sufficient width to allow for the concrete to be placed to the full specified width. The bottom of the trench shall be trimmed true to line and grade.
- c) The in situ concrete bed 150 mm thick shall be cast and the pipeline laid thereon true to line and level leaving a gap nowhere less than 50 mm between the pipe and the bed. If the encasement on the drawings is shown to extend further than 200mm below the invert of the pipe, the 150mm thick concrete bed shall be increased accordingly.
- d) After jointing, the pipes shall be secured to steel loops left in/anchored to the bed. Concrete shall then be punned under and around the pipes from one side only until the bottom quarter of circumference of the pipes is in contact with the concrete bed.
- e) The pipe shall be tested in accordance with the applicable tests given in Clause 5, care being taken to ensure that the pipe do not move during testing.
- f) After the pipeline has been tested, suitable formwork shall be erected, and concrete carefully placed and vibrated in position up both sides of the pipe. The concrete level shall be raised equally on both sides of the pipe until encasement is complete and a cover over the surface of the pipe is provided that is nowhere less than that ordered or shown on the drawings.
- g) No casting of subsequent concrete members or earth filling over the concrete encasing shall be commenced until the concrete encasing has achieved its 28-day compressive strength (minimum 7 days)."

6 TOLERANCES (CLAUSE 6)

6.1 MOISTURE CONTENT AND DENSITY (SUBCLAUSE 6.1)

In this Subclause, replace "be as given below, appropriate to the particular class of work" in the first sentence with "be those for Degree of Accuracy II class of work, as given below"

7 TESTING (CLAUSE 7)

Replace the contents of Subclause 7.1 with the following:

"The Contractor shall carry out density tests as specified in TMH1: Standard Methods of Testing Road Construction Materials, 1986, in the positions indicated by the Engineer, to determine the compaction of the backfill material in the trenches and the material used for reinstating the road construction layers. No single test result which is below the specified density, will be accepted.

In the case of trenches in areas subject to traffic loads, the Contractor shall bear the cost of all density tests carried out except in the following case. Where the test results in areas subject to traffic loads are equal to or exceed the specified density, the Employer will bear the cost of that number of those tests ordered by the Engineer in excess of one test per 20 m³ of compacted material, based on the total volume of backfill and reinstated road layers, which volume is to include the replacement of any over excavation.

In the case of trenches not in areas subject to traffic loads, the Contractor shall undertake one density test per 20 m of installed pipe on the trench bottom and for each layer backfilled. The Contractor shall bear the cost of these density tests. The Contractor shall also bear the cost of additional density tests ordered by the Engineer where the test results of these additional tests are below the specified density.

If the density is found, in any case, to be below the specified value, the Engineer may order the re-compaction of the backfill and retesting, both at the Contractor's expense."

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 PRINCIPLES (SUBCLAUSE 8.1)

~~8.1.1~~ Volume of bedding materials (Subclause 8.1.3)

Add to this Subclause:

- "(c) The volume of bedding material shall be measured net i.e. the volume of the pipe is to be deducted.
- (d) No additional payment will be made for bedding material placed in joint (fox) holes.
- (e) The rate for bedding and backfill material from insitu material shall include the selection and sieving of the material.
- (f) No allowance will be made for bulking or any additional volume of bedding material required due to over break or any other cause."

~~8.1.2~~ Disposal of displaced material (Subclause 8.1.5)

Replace the contents of this subclause with 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 is payable for such material."

~~8.1.3~~ Freehaul (Subclause 8.1.6)

Delete the contents of this Subclause and substitute the following:

"Subclause 5.2.5 of SANS 1200D shall be applicable."

8.2 SCHEDULED ITEMS (SUBCLAUSE 8.2)

~~8.2.1~~ Provision of bedding from trench excavation (Subclause 8.2.1)

Delete the contents of this Subclause and substitute the following:

- "a) Selected granular material Unit : m³
 - i) Without the need for screening:

The rates shall cover the cost of acquiring, from any point along the trench excavation as may be selected by the Engineer, bedding that complies with the relevant requirements of the specification, of delivering it to points alongside the trench spaced to suit the Contractor's methods of working, of making good any backfill deficiency from points where backfill has been acquired, and of disposing of displaced material.

ii) Including for screening:

The rates shall cover the cost of screening or otherwise treating excavated material, at any point along the trench excavation as may be selected by the Engineer, in order to produce bedding that complies with the relevant specification, delivering it to points alongside the trench, spaced to suit the Contractor's methods of working, of making good any backfill deficiency there may be from points where screened backfill material has been acquired, and of disposing of displaced material."

8.2.2 Supply only of bedding by importation (Subclause 8.2.2)

Delete Subclause 8.2.2.1 and substitute the following:

"8.2.2.1 Including for screening and/or other treatment:

- a) Selected granular material Unit : m³
- b) Bedding sand to specified bedding dimensions Unit : m³

The rates shall cover the cost of acquiring, loading, transporting, offloading, screening or otherwise treating excavated material in order to produce bedding that complies with the relevant specification, delivering it to points alongside the trench spaced to suit the Contractor's methods of working and of disposing of displaced material.

NOTE: The rate for the supply and laying of pipelines covers the cost of handling the bedding material from alongside the trench, placing it under the pipeline, forming joint holes and completing the bedding around and over the pipeline."

Add the following after item b) of Subclause 8.2.2.3:

"(c) 6,7 mm concrete stone to SANS 1083.....Unit: m³"

Delete the words "of 0.5 km" in the last line of Subclause 8.2.2.3.

Add the following to the end of Subclause 8.2.2.3:

"Commercial sources shall include off-site-sources located by the Contractor.

In areas where waterlogged conditions exist or where ordered by the Engineer, the Contractor shall install 19 mm crushed stone as selected granular material for concrete pipes with filter fabric as shown on the project-specific drawings.

The geotextile filter blanket shall be measured by area as:

$$\text{Area} = 2 \times (\text{specified stone layer thickness} + \text{minimum base width}) \times \text{net length}.$$

The rate shall include the cost of supply, placing and losses as a result of overlaps and over excavated trench widths."

Add the following new Subclause to the end of 8.2.2:

"8.2.2.4 From other sources on site:

- a) Selected granular material Unit : m³
- b) Selected fill material Unit : m³

The rates shall cover the cost of acquiring, loading, transporting, offloading, screening or otherwise treating excavated material from other locations on the site in order to produce bedding that complies with the relevant specification, delivering it to points alongside the trench spaced to suit the Contractor's methods of working and of disposing of displaced material.

NOTE: The rate for the supply and laying of pipelines covers the cost of handling the bedding material from alongside the trench, placing it under the pipeline, forming joint holes and completing the bedding around and over the pipeline."

8.2.3 Concrete bedding cradle (Subclause 8.2.3)

Add the following paragraph to the Subclause:

"All concrete bedding to pipes will require formwork. The rate for concrete bedding shall include for the supply, installation and stripping of all formwork."

8.2.4 Encasing of pipes in concrete (Subclause 8.2.4)

Replace the first sentence with the following:

Separate items will be scheduled for each size of pipe (or range of pipes), for each grade of concrete specified and whether the encasing is unreinforced or reinforced (unreinforced unless otherwise specified).

Delete the fifth and sixth lines and substitute the following:

"encasing the pipe in concrete including the cost of formwork (if any, inclusive of supply, installation, and stripping), etc. and the cost of formwork to form stop ends on either side of collars, couplings, joints etc., if instructed by the Engineer. .

Where encasings are specified as reinforced, the rate shall also include the cost of reinforcing (120kg of steel reinforcing per m³ of concrete encasing, unless otherwise specified). Where no encasing width or height is given on the drawings, the encasement shall extend 200 mm above and below the pipe and 200 mm on both sides of the pipe."

8.2.5 Extra-over for bedding stabilised with 5% cement (New Subclause 8.2.6)..... Unit : m³

The tendered rate shall include full compensation for selecting, mixing, backfilling, and compacting the stabilised material to 93% modified AASHTO density.

**8.2.5 Supply and install geofabric material (Kaytech A2 or similar approved) (New Subclause 8.2.7)
.....Unit: m²**

"The unit of measurement shall be the square metre, measured in accordance with Subclause 8.2.4 of SANS 1200 DK."

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1 SCOPE (CLAUSE 1)

No amendments.

2 INTERPRETATIONS (CLAUSE 2)

No amendments.

3 MATERIALS (CLAUSE 3)**3.1 DUCTS (SUBCLAUSE 3.1)**

Delete the following words at the start of this Subclause:

“Except that the GPO will supply all pipes for cable ducts required for GPO purposes,”

Add the following after item d):

“e) Kabelflex or similar approved in the case of HDPE pipes, complying with SANS 61386-24 (Type N 450).”

Add the following to the end of this Subclause:

“Ducts shall be supplied by the Contractor complete with end caps, joints, sealing and draw wires.

Unless otherwise specified on the drawings or in the Bill of Quantities, cable ducts shall be Kabelflex or similar approved HDPE ducts.”

3.2 CABLE DUCT MARKERS (SUBCLAUSE 3.4)

Add the following:

"A cable duct marker shall consist of a 300 mm x 300 mm x 100 mm deep, class 20 MPa/19 mm concrete block, connected by means of a non-ferrous metal strip to a temporary plug to seal the end of the duct. The plug shall prevent moisture or soil from entering the duct. The metal strip shall be firmly connected to both the plug and the concrete block. The concrete block shall be positioned not further than 0,5 m horizontally from the end of the cable duct. The face of the concrete block shall be clearly marked "E" to indicate electricity cables."

4 PLANT (CLAUSE 4)

No amendments.

5 CONSTRUCTION (CLAUSE 5)**5.1 Sealing of ends (New Subclause 5.3.5)**

The ends of electrical ducts shall be sealed with end caps or suitable ingress and moist protection.

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)

No amendments.

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 Excavation (Subclause 8.2.2)

In Subclause 8.2.2(b), replace both “1) Intermediate excavation” and the corresponding unit of measure with “1) Not applicable (VOID)”. No extra-over payment will be made for excavation in material classified as intermediate excavation.

8.2 Supply, lay, bed and prove duct (Subclause 8.2.5)

Replace the contents of this Subclause with the following:

“Separate items will be scheduled for each diameter of duct.

The per meter rate shall be per meter of cable duct and not per meter of trench (i.e. for a 10m long trench with 4 ducts, it shall be 40m) and the rate shall cover the cost of providing the ducts (complete as specified in 3.1) and the cost of laying, jointing, bedding, building into draw pits, proving, and installing draw wire as specified. The rates shall also include for all costs involved in sealing and marking duct ends and the re-excavation and backfilling for marking purposes.”

8.3 Cable markers (Subclause 8.2.8)

Delete this Subclause

Marking of ducts will not be measured and paid for separately, and shall be included in the rate tendered for laying of ducts.

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1 SCOPE (CLAUSE 1)

No Amendments.

2 INTERPRETATION (CLAUSE 2)

No Amendments.

3 MATERIALS (CLAUSE 3)**3.1 MANHOLES, CHAMBERS, ETC (SUBCLAUSE 3.5)****3.1.1 Precast concrete sections (Subclause 3.5.2)**

Add the following:

"Sectional spun-concrete cylinders shall be manufactured from dolomitic aggregate."

3.1.2 Step irons (Subclause 3.5.7)

Delete the contents of this Subclause and substitute with the following:

"Step irons shall be of the copolymer polypropylene type with a 12 mm dia. high tensile steel reinforced core and shall be of length suitable for fixing in brick, precast concrete or reinforced fibre cement as applicable."

3.2 MARKER POSTS (SUBCLAUSE 3.6)

Replace the words "Project Specification" with "Drawings". To the end of this Subclause, add the following "Where no drawings exist, the Contractor shall propose marker posts that are suitable for the purpose, for approval of the Engineer."

4 PLANT (CLAUSE 4)

No Amendments.

5 CONSTRUCTION (CLAUSE 5)**5.1 CONNECTING SEWERS (SUBCLAUSE 5.9)****5.1.1 Location and details (Subclause 5.9.1)**

Delete the following from the first paragraph:

"or required in terms of the Project Specifications"

Delete the second paragraph.

5.1.2 Marker Posts (Subclause 5.9.2)

Replace this Subclause with the following:

"Unless otherwise specified, the Contractor shall supply and accurately place marker posts on the centreline of buried pipelines, or as instructed by the Engineer. Marker posts shall be placed at all points of intersection, chambers and at a maximum spacing of 250 m. Marker posts shall be placed only once the pipelines, or any sections thereof, have been successfully tested and the trenches backfilled."

The co-ordinates, level and centreline distance (as determined from the as-built survey and drawings) of each marker post shall be accurately determined and recorded by the Contractor. All details shall be given to the Engineer in writing."

5.2 BACKFILLING AROUND MANHOLES (NEW SUBCLAUSE 5.11)

Material used to backfill around manholes that fall within the road reserve must comply with Subclause 3.1 of SANS 1200 LB. Material used to backfill around other manholes must comply with Subclause 3.5 of SANS 1200 DB.

Material adjacent to the walls of the manholes must be watered and mixed to its optimum moisture content, and compacted in layers not exceeding 150 mm in the compacted state. Compaction must be minimum 100% MOD AASHTO for non-cohesive material, and minimum 93% of MOD AASHTO density for cohesive materials.

Backfilling around the structure must be carried out in even layers to avoid uneven side forces.

6 TOLERANCES (CLAUSE 6)

No Amendments.

7 TESTING (CLAUSE 7)

7.1 TESTS AND ACCEPTANCE/REJECTION CRITERIA (SUBCLAUSE 7.2)

7.1.1 Watertightness of manholes (Subclause 7.2.6)

Add the following:

"Manholes will be inspected at the end of the first winter after completion. No ingress of groundwater into the manhole will be allowed.

Should any manhole fail to pass the inspection to the satisfaction of the Engineer, the fault or faults shall be made good by the Contractor at his own expense according to methods approved by the Engineer and the work shall be inspected again. The cost of all extra work and inspection shall be borne by the Contractor."

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 SCHEDULED ITEMS (SUBCLAUSE 8.2)

8.1.1 Inspection chambers, etc. (Subclause 8.2.5)

Replace the contents of this Subclause with the following:

"Separate items will be scheduled for manholes, backdrops, and inspection chambers, etc of each type and of each depth in increments of 0,5 m. The rate shall cover the cost of dealing with any excavation (in all materials including disposal of surplus) and backfilling with suitable material in accordance with 5.11 (New Subclause) (including import of material if required) additional to what is measured under Subclauses 8.2.2 and 8.2.3 of SANS 1200 DB. The rate shall cover the cost of construction of manholes complete with channels, benching, short pipes (1 m long) and all flexible connections in accordance with the detail shown on the drawings.

The depth category of manholes shall be measured as the difference between the cover level and the deepest invert level of the manhole."

8.1.2 Erf connections (Subclause 8.2.6)

Replace the contents of the two paragraphs with the following:

- a) Connections to sewer Unit: No.
 Separate items will be listed for connections measured at different depths. The depth will be that of the main sewer at the point of connection. The size, type, class and treatment of the junction and bend shall be the same as for the connection pipe.
 The rate shall cover the cost for excavation in all materials, bedding and backfilling (including importation of suitable material if required), disposal of surplus, supply and installation of a junction with erf connection entering the main sewer line flush with the soffit of the main sewer, 45-degree bend and the end cap.
- b) Connections to sewer manhole Unit: No.
 The rate shall cover the cost for adapting a standard manhole to accommodate the erf connection pipe, and the supply and installation of the end cap."

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1 SCOPE (CLAUSE 1)

No Amendments.

2 INTERPRETATION (CLAUSE 2)

No Amendments.

3 MATERIALS (CLAUSE 3)**3.1 CULVERT UNITS AND PIPES (SUBCLAUSE 3.1)**

Add the following to the end of Subclause 3.1d):

"Skewed ends for pipe culverts may be cut on Site."

3.2 MANHOLES, CATCHPITS, AND ACCESSORIES (SUBCLAUSE 3.4)**3.2.1 Bricks (Subclause 3.4.1)**

Add the following:

"Bricks shall be engineering bricks complying with the requirements of SANS 227."

3.3 MATERIALS FOR SUBSURFACE DRAINS (NEW SUBCLAUSE 3.6)**a) Pipes and fittings**

Pipes for subsurface drains shall be normal duty, perforated or slotted uPVC pipes complying with SANS 791. Fittings shall be heavy duty and shall also comply with SANS 791.

The size of the perforations in perforated pipes shall in all cases be 8 mm in diameter $\pm 1,5$ mm, and the number of perforations per metre shall not be less than 26 for 100 mm pipes and 52 for 150 mm pipes. Perforations shall be spaced in two rows for 100 mm pipes and in four rows for 150 mm pipes, as shown on the Drawings.

Slotted pipes shall have a slot width of 8 mm with a tolerance of 1,5 mm in width. The arrangement of the slots is subject to the Engineer's approval, but the total slot area shall not be smaller than that specified for perforations.

b) Crushed stone

Crushed stone shall be 19 mm single-sized and shall comply with the requirements of SANS 1083.

c) Geotextiles

Geotextiles shall be a non-woven, spun or thermic-bonded continuous filament fabric consisting of at least 85% by mass of polypropylene, polyester or other approved material and manufactured for civil-engineering applications by a recognised manufacturer.

4 PLANT (CLAUSE 4)

No Amendments.

5 CONSTRUCTION (CLAUSE 5)**5.1 SUBSURFACE DRAINS (NEW SUBCLAUSE 5.8)**

Subsurface drains shall be constructed where shown on the Drawing or as ordered by the Engineer to the detail as shown on the Drawings.

After the completion of the excavations, the bottom portion of the trench shall be lined with geotextile sheeting as shown on the Drawings. The top edges of the vertical portions of the geotextile sheeting shall be tacked to the sides of the excavations with nails or by another suitable approved means. An overlap of at least 200 mm shall be provided at each joint. Geotextile sheeting damaged during the installation or construction shall be replaced at the Contractor's cost.

A layer of crushed stone of the thickness shown on the Drawings shall be placed on the geotextile and be lightly tamped and finished to the required gradient.

Pipes of the required size shall be firmly bedded on the permeable material, true to level and grade, and coupled where required. The trench shall then be backfilled with crushed stone to the height above the pipes shown on the Drawings or as directed by the Engineer.

Crushed stone shall be placed in layers of not more than 300 mm at a time and shall be lightly compacted. Care shall be taken to prevent the contamination of crushed stone during construction of the subsurface drains and all material contaminated by soil or silt shall be removed and replaced by the Contractor at his own expense.

Perforated and slotted pipes shall be joined by couplers. Perforated pipes shall be laid with the perforations at the top or at the bottom, as directed. The higher end of subsurface drain pipes shall terminate at an inspection chamber or rodding eye, as shown on the Drawings and at the lower end of the pipe shall be built into a concrete head wall providing a positive outlet, or it shall be connected to the storm water pipes or culverts.

After all the crushed stone filter material has been placed, the protruding vertical filter material has been placed, the protruding vertical sections of the geotextile sheeting shall be folded back across the filter material so that the filter material will be completely enwrapped in the geotextile. An overlap of at least 200 mm shall be provided between the portions folded back.

The remainder of the trench shall be immediately backfilled with approved impermeable material preferably obtained from the excavations, in layers not exceeding 150 mm and compacted to 90% of modified AASHTO density, unless otherwise ordered by the Engineer. The trench shall be specially protected against the ingress of water, soil and silt until the backfilling with impermeable material has been completed.

Permeable material in subsoil drains shall not be taken to the surface but shall be discontinued at such heights as will be determined by the Engineer.

Any section of a subsurface drain constructed with pipes without perforations or slots shall be backfilled with impermeable backfill material as described above. Suitable excavated material may be used for backfilling. Payment for excavations as well as for backfilling with impermeable material will be made under SABS 1200 DB.

5.2 BACKFILLING AROUND STRUCTURES (NEW SUBCLAUSE 5.9)

Material used to backfill around manholes that fall within the road reserve must comply with Subclause 3.1 of SANS 1200 LB. Material used to backfill around other manholes must comply with Subclause 3.5 of SANS 1200 DB.

Material adjacent to the walls of the manholes must be watered and mixed to its optimum moisture content and compacted in layers not exceeding 150 mm in the compacted state. Compaction must be minimum 100% MOD AASHTO for non-cohesive material, and minimum 93% of MOD AASHTO density for cohesive materials.

Backfilling around the structure must be carried out in even layers to avoid uneven side forces.

6 TOLERANCES (CLAUSE 6)

No Amendments.

7 TESTING FOR LEAKAGE (CLAUSE 7)

No Amendments.

8 MEASUREMENT AND PAYMENT (CLAUSE 8)**8.1 SCHEDULED ITEMS (SUBCLAUSE 8.2)****8.1.1 Supply and installation of manholes, catchpits, and the like (Subclause 8.2.8)**

In the heading of this Subclause, replace the words “and the Like” with “inspection chambers, rodding eyes and the like”.

Replace the contents of the Subclause with the following:

“For the purpose of measurement and payment, the depth of a manhole, catchpit, etc., is defined as the depth from the top of the cover to the invert level of the manhole, catchpit, etc. (where the invert level for larger manholes, catchpits, etc. is that of the main floor area and not the invert of a localized recess used for draining the manhole, catchpit, etc.).

Separate items are listed for manholes, catchpits, etc. with depth increments (if applicable) and type. The rate shall cover the cost of any excavation in all material (including disposal of surplus) and backfilling with suitable material (including importation of material if required), additional to what is measured under the relevant pipe trench item (refer to Subclauses 8.2.2 and 8.2.3 of SANS 1200 DB). The rate shall further cover the cost of building the manholes, catchpits, etc., complete as shown on the relevant drawings, including step irons, cover and frames (Type 2 A unless otherwise shown on the drawings), benching, vents, brickwork, concrete work, grids, other accessories, and the building in of pipework and valves (but excluding supply of the main pipework and valves), along with all materials, plant and labour.”

8.1.2 Subsurface drains (New Subclause 8.2.14)

Depending on the conditions where subsurface drains are to be constructed, they will be scheduled and measured, at the discretion of the Engineer, either by individual items for excavation and for the supply and installation of the materials required for the drains, or by a single rate per metre length or square meter area of drain constructed.

Where a single rate per metre length or square meter is scheduled, the tendered rate shall cover the cost of excavation, disposal of surplus material, supply of all material, labour, plant and incidentals to complete the construction of the subsurface drain as shown on the drawings.

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1 SCOPE (CLAUSE 1)

No amendments.

2 INTERPRETATIONS (CLAUSE 2)

No amendments.

3 MATERIALS (CLAUSE 3)**3.1 PIPES, FITTINGS AND COUPLINGS (SUBCLAUSE 3.1)****3.1.1 Polyethylene Pipes (Subclause 3.1.4)**

Replace the contents of this Subclause with the following:

"Type IV Class 12 High density Polyethylene pipes must be used with an internal diameter as specified in the drawings and bill of quantities. P.V.C. or Nylon couplings and fittings similar to the "Plasson" type must be used. The pipes must comply with the relevant SABS 533 requirements."

3.1.2 Ferrule (New Subclause 3.1.8)

A bronze or galvanised ferrule that can be closed off similar to the "Talbot" standard pattern and in accordance with BS 1400 must be supplied.

4 PLANT (CLAUSE 4)

No amendments.

5 CONSTRUCTION (CLAUSE 5)

No amendments.

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)

No amendments.

8 MEASUREMENT AND PAYMENT (CLAUSE 8)**8.1 SCHEDULED ITEMS (SUBCLAUSE 8.2)****8.1.1 Supply, install and test erf connection (Subclause 8.2.2)**

Add the following:

"The rate shall also include for the excavation, backfilling and disposal of the surplus material as well as for the supply and construction of sand bedding."

8.1.2 Supply and installation of specials (Subclause 8.2.3)

Replace the contents of the subclause with the following:

"Separate items are listed for specials of each type and size."

The rate shall cover the cost of excavating in all material (including disposal of surplus or unsuitable material), the supply of sand bedding, the supply and installation of specials, the connection to the watermain including all jointing material and testing, as well as backfilling with suitable material including the supply thereof."

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1 SCOPE (CLAUSE 1)

No amendments.

2 INTERPRETATIONS (CLAUSE 2)

No amendments.

3 MATERIALS (CLAUSE 3)

No amendments.

4 PLANT (CLAUSE 4)

No amendments.

5 CONSTRUCTION (CLAUSE 5)

No amendments.

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)**7.1 PROCESS CONTROL (SUBCLAUSE 7.2)**

Add the following:

"The process control required of the Contractor shall be carried out by an independent testing laboratory approved by the Engineer."

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

No amendments.

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1. SCOPE (CLAUSE 1)

No amendments.

2. INTERPRETATIONS (CLAUSE 2)

No amendments.

3. MATERIALS (CLAUSE 3)**3.1 PHYSICAL PROPERTIES (SUBCLAUSE 3.2)****3.1.1 Subbase material (Subclause 3.2.1)**

Replace the contents of paragraph (a) with the following:

"(a) The maximum particle dimension of the gravel shall not exceed 63 mm."

Replace the contents of paragraph (d) with the following:

"(d) The CBR at specified density shall be 45 for unstabilized material as well as for stabilized material prior to stabilization."

Delete paragraph (e).

3.1.2 Gravel shoulder and gravel wearing course material (Subclause 3.2.2)

Replace the contents of this subclause with the following:

"The material used for gravel shoulders and gravel wearing course shall comply with the following:

- (a) The PI shall not be less than 6 and not more than $(3 \times \text{GM}) + 10$.
- (b) The maximum particle dimension of the gravel shall not exceed 40 mm.
- (c) The CBR shall be greater than 15 at 93% of modified AASHTO density."

4. PLANT (CLAUSE 4)

No amendments.

5. CONSTRUCTION (CLAUSE 5)**5.1 EXCAVATION (SUBCLAUSE 5.2)****5.1.1 Borrow pits (Subclause 5.2.2)**

Insert the words "designated by the Engineer and" between the words "pits" and "established" in the first line.

5.1.2 Transport (Subclause 5.7)

Replace the contents of this Subclause with the following:

"All movement of material on this Contract will be considered as freehaul. No haulage cost will be paid."

5.1.3 Weed killer (New Subclause 5.8)

The subbase layer shall be treated before compaction by applying and mixing in an approved weed-killer in accordance with the manufacturer's instructions.

5.1.4 Insecticide (New Subclause 5.9)

An insecticide approved by the Engineer shall be applied strictly in accordance with the manufacturer's instructions over the total area of the subbase. The instructions indicate whether the poison is to be applied before or after compaction of the layer.

6. TOLERANCES (CLAUSE 6)

No amendments.

7. TESTING (CLAUSE 7)

No amendments.

8. MEASUREMENT AND PAYMENT (CLAUSE 8)**8.1 BASIC PRINCIPLES (SUBCLAUSE 8.1)**

Insert a semicolon in the first line of paragraph (b) after the words "will be paid for once only" and delete the rest of the paragraph.

Replace the words "the freehaul will be 2,0 km" in paragraph (c) with the words "all movement of material will be considered freehaul".

Replace paragraph (d) with the following:

"(d) that, in the case of material from a commercial source or from borrow pits selected by the Contractor, no additional payment will be made for the class of excavation, method of processing (except stabilizing), or overhaul."

8.2 SCHEDULED ITEMS (SUBCLAUSE 8.3)**8.2.1 Construct the subbase course/shoulders/gravel wearing course with material from designated excavations (Subclause 8.3.2)**

Replace the contents of subitem (a) with the following:

"The rate for (a) shall include full compensation for excavating and selecting subbase material, for loading and transporting the material within the freehaul distance, and for either placing the material on the road or stockpiling the material for later use. When material is stockpiled, the rate shall include compensation for shaping and grading the stockpile so that it is free-draining."

8.2.2 Construct the subbase course/shoulders/gravel wearing course with material from commercial sources or designated borrow areas (Subclause 8.3.3)

Replace the heading of this Subclause with the following:

"8.3.3 Construct the subbase course/shoulders/gravel wearing course with material from commercial sources"

Add the following paragraph to the end of this Subclause:

"This item shall also apply to the construction of subbase course/shoulders/gravel wearing course with material from borrow pits selected by the Contractor."

8.2.3 Extra over item 8.3.1 for class of excavation (Subclause 8.3.4)

Replace both “a) Intermediate excavation” and the corresponding unit of measure with “a) Not applicable (VOID)”. No extra-over payment will be made for excavation in material classified as intermediate excavation.

8.2.3 Screened-out material not used in the subbase (Subclause 8.3.7)

Remove the words “within the freehaul distance of 2 km” from the last sentence of this Subclause.

8.2.4 Overhaul (haul exceeding 2 km): (Subclause 8.3.9)

Delete this Subclause.

No overhaul will be paid on material for the purposes of this Contract and all costs for transporting material must be included in the applicable tendered rates and amounts.

8.2.5 Treatment of subbase with: (New Subclause 8.3.11)

(a) Weed killer.....Unit: m²

(b) Insecticide.....Unit: m²

The tendered rates shall include full compensation for the supply, spreading and mixing-in or application of the poison.

Only areas that were treated on the written instructions of the Engineer will be measured for payment.

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1 SCOPE (CLAUSE 1)

No amendments.

2 INTERPRETATIONS (CLAUSE 2)

No amendments.

3 MATERIALS (CLAUSE 3)**3.1 PHYSICAL AND CHEMICAL PROPERTIES (SUBCLAUSE 3.3)****3.1.1 Natural gravel (stabilized or unstabilized) (Subclause 3.3.1)**

Replace the contents of paragraph (a) with the following:

"(a) The maximum particle dimension of the gravel shall not exceed 63 mm."

4 PLANT (CLAUSE 4)

No amendments

5 CONSTRUCTION (CLAUSE 5)**5.1 PLACEMENT AND COMPACTION OF A BASE OTHER THAN A WATER-BOUND MACADAM BASE (SUBCLAUSE 5.4)****5.1.1 Compaction (Subclause 5.4.4)**

Replace "98% of modified AASHTO maximum density" with "102% of modified AASHTO maximum dry density."

5.1.2 Transport (Subclause 5.9)

Replace the contents of this Subclause with the following:

"All movement of material on this Contract will be considered as free-haul. No haulage cost will be paid."

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)**7.1 ROUTINE INSPECTION AND TESTING (Subclause 7.3)**

Replace table 4 with the following:

"

TABLE 4 - APPARENT DENSITY OF BASE

Specified apparent density %	Number of tests per lot	Minimum average density, %	Minimum value for any single test, %
86	4	86,1	82,7
	5	86,4	82,6
	6	86,5	82,4
	7	86,7	82,3
	8	86,8	82,2
	9	86,9	82,1

“

MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 SCHEDULED ITEMS (SUBCLAUSE 8.3)

8.1.1 Construct base with material from commercial sources or designated borrow areas (Subclause 8.3.3)

Replace the heading of Subclause 8.3.3 with the following:

"8.3.3 Construct base with material from commercial sources and compact to the specified modified AASHTO density"

8.1.2 Extra over 8.3.1 and 8.3.2, as applicable, for class of excavation (Subclause 8.3.4)

Replace both "a) Intermediate excavation" and the corresponding unit of measure with "a) Not applicable (VOID)". No extra-over payment will be made for excavation in material classified as intermediate excavation.

8.1.3 Overhaul (Subclause 8.3.9)

Delete this Subclause.

No overhaul will be paid on material for the purposes of this Contract and all the costs for transporting material must be included in the applicable tendered rates and amounts.

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1 SCOPE (CLAUSE 1)

No amendments.

2 INTERPRETATIONS (CLAUSE 2)

No amendments.

3 MATERIALS (CLAUSE 3)

No amendments.

4 PLANT AND EQUIPMENT (CLAUSE 4)

No amendments.

5 CONSTRUCTION (CLAUSE 5)**5.1 DESIGN OF ASPHALT (SUBCLAUSE 5.5)****5.1.1 General (Subclause 5.5.1)**

Replace the contents of this Subclause with the following:

"The design of the asphalt mixes shall be in accordance with the design guidelines of TRH 8."

5.1.2 Marshall criteria (Subclause 5.5.2)

Delete this Subclause.

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)

No amendments.

8 MEASUREMENT AND PAYMENT (CLAUSE 8)**8.1 RATES OF APPLICATION AND BITUMINOUS BINDER CONTENT (SUBCLAUSE 8.1)****8.1.1 Prime (Subclause 8.1.2)**

Add the following:

"The prime coat shall be inverted bitumen emulsion (MSP1) or cut-back bitumen emulsion (Col Prime) applied at a rate of 0,75 litre/m²."

8.1.2 Tack coat (Subclause 8.1.4)

Replace the contents of this Subclause with the following:

"The tack coat shall be a 30% spray grade emulsion applied at a rate of 0,55 litre/m²."

8.2 SCHEDULED ITEMS (SUBCLAUSE 8.5)

8.2.1 Asphalt (Subclause 8.5.4)

Change the unit of measure from “Unit: t” to “Unit: m²”.

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1 SCOPE (CLAUSE 1)

No amendments.

2 INTERPRETATION (CLAUSE 2)

No amendments.

3 MATERIALS (CLAUSE 3)

No amendments.

4 PLANT (CLAUSE 4)

No amendments.

5 CONSTRUCTION (CLAUSE 5)**5.1 EDGE RESTRAINTS (SUBCLAUSE 5.2)**

Add the following to the end of this Subclause:

"Edge Restraints shall be constructed with expansion joints of width at least 12 mm at intervals not exceeding 10 m. These joints must be filled with a compound such as flexcell or similar approved product and sealed with a polysulphide sealant."

5.2 JOINT FILLING (SUBCLAUSE 5.7)

Replace the last two paragraphs of this Subclause with the following:

"A mixture of sand that complies with 3.3(b) and cement (Ratio 5:1) shall be brushed into the joints until they are full, and sufficient passes of a plate compactor shall be made to settle the joint filling. The procedure shall be repeated until the joints remain full after compaction.

All excess shall be washed off and care shall be taken not to contaminate the stormwater system. Damage caused during compaction shall be made good by the Contractor at his own expense."

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)

No amendments.

8 MEASUREMENT AND PAYMENT (CLAUSE 8)**8.1 SCHEDULED ITEMS (SUBCLAUSE 8.2)****8.1.1 Provision of edge restraints (Subclause 8.2.1)**

Add the following to the end of this Subclause:

"The rates shall cover all the costs for excavating, bedding, laying (including expansion joints), jointing, compacting and backfilling, including the removal of excess material."

8.1.2 Construction of paving complete (Subclause 8.2.2)

Add the following to the end of this Subclause:

"The tendered rate shall also include full compensation for cutting units to fit edge restraints, for waste and the removal thereof from the Site, and delays and disruptions to the programme."

8.1.3 Cutting units to fit edge restraints (Subclause 8.2.3)

Delete the contents of this clause and replace with the following:

"Cutting units to fit edge restraints will not be measured separately but be included for in the rate for 8.2.2."

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1 SCOPE (CLAUSE 1)

No amendments.

2 INTERPRETATIONS (CLAUSE 2)

No amendments.

3 MATERIALS (CLAUSE 3)**3.1 CONCRETE (SUBCLAUSE 3.1)**

Add the following to the end of this Subclause:

"The Contractor shall timeously submit the concrete mix design for cast-in-situ kerbing to the Engineer for approval and no kerbing shall be placed before the mix design has been approved."

3.2 PRECAST KERBING AND CHANNELLING (SUBCLAUSE 3.2)**3.2.1 General (Subclause 3.2.1)**

Add the following to the end of this Subclause:

"The profile/dimensions of precast kerbs and channels must be in accordance with the details shown on the drawing."

3.2.2 Curved Kerbing (Subclause 3.2.2)

In the heading, replace the word "Kerbing" with "Kerbing and Channelling".

Replace the references to "kerbing" throughout this Subclause with "kerbing and channelling".

3.3 BEDDING MATERIAL (SUBCLAUSE 3.9)

Replace the contents of this Subclause with the following:

"The concrete on which the kerbing and channelling will be placed must be of the strength and thickness specified in the drawings. Where no details are provided on the drawings, the material shall consist of crushed stone, cinders, slag, sand, or other approved porous material having a maximum particle size of 13.2mm."

4 PLANT (CLAUSE 4)

No amendments.

5 CONSTRUCTION (CLAUSE 5)**5.1 EXCAVATION AND BEDDING (SUBCLAUSE 5.1)**

Replace all instances of "90%" with "93% (100% for sand)".

5.2 PRECAST CONCRETE KERBING AND CHANNELING (SUBCLAUSE 5.2)

Replace the first sentence with:

"Kerbing and Channelling of precast concrete must be placed on a concrete bedding as required in 3.9."

5.3 TRANSITION SECTIONS AND INLET AND OUTLET STRUCTURES (SUBCLAUSE 5.11)

Delete the words "and with the requirements of the Specification" in the second paragraph.

5.4 EXISTING KERBING (NEW SUBCLAUSE 5.13)

The kerbs to be removed shall be inspected by the engineer in the presence of the contractor prior to their removal to determine the number of kerbs suitable for re-use.

The contractor is advised to use the greatest care when removing those kerbs earmarked for re-use, for should the kerbs be damaged and be subsequently rejected, he shall replace them with new kerbs at his own cost.

5.5 WATERTESTING OF KERBS (NEW SUBCLAUSE 5.14)

After the kerbs, channels inlets etc. have been constructed the kerbs, channels, etc must be cleaned and tested with water to ensure that no water is standing in any channel. This test must be done after the base has been completed but before the placing of the surface seal. Any adjustments to kerbs, channels etc must be completed before the surface seal is applied.

5.6 EXPANSION JOINTS (NEW SUBCLAUSE 5.15)

These joints shall be provided at 10 m intervals, through both the kerb and channels. These joints shall be 12 mm wide, filled with a compound such as flexcell or similar product and sealed with a polysulphide sealant. Costs of furnishing the materials and construction of the joint are deemed to be included in the laying rate.

6 TOLERANCES (CLAUSE 6)

No amendments.

7 TESTING (CLAUSE 7)

7.1 CAST-IN-SITU AND EXTRUDED KERBING AND CHANNELLING (SUBCLAUSE 7.2)

Delete subclauses 7.2.1 and 7.2.2 and replace with the following:

"7.2.1 Tests. The Contractor shall carry out a minimum of three cube crushing tests per 1 000 m of kerbing placed. The cost of such tests shall be deemed included in the rates tendered for kerbing.

One cube crushing test shall consist of a set of six cubes made with concrete taken from the mixer, the kerbing machine or from any part of the work as ordered.

If, after 28 days in an approved laboratory, after three cubes of any set of six cubes have been tested, the average crushing strength is found to be more than 3 MPa below the specified strength, the kerbing represented by the cubes will be rejected.

The Contractor may apply for resubmission of the rejected section based on cores drilled from this section and tested for the estimated actual crushing strength in accordance with SABS method 865 (excluding Appendix A). The cost of drilling and testing the cores is for the Contractor's account, regardless of the outcome of the tests on the cores. The number of cores required will be determined by the Engineer and the criterion for rejection or acceptance of the section represented by the cores shall be as specified above for cubes."

7.2 RESPONSIBILITY FOR THE COST OF TESTING (SUBCLAUSE 7.3)

Delete this subclause

8 MEASUREMENT AND PAYMENT (CLAUSE 8)

8.1 SCHEDULED ITEMS (SUBCLAUSE 8.2)

8.1.1 Concrete kerbing (Subclause 8.2.1)

In the heading, replace the word "Kerbing" with "Kerbing and Channelling".

Replace "5.8.2" in the third line of paragraph (e) with "5.8.3".

Replace the word "kerbing" throughout this subclause with "kerbing and channelling".

8.1.2 Variations of tests on extruded kerbing (Subclause 8.2.3)

Delete this Subclause.

8.1.3 Ancillaries (Subclause 8.2.6)

In Subclause 8.2.6.2, replace both "(2) Extra-over for intermediate material" and the corresponding unit of measure with "(2) Not applicable (VOID)". No extra-over payment will be made for excavation in material classified as intermediate excavation.

8.1.4 Trimming of Excavations for Concrete-Lined Open Drains in (Subclause 8.2.7)

Replace "a) Soft material" with "a) Soft and intermediate material".

Replace both "b) Intermediate material" and the corresponding unit of measure with "b) Not applicable (VOID)".

Replace the words "distinguish between trimming in soft material" with "distinguish between trimming in soft/intermediate material".

8.1.5 Remove existing kerbing and: (New Subclause 8.2.14)

(a) Dispose of them off Site Unit : m

The tendered rates shall include full compensation for providing all labour and equipment, for excavations, for lifting the kerbs and for loading and transporting the kerbs from the Site.

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7. TESTING (CLAUSE 7)	2
8. MEASUREMENT AND PAYMENTS (CLAUSE 8)	2

1. SCOPE (CLAUSE 1)

No Amendments.

2. INTERPRETATIONS (CLAUSE 2)

No Amendments.

3. MATERIALS (CLAUSE 3)**3.1 ROAD SIGNS (SUBCLAUSE 3.2)****3.1.1 Structural steel (Subclause 3.2.2)**

Delete the words "except that they shall be of D-shape cross-section" in the first paragraph.

Add the following:

"All steel sign supports shall be hot-dip zinc-coated (galvanized)."

3.1.2 Paints and protective coatings (Subclause 3.2.8)

Replace the contents of Subclause 3.2.8.1 with the following:

"The sign supports and the backs of all road sign faces shall be painted grey. The colour code of the paint shall be code No D36 according to the CKS 279 classification.

Newly galvanized surfaces shall be thoroughly scrubbed down with an approved galvanized iron cleaner to remove all traces of the resinous protective coating. The surface shall be washed down and scrubbed to remove all traces of grease, oil, dirt, etc. Two coats of calcium plumbate primer shall be applied to a dry film thickness of not less than 0,028 mm. The undercoat shall follow within one week of the primer."

4. PLANT (CLAUSE 4)

No Amendments.

5. CONSTRUCTION (CLAUSE 5)

No Amendments.

6. TOLERANCES (CLAUSE 6)

No Amendments.

7. TESTING (CLAUSE 7)

No Amendments.

8. MEASUREMENT AND PAYMENTS (CLAUSE 8)

Replace all "km" units with "km or m"

Part C4: SITE INFORMATION

C4.1 GEOTECHNICAL INFORMATION

Refer **Appendix E** for the geotechnical investigation previously performed.

In addition, as part of this scope of Works, the Contractor will be required to perform an additional investigation (rotary core drilling) at the proposed position of the abstraction works to confirm the founding conditions and verify the Employer's design.

C4.2 RAINFALL DATA

Mthatha Rainfall Data between 2000 to 2020 was used for this project. For rainfall Data see **Appendix F**.

O.R. TAMBO DISTRICT MUNICIPALITY
 CONTRACT NO.: MIS 478 793 A
 SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B – CONSTRUCTION OF
 ABSTRACTION WORKS AND MALEPELEPE WATER TREATMENT WORKS - CONTRACT 1

Part C5: LIST OF TENDER DRAWINGS

Refer **Appendix G** for following tender drawings:

Drawing Number	Drawing Name
503081-GENR-MDM-CC-0200	Project Layout
503081-WTW1-DRG-PP-1025	Block Flow Diagram
503081-WTW1-DRG-PP-1027	Process flow diagram (Sheet 1 of 2)
503081-WTW1-DRG-PP-1028	Process flow diagram (Sheet 2 of 2)
503081-WTW1-DRG-CC-1225	WTW Site Layout
503081-WTW1-DRG-CC-1230	WTW All Service Layout
503081-WTW1-DRG-CC-1165	WTW Road Layout
503081-WTW1-DRG-CC-1166	WTW Road A & B Plan and Longsections (Sheet 1 of 2)
503081-WTW1-DRG-CC-1167	WTW Main Road Plan and Longsection (Sheet 2 of 2)
503081-WTW1-DRG-CC-1168	WTW Road Typical Details
503081-WTW1-DRG-CC-1169	WTW Bulk Platform Levels and Coordinates (Sheet 1 of 2)
503081-WTW1-DRG-CC-1170	WTW Bulk Platform Levels and Coordinates (Sheet 2 of 2)
503081-WTW1-DRG-CC-1171	WTW Finished Levels and Coordinates (Sheet 1 of 2)
503081-WTW1-DRG-CC-1172	WTW Finished Levels and Coordinates (Sheet 2 of 2)
503081-WTW1-DRG-CC-1174	WTW Retaining Wall Layout & Details
503081-WTW1-DRG-CC-1178	WTW FFL for Stairs
503081-WTW1-DRG-CC-1179	WTW Typical Detail of Culverts entering a Manhole
503081-WTW1-DRG-CC-1180	WTW Interconnecting Pipework
503081-WTW1-DRG-CC-1181	WTW Interconnecting Longsections (Sheet 1 of 2)
503081-WTW1-DRG-CC-1182	WTW Interconnecting Pipework Longsections (Sheet 2 of 2)
503081-WTW1-DRG-CC-1183	Water Treatment Works Joint Layout
503081-WTW1-DRG-CC-1184	WTW Channels & Berm Setting-out and Details
503081-WTW1-DRG-CC-1185	WTW Typical Stormwater Details (Sheet 1 of 2)

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503081-WTW1-DRG-CC-1188	WTW Lagoon Diversion Chamber & Stormwater Pipe Details
503081-WTW1-DRG-CC-1189	WTW Lagoon Diversion Chamber & Collection Chamber Reinforcement Details
503081-WTW1-DRG-CC-1190	WTW Sewer Reticulation Layout
503081-WTW1-DRG-CC-1191	WTW Sewer Reticulation Longsections
503081-WTW1-DRG-CC-1192	WTW Sewer Trench and Manhole Details
503081-WTW1-DRG-CC-1193	WTW Sewer Septic Tank Details
503081-WTW1-DRG-CC-1210	WTW Fence Layout
503081-WTW1-DRG-CC-1211	WTW Fence Typical Details (Sheet 1 of 2)
503081-WTW1-DRG-CC-1212	WTW Fence Typical Details (Sheet 2 of 2)
503081-WTW1-DRG-CC-1227	WTW Service and Fire Water Reticulation Layout
503081-WTW1-DRG-CC-1228	WTW Typical Water Details
503081-WTW1-DRG-CC-1231	WTW Sleeves Layout
503081-WTW1-DRG-CC-1232	WTW Services Duct Details
503081-WTW1-DRG-CC-1295	Abstraction Works Isometric View
503081-WTW1-DRG-CC-1296	Abstraction Works Plan View
503081-WTW1-DRG-CC-1297	Abstraction Works Sectional Views
503081-WTW1-DRG-CC-1298	Abstraction Works Sectional Views
503081-WTW1-DRG-CC-1299	Abstraction Works Sluice Gates Sectional Views
503081-WTW1-DRG-CC-1450	Abstraction Works General Layout
503081-WTW1-DRG-CC-1451	Abstraction Works Setting Out Layout
503081-WTW1-DRG-CC-1675	High-Lift Pump Station Isometric View
503081-WTW1-DRG-CC-1676	High-Lift Pump Station Plan View

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 SIDWADWENI REGIONAL WATER SUPPLY SCHEME PHASE 5B – CONSTRUCTION OF
 ABSTRACTION WORKS AND MALEPELEPE WATER TREATMENT WORKS - CONTRACT 1

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503081-WTW1-DRG-CC-1677	High-Lift Pump Station Sectional View
503081-WTW1-DRG-CC-1925	Low-Lift And Motive Pipeline Layout
503081-WTW1-DRG-CC-1926	Low-Lift Pipeline Horizontal And Vertical Alignment
503081-WTW1-DRG-CC-1928	Motive Pipeline Horizontal And Vertical Alignment
503081-WTW1-DRG-CC-1932	Scour Valve Chamber
503081-WTW1-DRG-CC-1933	Scour Valve Chamber Isometric Layout
503081-WTW1-DRG-CC-1934	Bridge Crossing Details
503081-WTW1-DRG-CC-1275	Abstraction 3D Views
503081-WTW1-DRG-CC-1276	Abstraction Elevations 1
503081-WTW1-DRG-CC-1277	Abstraction Elevations 2
503081-WTW1-DRG-CC-1278	Abstraction Floor
503081-WTW1-DRG-CC-1279	Abstraction Landing 02
503081-WTW1-DRG-CC-1280	Abstraction Landing 01
503081-WTW1-DRG-CC-1281	Abstraction Roof
503081-WTW1-DRG-CC-1282	Abstraction Hardstand & Fence
503081-WTW1-DRG-CC-1283	Gantries Layout & Details
503081-WTW1-DRG-CC-1284	Abstraction Electrical Building
503081-WTW1-DRG-CC-1285	Abstraction Sections 1
503081-WTW1-DRG-CC-1286	Abstraction Sections 2
503081-WTW1-DRG-CC-1287	Abstraction Sections 3
503081-WTW1-DRG-CC-1288	Gantries Details
503081-WTW1-DRG-CC-1289	Removable Pre-cast panels
503081-WTW1-DRG-CC-1525	Flocculation and Sedimentation Complex: Plans at 896.550 Level
503081-WTW1-DRG-CC-1526	Flocculation and Sedimentation Complex: Plans at 899.200 Level

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Drawing Number	Drawing Name
503081-WTW1-DRG-CC-1527	Flocculation and Sedimentation Complex: Plan On Screed, Sections and Details
503081-WTW1-DRG-CC-1528	Flocculation and Sedimentation Complex: Sections
503081-WTW1-DRG-CC-1600	Filter Foundation and Backwash Bund
503081-WTW1-DRG-CC-1625	Pump & Clearwell Complex Isometric View
503081-WTW1-DRG-CC-1626	Pump & Clearwell Complex Plan Layout
503081-WTW1-DRG-CC-1627	Pump & Clearwell Complex Pumpstation Foundation Layout & Details
503081-WTW1-DRG-CC-1628	Pump & Clearwell Complex Pumpstation Surface Bed Layout
503081-WTW1-DRG-CC-1629	Pump & Clearwell Complex Clearwell Floor Slab Layout
503081-WTW1-DRG-CC-1630	Pump & Clearwell Complex Roof Layout
503081-WTW1-DRG-CC-1631	Pump & Clearwell Complex Steel Roof Layout
503081-WTW1-DRG-CC-1632	Pump & Clearwell Complex Sections
503081-WTW1-DRG-CC-1633	Pump & Clearwell Complex Elevations
503081-WTW1-DRG-CC-1634	Pump & Clearwell Complex Elevations
503081-WTW1-DRG-CC-1638	Pump & Clearwell Complex Sections
503081-WTW1-DRG-CC-1745	Admin Building-Layout & Section
503081-WTW1-DRG-CC-1746	Admin Building-Elevations
503081-WTW1-DRG-CC-1747	Admin Building-Details
503081-WTW1-DRG-CC-1800	Chemical Building Layout & Details
503081-WTW1-DRG-CC-1801	Chemical Building Elevations
503081-WTW1-DRG-CC-1802	Chemical Building Sections
503081-WTW1-DRG-CC-1850	Guard House
503081-WTW1-DRG-CC-1851	Guard House-Details
503081-WTW1-DRG-CC-1883	Staff House
503081-WTW1-DRG-CC-1884	Staff House-Elevations

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Drawing Number	Drawing Name
503081-WTW1-DRG-CC-1885	Staff House-Details
503081-WTW1-DRG-CC-1900	Lagoons Isometric View A
503081-WTW1-DRG-CC-1901	Lagoons Isometric Views Outlet & Inlet
503081-WTW1-DRG-CC-1902	Lagoons Structural Plan Layout
503081-WTW1-DRG-CC-1905	Lagoons Inlet Structure Sections and Structural Plan
503081-WTW1-DRG-CC-1906	Lagoons Outlet Structure Sections and Structural Plan
503081-WTW1-DRG-CC-1916	Residue Holding Tank: Isometric Views
503081-WTW1-DRG-CC-1917	Residue Holding Tank: General Arrangement
503081-WTW1-DRG-CC-1918	Residue Holding Tank: Sections and Detail
503081-WTW1-DRG-CC-1964	Pipe Schedule
503081-ROAD-DRG-CC-5000	Road 1 Plan and Longsection
503081-ROAD-DRG-CC-5001	Road 2 Plan and Longsection
503081-ROAD-DRG-CC-5100	Road 1 Plan and Cross Sections and Templates
503081-ROAD-DRG-CC-5101	Road 2 Plan and Cross Sections and Templates
503081-ROAD-DRG-CC-5200	Road 1 Storm Water Plan and Long Sections
503081-ROAD-DRG-CC-5201	Road 2 Storm Water Plan and Long Sections
503081-ROAD-DRG-CC-5300	Gabion Plan and Details
503081-ROAD-DRG-CC-5002	Bridge Elevation, Section and Plan Layout
503081-ROAD-DRG-CC-5003	Bridge Left and Right Elevation and Plan Layout
503081-ROAD-DRG-CC-5004	Bridge Left and Right Elevation and Foundation Layout
503081-ROAD-DRG-CC-5005	Bridge Concrete Notes
503081-ROAD-DRG-CC-5400	Typical Stormwater Details (1 of 5)
503081-ROAD-DRG-CC-5401	Typical Stormwater Details (2 of 5)
503081-ROAD-DRG-CC-5402	Typical Stormwater Details (3 of 5)
503081-ROAD-DRG-CC-5403	Typical Stormwater Details (4 of 5)

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Drawing Number	Drawing Name
503081-ROAD-DRG-CC-5404	Typical Stormwater Details (5 of 5)
503081-GENR-DRG-CC-0300	General Notes (Structural)
503081-GENR-DRG-CC-0301	Joint Details for Watertight Concrete
503081-GENR-DRG-CC-0302	Typical Masonry Details (Sheet 1 of 2)
503081-GENR-DRG-CC-0303	Typical Masonry Details (Sheet 2 of 2)
503081-GENR-DRG-CC-0304	Typical Flooring Details (Sheet 1 of 3)
503081-GENR-DRG-CC-0305	Typical Flooring Details (Sheet 2 of 3)
503081-GENR-DRG-CC-0306	Typical Flooring Details (Sheet 3 of 3)
503081-GENR-DRG-CC-0307	Typical Handrailing Details (Sheet 1 of 2)
503081-GENR-DRG-CC-0308	Typical Handrailing Details (Sheet 2 of 2)
503081-GENR-DRG-CC-0309	Typical Concrete Surface Bed Details
503081-GENR-DRG-CC-0310	Typical Concrete and Associated Details
503081-GENR-DRG-CC-0311	Typical Brickwork and Waterproofing Details
503081-GENR-DRG-CC-0312	Typical Chamber Details
503081-GENR-DRG-CC-0313	Typical Inlet and Outlet Ventilators Detail (Sheet 1 of 2)
503081-GENR-DRG-CC-0314	Typical Inlet and Outlet Ventilators Detail (Sheet 2 of 2)
503081-GENR-DRG-CC-0315	Steel Ladder Details (Sheet 1 of 3)
503081-GENR-DRG-CC-0316	Steel Ladder Details (Sheet 2 of 3)
503081-GENR-DRG-CC-0317	Steel Ladder Details (Sheet 3 of 3)
503081-GENR-DRG-CC-0318	Typical Steel Door Details-Single
503081-GENR-DRG-CC-0319	Typical Steel Door Details-Double
503081-GENR-DRG-CC-0320	Typical Steel Door Details-Ironmongery (Sheet 1 of 2)
503081-GENR-DRG-CC-0321	Typical Steel Door Details-Ironmongery (Sheet 2 of 2)
503081-GENR-DRG-CC-0322	Typical Floor Drain details
503081-GENR-DRG-CC-0323	Admin Guard Staff Houses - Window schedules 1

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Drawing Number	Drawing Name
503081-GENR-DRG-CC-0324	Admin Guard Staff Houses - Door schedules 1
503081-GENR-DRG-CC-0325	Admin - Facade schedules
503081-GENR-DRG-CC-0326	Admin Guard Staff House - Finishing Schedules
503081-GENR-DRG-CC-0327	Admin Guard Staff House - Sanitary Schedules
503081-GENR-DRG-CC-0328	High Lift Abstraction Chemical - Window schedules 1
503081-GENR-DRG-CC-0329	High Lift Abstraction Chemical - Door schedules 1
503081-GENR-DRG-CC-0330	High Lift Abstraction Chemical - Finishing Schedules
503081-GENR-DRG-CC-0331	Admin Guard Staff Houses - Window schedules 2
503081-GENR-DRG-CC-0332	High Lift Abstraction Chemical - Window schedules 2
503081-GENR-DRG-CC-0333	Access Hatch Details
503081-GENR-DRG-CC-0334	High Lift Abstraction Chemical - Door schedules 2
503081-GENR-DRG-CC-0335	Staff House - Joinery
503081-GENR-DRG-CC-0336	Admin Building - Joinery 1
503081-GENR-DRG-CC-0337	Admin Building - Joinery 2
503081-GENR-DRG-CC-0338	Admin Building - Joinery 3
503081-GENR-DRG-CC-0339	Guardhouse - Joinery
503081-GENR-DRG-CC-0340	Admin Guard Staff Houses - Door schedules 2
503081-GENR-DRG-CC-0341	Typical Roof Drain Details
503081-GENR-DRG-CC-0400	Duct Drawpit
503081-WTW1-DRG-EE-1250	SLD - Legend
503081-WTW1-DRG-EE-1256	Typical Streetlight & CCTV Pole Detail
503081-WTW1-DRG-EE-1266	CCTV Network Architecture
503081-WTW1-DRG-EE-1308	Abstraction Works - Cable Route Layout
503081-WTW1-DRG-EE-1309	Abstraction Works - Earthing Layout
503081-WTW1-DRG-EE-1310	Abstraction Works - Fibre Cable Layout

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Drawing Number	Drawing Name
503081-WTW1-DRG-EE-1355	Abstraction Works - Building Lighting Layout
503081-WTW1-DRG-EE-1356	Abstraction Works - Area Lighting Layout
503081-WTW1-DRG-EE-1357	Abstraction Works - Small Power Layout
503081-WTW1-DRG-EE-1358	Abstraction Works - CCTV Layout
503081-WTW1-DRG-EE-1359	Abstraction Works SLD DB-ABS-01
503081-WTW1-DRG-EE-1360	Abstraction Works SLD DB-ABS-02
503081-WTW1-DRG-EE-1699	Pump & Clearwell Complex - Earthing Layout
503081-WTW1-DRG-EE-1700	Pump & Clearwell Complex- Lighting Layout
503081-WTW1-DRG-EE-1701	Pump & Clearwell Complex - Small Power Layout
503081-WTW1-DRG-EE-1702	Pump & Clearwell Complex - CCTV Layout
503081-WTW1-DRG-EE-1703	Pump & Clearwell SLD DB
503081-WTW1-DRG-EE-1780	Admin Building Lighting Layout
503081-WTW1-DRG-EE-1781	Admin Building Small Power Layout
503081-WTW1-DRG-EE-1782	Admin Building CCTV Layout
503081-WTW1-DRG-EE-1783	Admin Building SLD - DB-ADM
503081-WTW1-DRG-EE-1838	Chemical Building - Earthing Layout
503081-WTW1-DRG-EE-1839	Chemical Dosing Building - Lighting Layout
503081-WTW1-DRG-EE-1840	Chemical Building - Small Power Layout
503081-WTW1-DRG-EE-1841	Chemical Dosing Building - CCTV
503081-WTW1-DRG-EE-1842	Chemical Building SLD - DB-CHM
503081-WTW1-DRG-EE-1860	Guardhouse Lighting Layout
503081-WTW1-DRG-EE-1861	Guardhouse Small Power Layout
503081-WTW1-DRG-EE-1862	Guardhouse Building CCTV Layout
503081-WTW1-DRG-EE-1863	Guardhouse SLD - DB-GH
503081-WTW1-DRG-EE-1891	Typical Staff House Lighting Layout

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Drawing Number	Drawing Name
503081-WTW1-DRG-EE-1892	Typical Staff House Small Power Layout
503081-WTW1-DRG-EE-1893	Typical Staff House SLD DB-H01-03
503081-WTW1-DRG-EE-1911	Malepelepe WTW Street & Area Lighting Layout
503081-WTW1-DRG-EE-1912	Malepelepe WTW Site CCTV Layout
503081-WTW1-DRG-EE-1913	Malepelepe WTW SLD Area Lighting Kiosk EK-01
503081-PIPE-DRG-CC-2000	High-lift Rising Main Overall Layout
503081-PIPE-DRG-CC-2001	Key Plan to Longsection Drawings
503081-PIPE-DRG-CC-2002	Rising Main Plan and Longitudinal Section Sheet 1
503081-PIPE-DRG-CC-2003	Rising Main Plan and Longitudinal Section Sheet 2
503081-PIPE-DRG-CC-2016	Coordinate Projection and Set-Out Data
503081-PIPE-DRG-CC-2020	Air Valve Chamber: Layout and Sections
503081-PIPE-DRG-CC-2022	Scour Valve Chamber: Layout and Sections
503081-PIPE-DRG-CC-2023	Scour Valve Detail - Type 2
503081-PIPE-DRG-CC-2030	Typical Pipe Trench, Bedding and Backfill Details
503081-PIPE-DRG-CC-2032	Pipe Marker Post Details
503081-PIPE-DRG-CC-2034	Pipe Erosion Protection Details
503081-PIPE-DRG-CC-2035	Thrust and Anchor Block Details
503081-PIPE-DRG-CC-2036	General Chamber Details
503081-PIPE-DRG-CC-2037	Standard Detail Pipe Support
503081-PIPE-DRG-CC-2038	Standard Detail Access Manhole Cover and Frame Sheet 1 of 2
503081-PIPE-DRG-CC-2039	Standard Detail Access Manhole Cover and Frame Sheet 2 of 2
503081-PIPE-DRG-CC-2040	Standard Detail - Access Ladder Details
503081-PIPE-DRG-CC-2042	Standard Detail - Inlet and Outlet Ventilators Sheet 1 of 2
503081-PIPE-DRG-CC-2043	Standard Detail - Inlet and Outlet Ventilators Sheet 2 of 2
503081-PIPE-DRG-CC-2044	Small Headwall Drainage Outlet Structure Detail

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Drawing Number	Drawing Name
503081-PIPE-DRG-CC-2045	Standard Detail Pipeline Reinforcement
503081-0000-DRG-EE-7000	Bulk Electrical Single Line Diagram
503081-BLEC-DRG-EE-7001	Electrical Bulk Supply 22kV Overhead Line Route
503081-BLEC-DRG-EE-7002	Electrical Bulk Supply 22kV Overhead Line Route: Line Route Approach to Abstraction and Water Treatment Works

APPENDIX A: LOCALITY PLAN

A locality plan for the Sidwadweni Regional Water Supply Scheme, is provided on the page that follows.

Also refer tender drawing: 503081-GENR-DRG-CC-0020 Rev T0, which illustrates all infrastructure proposed as part of the augmentation of the bulk water supply to the Sidwadweni Regional Water Supply Scheme, noting that only the following components are proposed to be constructed as part of this contract, "Contract 1":

- Abstraction works (civil and structural)
- Access road to WTW and abstraction works
- Water Treatment works (civil and structural)
- A portion of the highly-lift rising main within the site of the proposed Malepelepe WTW and along the proposed access road, up to air valve chamber at Chainage 580.

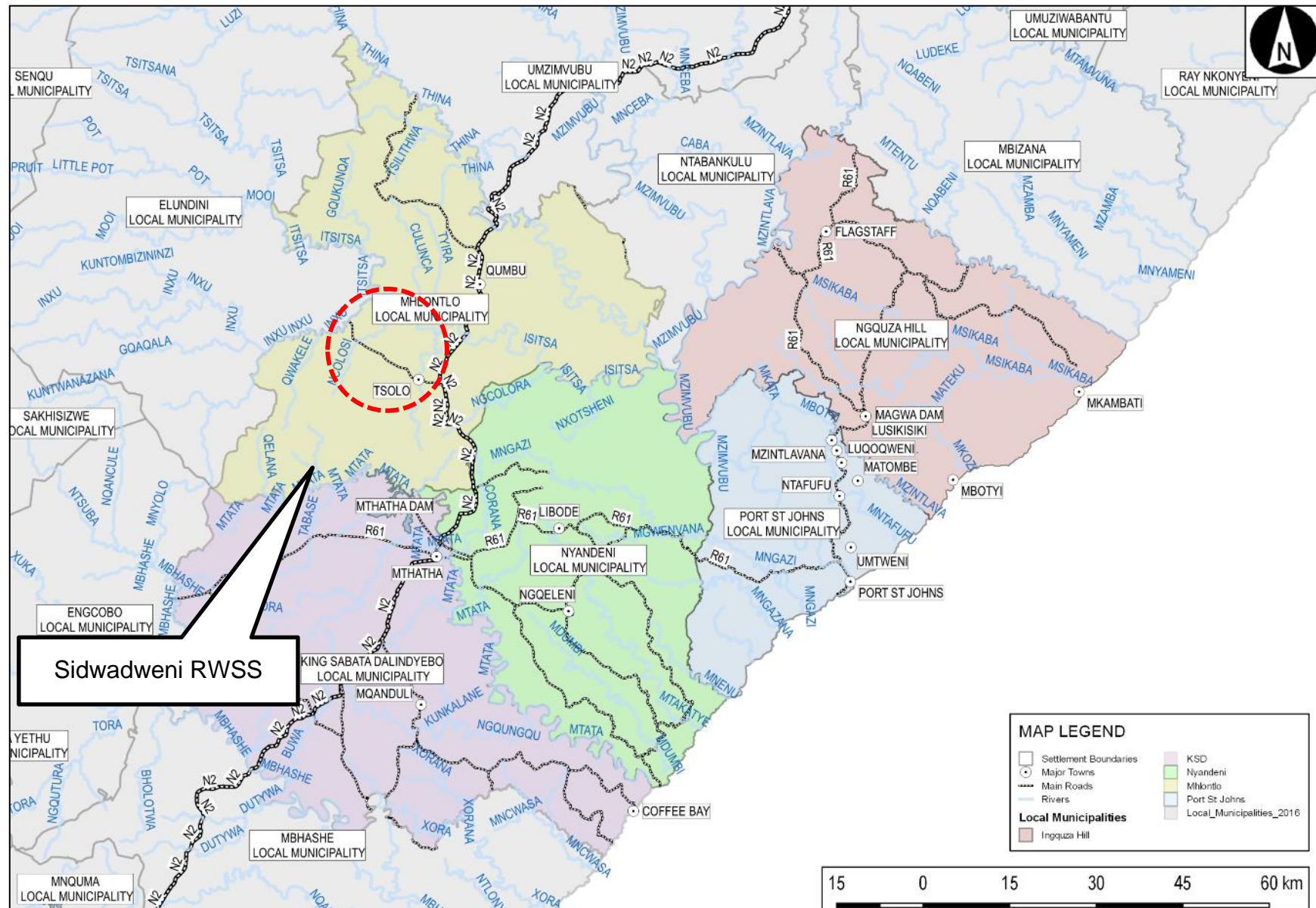
The following infrastructure will be constructed in future separate contracts:

- High-lift pumping main from air valve chamber at Chainage 580 to Nduku Command Reservoir.
 - Nduku Command Reservoir
 - Access road to Nduku command reservoir
 - Mechanical and electrical equipping of the abstraction works and the water treatment works
 - Secondary bulk pipelines
 - Distribution reservoirs
 - Village reticulation.
-

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APPENDIX B: MONTHLY REPORTING TEMPLATES
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LABOUR MONTHLY SUMMARY SHEET

Name of Contractor
Project Name
Project Number
Applicable Month

No of Working Days: Maximum including training = 23 days per month

Number of workers	Surname	Initials	First Name	ID Number	Birth Date	(M)ale / (F)emale	(D)isabled	Rate per day	Number of days worked this month	Number of training days this month	Total amount paid to beneficiary	Course name	Course Code
1											0		
2											0		
3											0		
4											0		
5											0		
6											0		
7											0		
8											0		
9											0		
10											0		
11											0		
12											0		
13											0		
14											0		
15											0		
16											0		
17											0		
18											0		
19											0		
20											0		
20	Totals for month										0	0	0

Signature Consultant

PAYMENT REGISTER

[illegible]

Signature of Contractor for receipt of monies

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DAILY SITE ATTENDANCE REGISTER

Name of Contractor
Project Name

Project Number
Month:

1 = At Work A = Absent L = Leave SC = Site Closed
SL = Sick Leave P = Public Holiday 2 = Training

Validation: Cannot
be more than 23
days per person
per month.

	Surname	Initials	ID Number	Birth Date	Rate per day (R)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total Work days	Total Training Days	Total work days & training days
1																																				0	0	0	
2																																				0	0	0	
3																																				0	0	0	
4																																				0	0	0	
5																																				0	0	0	
6																																				0	0	0	
7																																				0	0	0	
8																																				0	0	0	
9																																				0	0	0	
10																																				0	0	0	
11																																				0	0	0	
12																																				0	0	0	
13																																				0	0	0	
14																																				0	0	0	
15																																				0	0	0	
16																																				0	0	0	
17																																				0	0	0	
18																																				0	0	0	
19																																				0	0	0	
20																																				0	0	0	
20 TOTALS																																				0	0	0	

Signature of CLO

Validation:
Total work days
Total training days
Total work days + training days
Variance
Variance must be 0

Week 1: Signature of Contractor

Week 2: Signature of Contractor

Week 3: Signature of Contractor

Week 4: Signature of Contractor

Week 1 - 2: Signature of Contractor Organisation

Week 3 - 4: Signature of Contractor Organisation

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BENEFICIARY LIST

Name of Contractor
Project Name
Project Number
Month:

Youth = 35yrs and less												
Month:	Number of workers	Surname	Initials	Name	ID Number	Date of Birth	Male/Female	Has Disability (Y/N)	Is Youth (Y/N)	Education Level*	Date Start	Contact Number
	1											
	2											
	3											
	4											
	5											
	6											
	7											
	8											
	9											
	10											
	11											
	12											
	13											
	14											
	15											
	16											
	17											
	18											
	19											

Signature of CLO

5. Actual EMPLOYMENT GENERATION**5.1. Actual Number of persons employed**

Occupational Category			Adult				Youth				Disabled			
			Women		Men		Female		Male		Female		Male	
	Persons	Person Days	Persons	Person Days	Persons	Person Days	Persons	Person Days	Persons	Person Days	Persons	Person Days	Persons	Person Days
Clerical														
Labourer														
Managerial														
Semi-skilled														
Skilled														
Supervisor														
Total														

Please note: - The definition of youth is any person under the age of 35 years. (18-35 Years)

- Each person may only be counted once. If a person falls into more than one category, disabled persons take preference, then youth, then adults.

- Must include all occupational categories (Clerical, Labourer, Managerial, Semi-skilled, Skilled and Supervisor).

5.2. Average daily wage per category

Please note that the totals are calculated averages for the number of records submitted per category.

Occupational Category	Category Average	Adult		Youth		Disabled	
		Women	Men	Female	Male	Female	Male
		Daily wage	Daily wage	Daily wage	Daily wage	Daily wage	Daily wage
Clerical							
Labourer							
Managerial							
Semi-skilled							
Skilled							
Supervisor							
Average of the Daily Wage							

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6.1 Non-Accredited Training

[illegible]

6.2 Accredited Training

[illegible]

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6.3 Categories of Accreditation

Training Type	If Accredited			Note:
	NSB Number	NQF Level	ETQA/CETA	
Administration				NQF Level of Training Level 1 – General Education and Training Level 2,3,4 - Further Education and Training Level 5 - Higher Education and Training NSB Number: NSB 01: Agriculture and Nature Conservation NSB 02: Culture and Arts NSB 03: Business, Commerce and Management Studies NSB 04: Communication Studies and Language NSB 05: Education, Training and Development NSB 06: Manufacturing, Employer's Agenting and Technology NSB 07: Human and Social Studies NSB 08: Law, Military Science and Security NSB 09: Health Science and Social Services NSB 10: Physical, Mathematical, Computer and Life Sciences NSB 11: Services NSB 12: Physical Planning and Construction
Technical				
Lifeskills / ISD				
Literacy & Numeracy				
Vocational Skills				
Business Skills				
Total Training				

7. SMME'S USED SINCE THE START OF THE PROJECT:

Please remember to include all the SMME's that worked on the project since it started. Then add all the person days and all the funds paid to each SMME since the start of the project, and only record the latest total in the table.

For example, if a SMME completed all their work during the first reporting period, the name and details of that SMME must be added to every subsequent report.

SMME	Information about the SMME. (If it is a subsidiary: provide information for whole group and not for the SMME only)		Information about the work on the PROJECT			
	No. of permanent employees	Turnover previous 12 months	Total no. of person days to date	Amount paid to SMME to date. (Total)	Person days locally sourced: 0-25% 26-50% 51-75% 75-100%	Total value of work: SMME Involvement
Name of SMME						

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8. BEE ORGANISATIONS USED SINCE THE START OF THE PROJECT:

Note that Black Economic Empowerment (BEE) Organisations are referred to in the table below as Affirmable Business Enterprises (ABE's).

The definition of an ABE is as per the Department of Public Works definition: *A sole trader, partnership or legal entity which adheres to statutory labour practises, is registered with South African revenue Services and is a continuing and independent enterprise for profit, providing a commercially useful function and for which at least two thirds (67%) is owned by one or more PDI's and whose management and daily business operations are in control of one or more PDI's who effectively own it, and provided that the annual average turnover excluding VAT, does not exceed the maximum values given for each respective ABE category.*

Please remember to include all the ABE's that worked on the project since it started. Then add all the person days and all the funds paid to each ABE since the start of the project, and only record the latest

ABE	Information about the ABE. (If it is a subsidiary: provide information for whole group and not for the ABE only)		Information about the work on the PROJECT			
	No. of permanent employees	Turnover previous 12 months	Total no. of person days to date	Amount paid to ABE to date. (Total)	Person days locally sourced: 0-25% 26-50% 51-75% 75-100%	Total value of work: SMME Involvement
Name of ABE						

APPENDIX C: ENVIRONMENTAL SPECIFICATIONS

<p>APPENDIX D: OHS SPECIFICATION AND BASELINE RISK ASSESSMENT</p>
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APPENDIX E: GEOTECHNICAL REPORT
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APPENDIX F: RAINFALL DATA

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APPENDIX G: BOOK OF DRAWINGS
