

# **GERT SIBANDE DISTRICT MUNICIPALITY ON BEHALF OF MKHONDO LOCAL MUNICIPALITY**



## **CONTRACT NUMBER GSDM17/2022 AMSTERDAM BULK WATER SUPPLY SCHEME: PHASE 4: GABOSCH DAM**

### **BID DOCUMENT**

**CLOSING DATE: 14 December 2022**

**Issued by:**

Gert Sibande District Municipality  
PO Box 1748  
ERMELO  
2350

**NAME OF TENDERER:** \_\_\_\_\_

**TOTAL BID PRICE (EXCL. VAT):** \_\_\_\_\_

**TOTAL BID PRICE (INCL. VAT):** \_\_\_\_\_

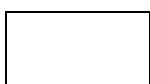
**PREFERENCE / B-BBEE GRADING:** \_\_\_\_\_

**CENTRAL SUPPLIER DATABASE (MAAA) NO:** \_\_\_\_\_

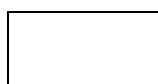
**TAX COMPLIANT STATUS PIN:** \_\_\_\_\_

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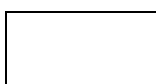
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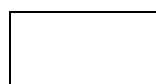
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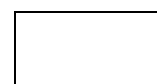
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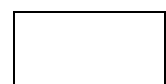
Witness 2



Employer



Witness 1



Witness 2

## TENDER

This part of the Bid Specification Document consists of the following two sections:

- **Part T1: Tendering Procedures**

This section details the:

- tender notice and invitation to tender (white pages); and
- tender data pertaining to the rules of the tender and the evaluation method (pink pages).

- **Part T2: Returnable Documents**

This section details the:

- list of returnable documents for evaluation and contract purposes (yellow pages); and
- returnable document requirements listed in Forms A to S (yellow pages).



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

## Part T1: Tendering Procedures

### T1.1 Tender Notice and Invitation to Tender

Tenders are hereby invited as a Contractor to be appointed for the construction of the **AMSTERDAM BULK WATER SUPPLY SCHEME: PHASE 4 GABOSCH DAM** to be executed on behalf of **MKHONDO LOCAL MUNICIPALITY, GSDM17/2022**. Tenderers should have a CIDB grading of **9CE**.

Tender documents will be available at no cost on the GSDM Website at [www.gsibande.gov.za](http://www.gsibande.gov.za) and e-Tender Website at <http://www.etennent/adveders.gov.za/cortised-tenders> as from **15 November 2022**. Tender documents will also be obtainable from Supply Chain Management Unit (SCM) of Gert Sibande District Municipality Office in Ermelo against payment of a non-refundable levy of **R250.00**, only bank guaranteed cheques or cash will be accepted as from **22 November 2022**. Cheques shall be made payable to Gert Sibande District Municipality. Documents can be obtained during normal working hours which are 07h30 - 16h30 Mondays to Thursdays and 07h30 to 13h30 on Fridays

Duly completed tenders enclosed in a sealed envelope marked **“TENDER NO GSDM17/2022: APPOINTMENT OF A CONTRACTOR FOR THE CONSTRUCTION OF AMSTERDAM BULK WATER SUPPLY SCHEME: PHASE 4 GABOSCH DAM; Closing date: 14 December 2022, at 12h00”** with the name of the Tenderer, shall be deposited in the tender box provided at the Gert Sibande District Municipality in Ermelo before 12h00 on the closing date. Tenders may only be submitted on the tender documentation that is issued.

A compulsory briefing session will take place on the **23 November 2022, at Mkhondo Local Municipal Offices in Amsterdam, Corner President & Voortrekker Street, 1132 Amsterdam at 10:30am. (26°37'21.76" S 30°39'40.63" E)**. Tenderers are advised to read and understand the tender conditions. Prospective bidders that arrive 15 minutes late will not be allowed to attend the meeting or to sign the attendance register.

Tenders must be submitted on the original documents and remain valid for ninety (90) days after closing date of the tender. Technical queries may be directed to **Mr T Mpuu on 017 801 7095/082 704 0239 or Email: [tebogomp@gsibande.gov.za](mailto:tebogomp@gsibande.gov.za)**. Tender documents enquiries may be directed to **Mr L Mbuyane on 017 801 7155 or Email: [records@gsibande.gov.za](mailto:records@gsibande.gov.za)**.

All tenders will be subjected to the 90/10 point system. The 90/10 point system shall apply whereby a contract will be allocated to a tenderer in accordance with the Preferential Procurement Policy Framework Act, Act No 5 of 2000 and as defined in the Conditions of Tender in the tender document, read in conjunction with the Preferential Procurement Policy of Gert Sibande District Municipality where 90 points will be allocated in respect of price and 10 points in respect of BBBEE.

Tenderers must have the necessary skills, experience and capacity to perform the required work. The closing date and time for the tender is **14 December 2022, @ 12h00**.

The District Municipality is not obliged to appoint the bidder with the lowest price but will consider the bidder scoring the highest number of points in line with the set criteria. The Gert Sibande District Municipality reserves the right to withdraw any invitation to tender and/or to re-advertise or to reject any tender or to accept a part of it.

**MS ME RADEBE**  
**ACTING MUNICIPAL MANAGER**  
**GERT SIBANDE DISTRICT MUNICIPALITY**



Contractor



Witness 1



Witness 2



Employer

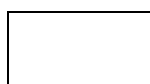


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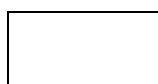


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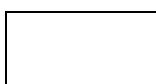
<b>YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF THE (GERT SIBANDE DISTRICT MUNICIPALITY)</b>					
BID NUMBER:	GSDM17/2022	CLOSING DATE:	14 December 2022	CLOSING TIME:	12H00
DESCRIPTION	<b>Amsterdam Bulk Water Supply Scheme – Phase 4: Gabosch Dam</b>				
<b>THE SUCCESSFUL BIDDER WILL BE REQUIRED TO FILL IN AND SIGN A WRITTEN CONTRACT FORM (MBD7).</b>					
BID RESPONSE DOCUMENTS MAY BE DEPOSITED IN THE BID BOX SITUATED AT (STREET ADDRESS)					
<b>Corner of Joubert and Oosthuise Street</b>					
<b>ERMELO, 2350</b>					
<b>Tender Box Situated at Main Entrance- Reception of Gert Sibande District Municipality</b>					
<b>SUPPLIER INFORMATION</b>					
NAME OF BIDDER					
POSTAL ADDRESS					
STREET ADDRESS					
TELEPHONE NUMBER	CODE		NUMBER		
CELLPHONE NUMBER					
FACSIMILE NUMBER	CODE		NUMBER		
E-MAIL ADDRESS					
VAT REGISTRATION NUMBER					
TAX COMPLIANCE STATUS	TCS PIN:		OR	CSD No:	
B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE [TICK APPLICABLE BOX]	<input type="checkbox"/> Yes  <input type="checkbox"/> No		B-BBEE STATUS LEVEL SWORN AFFIDAVIT	<input type="checkbox"/> Yes  <input type="checkbox"/> No	
<b>[A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE/ SWORN AFFIDAVIT (FOR EMES &amp; QSEs) MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS FOR B-BBEE]</b>					
ARE YOU THE ACCREDITED REPRESENTATIVE IN SOUTH AFRICA FOR THE GOODS / SERVICES /WORKS OFFERED?	<input type="checkbox"/> Yes <input type="checkbox"/> No [IF YES ENCLOSE PROOF]		ARE YOU A FOREIGN BASED SUPPLIER FOR THE GOODS /SERVICES /WORKS OFFERED?	<input type="checkbox"/> Yes <input type="checkbox"/> 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:					
<div style="border-bottom: 1px solid black; height: 20px; width: 300px; margin-bottom: 10px;"></div>					



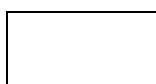
Contractor



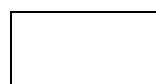
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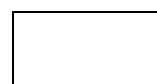
Witness 2



Employer



Witness 1



Witness 2

## PART B TERMS AND CONDITIONS FOR BIDDING

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

**NB: FAILURE TO PROVIDE ANY OF THE ABOVE PARTICULARS MAY RENDER THE BID INVALID.  
NO BIDS WILL BE CONSIDERED FROM PERSONS IN THE SERVICE OF THE STATE.**

SIGNATURE OF BIDDER: .....

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

DATE: .....

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

## T1.2 Tender Data

The conditions of tender are the Standard Conditions of Tender as contained in Annexure F of the CIDB Standard for Uniformity for Construction Procurement (July 2015) as published in Board Notice 136 Government Gazette No 38960 of 10 July 2015.

The Standard Conditions of Tender makes several references to the Tender Data. 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 below is cross-referenced to the clause in the Standard Conditions of Tender to which it applies, and which is annexed to this document as Annexure A.

Clause	Description
F.1.1	The Employer is the Gert Sibande District Municipality
F.1.2	The tender document consists of one volume as follows:
	<b>TENDER</b>
<b>Part T1</b>	<b>Tendering procedure</b>
T1.1	Tender Notice and Invitation to Tender (White)
T1.2	Tender Data (Pink)
<b>Part T2</b>	<b>Returnable Documents</b>
T2.1	List of Returnable Documents (Yellow)
T2.2	Returnable Schedules (Yellow)
	<b>CONTRACT</b>
<b>Part C1</b>	<b>Agreement and Contract Data</b>
C1.1	Form of Offer and Acceptance (Yellow)
C1.2	Contract Data (Yellow)
C1.3	Performance Guarantee (White)
<b>Part C2</b>	<b>Pricing Data</b>
C2.1	Pricing Instructions (Yellow)
C2.2	Bill of Quantities (Yellow)
<b>Part C3</b>	<b>Scope of Work</b>
C3.1	Scope of Work (Blue)
<b>Part C4</b>	<b>Site Information</b>
C4.1	Site Information (Green)
	<b>ANNEXURES</b>

Contractor

Witness 1

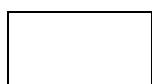
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Employer

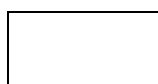
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Witness 2

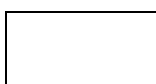
F.1.4	<p>Communications and Employer's Agent</p> <p>The Employer's Agent is Mr T Mpuru</p> <p>The Employer's Agent's address for receipt of communications and notices is:</p>
	<p>Tel: 017 801 7095/082 704 0239</p> <p>E-mail: tebogomp@gsibande.gov.za Address (Physical):</p> <p>Address (Postal) PO Box 1748 C/o Joubert &amp; Oosthuise St</p> <p>ERMELO ERMELO</p> <p>2350 M 2350 M</p> <p>Verbal communication given by the Employer's representative prior to the close of tenders will not be regarded as binding on the employer. Only information issued formally by the employer in writing to the tenders, under the signature of the Accounting Officer or his nominee will be regarded as amending the tender documents. Tender offer communicated on paper shall be submitted as an original. Questions or queries must be submitted at least ten (10) working days before the stipulated closing date and time of the tender. However, GSDM shall not be liable nor assume liability for failure to respond to any questions and queries raised by the Bidder.</p> <p>In the event that no correspondence or communication is received from the GSDM within ninety (90) days after the stipulated closing date and time of the tender, the tender proposal will be deemed to be unsuccessful.</p>
F.2.1	<p>Only those Tenderers who are registered with the Construction Industry Development Board (CIDB), in a Contractor grading designation equal to or higher than 9CE class construction work, are eligible to have their tenders evaluated.</p> <p>Joint Ventures are eligible to submit tenders provided that:</p> <ol style="list-style-type: none"> <li>1. every member of the joint venture is registered with the CIDB;</li> <li>2. the combined Contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than 9CE class of construction work.</li> <li>3. both members of the JV be represented at the compulsory clarification meeting.</li> </ol> <p>Responsive tenders are <b>ONLY</b> those tenders with all documents and pages contained herein, that have been signed by the responsible person duly authorised to sign all documents indicated on the returnable document "Form D: Authority of Signatory".</p>
F.2.2	<p>The Employer will not compensate the bidder for any cost incurred in attending the compulsory briefing session or making any submission with regards to the tender.</p>
F.2.5	<p>The documents to be used as reference documents in terms of this project is:</p> <ul style="list-style-type: none"> <li>• Standard Conditions of Tender as contained in Annexure F of the CIDB Standard for Uniformity for Construction Procurement (July 2015) as published in Board Notice 136 Government Gazette No 38960 of 10 July 2015.</li> </ul>



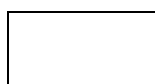
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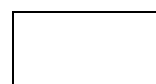
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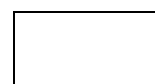
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Employer



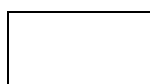
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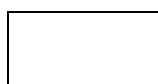
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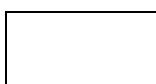
	<ul style="list-style-type: none"> <li>• General Conditions of Contract for Construction Works, Third Edition (2015) as published by SAICE.</li> <li>• SANS 1200 Suite of Construction Specifications and COTO Standard Specifications for Road and Bridge works for South African Road Authorities (2020 edition).</li> <li>• Gert Sibande District Municipality Supply Chain Management Policy (2021-2022)</li> <li>• The relevant statutes / laws pertaining to the Works i.e., OHS Act No.85 of 1993 as amended and Construction Regulations (GNR.84 of 07 February 2014), NEMA Act No.107 of 1998, the Labour Law etc.</li> </ul>
F.2.7	<p>A compulsory clarification meeting with representatives of the Employer will take place at: Mkhondo Local Municipality Offices in Amsterdam Address: Corner President &amp; Voortrekker Street 1132 Amsterdam 2375 (26°37'21.76" S 30°39'40.63" E) Municipal Hall opposite SAPS Amsterdam Date: 23 November 2022 Time: 10:30 am</p> <p>Confirmation of attendance will be recorded on site in the attendance register to be signed by all bidders. No individual may represent more than one bidder at the compulsory briefing session. Representatives must attend the session in totality. Non-completion of the attendance register will lead to automatic disqualification.</p> <p>Tender documents will not be made available at the clarification meeting.</p>
F.2.9	The Employer will not be responsible for any insurance in terms of the contract.
F.2.11	No alterations may be made to the tender document issued by the employer. Proposals and any other supporting documents as called for in the returnable schedules must be attached to the back of this tender document as Annexures corresponding with the applicable returnable Form reference.
F.2.12	No alternative tender offers will be considered or accepted.
F.2.13	<p>Only the original tender offer shall be submitted. No copies are required. The authorized signatories and witnesses shall sign the tender offer as indicated throughout the document as well as on the cover page and the annexures. The employer will hold all authorized signatories liable on behalf of the tenderer. Signatories for tenderers proposing to contract as joint ventures shall state which of the signatories is the lead partner whom the employer shall hold liable for the purpose of the tender offer.</p> <p>Seal the tender offer and state on the outside the following identification details:</p> <p style="text-align: center;"><b>THE ACTING MUNICIPAL MANAGER GERT SIBANDE DISTRICT MUNICIPALITY CONTRACT NO: GSDM17/2022 AMSTERDAM BULK WATER SUPPLY SCHEME: PHASE 4: GABOSCH DAM</b></p>



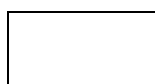
Contractor



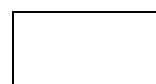
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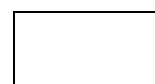
Witness 2



Employer



Witness 1



Witness 2

	The employer's address as listed in F.1.4 shall be indicated for delivery, as well as the bidder's name and contact address. The tender offer shall be placed in the Tender Box located at the foyer of the Gert Sibande District Municipality.
F2.14	Tender offers not providing all the data or information requested completely will be regarded as non-responsive.
F.2.15	The closing time for submission of tender offers is <b>12:00 on 14 December 2022.</b>
F.2.16	The tender offer validity period is 90 days from closure.
F.3.8	Non-Responsive tenders will be rejected and not be considered for detailed evaluation.
F.3.9	Tenderers that do not accept correction of arithmetical errors in the manner prescribed by the standard tender conditions will be rejected.
F.3.11	<p>The tender offers will be evaluated in terms of Method 2 based on functionality, price, and preference. Functionality is defined under F.3.11.3.</p> <p>Tender offers are expected to be above R50 000 000.00 in which case the following system will apply:</p> <ul style="list-style-type: none"> <li>• The 90/10 preference point system for services with a Rand value above R50 million.</li> </ul>
F.3.11.3 (Method 2)	<p>Method 2 will evaluate a responsive tender based on functionality, price, and preference.</p> <p>Score functionality, rejecting all tender offers that fail to achieve the minimum number of points for functionality as stated in the Tender Data. No tender must be regarded as an acceptable tender if it fails to achieve the minimum qualifying score for functionality as indicated in the tender invitation.</p> <p>All tenders will initially be subject to the responsiveness criteria in terms of the requirements of the returnable document called for in this bid specification document.</p>

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

## FUNCTIONALITY EVALUATION

It is a condition of tender that tenderers must complete and submit all schedules to acquire functionality points. The minimum threshold shall be 70 points out of a possible 100 points. Tenders that do not meet the minimum threshold will be rejected and not be considered for further evaluation.

Criterion	Assessment	Weighting
<b>Key Personnel Experience</b>	Key Personnel Experience evaluated as per criteria in <b>Form I</b> .	35
<b>Previous Company Experience</b>	Previous Company Experience evaluated as per criteria in <b>Form J</b> .	35
<b>Specialist Sub-Contractors</b>	Nominated Specialist Sub-Contractors evaluated as per criteria in <b>Form M</b> .	10
<b>Method Statement, Programme, and Organogram</b>	Method Statement, Programme, and Organogram evaluated as per criteria in <b>Form P</b> .	20
<b>Maximum Score:</b>		<b>100</b>

Tenders that have achieved the minimum qualification score for functionality will be evaluated further in terms of the preference points system prescribed in the table set out below. An electronic sheet (Excel) will be made available to tenderers for provision of functionality criteria. Tenderers are only to change the green highlighted sections in the functionality evaluation sheet. The points will be calculated automatically and converted to the correct weighting as described in each Returnable Form (I, J, M, and P).

## PREFERENCE POINTS

The following preference points are applicable in terms of the preferential procurement regulations:

B-BBEE Status Level of Contributor	90/10 Preference Points System
1	10
2	9
3	8
4	5
5	4
6	3
7	2
8	1
Non-compliant contributor	0
Points for Price	90
Maximum number of points	100

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

## **Part T2: Returnable Documents**

### **T2.1 List of Returnable Documents**

The following documents are to be completed and returned as they constitute 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 return all information requested.

#### **RETURNABLE DOCUMENTS REQUIRED FOR TENDER EVALUATION PURPOSES**

Form A: Compulsory Enterprise Questionnaire .....	12
Form B: Declaration of Bidder's Past Supply Chain Management Practices .....	15
Form C: Declaration of Interest .....	17
Form D: Authority of Signatory .....	21
Form E: Declaration of Good Standing Regarding Tax .....	24
Form F: Financial References / Tenderer's Credit Rating and Bank Details .....	26
Form G: Municipal Utility Account .....	28
Form H: Preference Schedule .....	30
Form I: Key Personnel .....	37
Form J: Schedule of Previous Experience.....	46
Form K: Schedule of Current Projects.....	48
Form L: Schedule of Plant and Equipment.....	49
Form M: Schedule of Proposed Specialist Sub-Contractors.....	50
Form N: Record of Addenda to Tender Documents .....	52
Form O: Proof of Good Standing with Compensation Commissioner .....	53
Form P: Method statement, Construction Programme, and Construction Organogram .....	54
Form Q: Certificate of Independent Bid Determination .....	57
Form R: Declaration of Tenderer's Litigation History .....	60
Form S: Audited 3-Year Financial Statements .....	63
Form T: Declaration Certificate for Local Production and Content for Designated Sectors .....	64

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

## DOCUMENTS THAT WILL BE INCORPORATED INTO THE CONTRACT

- C1.1 Form of Offer and Acceptance
- C1.2 Contract Data Part 2: Data Provided by the Contractor
- C1.3 Performance Guarantee
- C2.2 Bill of Quantities



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

## **T2.2 Returnable Documents**

### **Form A: Compulsory Enterprise Questionnaire**

In the case of a Joint Venture this page is to be completed and submitted in respect of each partner.

1. NAME OF ENTERPRISE AND CONTACT PERSON

2. CONTACT NUMBER

3. FAX NUMBER

**N/A**

4. E-MAIL ADDRESS

5. POSTAL ADDRESS

6. PHYSICAL ADDRESS

7. VAT REGISTRATION

8. TAX REFERENCE NUMBER

9. CIDB REGISTRATION NUMBER

10. CIDB GRADING

11. HAS A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE BEEN SUBMITTED? **YES / NO**



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

IF YES, WHO WAS THE CERTIFICATE ISSUED BY? (Delete which not applicable)

- An accounting officer as contemplated in the close corporation act (CCA)
- A verification agency accredited by the South African national accreditation system (SANAS)
- A registered auditor

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

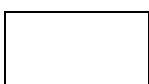
12. ARE YOU THE ACCREDITED REPRESENTATIVE IN SOUTH AFRICA FOR THE GOODS / SERVICES / WORKS OFFERED? **YES / NO**

\_\_\_\_\_  
Signature

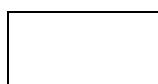
\_\_\_\_\_  
Date

\_\_\_\_\_  
Capacity under which the Bid is signed

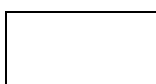
\_\_\_\_\_  
Name of bidder



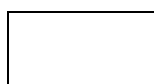
Contractor



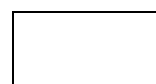
Witness 1



Witness 2



Employer



Witness 1



Witness 2

**ATTACH THE FOLLOWING DOCUMENTS AS AN ANNEXURE TO THE TENDER DOCUMENT  
WITH REFERENCE TO THE APPLICABLE RETURNABLE SCHEDULE – FORM A:**

**1. For Closed Corporations**

- CK1 or CK2 as applicable (Founding Statement)

**2. For Companies**

- A copy of the Certificate of Incorporation
- Certified Copies of the IDs of the Directors and
- the shareholders register

**3. For Joint Venture Agreements**

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

**4. For Partnership**

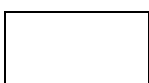
- Certified Copies of the IDs of the partners

**5. One-person Business / Sole trader**

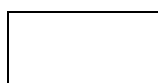
- Certified Copy of ID

**6. B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE**

- Original and valid B-BBEE Status Level Verification Certificates or Certified Copy thereof.



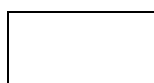
Contractor



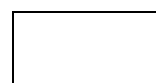
Witness 1



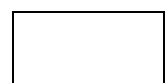
Witness 2



Employer



Witness 1



Witness 2



**Form B: 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( <a href="http://www.treasury.gov.za">www.treasury.gov.za</a> ) and can be accessed by clicking on its link at the bottom of the home page.	Yes <input type="checkbox"/>	No <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 ( <a href="http://www.treasury.gov.za">www.treasury.gov.za</a> ) by clicking on its link at the bottom of the home page.	Yes <input type="checkbox"/>	No <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?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
4.3.1	If so, furnish particulars:		

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

4.4	Does the bidder or any of its directors owe any municipal rates and taxes or municipal charges to the municipality / municipal entity, or to any other municipality / municipal entity, that is in arrears for more than three months?	Yes <input type="checkbox"/>	No <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?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
4.7.1	If so, furnish particulars:		

### CERTIFICATION

I, the undersigned (name) \_\_\_\_\_

certify that the information furnished on this declaration form is true and correct.

I accept that the state may reject the bid or act against me in terms of paragraph 23 of the general conditions of contract should this declaration prove to be false.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Position

\_\_\_\_\_  
Name of bidder

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**Form C: Declaration of Interest**

- 1 Any legal person, including persons employed by the State<sup>1</sup>, or persons having a kinship with persons employed by the State, including a blood relationship, may make an offer or offers in terms of this invitation to bid (includes a price quotation, advertised competitive bid, limited bid, or proposal). In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons employed by the State, or to persons connected with or related to them, it is required that the bidder or his/her authorised representative declare his/her position in relation to the evaluating/adjudicating authority where:
- the bidder is employed by the State; and/or
  - the legal person on whose behalf the bidding document is signed, has a relationship with persons/a person who are/is involved in the evaluation and or adjudication of the bid(s), or where it is known that such a relationship exists between the person or persons for or on whose behalf the declarant acts and persons who are involved with the evaluation and or adjudication of the bid.

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

2.1 Full Name of bidder or his or her representative:

2.2 Identity Number:

2.3 Position occupied in the Company (director, trustee, shareholder<sup>2</sup>):

2.4 Company Registration Number:

2.5 Tax Reference Number:

2.6 VAT Registration Number:

2.6.1 The names of all directors / trustees / shareholders / members, their individual identity numbers, tax reference numbers and, if applicable, employee / personal numbers must be indicated in paragraph 3 below

<sup>1</sup> "State" means:

- a) 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);
- b) any municipality or municipal entity;
- c) provincial legislature;
- d) National Assembly or the National Council of Provinces; or
- e) Parliament.

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

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

2.7 Are you or any person connected with the bidder presently employed by the state? **YES / NO**

2.7.1 If so, furnish the following particulars:

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\_\_\_\_\_  
Name of person / director / trustee / shareholder/ member:

\_\_\_\_\_  
Name of state institution at which you or the person connected to the bidder is employed:

\_\_\_\_\_  
Position occupied in the state institution:

\_\_\_\_\_  
Any other particulars:

---

---

2.7.2 If you are presently employed by the state, did you obtain the appropriate authority to undertake remunerative work outside employment in the public sector? **YES / NO**

2.7.2.1 If yes, did you attach proof of such authority to the bid document? **YES / NO**

(Note: Failure to submit proof of such authority, where applicable, may result in the disqualification of the bid.)

2.7.2.2 If no, furnish reasons for non-submission of such proof:

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2.8 Did you or your spouse, or any of the company's directors / trustees / shareholders / members or their spouses conduct business with the state in the previous twelve months? **YES / NO**

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Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

2.8.1 If so, furnish particulars:

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2.9 Do you, or any person connected with the bidder, have any relationship (family, friend, other) with a person employed by the state and who may be involved with the evaluation and or adjudication of this bid? **YES / NO**

2.9.1 If so, furnish particulars:

---

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2.10 Are you, or any person connected with the bidder, aware of any relationship (family, friend, other) between any other bidder and any person employed by the state who may be involved with the evaluation and or adjudication of this bid? **YES / NO**

2.10.1 If so, furnish particulars:

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2.11 Do you or any of the directors / trustees / shareholders / members of the company have any interest in any other related companies whether or not they are bidding for this contract? **YES / NO**

2.11.1 If so, furnish particulars:

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Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

### 3. FULL DETAILS OF DIRECTORS / TRUSTEES / MEMBERS / SHAREHOLDERS

Full Name	Identity Number	Personal Tax Reference Number	State Employee Number / Personal

### 4. DECLARATION

I, the undersigned (name) \_\_\_\_\_

certify that the information furnished in paragraphs 2 and 3 above is correct.

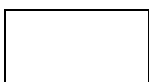
I accept that the state may reject the bid or act against me in terms of paragraph 23 of the general conditions of contract should this declaration prove to be false.

\_\_\_\_\_  
Signature

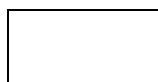
\_\_\_\_\_  
Date

\_\_\_\_\_  
Position

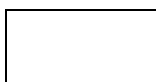
\_\_\_\_\_  
Name of bidder



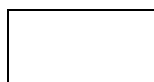
Contractor



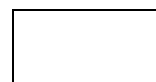
Witness 1



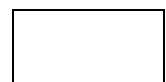
Witness 2



Employer



Witness 1



Witness 2

**Form D: Authority of Signatory**

Details of person responsible for tender process:

Name: \_\_\_\_\_

Contact number: \_\_\_\_\_

Office address: \_\_\_\_\_

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

---

**PRO-FORMA FOR COMPANIES AND CLOSE CORPORATIONS:**

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

Mr/Ms \_\_\_\_\_  
has been duly authorized to sign all documents in connection with the Tender for:

**CONTRACT NO: GSDM17/2022**  
**AMSTERDAM BULK WATER SUPPLY SCHEME: PHASE 4: GABOSCH DAM**

and any Contract which may arise there from on behalf of:

\_\_\_\_\_  
(BLOCK CAPITALS)  
SIGNED ON BEHALF OF THE COMPANY IN HIS CAPACITY AS:

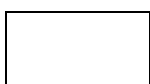
DATE: \_\_\_\_\_

FULL NAMES OF SIGNATORY: \_\_\_\_\_

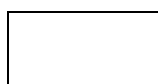
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AS WITNESSES: 1. \_\_\_\_\_

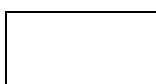
2. \_\_\_\_\_



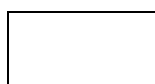
Contractor



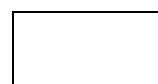
Witness 1



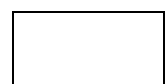
Witness 2



Employer



Witness 1



Witness 2

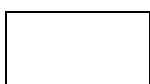
**PRO-FORMA FOR JOINT VENTURES:**

We, the undersigned, are submitting this tender offer in Joint Venture and hereby authorise

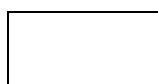
Mr/Ms \_\_\_\_\_,

authorised signatory of the company \_\_\_\_\_,  
acting in the capacity of lead partner, to sign all documents in connection with the tender offer and  
any contract resulting from it on our behalf.

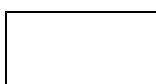
NAME OF FIRM	ADDRESS	DULY AUTHORISED SIGNATORY
		Signature: _____ Name: _____ Designation: _____
		Signature: _____ Name: _____ Designation: _____
		Signature: _____ Name: _____ Designation: _____
		Signature: _____ Name: _____ Designation: _____



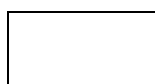
Contractor



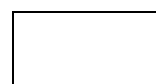
Witness 1



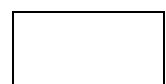
Witness 2



Employer



Witness 1



Witness 2



**ATTACH THE FOLLOWING DOCUMENTS AS AN ANNEXURE TO THE TENDER DOCUMENT  
WITH REFERENCE TO THE APPLICABLE RETURNABLE SCHEDULE – FORM D:**

- Duly signed and dated original or certified copy of Authority of Signatory on company letterhead.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

### **Form E: Declaration of Good Standing Regarding Tax**

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.

In bids where Consortia / Joint Ventures / Sub-contractors are involved, each party must submit a separate Tax Clearance Certificate

### **MBD 2 Tax Clearance Certificate Requirements**

**It is a condition of bid that the taxes of the successful bidder must be in order, or that satisfactory arrangements have been made with South African Revenue Service (SARS) to meet the bidder's tax obligations.**

1. In order to meet this requirement bidder is required to complete in full the attached 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 bidders / individuals who wish to submit bids.
2. SARS will then furnish the bidder 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.
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](http://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](http://www.sars.gov.za).



Contractor



Witness 1



Witness 2



Employer



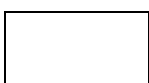
Witness 1



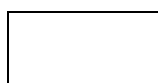
Witness 2

**ATTACH THE FOLLOWING DOCUMENTS AS AN ANNEXURE TO THE TENDER DOCUMENT  
WITH REFERENCE TO THE APPLICABLE RETURNABLE SCHEDULE – FORM E:**

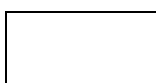
- Original valid Tax Clearance Certificate



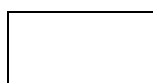
Contractor



Witness 1



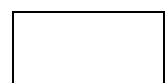
Witness 2



Employer



Witness 1



Witness 2

**Form F: Financial References / Tenderer's Credit Rating and Bank Details**

**Notes to tenderer:**

1. The tenderer shall attach to this form a letter from the bank confirming the bank account and details. Failure to provide the required letter with the tender submission shall render the tenderer's offer unresponsive.
2. The tenderer's banking details as they appear below shall be completed.
3. In the event that the tenderer is a joint venture enterprise, details of all the members of the joint venture shall be similarly provided and attached to this form.

<b>BANK NAME:</b>		
<b>ACCOUNT NAME:</b> <i>(e.g. ABC Civil Construction cc)</i>		
<b>ACCOUNT TYPE:</b> <i>(e.g. Savings, Cheque etc.)</i>		
<b>ACCOUNT NO:</b>		
<b>ADDRESS OF BANK:</b>		
<b>CONTACT PERSON:</b>		
<b>TELEPHONE NUMBER OF BANK OR CONTACT PERSON:</b>		
How long has this account been in existence (tick which is appropriate):	0-6 months	
	7-12 months	
	13-24 months	
	More than 24 months	

Name of Tenderer: \_\_\_\_\_

Date: \_\_\_\_\_

Signature: \_\_\_\_\_

Full name of signatory: \_\_\_\_\_

\_\_\_\_\_

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Contractor

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Witness 1

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Witness 2

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Employer

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Witness 1

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Witness 2

**ATTACH THE FOLLOWING DOCUMENTS AS AN ANNEXURE TO THE TENDER DOCUMENT  
WITH REFERENCE TO THE APPLICABLE RETURNABLE SCHEDULE – FORM F:**

- Original or certified copy of a letter from tenderer's bank (not older that three months from tender closure)



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**Form G: Municipal Utility Account**  
**DECLARATION BY THE TENDERER**

I the undersigned \_\_\_\_\_

\_\_\_\_\_ has been duly authorized to sign all documents with the Tender for:

**CONTRACT NO: GSDM17/2022**  
**AMSTERDAM BULK WATER SUPPLY SCHEME: PHASE 4: GABOSCH DAM**

\_\_\_\_\_  
(Referred to herein as "the Bidder")

hereby make a declaration as follows:

1. I declare that the bidder and /or any of its director(s) / member(s) does not owe the municipality, or any other municipality and/or municipal entity any amount which is in arrears in respect of any municipal rates and taxes or municipal service charges.
2. I understand and accept that in the event that this declaration is proved to be false, the bid shall be rejected forthwith. All other rights of the municipality (including but not limited to the right to claim damages where applicable) shall remain reserved in full.

SIGNED ON BEHALF OF  
THE COMPANY

\_\_\_\_\_

IN HIS CAPACITY AS

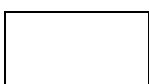
\_\_\_\_\_

DATE

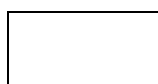
\_\_\_\_\_

FULL NAMES OF SIGNATORY

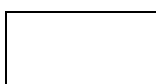
\_\_\_\_\_



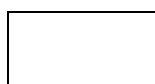
Contractor



Witness 1



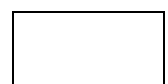
Witness 2



Employer



Witness 1



Witness 2

**ATTACH THE FOLLOWING DOCUMENTS AS AN ANNEXURE TO THE TENDER DOCUMENT  
WITH REFERENCE TO THE APPLICABLE RETURNABLE SCHEDULE – FORM G:**

- Municipal utility account (not older that three months)



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**Form H: Preference Schedule**

**PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2011**

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

NB: BEFORE COMPLETING THIS FORM, TENDERS MUST STUDY THE GENERAL CONDITIONS, DEFINITIONS AND DIRECTIVES APPLICABLE IN RESPECT OF B-BBEE, AS PRESCRIBED IN THE PREFERENTIAL PROCUREMENT REGULATIONS, 2011.

**1. GENERAL CONDITIONS**

- 1.1 The following preference point systems are applicable to all bids:  
the 80/20 system for requirements with a Rand value of up to R50 000 000 (all applicable taxes included); and  
the 90/10 system for requirements with a Rand value above R50 000 000 (all applicable taxes included).
- 1.2 The value of this bid is estimated to **exceed R50 000 000** (all applicable taxes included) and therefore the **90/10** system shall be applicable.
- 1.3 Preference points for this bid shall be awarded for:
- Price; and
  - B-BBEE Status Level of Contribution.

- 1.3.1 The maximum points for this bid are allocated as follows:

DESCRIPTION	POINTS
PRICE	90
B-BBEE STATUS LEVEL OF CONTRIBUTION	10
<b>Total points for Price and B-BBEE must not exceed</b>	<b>100</b>

- 1.4 Failure on the part of a bidder to fill in and/or to sign this form and submit a B-BBEE Verification Certificate from a Verification Agency accredited by the South African Accreditation System (SANAS) or a Registered Auditor approved by the Independent Regulatory Board of Auditors (IRBA) or an Accounting Officer as contemplated in the Close Corporation Act (CCA) together with the bid, will be interpreted to mean that preference points for B-BBEE status level of contribution are not claimed.
- 1.5 The purchaser reserves the right to require of a bidder, either before a bid is adjudicated or at any time subsequently, to substantiate any claim in regard to preferences, in any manner required by the purchaser.

**2 DEFINITIONS**

- 2.1 "All applicable taxes" includes value-added tax, pay as you earn, income tax, unemployment insurance fund contributions and skills development levies;
- 2.2 "B-BBEE" means broad-based black economic empowerment as defined in section 1 of the Broad -Based Black Economic Empowerment Act;
- 2.3 "B-BBEE status level of contributor" means the B-BBEE status received by a measured entity based on its overall performance using the relevant scorecard contained in the Codes of Good Practice on Black Economic Empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act;

Contractor

Witness 1

Witness 2

Employer

Witness 1

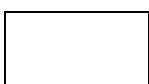
Witness 2



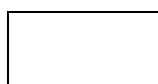
- 2.4 “bid” means a written offer in a prescribed or stipulated form in response to an invitation by an organ of state for the provision of services, works or goods, through price quotations, advertised competitive bidding processes or offers;
- 2.5 “Broad-Based Black Economic Empowerment Act” means the Broad-Based Black Economic Empowerment Act, 2003 (Act No. 53 of 2003);
- 2.6 “Comparative price” means the price after the factors of a non-firm price and all unconditional discounts that can be utilized have been taken into consideration;
- 2.7 “Consortium or joint venture” 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;
- 2.8 “contract” means the agreement that results from the acceptance of a bid by an organ of state;
- 2.9 “EME” means any enterprise with an annual total revenue of R5 million or less.
- 2.10 “Firm price” means the price that is only subject to adjustments in accordance with the actual increase or decrease resulting from the change, imposition, or abolition of customs or excise duty and any other duty, levy, or tax, which, in terms of the law or regulation, is binding on the contractor and demonstrably has an influence on the price of any supplies, or the rendering costs of any service, for the execution of the contract;
- 2.11 “functionality” means the measurement according to predetermined norms, as set out in the bid documents, of a service or commodity that is designed to be practical and useful, working or operating, considering, among other factors, the quality, reliability, viability and durability of a service and the technical capacity and ability of a bidder;
- 2.12 “non-firm prices” means all prices other than “firm” prices;
- 2.13 “person” includes a juristic person;
- 2.14 “Rand value” means the total estimated value of a contract in South African currency, calculated at the time of bid invitations, and includes all applicable taxes and excise duties;
- 2.15 “sub-contract” means the primary contractor’s assigning, leasing, making out work to, or employing, another person to support such primary contractor in the execution of part of a project in terms of the contract;
- 2.16 “Total revenue” bears the same meaning assigned to this expression in the Codes of Good Practice on Black Economic Empowerment, issued in terms of section 9(1) of the Broad-Based Black Economic Empowerment Act and promulgated in the Government Gazette on 9 February 2007;
- 2.17 “trust” means the arrangement through which the property of one person is made over or bequeathed to a trustee to administer such property for the benefit of another person; and
- 2.18 “trustee” means any person, including the founder of a trust, to whom property is bequeathed in order for such property to be administered for the benefit of another person.

### **3. ADJUDICATION USING A POINT SYSTEM**

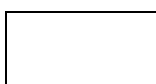
- 3.1 The bidder obtaining the highest number of total points will be awarded the contract.
- 3.2 Preference points shall be calculated after prices have been brought to a comparative basis considering all factors of non-firm prices and all unconditional discounts.
- 3.3 Points scored must be rounded off to the nearest 2 decimal places.
- 3.4 In the event that two or more bids have scored equal total points, the successful bid must be the one scoring the highest number of preference points for B-BBEE.



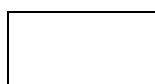
Contractor



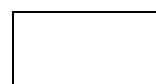
Witness 1



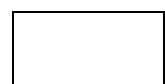
Witness 2



Employer



Witness 1



Witness 2

- 3.5 However, when functionality is part of the evaluation process and two or more bids have scored equal points including equal preference points for B-BBEE, the successful bid must be the one scoring the highest score for functionality.
- 3.6 Should two or more bids be equal in all respects, the award shall be decided by the drawing of lots.

#### 4. POINTS AWARDED FOR PRICE

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

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

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

80/20                      or                      90/10

Where

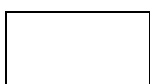
Ps = Points scored for comparative price of bid under consideration  
Pt = Comparative price of bid under consideration  
Pmin = Comparative price of lowest acceptable bid

#### 5. POINTS AWARDED FOR B-BBEE STATUS LEVEL OF CONTRIBUTION

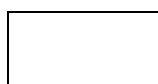
- 5.1 In terms of Regulation 5 (2) and 6 (2) of the Preferential Procurement Regulations, preference points must be awarded to a bidder for attaining the B-BBEE status level of contribution in accordance with the table below:

B-BBEE Status Level of Contributor	Number of points (90/10 system)	Number of points (80/20 system)
1	10	20
2	9	18
3	8	16
4	5	12
5	4	8
6	3	6
7	2	4
8	1	2
Non-compliant contributor	0	0

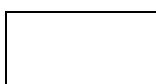
- 5.2 Tenderers who qualify as EMEs in terms of the B-BBEE Act must submit a certificate issued by an Accounting Officer as contemplated in the CCA or a Verification Agency accredited by SANAS or a Registered Auditor. Registered auditors do not need to meet the prerequisite for IRBA's approval for the purpose of conducting verification and issuing EMEs with B-BBEE Status Level Certificates.
- 5.3 Tenderers other than EMEs must submit their original and valid B-BBEE status level verification certificate or a certified copy thereof, substantiating their B-BBEE rating issued by a Registered Auditor approved by IRBA or a Verification Agency accredited by SANAS



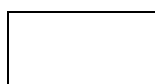
Contractor



Witness 1



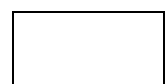
Witness 2



Employer



Witness 1



Witness 2

- 5.4 A trust, consortium, or joint venture will qualify for points for their B-BBEE status level as a legal entity, provided that the entity submits their B-BBEE status level certificate.
- 5.5 A trust, consortium or joint venture will qualify for points for their B-BBEE status level as an unincorporated entity, provided that the entity submits their consolidated B-BBEE scorecard as if they were a group structure and that such a consolidated B-BBEE scorecard is prepared for every separate bid.
- 5.6 Tertiary institutions and public entities will be required to submit their B-BBEE status level certificates in terms of the specialized scorecard contained in the B-BBEE Codes of Good Practice.
- 5.7 A person will not be awarded points for B-BBEE status level if it is indicated in the bid documents that such a bidder intends sub-contracting more than 25% of the value of the contract to any other enterprise that does not qualify for at least the points that such a bidder qualifies for, unless the intended sub- contractor is an EME that has the capability and ability to execute the sub-contract.
- 5.8 A person awarded a contract may not sub-contract more than 25% of the value of the contract to any other enterprise that does not have an equal or higher B-BBEE status level than the person concerned, unless the contract is sub-contracted to an EME that has the capability and ability to execute the sub-contract.

## **6. BID DECLARATION**

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

## **7. B-BBEE STATUS LEVEL OF CONTRIBUTION CLAIMED IN TERMS OF PARAGRAPHS 1.3.1.2 AND 5.1**

- 7.1 B-BBEE Status Level of Contribution: \_\_\_\_\_ = \_\_\_\_\_ maximum of 10 or 20 points)  
(Points claimed in respect of paragraph 7.1 must be in accordance with the table reflected in paragraph 5.1 and must be substantiated by means of a B-BBEE certificate issued by a Verification Agency accredited by SANAS or a Registered Auditor approved by IRBA, or an Accounting Officer as contemplated in the CCA).

## **8. SUB-CONTRACTING**

- 8.1 Will any portion of the contract be sub-contracted? **YES /NO**

- 8.1.1 If yes, indicate:

i) what percentage of the contract will be subcontracted? \_\_\_\_\_ %

ii) the name of the sub-contractor?

iii) the B-BBEE status level of the sub-contractor?

iv) whether the sub-contractor is an EME?

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**9. DECLARATION WITH REGARD TO COMPANY/FIRM**

9.1 Name of firm:

9.2 VAT registration number

9.3 Company registration number

9.4 Type of Firm (Tick Applicable Box):

<input type="checkbox"/>	Partnership/ Joint Venture/ Consortium
<input type="checkbox"/>	One Person business/ sole propriety
<input type="checkbox"/>	Close Corporation
<input type="checkbox"/>	Company
<input type="checkbox"/>	(Pty) Ltd
<input type="checkbox"/>	Other (Specify):

9.5 Describe Principal Business Activities

9.6 Company Classification (Tick Applicable Box):

<input type="checkbox"/>	Manufacturer
<input type="checkbox"/>	Supplier
<input type="checkbox"/>	Professional service provider
<input type="checkbox"/>	Other service providers, e.g., transporter, etc.

9.7 Municipal Information:  
Municipality where business is situated

Registered Account Number

Stand Number

9.8 Total number of years the company/firm has been in business?

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Contractor

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Witness 1

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Witness 2

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Employer

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Witness 1

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Witness 2

- 9.9 I/we, the undersigned, who is / are duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the B-BBE status level of contribution indicated in paragraph 7 of the foregoing certificate, qualifies the company/ firm for the preference(s) shown and I / we acknowledge that:
- i. The information furnished is true and correct;
  - ii. The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form.
  - iii. In the event of a contract being awarded as a result of points claimed as shown in paragraph 7, the contractor may be required to furnish documentary proof to the satisfaction of the purchaser that the claims are correct;
  - iv. If the B-BBEE status level of contribution has been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the purchaser may, in addition to any other remedy it may have –
    - a) disqualify the person from the bidding process;
    - b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;
    - c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;
    - d) restrict the bidder or contractor, its shareholders, and directors, or only the shareholders and directors who acted on a fraudulent basis, 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 forward the matter for criminal prosecution

WITNESSES:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

SIGNATURE(S) OF BIDDER(S)

DATE:

\_\_\_\_\_

ADDRESS:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**ATTACH THE FOLLOWING DOCUMENTS AS AN ANNEXURE TO THE TENDER DOCUMENT  
WITH REFERENCE TO THE APPLICABLE RETURNABLE SCHEDULE – FORM H:**

- Certified B-BBEE Certificate

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Contractor

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Witness 1

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Witness 2

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Employer

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Witness 1

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Witness 2

### Form I: Key Personnel

Evaluation criteria for Key Personnel is as follows:

**Note: If the Tenderer does not propose key personnel that meets the minimum criteria for the Contracts Manager and Construction Manager, the Tenderer will be disqualified.**

No.	Role Description	Academic Qualification	Points	Total Years Experience	Points	Project Related Experience	Points	Professional Registration - ECSA / SACPCMP	Points	Points Total / Role		
1	Contracts Manager - Appointment 16.1	BEng / BTech in relevant Engineering disciplines	2	15 years and more	2	One (1) Category II Dam	2	Pr Eng / Pr Tech Eng and Pr CPM / Pr CM	2	8.000		
				10-14 years	1.5	Three (3) Bulk Water Projects Exceeding value of R200M per project	1.5	Pr Eng / Pr Tech Eng or Pr CPM / Pr CM	1.5			
						Two (2) Bulk Water Projects Exceeding value of R200M per project	1					
						One (1) Bulk Water Project Exceeding value of R200M	0.5					
2	Construction Manager - Appointment 8.1	BEng / BTech in relevant Engineering disciplines	2	15 years and more	2	One (1) Category II Dam	2	Pr Eng / Pr Tech Eng or Pr CPM / Pr CM	1	7.000		
				10-14 years	1.5	Three (3) Bulk Water Projects Exceeding value of R200M per project	1.5					
						Two (2) Bulk Water Projects Exceeding value of R200M per project	1					
						One (1) Bulk Water Project Exceeding value of R200M	0.5					
3	Assistant Construction Manager - Dam - Appointment 8.2	National Diploma in relevant Engineering disciplines	1	10-14 years	1.5	Three (3) Bulk Water Projects Exceeding value of R200M per project	1.5	Pr Techni Eng or Pr CM	1	5.000		
				5-9 years	1	Two (2) Bulk Water Projects Exceeding value of R200M per project	1					
						One (1) Bulk Water Project Exceeding value of R200M	0.5					

**Amsterdam Bulk Water Supply Scheme: Phase 4: Gabosch Dam**

No.	Role Description	Academic Qualification	Points	Total Years Experience	Points	Project Related Experience	Points	Professional Registration - ECSA/ SACPCMP	Points	Points Total / Role
4	Assistant Construction Manager - Road - Appointment 8.2	National Diploma in relevant Engineering disciplines	0.5	10-14 years	1.5	Three (3) Roads and Stormwater Projects exceeding a value of R12M	1	Pr Techni Eng or Pr CM	1	4.000
				5-9 years	1	Two (2) Roads and Stormwater Projects exceeding a value of R12M	0.75			
						One (1) Roads and Stormwater Project exceeding a value of R12M	0.5			
5	Health and Safety Manager (CHSM)	Higher Certificate in Safety Management	0.5	10-14 years	1	Two (2) Civil and Structural Projects Exceeding value of R50M per project	1	CHSM	1	3.500
				5-9 years	0.5	One (1) Civil and Structural Project Exceeding value of R50M	0.5			
6	Health and Safety Officer - Appointment 8.5	Higher Certificate in Safety Management	0.5	5-9 years	0.5	One (1) Civil and Structural Project Exceeding value of R50M	1	CHSO	1	3.000
				Less than 5 Years	0.25	One (1) Civil and Structural Project Exceeding value of R30M	0.5			
7	Construction Supervisor - Dam - Appointment 8.7	National Certificate	0.5	10-14 years	1	One (1) Bulk Water Project Exceeding value of R200M	1	N/A	N/A	2.500
				5-9 years	0.5	Two (2) Bulk Water Projects Exceeding value of R100M per project	0.5			
8	Construction Supervisor - Road - Appointment 8.7	National Certificate	0.5	10-14 years	0.5	Three (3) Roads and Stormwater Projects exceeding a value of R12M	1	N/A	N/A	2.000
				5-9 years	0.25	Two (2) Roads and Stormwater Projects exceeding a value of R12M	0.75			
						One (1) Roads and Stormwater Project exceeding a value of R12M	0.5			
Total										35



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2



Tenderers to provide the following documentation as proof of compliance with the evaluation criteria

- Certified copy of Academic Qualification.
- Maximum three (3) page Curriculum Vitae (CV), according to the format provided, stating the candidate's overall experience in Civil Infrastructure projects as well as project specific related experience.
- Certified copy of Professional Registration (s) (SACPCMP / ECSA)

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

## Key Personnel to be appointed on this contract.

In order to be declared responsive, the tenderer must have the following key personnel in its permanent employment at the close of tender. Alternatively, signed undertakings from contracted personnel having the required qualification and experience, stating that they will undertake the work on behalf of the tenderer in terms of a service level agreement between the parties, will be acceptable. Such letters of undertaking must be attached as part of the returnable schedule Form I. **It must be understood that the minimum required personnel as sated below will be required for the tender to be responsive.**

DESCRIPTION	Name of Full-time member	Minimum number of personnel required	
		Permanent personnel	Contracted personnel
1. Contracts Manager – Appointment 16.1		One (1) Required	N/A
2. Construction Manager – Appointment 8.1		One (1) Required	N/A
3. Assistant Construction Manager – Dam - Appointment 8.2		One (1) Required	
4. Assistant Construction Manager – Road - Appointment 8.2		One (1) Required	
5. Construction Health and Safety Manager (CHSM)		One (1) Required	
6. Construction Health and Safety Officer – Appointment 8.5		One (1) Required	
7. Construction Supervisor - Dam – Appointment 8.7		One (1) Required	
8. Construction Supervisor - Road – Appointment 8.7		One (1) Required	

**Note:** 16 (1) Appointment in terms of the OHS Act No.85 of 1993

18 (1), 18 (2), 18 (5), 18 (7) and 18 (8) Appointment in terms of Construction Regulations, 2014.

Appointment of additional personnel contemplated in Construction Regulations 8(2), 8(7) and 8(8) is subject to the Contractor's consideration of the project size and/or instruction by an inspector if in the opinion of the inspector, enough personnel is not appointed on the construction site, to supervise the construction work.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

A CV of each key staff member of not more than 3 pages should be attached. The CV should be structured, **as per the template provided**, under the following headings:

1. Personal particulars: Name, date and place of birth, place(s) of tertiary education and dates associated therewith and professional awards
2. Qualifications & Registrations (degrees, diplomas, grades of membership of professional societies and professional registrations – Original certified copies within three months of the closing date).
3. Name of current employer and position in enterprise
4. Breakdown of positions Held from time qualification was obtained to date.
5. Overview of post graduate / diploma experience (dates, organization and position)
6. Outline of recent and completed assignments / experience that has a bearing on the scope of work.
7. Undertaking and signature by key personnel that they are aware of their inclusion as part of the proposed team.

**The CV template to be duplicated and completed for each key personnel member listed and offered in the key personnel schedule above.**

**Failure to comply with these guidelines will render the CV invalid and thus will not be considered during evaluation.**

**Much importance will be placed on the qualifications and relevant experience of the staff proposed. The Tenderer must ensure that, if selected for the assignment, the nominated staff will be assigned as proposed to meet the minimum competence stated. Failure to do so may result in the award of Service being cancelled by the Employer.**

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

### CURRICULUM VITAE TEMPLATE (Page 1 of 3)

<b>Proposed Role in the project</b>	
-------------------------------------	--

<b>1. Surname</b>	
<b>2. First Name</b>	
<b>3. Date and place of birth</b>	
<b>4. Nationality</b>	
<b>5. Membership of Professional Bodies and Professional Registration</b>	

**6. Education**

Institution (Date from – Date to)	Degree(s) or Diploma(s) obtained

**7. Post Graduate / Diploma Experience**

Company / Organisation	(Date from – Date to)	Years of Employment	Position

**8. Key Experience Relevant to Project**


**9. Knowledge of issues pertinent to project (e.g., local conditions, legislation and techniques)**


**10. Other Relevant Information (e.g., relevant papers, publications and software developments)**


Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**CURRICULUM VITAE TEMPLATE (Page 2 of 3 [Duplicate page for additional space])**

**11. Project Specific Training and Experience which is directly linked to the scope of work**

<b>Project Name and Locality</b>	
<b>Project Dates and Value</b>	
<b>Project Position (e.g., Project Manager, Engineer, etc.)</b>	
<b>Description of duties</b>	

<b>Project Name and Locality</b>	
<b>Project Dates and Value</b>	
<b>Project Position (e.g., Project Manager, Engineer, etc.)</b>	
<b>Description of duties</b>	

<b>Project Name and Locality</b>	
<b>Project Dates and Value</b>	
<b>Project Position (e.g., Project Manager, Engineer, etc.)</b>	
<b>Description of duties</b>	

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Contractor

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Witness 1

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Witness 2

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Employer

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Witness 1

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Witness 2

### CURRICULUM VITAE TEMPLATE (Page 3 of 3)

<b>Project Name and Locality</b>	
<b>Project Dates and Value</b>	
<b>Project Position (e.g., Project Manager, Engineer, etc.)</b>	
<b>Description of duties</b>	

<b>Project Name and Locality</b>	
<b>Project Dates and Value</b>	
<b>Project Position (e.g., Project Manager, Engineer, etc.)</b>	
<b>Description of duties</b>	

<b>Project Name and Locality</b>	
<b>Project Dates and Value</b>	
<b>Project Position (e.g., Project Manager, Engineer, etc.)</b>	
<b>Description of duties</b>	

#### 12. References

Company Name	Contact Person	Position Held	Contact Details

*I, ....., hereby declare that I am aware of the inclusion of my Curriculum Vitae in the proposed project team and make myself available for this project.*

*Signature : ..... Date : .....*

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**ATTACH THE FOLLOWING DOCUMENTS AS AN ANNEXURE TO THE TENDER DOCUMENT  
WITH REFERENCE TO THE APPLICABLE RETURNABLE SCHEDULE – FORM I:**

- CV, Certified Qualification and Registration Certificates per Key Personnel
- Letters of undertaking from proposed contracted personnel.
- Organogram of proposed project team clearly indicating appointments in terms of the OHS Act, Act No.85 of 1993 and Construction Regulations, 2014 with latest amendments.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**Form J: Schedule of Previous Experience**

In terms of Previous Experience evaluation, the following important information is to be noted:

- Experience in Dam, Bulk Water and Roads & Stormwater infrastructure projects.
- Experience in projects of similar size.
- The Tenderer to provide an appointment letter and completion certificate.
- The previous experience needs to be in the last 30 years for dam infrastructure works.
- The previous experience needs to be in the last 10 years for bulk water projects, and road and stormwater infrastructure works.
- The description needs to be clear if it was for a dam, bulk water, or roads and stormwater.
- The road and stormwater projects can be split or given as a combined project that exceeds the required construction value.
- The evaluation will focus on Dam projects which will determine in what Experience Level the Tenderer can receive points.

Points will be allocated as follows:

No.	Infrastructure Works Description	Project related experience	Points	Total Points
1	Dam	Two (2) Category III Dams	10	35
		One (1) Category III Dam	8	
		Two (2) Category II Dams	7	
		One (1) Category II Dam	5	
2	Bulk Water	Three (3) Bulk Water Projects exceeding a value of R200M	15	
		Two (2) Bulk Water Projects exceeding a value of R200M	10	
		One (1) Bulk Water Projects exceeding a value of R200M	5	
3	Roads & SW	Three (3) Roads and Stormwater Projects exceeding a value of R12M	10	
		Two (2) Roads and Stormwater Projects exceeding a value of R12M	8	
		One (1) Roads and Stormwater Projects exceeding a value of R12M	5	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2



**Note: Attach additional pages as Annexure J if more space is required.**

Description of Work / Experience	Value (R) VAT excluded	Period work executed		Reference		
		Appointment Date	Completion Date	Name	Organisation	Tel No and e-mail

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**Form K: Schedule of Current Projects**

**Note: Attach additional pages as Annexure K if more space is required.**

Provide the following information on current projects. **This information is material to the award of the Contract.**

Description of Project	Value (R) VAT excluded	Appointment Date	Completion Date	Reference		
				Name	Organisation	Tel No and e-mail / Fax

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

## Form L: Schedule of Plant and Equipment

Provide information on the following:

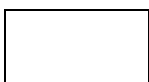
### 1. Equipment

Provide information on equipment and resources that you have available for this project.

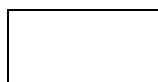
Construction Equipment	Number of Units Allocated to this Contract	
	Owned	To be Hired
1. Grader		
2. TLB		
3. Drum Rollers		
4. Excavators		
5. Tipper Trucks		
6. Compactors		
7. Water Trucks		
8. Dozers		
9. Tower cranes		
10. Sheepsfoot rollers		
11. Concrete Ready Mix batch plant		
12. Multi-stage screening and crushing plant		
13. Concrete pneumatic poker system		
<b>Other</b>		
14.		
15.		
16.		
17.		

Tenderers to take note of the following:

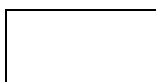
- The above equipment is provided as a minimum, but not limited to.



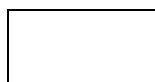
Contractor



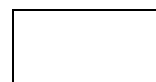
Witness 1



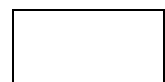
Witness 2



Employer



Witness 1



Witness 2

**Form M: Schedule of Proposed Specialist Sub-Contractors**

The schedule of proposed nominated specialist sub-contractors will be evaluated as follows:

No.	Nominated Specialist Sub-Contract - Nature of Work	Proposed Specialist Sub-Contract - Name	Required Project Value (Min)	Company Experience - Projects (No.)	Points	Minimum Requirements met (Yes / No)	Points	Letter of Intent Submitted (Yes / No)	Points	Total Points
1	Dam instrumentation		R 2.5M	3	2	N/A	N/A	Yes	1.00	2.00
				2	1			No	0.00	
				1	0.5					
2	Quarry		R 80M	3	5	Yes	1	Yes	1.00	5.00
				2	3	No	0.5	No	0.00	
				1	1					
3	Drilling and Grouting		R 6M	3	3	Yes	1	Yes	1.00	3.00
				2	1.75	No	0.5	No	0.00	
				1	0.5					
Total										10.00

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

In addition to the table, tenderers to take note of the following:

- The Tenderer must submit a letter of intent from the nominated specialist sub-contractors indicated their intent to carry out specialist construction works should the Tenderer be successful. Without the letter of intent, the Tenderer will score zero (0) for the nominated specialist sub-contractor.
- The Dam instrumentation has the following minimum requirements:
  - No additional requirements.
- The Quarry has the following minimum requirements:
  - Certificate of Blasting competence in terms of the Mine Health and Safety Act, 1996 (Act 29 of 1996).
- The Drilling and Grouting has the following minimum requirements:
  - Drill rig operator with 5 Years or more experience;
  - Water test operator with 5 Years or more experience; and
  - Grout plant operator with 5 Years or more experience.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

## Form N: Record of Addenda to Tender Documents

We confirm that the following communication received from the Employer before the submission of this tender offer, amending the tender documents, have been considered in this tender offer.

[illegible]

**Form O: Proof of Good Standing with Compensation Commissioner**

**ATTACH THE FOLLOWING DOCUMENTS AS AN ANNEXURE TO THE TENDER DOCUMENT  
WITH REFERENCE TO THE APPLICABLE RETURNABLE SCHEDULE – FORM O:**

- Certified copy of Letter of Good Standing with Compensation Commissioner.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**Form P: Method statement, Construction Programme, and Construction Organogram**

The Method Statement, Construction Programme and Construction Organogram will be evaluated as per the following criteria:

No.	Description	Requirements										Points	Total Points
1	Method Statement	Method Statement is project specific and explains all eight (8) sub-headings.										8	20
		Method Statement is project specific and explains only seven (7) sub-headings.										7	
		Method Statement is project specific and explains only six (6) sub-headings.										6	
		Method Statement is project specific and explains only five (5) sub-headings.										5	
		Method Statement is project specific and explains only four (4) sub-headings.										4	
		Method Statement is project specific and explains only three (3) sub-headings.										3	
		Method Statement is project specific and explains only two (2) sub-headings.										2	
		Method Statement is project specific and explains only one (1) sub-headings.										1	
2	Construction Programme	Project Duration	Points	Contractual Dates	Points	Sub-projects	Points	Work-packages	Points	Activities	Points	8	20
		Yes	1	Yes	1	Yes	2	Yes	2	Yes	2		
		No	0	No	0	No	0	No	0	No	0		
3	Construction Organogram	Role and Responsibilities of all 8 proposed key personnel as per Form I.										4	20
		Role and Responsibilities for only 7 of proposed key personnel as per Form I.										3.5	
		Role and Responsibilities for only 6 of proposed key personnel as per Form I.										3	
		Role and Responsibilities for only 5 of proposed key personnel as per Form I.										2.5	
		Role and Responsibilities for only 4 of proposed key personnel as per Form I.										2	
		Role and Responsibilities for only 3 of proposed key personnel as per Form I.										1.5	
		Role and Responsibilities for only 2 of proposed key personnel as per Form I.										1	
		Role and Responsibilities for only 1 of proposed key personnel as per Form I.										0.5	

Contractor

Witness 1

Witness 2

Employer

Witness 1

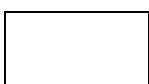
Witness 2



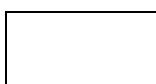
**Notes to tenderer:**

- The intention of this form is to demonstrate the tenderer's understanding of the scope of works by providing a method statement, construction programme, and key personnel organogram.
- The Tenderer to provide a method statement that is project specific under the following headings:
  1. Scope of management.
    - (i) The Tenderer to explain its understanding of works and intend to manage it.
  2. Scheduling of the works.
    - (i) The Tenderer to explain its intended construction logic and how integration of various construction activities on project, sub-project and work package level will be achieved.
  3. Cost management
    - (i) The Tenderer to explain its intend to manage the project funding.
  4. Resource Management
    - (i) The Tenderer to explain its intend to manage its resources which may inter alia entail site facilities, plant and equipment, construction materials, human resources and IT.
  5. Communications Management
    - (i) The Tenderer to explain its intend to manage project communications and its project communication plan.
  6. Quality management
    - (i) The Tenderer to explain the quality control processes that will be put in place to control its outputs in terms of works and design requirements.
  7. Socio-economic Development and subcontractor procurement management.
    - (i) The Tenderer to explain how work packages will be identified to ensure that SED targets are met in terms of local subcontractor procurement.
    - (ii) The Tenderer to explain how the local subcontractors will be managed.
    - (iii) The Tenderer to explain how local upliftment projects will be identified and managed
    - (iv) The Tenderer to explain how the specialist subcontractors will be procured and managed.
  8. Risk Management
    - (i) The Tenderer to explain how project risk will be managed which may inter alia entail identifying, analyzing, planning risk response, carrying out risk response and monitoring.
- The Tenderer to provide a project specific construction programme with the following information:
  1. Project Duration.
  2. Contractual dates.
  3. The scope of works to be packaged in the following order:
    - (i) Sub-projects;
      - a. Work-packages; and
      - i. Activities.
- The Tenderer to provide a key personnel organogram with the following information:
  1. The role and responsibility of the eight (8) proposed key personnel on the project, as per **Form I**.

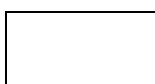
SIGNED ON BEHALF OF THE TENDERER: \_\_\_\_\_



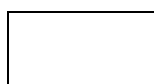
Contractor



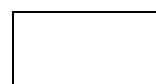
Witness 1



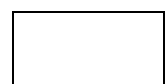
Witness 2



Employer



Witness 1



Witness 2

**ATTACH THE FOLLOWING DOCUMENTS AS AN ANNEXURE TO THE TENDER DOCUMENT  
WITH REFERENCE TO THE APPLICABLE RETURNABLE SCHEDULE – FORM P:**

- Tenderer's method statement, project programme and project organogram



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**Form Q: Certificate of Independent Bid Determination**

- 1 This Municipal Bidding Document (MBD) must form part of all bids<sup>1</sup> invited.
- 2 Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging) <sup>2</sup> Collusive bidding is a pe se prohibition meaning that it cannot be justified under any grounds.
- 3 Municipal Supply Regulation 38 (1) prescribes that a supply chain management policy must provide measures for the combating of abuse of the supply chain management system, and must enable the accounting officer, among others, to:
  - a) 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:

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

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

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

## CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

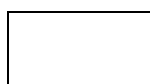
**CONTRACT NO: GSDM17/2022**  
**AMSTERDAM BULK WATER SUPPLY SCHEME: PHASE 4: GABOSCH DAM**  
*(Bid Number and Description)*

in response to the invitation for the bid made by:  
**GERT SIBANDE DISTRICT MUNICIPALITY**  
*(Name of Municipality / Municipal Entity)*

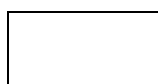
do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of: \_\_\_\_\_ that:  
*(Name of Bidder)*

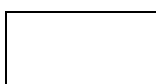
- 1 I have read and I understand the contents of this Certificate;
- 2 I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect;
- 3 I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid,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



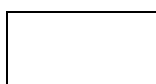
Contractor



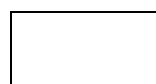
Witness 1



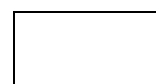
Witness 2



Employer



Witness 1



Witness 2

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

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Signature

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Date

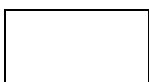
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Position

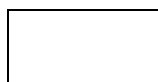
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Name of bidder

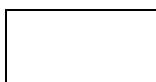
<sup>3</sup> *Joint venture or Consortium means an association of persons for the purpose of combining their expertise, property, capital, efforts, skill, and knowledge in an activity for the execution of a contract.*



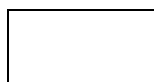
Contractor



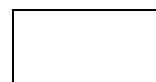
Witness 1



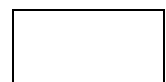
Witness 2



Employer



Witness 1



Witness 2

**Form R: Declaration of Tenderer's Litigation History**

**Note to tenderer:**

The tenderer shall list below details of any litigation with which the tenderer (including its directors, shareholders, or other senior members in previous companies) has been involved with any organ of state or state department within the last ten years. The details must include the year, the litigating parties, the subject matter of the dispute, the value of any award or estimated award if the litigation is current and in whose favour the award, if any, was made.

<b>Employer</b>	<b>Other Litigating Party</b>	<b>Dispute</b>	<b>Award Value</b>	<b>Date Resolved</b>

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Signature

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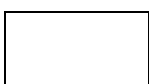
Date

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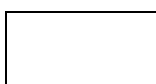
Position

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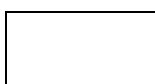
Name of bidder



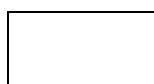
Contractor



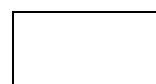
Witness 1



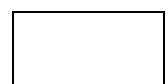
Witness 2



Employer



Witness 1



Witness 2

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**FORM S: DECLARATION FOR PROCUREMENT ABOVE R10 MILLION (ALL APPLICABLE TAXES INCLUDED)**

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

1. Are you by law required to prepare annual financial statements for auditing? **YES / NO**

1.1. If yes, submit audited annual financial statements for the past three years or since the date of establishment if established during the past three years.

2. Do you have any outstanding undisputed commitments for municipal services towards any municipality for more than three months or any other service provider in respect of which payment is overdue for more than 30 days? **YES / NO**

2.1 If no, this serves to certify that the bidder has no undisputed commitments for municipal services towards any municipality for more than three months or other service provider in respect of which payment is overdue for more than 30 days.

2.2 If yes, provide particulars.

.....  
.....

3. Has any contract been awarded to you by an organ of state during the past five years, including particulars of any material non-compliance or dispute concerning the execution of such contract? YES / NO

3.1 If yes, furnish particulars

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

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

4.1 If yes, furnish particulars

CERTIFICATION

I, THE UNDERSIGNED (NAME) .....

CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS CORRECT.  
I ACCEPT THAT THE STATE MAY ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.

Signature

Date

Position

Name of Bidder



**Form S: Audited 3-Year Financial Statements**

**ATTACH THE FOLLOWING DOCUMENTS AS AN ANNEXURE TO THE TENDER DOCUMENT  
WITH REFERENCE TO THE APPLICABLE RETURNABLE SCHEDULE – FORM S:**

- 3 Year audited financial statements.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

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## Form T: Declaration Certificate for Local Production and Content for Designated Sectors

This Municipal Bidding Document (MBD 6.2) must form part of all bids invited. It contains general information and serves as a declaration form for local content (local production and local content are used interchangeably).

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

### 1. General Conditions

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

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

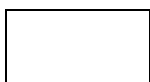
Where:

x is the imported content in Rand

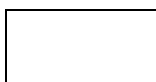
y is the bid price in Rand excluding value added tax (VAT)

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

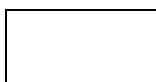
**The SABS approved technical specification number SATS 1286:2011 is accessible on [http://www.thedti.gov.za/industrial development/ip.jsp](http://www.thedti.gov.za/industrial%20development/ip.jsp) at no cost.**



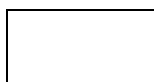
Contractor



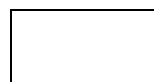
Witness 1



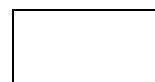
Witness 2



Employer



Witness 1



Witness 2

- 1.6. A bid may be disqualified if this Declaration Certificate and the Annex C (Local Content Declaration: Summary Schedule) are not submitted as part of the bid documentation.
2. **The stipulated minimum threshold(s) for local production and content (refer to Annex A of SATS 1286:2011) for this bid is/are as follows:**

<u>Description of services, works or goods</u>	<u>Stipulated minimum threshold</u>
_____	_____ %
_____	_____ %
_____	_____ %

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

(Tick applicable box)

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

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

The relevant rates of exchange information are accessible on [www.reservebank.co.za](http://www.reservebank.co.za)

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

Currency	Rates of exchange
US Dollar	
Pound Sterling	
Euro	
Yen	
Other	

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

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

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Contractor

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Witness 1

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Witness 2

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Employer

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Witness 1

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Witness 2

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

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

**IN RESPECT OF BID NO. GSDM17/2022**

**ISSUED BY: GERT SIBANDE DISTRICT MUNICIPALITY**

NB

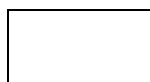
- 1 The obligation to complete, duly sign and submit this declaration cannot be transferred to an external authorized representative, auditor or any other third party acting on behalf of the bidder.
- 2 Guidance on the Calculation of Local Content together with Local Content Declaration Templates (Annex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

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

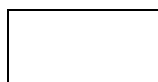
- (a) The facts contained herein are within my own personal knowledge.
- (b) I have satisfied myself that:
  - (i) the goods/services/works to be delivered in terms of the above-specified bid comply with the minimum local content requirements as specified in the bid, and as measured in terms of SATS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

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

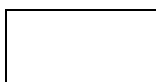
**If the bid is for more than one product, the local content percentages for each product contained in Declaration C shall be used instead of the table above.**



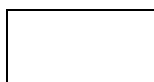
Contractor



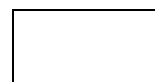
Witness 1



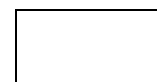
Witness 2



Employer



Witness 1



Witness 2

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

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

**SIGNATURE:** \_\_\_\_\_

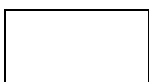
**DATE:** \_\_\_\_\_

**WITNESS No. 1** \_\_\_\_\_

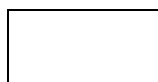
**DATE:** \_\_\_\_\_

**WITNESS No. 2** \_\_\_\_\_

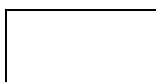
**DATE:** \_\_\_\_\_



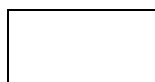
Contractor



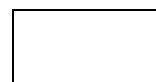
Witness 1



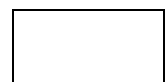
Witness 2



Employer



Witness 1



Witness 2

## CONTRACT

This part of the Bid Specification Document consists of the following four sections:

- **Part C1: Agreement and Contract Data**

This section details the:

- form of offer and acceptance (yellow pages);
- contract data (yellow pages); and
- performance guarantee (white pages).

- **Part C2: Pricing Data**

This section details the:

- pricing instructions (yellow pages); and
- bill of quantities (yellow pages).

- **Part C3: Scope of Work**

This section details the:

- scope of work (Blue).

- **Part C4: Site Information**

This section details the:

- site information (Green).



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

## Part C1: Agreement and Contract Data

### C1.1 Form of Offer and Acceptance

#### OFFER

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

**CONTRACT NO: GSDM17/2022**  
**AMSTERDAM BULK WATER SUPPLY SCHEME: PHASE 4: GABOSCH DAM**

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 VALUE ADDED TAX IS:

\_\_\_\_\_ Rand (*in words*);

and R\_\_\_\_\_ (*in figures*).

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

#### For the Tenderer:

Signature(s):

\_\_\_\_\_

Name(s):

\_\_\_\_\_

Capacity:

\_\_\_\_\_

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Contractor

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Witness 1

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Witness 2

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Employer

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Witness 1

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Witness 2

Name and address of the organisation:

Name and address of the organisation:

Signature:

Name:

Date:



## ACCEPTANCE

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

The terms of the contract, are contained in:

- Part C1 Agreements and Contract Data (which includes this Agreement);
- Part C2 Pricing Data;
- Part C3 Scope of Work;
- Part C4 Site Information; and
- drawings and documents or parts thereof, which may be incorporated by reference into Parts 1 to 4 above.

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

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

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

### For the Employer:

Signature(s):

\_\_\_\_\_

Name(s):

\_\_\_\_\_

Capacity:

\_\_\_\_\_



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

Name and address of organisation:

Signature and name of witness:

Signature:

Name:

Date:

## SCHEDULE OF DEVIATIONS

Notes:

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

Subject:

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Details:

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Subject:

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Details:

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Subject:

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Details:

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Subject:

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Details:

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Subject:

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Details:

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Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Subject:

Details:

Subject:

Details:

Subject:

Details:

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

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

For the Tenderer:

For the Employer:

Signature

Name

Capacity



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

Name and address of organisation:	Name and address of organisation:
Witness Signature:	Witness Signature:
Witness Name	Witness Name
Date:	Date:

## C1.2 Contract Data

### PART 1: DATA PROVIDED BY THE EMPLOYER

#### CONDITIONS OF CONTRACT

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

#### 1. GENERAL

The following contract specific data, referring to the General Conditions of Contract for Construction Works, Third Edition (2015) are applicable to this Contract:

Clause	Description
1.1.1.13	The Defects Liability Period is 12 months.
1.1.1.14	The time for achieving Practical Completion from commencement of works is 36 months.
1.1.1.15	The Employer is <b>Gert Sibande District Municipality</b> .
1.2.1.2	The address of the Employer is: Contact Person: Mr Tebogo Mpuru Tel: 017 801 7095 Fax: 017 811 1207 Address (Physical): C/o Joubert & Oosthuise Streets ERMELO 2350 M Address (Postal) PO Box 1748 ERMELO 2350 M E-mail: tebogomp@gsibande.gov.za
1.1.1.16	The Employer's Agent is <b>AFI Consult (Pty) Ltd</b> .
1.2.1.2	The address of the Employer's Agent is: Contact Person: Mr. AD Watts Pr Tech Eng Tel: 012 346 1848 Address (Physical): Irene Corporate Corner 21 Via Latina Ring 1 <sup>st</sup> Floor CENTURION 0157 Address (Postal) PO Box 25905 MONUMENTPARK 0105 E-mail: ad@aficonsult.co.za



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

1.1.1.26	The Pricing Strategy is re-measurement Contract.
3.2.3	<p>The Employer's Agent shall obtain specific approval of the Employer before carrying out any of his functions or duties according to the following Clauses of the General Conditions of Contract:</p> <ul style="list-style-type: none"> <li>a) Approve extension of time for practical completion in terms of Clause 5.12.1;</li> <li>b) Approve imposition of penalty for delay in terms of Clause 5.13.1;</li> <li>c) Issue of a Variation Order in terms of Clause 6.3.2; and</li> <li>d) Approve the use of contingency funds.</li> </ul>
5.1.1 5.8.1	<p>The non-working days are Sundays.</p> <p>The special non-working days applicable to this contract are:</p> <ul style="list-style-type: none"> <li>a) Public Holidays; and</li> <li>b) The traditional year-end breaks provisionally commencing: <ul style="list-style-type: none"> <li>• 15 December 2022 and ending on 09 January 2023;</li> <li>• 15 December 2023 and ending on 08 January 2024;</li> <li>• 13 December 2024 and ending on 06 January 2025; and</li> <li>• 15 December 2025 and ending on 05 January 2026.</li> </ul> </li> </ul> <p>Changes in the provisional dates will be coordinated between the Employer's Agent and the Contractor.</p>
5.3.1	<p>The documentation required before commencing with the Works are:</p> <ul style="list-style-type: none"> <li>a) Health and Safety Plan (Refer to Clause 4.3);</li> <li>b) Initial programme (Refer to Clause 5.6);</li> <li>c) Detailed cash flow forecast (Refer to Clause 5.6);</li> <li>d) Security (Refer to Clause 6.2);</li> <li>e) Insurance (Refer to Clause 8.6);</li> <li>f) Proof of registration with the Workman's Compensation Commissioner;</li> <li>g) Valid original copy of Tax Clearance Certificate; and</li> <li>h) Written acceptance of appointment.</li> <li>i) Signed Contract.</li> <li>j) Socio- Economic Development (SED) Plan (Refer to Part C3 C 3.3.1)</li> </ul>
5.3.2	The time to submit the documentation required before commencement of the Works is 28 days.
5.4.2	The access and possession of Site shall not be exclusive to the Contractor but as set out in the Site Information.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

5.13.1	<p>The penalty for failing to complete portions of, or the whole of the Works, will be applied as follows:</p> <table><tr><th colspan="6">PENALTY TABLES</th></tr><tr><th rowspan="2">Delays on Items attracting penalties</th><th colspan="5">Value of Contract (Excl. VAT, in millions R)</th></tr><tr><th>&lt; 1</th><th>≥ 1 &lt; 5</th><th>≥ 5 &lt; 20</th><th>≥ 20 &lt; 50</th><th>≥ 50</th></tr><tr><td>Programme and Preliminary Documents (R per day delay)</td><td>2,000</td><td>5,000</td><td>20,000</td><td>20,000</td><td>20,000</td></tr><tr><td>Drawings and Design Pack (R per day delay)</td><td>5,000</td><td>10,000</td><td>30,000</td><td>40,000</td><td>50,000</td></tr><tr><td>Sectional Completion</td><td colspan="5">2% of the value of the outstanding work / week</td></tr><tr><td>Overall Completion</td><td colspan="5">2% of the value of the outstanding work / week</td></tr><tr><td>Commissioning (R per day delay)</td><td>10,000</td><td>20,000</td><td>30,000</td><td>40,000</td><td>50,000</td></tr></table>	PENALTY TABLES						Delays on Items attracting penalties	Value of Contract (Excl. VAT, in millions R)					< 1	≥ 1 < 5	≥ 5 < 20	≥ 20 < 50	≥ 50	Programme and Preliminary Documents (R per day delay)	2,000	5,000	20,000	20,000	20,000	Drawings and Design Pack (R per day delay)	5,000	10,000	30,000	40,000	50,000	Sectional Completion	2% of the value of the outstanding work / week					Overall Completion	2% of the value of the outstanding work / week					Commissioning (R per day delay)	10,000	20,000	30,000	40,000	50,000																														
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Programme and Preliminary Documents (R per day delay)	2,000	5,000	20,000	20,000	20,000																																																																									
Drawings and Design Pack (R per day delay)	5,000	10,000	30,000	40,000	50,000																																																																									
Sectional Completion	2% of the value of the outstanding work / week																																																																													
Overall Completion	2% of the value of the outstanding work / week																																																																													
Commissioning (R per day delay)	10,000	20,000	30,000	40,000	50,000																																																																									
	<table><tr><th colspan="6">PENALTY TABLES (continued)</th></tr><tr><th rowspan="2">Delays on Items attracting penalties</th><th colspan="5">Value of Contract (Excl. VAT, in millions R)</th></tr><tr><th>&lt; 1</th><th>≥ 1 &lt; 5</th><th>≥ 5 &lt; 20</th><th>≥ 20 &lt; 50</th><th>≥ 50</th></tr><tr><td colspan="6">Remedying of Defects</td></tr><tr><td>Critical to asset functioning / running (R per day delay)</td><td>10,000</td><td>50,000</td><td>100,000</td><td>100,000</td><td>100,000</td></tr><tr><td>Not critical to asset functioning / running (R per day delay)</td><td>1,000</td><td>5,000</td><td>10,000</td><td>10,000</td><td>10,000</td></tr><tr><td colspan="6">SHERQ</td></tr><tr><td>SHERQ non-conformances, corrective and preventative actions not resolved within the agreed target dates</td><td>1,000</td><td>5,000</td><td>10,000</td><td>10,000</td><td>10,000</td></tr><tr><td colspan="6">Agreed target dates exceeding 5 working days</td></tr><tr><td>Non-reporting of SHERQ incidents and statistics within the required timeframe</td><td>1,000</td><td>5,000</td><td>10,000</td><td>10,000</td><td>10,000</td></tr><tr><td colspan="6">Within a shift / within 24 hours</td></tr><tr><td>Repeat SHERQ non conformances</td><td>2,000</td><td>10,000</td><td>20,000</td><td>20,000</td><td>20,000</td></tr><tr><td>During Construction Phase</td><td>2,000</td><td>10,000</td><td>20,000</td><td>20,000</td><td>20,000</td></tr></table>	PENALTY TABLES (continued)						Delays on Items attracting penalties	Value of Contract (Excl. VAT, in millions R)					< 1	≥ 1 < 5	≥ 5 < 20	≥ 20 < 50	≥ 50	Remedying of Defects						Critical to asset functioning / running (R per day delay)	10,000	50,000	100,000	100,000	100,000	Not critical to asset functioning / running (R per day delay)	1,000	5,000	10,000	10,000	10,000	SHERQ						SHERQ non-conformances, corrective and preventative actions not resolved within the agreed target dates	1,000	5,000	10,000	10,000	10,000	Agreed target dates exceeding 5 working days						Non-reporting of SHERQ incidents and statistics within the required timeframe	1,000	5,000	10,000	10,000	10,000	Within a shift / within 24 hours						Repeat SHERQ non conformances	2,000	10,000	20,000	20,000	20,000	During Construction Phase	2,000	10,000	20,000	20,000	20,000
PENALTY TABLES (continued)																																																																														
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During Construction Phase	2,000	10,000	20,000	20,000	20,000																																																																									
5.14.1	<p>The requirements for achieving Practical Completion are the practical completion of the following:</p> <ul style="list-style-type: none"><li>• Upgrade access intersection on regional road R65 with T-Junction Intersection for Main Access Road.</li><li>• Construction of all access roads with associated stormwater infrastructure to the site</li></ul>																																																																													

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2



	<p>of works, totalling approximately 1.3km complete with road signage.</p> <ul style="list-style-type: none"> <li>• Construction of Admin Building.</li> <li>• Construction of 2 river crossings along Main Access Road.</li> <li>• Rehabilitation of Quarry Site.</li> <li>• De-establishment of Quarrying Plant (Crusher, Screens, and Conveyor).</li> <li>• All civil works pertaining to the dam construction including right flank rockfill embankment, concrete spillway, inlet/outlet works, left flank gravity wall, spillway apron and stilling basin, right and left flank retaining walls, causeway, all bulk fill, compaction and shaping, measuring weir, general finishing and cleaning of the site.</li> <li>• All works pertaining to the downstream flow gauging weir.</li> <li>• All mechanical and electrical installations.</li> <li>• Commissioning of the works.</li> <li>• Full payment of all labourers and subcontractors.</li> <li>• Any other work that the Employer's Agent consider necessary to justify Practical Completion notified to the Contractor, following the Contractor's written request for a Certificate of Practical Completion.</li> </ul>
5.16.3	The latent defects periods are: 10 years for civil engineering works; 5 years for building works; 3 years for mechanical engineering works; and 3 years for electrical engineering works.
6.6.1	A provisional sum has been provided for work anticipated to construct a flow gauging weir which has not been quantified. The work will not be regarded as a Variation Order. Valuation of this work will be determined in accordance with the principles of a Variation Order as set out in Clause 6.4.
6.5.1.2.3	The percentage allowance on remuneration of workmen and cost of materials is 15%.
6.8.2	<p>The value of the certificates issued shall be adjusted in accordance with the Contract Price Adjustment Schedule with the following values:</p> <p>The values of the coefficients are:</p> <ul style="list-style-type: none"> <li>• a = 0.15 Labour</li> <li>• b = 0.20 Contractor's equipment</li> <li>• c = 0.55 Material</li> <li>• d = 0.10 Fuel</li> </ul> <p>The indices as follows are published by Statistics South Africa and shall be agreed on at commencement:</p> <ul style="list-style-type: none"> <li>• "L" is the "Labour Index";</li> <li>• "P" is the "Contractor's Equipment Index";</li> <li>• "M" is the "Materials Index"; and</li> <li>• "F" is the "Fuel Index".</li> </ul> <p>The base month "O" is November 2022</p>
6.10.1.5	The percentage advance on materials not yet built into the Permanent Works is 80%. The percentage advance on Plant not yet supplied to Site is nil.
6.10.3	The limit of retention money is 5% of the contract value.
8.6.1.1.2	No Plant and material will be supplied by the Employer.
8.6.1.1.3	The amount to cover professional fees for repairing damage and loss to be included in the insurance sum is R 1,000,000.00.
8.6.1.3	The limit of indemnity for liability insurance is R 40,000,000.00.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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10.5.1	Dispute resolution shall be by standing adjudication.
10.5.3	The number of Adjudication Board Members to be appointed is one.
10.7.1	The determination of disputes shall be by arbitration.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

## PART 2: DATA PROVIDED BY THE CONTRACTOR

### 1. GENERAL

Clause	Description																
1.1.1.9	The name of the Contractor is:																
1.2.1.2	<p>The address of the Contractor is:</p> <p>Contact Person: _____</p> <p>Tel: _____</p> <p>Fax: _____</p> <p>Address (Physical): _____</p> <p>_____</p> <p>Address (Postal) _____</p> <p>_____</p> <p>E-mail: _____</p>																
6.2.1	<p>The security to be provided by the Contractor shall be one of the following:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 80%;">Type of Security <i>(VAT to be excluded from the Contract Sum and the value of the Works for calculating the percentages)</i></th><th style="width: 20%;">Contractor's Choice: Yes / No</th></tr> </thead> <tbody> <tr> <td>Cash deposit of _____% of the Contract Sum.</td><td></td></tr> <tr> <td>Fixed Performance Guarantee of _____% of the Contract Sum.</td><td></td></tr> <tr> <td>Variable Performance Guarantee of _____% of the Contract Sum for the first period and _____% of the Contract Sum for the second period.</td><td></td></tr> <tr> <td>Retention of _____% of the value of the Works.</td><td></td></tr> <tr> <td>Cash deposit of _____% of the Contract Sum plus retention of _____% of the value of the Works.</td><td></td></tr> <tr> <td>Fixed Performance Guarantee of _____% of the Contract Sum plus retention of _____% of the value of the Works.</td><td></td></tr> <tr> <td>Variable Performance Guarantee of _____% of the Contract Sum for the first period and _____% of the Contract Sum for the second period plus retention of _____% of the value of the Works.</td><td></td></tr> </tbody> </table>	Type of Security <i>(VAT to be excluded from the Contract Sum and the value of the Works for calculating the percentages)</i>	Contractor's Choice: Yes / No	Cash deposit of _____% of the Contract Sum.		Fixed Performance Guarantee of _____% of the Contract Sum.		Variable Performance Guarantee of _____% of the Contract Sum for the first period and _____% of the Contract Sum for the second period.		Retention of _____% of the value of the Works.		Cash deposit of _____% of the Contract Sum plus retention of _____% of the value of the Works.		Fixed Performance Guarantee of _____% of the Contract Sum plus retention of _____% of the value of the Works.		Variable Performance Guarantee of _____% of the Contract Sum for the first period and _____% of the Contract Sum for the second period plus retention of _____% of the value of the Works.	
Type of Security <i>(VAT to be excluded from the Contract Sum and the value of the Works for calculating the percentages)</i>	Contractor's Choice: Yes / No																
Cash deposit of _____% of the Contract Sum.																	
Fixed Performance Guarantee of _____% of the Contract Sum.																	
Variable Performance Guarantee of _____% of the Contract Sum for the first period and _____% of the Contract Sum for the second period.																	
Retention of _____% of the value of the Works.																	
Cash deposit of _____% of the Contract Sum plus retention of _____% of the value of the Works.																	
Fixed Performance Guarantee of _____% of the Contract Sum plus retention of _____% of the value of the Works.																	
Variable Performance Guarantee of _____% of the Contract Sum for the first period and _____% of the Contract Sum for the second period plus retention of _____% of the value of the Works.																	

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

### C1.3 Pro Forma Performance Guarantee

#### GUARANTOR DETAILS AND DEFINITIONS

**“Guarantor”** means: \_\_\_\_\_

Physical address: \_\_\_\_\_

**“Employer”** means: Gert Sibande District Municipality

**“Contractor”** means: \_\_\_\_\_

**“Employer's Agent”** means: AFI Consult (Pty) Ltd

**“Works”** means: \_\_\_\_\_

**“Site”** means: \_\_\_\_\_

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

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

Amount in words: \_\_\_\_\_

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

Amount in words: \_\_\_\_\_

Type of Performance Guarantee: \_\_\_\_\_ *(Insert Variable or Fixed)*

**“Expiry Date”** means: Date of issuing of Certificate of Completion or any other later date set by the Employer provided such instruction is received prior to issuing of the Certificate of Completion.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

## CONTRACT DETAILS

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

### 1. VARIABLE PERFORMANCE GUARANTEE

1.1 Where a Variable Performance Guarantee has been selected, the Guarantor's liability shall be limited during the following periods to diminishing amounts of the Guaranteed Sum as follows:

1.1.1 From and including the date of signing the Performance Guarantee up to and including the date of the interim payment certificate certifying, for the first time, more than 50% of the Contract Sum:

R \_\_\_\_\_

Amount in words \_\_\_\_\_

\_\_\_\_\_

1.1.2 From the day following the date of the said interim payment certificate 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, whichever occurs first:

R \_\_\_\_\_

Amount in words \_\_\_\_\_

\_\_\_\_\_

1.2 The Employer's Agent and/or the Employer shall advise the Guarantor in writing of the date on which the interim payment certificate certifying, for the first time, more than 50% of the Contract Sum, has been issued and the date on which the Certificate of Completion of the Works has been issued.

### 2. FIXED PERFORMANCE GUARANTEE

2.1 Where a Fixed Performance Guarantee has been selected, the Guarantor's liability shall be limited to the amount of the Guaranteed Sum.

2.2 The Guarantor's period of liability shall be from and including the date on which the Performance Guarantee is signed, 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.

2.3 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.

### 3. CONDITIONS APPLICABLE TO VARIABLE AND FIXED PERFORMANCE GUARANTEES

3.1 The Guarantor hereby acknowledges that:

3.1.1 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.

\_\_\_\_\_

Contractor

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Witness 1

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Witness 2

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Employer

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Witness 1

\_\_\_\_\_

Witness 2

- 3.1.2 Its obligation under this Performance Guarantee is restricted to the payment of money.
- 3.2 Subject to the Guarantor's maximum liability referred to in 1.1 or 2.1, the Guarantor hereby undertakes to pay the Employer the sum certified upon receipt of the documents identified in 3.2.1 to 3.2.3:
- 3.2.1 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 3.2.2;
- 3.2.2 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 3.2.1 and the sum certified has still not been paid;
- 3.2.3 A copy of the aforesaid payment certificate which entitles the Employer to receive payment in terms of the Contract of the sum certified in 3.2.
- 3.3 Subject to the Guarantor's maximum liability referred to in 1.1 or 2.1, 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:
- 3.3.1 the Contract has been terminated due to the Contractor's default and that this Performance Guarantee is called up in terms of 3.3;
- 3.3.2 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 3.3; and
- 3.3.3 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.
- 3.4 It is recorded that the aggregate amount of payments required to be made by the Guarantor in terms of 3.2 and 3.3 shall not exceed the Guarantor's maximum liability in terms of 1.1 or 2.1.
- 3.5 Where the Guarantor has made payment in terms of 3.3, 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.
- 3.6 Payment by the Guarantor in terms of 3.2 or 3.3 shall be made within seven (7) calendar days upon receipt of the first written demand to the Guarantor.
- 3.7 Payment by the Guarantor in terms of 3.3 will only be made against the return of the original Performance Guarantee by the Employer.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

- 3.8 The Employer shall have the absolute right to arrange his affairs with the Contractor in any manner which the Employer may consider 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.
- 3.9 The Guarantor chooses the physical address as stated above for the service of all notices for all purposes in connection herewith.
- 3.10 This Performance Guarantee is neither negotiable nor transferable and shall expire in terms of 1.1.2 or 2.2, 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.
- 3.11 This Performance Guarantee, with the required demand notices in terms of 3.2 or 3.3, shall be regarded as a liquid document for the purposes of obtaining a court order.
- 3.12 Where this Performance Guarantee is issued in the Republic of South Africa the Guarantor hereby consents in terms of Section 45 of the Magistrates' 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 (1) \_\_\_\_\_



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

## **Part C2: Pricing Data**

### **C2.1 Pricing Instructions**

Measurement and payment shall be in accordance with Clause 8 of the SANS 1200 Standardised Specifications for Civil Engineering Construction and with Part C of the COTO Standard Specifications for Road and Bridge Works for South African Road Authorities referred to in the Scope of Works, subject to the variations and amendments contained in the Section C3.5 Project Specifications.

Descriptions in the Bill of Quantities are abbreviated and comply generally with those in the Standardised Specifications. Clause 8 and Part C of each Standardised Specification, read together with the relevant clauses of Part C3: Scope of Work, set out what ancillary or associated activities are included in the rates for the operations specified.

Should any requirements of the measurement and payment clause of the applicable Standardised Specification, or the Scope of Work, conflict with the terms of the Bill of Quantities, the Employer's Agent shall direct the applicable requirements.

The clauses in a specification in which further information regarding the listed items in the Bill of Quantities can be obtained appear under "Payment Reference" column.

The reference clauses indicated are not necessarily the only sources of information in respect of billed items. Further information and set specifications may be found in Section C3.5 Project Specifications. Standardised Specifications are identified by the letter or letters which follow "SANS" in the SANS 1200 series of specifications, e.g., G for SABS 1200 G, and are identified by the number or numbers which follows "COTO" in the COTO specifications, e.g., 1.6 for COTO Chapter 1.6.

Unless otherwise stated, items are measured nett in accordance with the drawings and no allowance is made for waste. The quantities set out in the Bill of Quantities are approximate and do not necessarily represent the actual amount of work to be done. The quantities of work accepted and certified for payment will be used for determining payments due only.

The prices and rates to be inserted in the Bill of Quantities are to be the full inclusive prices for the work described under the various items. The prices and rates shall cover all costs and expenses that may be required in and for the execution of the work described, and shall cover the cost of all general risks, liabilities, and obligations set forth or implied in the documents on which the tender is based, as well as overhead charges and profit. The prices will be used as a basis for assessment of payment for additional work that may have to be carried out.

It will be assumed that prices included in these Bill of Quantities are based on Acts, Ordinances, Regulations, By-laws, International Standards and National Standards that were published 28 days before the closing date for tenders. (Refer to [www.stanza.org](http://www.stanza.org) or [www.iso.org](http://www.iso.org) for information on standards).

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2



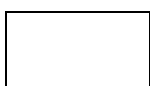
Where the Scope of Work requires detailed drawings and designs or other information to be provided, all costs associated therewith are deemed to have been provided for and included in the unit rates and sum amount tendered such items

A price or rate is to be entered against each item in the Bill of Quantities, whether the quantities are stated or not. An item against which no price is entered will be considered to be covered by the other prices or rates in the Bill of Quantities and recorded as zero. A single lump sum will apply should a number of items be grouped together for pricing purposes.

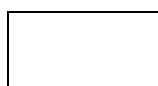
Except where rates only are required, the Tenderer shall insert all amounts to be included in his total tendered price in the "Amount" column and show the corresponding total tendered price.

The units of measurement described in the Bill of Quantities are metric units. Abbreviations used in the Bill of Quantities are as follows:

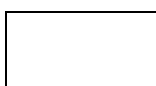
Ha	=	hectare
h	=	hour
kℓ	=	kilolitre
kg	=	kilogram
km	=	kilometre
kW	=	kilowatt
km-pass	=	kilometre pass
MN	=	Mega Newton
kPa	=	kilopascal
MN.m	=	Mega Newton-metre
ℓ	=	litre
%	=	percentage
m	=	metre
PC Sum	=	Prime Cost Sum
mm	=	millimetre
P Sum	=	Provisional Sum
PS/m	=	Provisional Sum per month
PS/d	=	Provisional Sum per day
Sum/wd	=	Sum per working day
m <sup>2</sup>	=	square metre
No.	=	number
m <sup>2</sup> .pass	=	square metre-pass
R/Only	=	Rate Only
m <sup>3</sup>	=	cubic metre
Sum	=	lump sum
m <sup>3</sup> .km	=	cubic metre-kilometre
t	=	ton (1 000 kg)
MPa	=	Mega Pascal
W/day	=	Work day
%	=	percentage
mth	=	month



Contractor



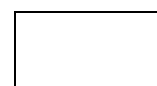
Witness 1



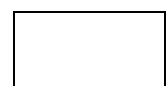
Witness 2



Employer



Witness 1



Witness 2

The parts of the contract to be constructed using labour-intensive methods have been marked in the Bill of Quantities with the letters LI in a separate column filled in against every item so designated.

The works, or parts of the works so designated, are to be constructed using labour-intensive methods only. The use of plant to provide such works, other than plant specifically provided for in the scope of work, is a variation to the contract. The items marked with the letters LI are not necessarily an exhaustive list of all the activities which must be done by hand, and this clause does not over-ride any of the requirements in the generic labour-intensive specification included with this document as Annexure D: EPWP Guidelines.

Payment for items which are designated to be constructed labour-intensively will not be made unless they are constructed using labour-intensive methods. Any unauthorised use of plant to carry out work which was to be done labour-intensively will not be condoned and any works so constructed will not be certified for payment.

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Contractor

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Witness 1

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Witness 2

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Employer

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Witness 1

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Witness 2

## C2.2 Bill of Quantities

Section No	SANS/COTO Ref	Description	Number of Pages	Special Instructions
Section 1	1200 A	PRELIMINARY AND GENERAL	3	Calculate and carry over to summary.
Section 2	1200 A	DAYWORKS	1	Calculate and carry over to summary.
Section 3		TEMPORARY WORKS	3	Calculate and carry over to summary.
Section 4		RIVER DIVERSION	1	Calculate and carry over to summary.
Section 5		DRILL AND GROUT	1	Calculate and carry over to summary.
Section 6	COTO	QUARRY	5	Calculate and carry over to summary.
Section 7		INSTRUMENTATION AND EQUIPMENT	2	Calculate and carry over to summary.
Section 8	1200 C, D, DB, DE, G, HA, L, MM	DAM	13	Calculate and carry over to summary.
Section 9.1		MAIN ACCESS ROAD	10	Calculate and carry over to summary.
Section 9.2		DAM ACCESS ROAD	8	Calculate and carry over to summary.
Section 10	1200 C, D, DB, G, H, HB, L, LB, LD, MM, MJ, MK	ADMIN BUILDING SITE	10	Calculate and carry over to summary.
Section 11		BULK POWER SUPPLY	4	Calculate and carry over to summary.
Section 12		ELECTRICAL INSTALLATION	13	Calculate and carry over to summary.
Section 13		RISING MAIN	5	Calculate and carry over to summary.
Section 14		GAUGING WEIR	1	Calculate and carry over to summary.
Section 15		SOCIO ECONOMIC DEVELOPMENT	1	Calculate and carry over to summary.
		SUMMARY OF SCHEDULES	1	Calculate and carry over to Form of Offer.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

## **Part C3: Scope of Work**

### **C3.1 Description of the Works**

#### **C3.1.1 Employer's objectives**

The Employer's objectives with this project are to upgrade the bulk water supply to the residents and extended recipients of the towns Amsterdam and Kwathandeka, located in Mkhondo Local Municipality in the Mpumalanga province.

This project is part of the Amsterdam Bulk Water Supply Scheme and is funded by the national government by means of the Regional Bulk Infrastructure Grant (RBIG).

#### **C3.1.2 Overview of the Works**

The permanent works will consist of the following:

- The provision of bulk electrical supply to enable the establishment and construction of the Works, as well as to enable the eventual operation of the infrastructure established.
- Placing of permanent beacons and benchmarks along the access road and around the dam site to enable setting out the Works.
- The construction of an access road of 1.2km to the Site, including 3 river crossings traversing the Gabosch River.
- The construction of a medium dam for raw water storage in the Gabosch River, including an outlet to enable flow to be released to the Dorps Dam located closer to the Amsterdam Water Treatment Works.
- The construction of a supply pipeline from the Dorps Dam to the Amsterdam Water Treatment Works.
- Construction of a compounded Crump flow gauging weir downstream of the dam inclusive with all measuring instrumentation. This work has not been quantified and a provisional sum has been included in the Pricing Schedule. The work will not be a variation to the Contract.

The temporary works will consist of the following:

- Placing of temporary beacons and benchmarks along the access road and around the dam site to enable setting out of the Works.
- Provision of temporary electrical supply around the Site to enable the construction of the Works.
- Construction of temporary construction / bypass roads around the Site to enable access to various portions of the Works.
- Temporary bridges to maintain access during dam construction: pedestrian- and vehicle bridges.
- Establishment, operation, and maintenance of an engineering quarry works for the procurement of suitable construction material, including all crushing and screening requirements.
- Establishment, operation, maintenance and removal of quarry plant.
- Clearing and stockpiling of topsoil.
- Clearing and stockpiling of overburden.
- Establish aggregate stockpiles and storage of cementitious materials.
- Establishment, operation, and maintenance of a batching plant to enable the batching of concrete.
- Establishment and maintenance of river diversion works and coffer dams.
- Establishment, monitoring, maintenance, and rehabilitation of a storm water

sedimentation pond.

- Control of ground water, sub-surface, stormwater, or spoiled water during construction.
- All formwork and falsework required to construct all parts of the work.
- Establishment and de-establishment of the construction yard, complete with all the required offices, workshops, laboratories, storerooms and facilities, ablution areas, dining areas etc. as may be required by the Works.
- Establishment of a temporary nursery including all related services including identifying, marking removing, storing, maintaining trees and shrubs, as required in the Environmental Management Plan.

None of the temporary works as been designed by the employer.

### **C3.1.3 Extent of the Works**

The extent of the work includes as follows:

#### **For the electrical supply:**

- Erection of an 11 kV Overhead Power Line from ESKOM bulk supply connection point to site of works.
- Connection to existing HV line at the Bulk Supply connection point to be informed by the Employer.
- Installation of a 75 kVA Transformer at the termination of the overhead power line at the Dam Site.

#### **For the access road:**

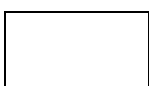
- Upgrade access intersection on regional road R65 with T-Junction Intersection for Main Access Road.
- Construction of Main Access Road approximately 1020 m long.
- Construction of East Access Road approximately 160 m long.
- Construction of Existing Dirt Road approximately 280 m long.
- Construction of Admin Road approximately 66 m long.
- Construction of 2 river crossings along Main Access Road.
- Construction of stormwater structures such as wing walls, field inlets, concrete chutes.
- Installation of road signage.

#### **For the quarry:**

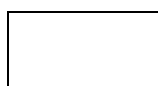
- Mining of approximately 126 300 m<sup>3</sup> of weathered and fresh andesite rock.
- Rehabilitation of the quarry site.

#### **For the dam:**

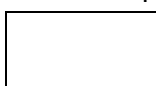
- Design, supply, delivery, and installation of monitoring instrumentation by specialist subcontractor.
- Installation of vibrating wire piezometers to measure uplift pressure in blocks.
- Monitoring of temperatures at specified positions at cross-section centroid in various blocks.
- Displacement measurement by resistant joint meters and surface displacement gauges.
- Installation of a floating boom system by specialist subcontractor.
- All civil works pertaining to the dam construction including:
  - Grubbing and clearing the dam solum;
  - Excavation of foundations to sound or mildly weathered rock;



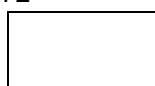
Contractor



Witness 1



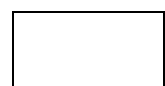
Witness 2



Employer



Witness 1



Witness 2

- Establishing spoil dumps and temporary stockpile areas;
  - Installation of rock anchors where required;
  - Foundation grouting;
  - Design, supply and installation of structure monitoring instrumentation by specialist subcontractor comprising piezometers, temperature gauges and crack and rotation monitoring installations;
  - Right flank rockfill embankment with asphalt core, toe drains and channels, seepage collection and measurement well and structure;
  - Concrete gravity overspill section with lined stilling basin / apron with flanking retaining walls;
  - Inlet/outlet works, with screened outlets, emergency gates, isolating valves, controlled release valves, overhead gantry for gate and screen handling, hydraulic pack for valve actuation, standby generator and access to gravity section inspection gallery
  - All mechanical and electrical installations including inter alia pipework, specials, valves, screens, gates, flow meters, switchgear, fittings, and pumps;
  - Left flank concrete gravity non-overspill wall;
  - Downstream causeway;
  - Downstream flow measuring weir;
  - All bulk fill, compaction and shaping, general finishing and cleaning of the site.
- Construction of masonry building(s), complete with all required water supply, plumbing and sanitation at dam and administration building site.
  - Installation of security fence.
  - Rehabilitation of the physical environment.

**For the flow gauging weir:**

- All civil works pertaining to the weir construction including:
  - Site clearance.
  - Bulk excavation and earthworks.
  - Foundations, formwork and reinforced concrete.
  - Land scaping, general site finishing and cleaning.
- Design, supply and installation of flow measurement instrumentation by specialist subcontractor.

**For the environmental and OHSA requirements:**

- Applying and managing the requirements of the Environmental Impact Assessment and the Environmental Management Plan.
- Applying and managing the requirements of the Health and Safety Plan.
- Applying and managing the requirements of the Water Use Licence.
- Applying and managing the requirements of the Mining License and Quarry.

**C3.1.4 Location of the Works**

The Works is located outside the town of Amsterdam towards Eswatini, approximately 65 km southeast of Ermelo, in the Mpumalanga province The site is accessed at a turnoff 2km long the R65 and then along a 1km track.

The GPS coordinates to the Gabosch Dam Site is:



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

- 26°36'11.40"S
- 30°40'40.66"E

Amsterdam is accessible via the R65 from Ermelo towards Eswatini and the R33 from Piet Retief in the south (50km) and the Oshoek-Ermelo N17 in the north. Westoe Dam, near which there is a fine aggregate source, is 15km to the north of Amsterdam along the R33.

### **C3.1.5 Temporary Works**

The temporary works for the Contractor's establishment is:

- Clearing of identified site and surroundings to create accessible working areas, as required, including excavation, filling of low areas, and compacting of soil.
- Installation of temporary lighting, water supply, and the provision of temporary drainage facilities, to enable erection of the Contractor's Camp.
- Installation of Contractor's camp, complete with all offices, parking spaces, workshops, laboratories, storage facilities, ablution facilities, changing area, dining area etc.
- Installation of fencing and access control around the Contractor's Camp.
- Installation of all statutory and specified signage.

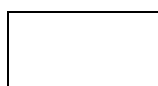
The remaining temporary works will consist of the following:

- Placing of benchmarks along the Site to enable setting out of the Works.
- Provision of temporary electrical supply around the Site to enable the construction of the Works.
- Construction of temporary construction / bypass roads around the Site to enable access to various portions of the Works.
- Establishment, operation, and maintenance of an engineering quarry for the procurement of suitable construction material, including all crushing and screening requirements.
- Establishment, operation, and maintenance of a batching plant to enable the batching of concrete.
- Establishment and maintenance of river diversion works and coffer dams.
- Establishment, monitoring, maintenance, and rehabilitation (where necessary) of storm water control works, including a storm water run-off and pollution control dam.
- All formwork and falsework required to construction all parts of the work.
- Establishment and de-establishment of the construction yard, complete with all the required offices, workshops, laboratories, storerooms and facilities, ablution areas, dining areas etc. as may be required by the Works.
- Handling and dealing with water for the duration of the construction period.

The above detailed temporary works may be expanded or changed by the Employer's Agent in the event that the circumstances on site necessitate any changes.



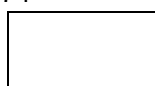
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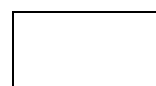
Witness 1



Witness 2



Employer



Witness 1



Witness 2

## **C3.2 Engineering**

### **C3.2.1 Employer's design**

The Contractor undertakes construction of the Works on the basis of designs issued by the Employer, and shall follow the specification, the design, and construction drawings as laid out in this Contract.

### **C3.2.2 Design brief**

The Contractor is responsible for the design of all temporary works, safe in terms of to the prevailing statutory requirements.

In addition, the Contractor is responsible for the design of all works procured through specialist subcontractors, safe to the terms of reference provided herewith, and the approval of the Employer's Agent.

#### **C3.2.2.1 Terms of Reference for Temporary Watercourse Diversion and Cofferd Dam**

Compile and submit for approval by the Employer's Agent, a comprehensive Watercourse Diversion and Cofferd Dam Plan, including a method statement and design for dealing with water during the construction phase, as well as sketches and quantities.

The Plan shall be based on the following river diversion methodology, Phases 1 to 4. Refer to drawings 2021/04/DW-L07 to L09.

##### **Phase 1**

The first phase of river diversion requires the installation of a 50m long culvert, to pass through the main coffer dam, when constructed. The final inlet channel must be excavated and another double culvert in the inlet channel, to allow construction of the main cofferdam and a temporary roadway over the inlet channel. The inlet channel must have its own coffer dam, that can be opened up in Phase 3, without permitting debris to be washed through the diversion gallery. With the closure of the river by the main cofferdam, the river will be diverted through the 50m culvert and allow final access over the coffer dam to the quarry and crusher area and the completion of construction of the batch plant platform, using stripped spoil from the dam solum.

Additional small cofferdams, probably using sandbags, must be installed to protect work on the right abutment and central embankment area as well as the right bank half of the causeway below the spillway (River crossing 3).

The river section of the embankment foundation will not be closed off. The embankment foundation in the river area will not be excavated in this phase, but the right bank and central areas will be accessed.

This diversion phase will allow access to the central spillway, outlet diversion works as well as left flank embankment, for earthworks, foundation preparations and first stage concrete works. In particular, the rockfill retaining wall must be addressed immediately, to enable alternate block construction of the spillway section and installation of the rockfill asphalt core plinths.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2



It is envisaged that a sandbag system be utilised for smaller cofferdam construction due to its inexpensiveness, ease of handling and manoeuvrability for follow-up river diversion phases as well as ease of dealing with potential seepage water into the system.

The Outlet Works must be excavated, and concrete construction completed to a level of 1276.5mAMSL, which will allow the river to be diverted through the outlet block diversion gallery in Phase 3.

Spillway block excavation and concrete construction can proceed at the same time.

## **Phase 2**

During this river diversion phase, the river must be returned to the right bank of the causeway. The spillway central and left bank apron area and the left bank of the causeway must be coffered off, to allow excavation and construction of the apron area and completion of the causeway.

This will entail closure of the main cofferdam and intake tower cofferdam with flow diversion through the new river culvert system. The cofferdams on the rockfill centreline as well as causeway to be adjusted to allow protection of the spillway centre section and left-flank embankment respectively.

Concrete construction of the left flank of the apron area must be complete with the upstream dam block to a safe level, along with the causeway, to allow for diversion through the outlet block during the next phase of river diversion.

A temporary wall will be required on the completed apron, which can be removed after impoundment, and the apron refurbished.

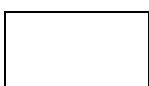
## **Phase 3**

The third phase river diversion will be through the outlet works, lower gallery, as with the full concrete design, with opening up of the intake coffer and closure of the entry to the 50m culvert downstream of the inflow channel. Flood water from the quarry, settlement pond and right flank hillside must be returned to upstream of the main cofferdam by installing a dumped rock coffer upstream of the embankment toe.

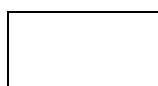
The diversion discharge will be through the part apron and left flank of the causeway. Closure of the right flank of the causeway will effectively coffer off the remainder of the works. The embankment riverine area and remainder of the apron can then be attacked. It is important that early access to the embankment centreline area be obtained in this diversion phase, to allow for construction and curing of the concrete foundation plinth as well as drilling and grouting of the grout curtain.

## **Phase 4**

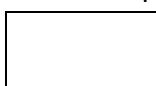
This is essentially impoundment, with closure of the outlet block diversion, removal of the channelling wall in the apron and part closure of the causeway.



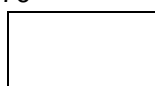
Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**C3.2.2.2 Terms of Reference for Monitoring Instrumentation and Equipment**

Refer to Particular Specifications Clause PI Monitoring Instrumentation and Equipment.

**C3.2.2.2 Terms of Reference for Drilling and Grouting**

Refer to Particular Specifications PJ: Drilling and Grouting.

**C3.2.2.3 Terms of Reference for Floating Boom**

Refer to Part C3.5.2 Amendments to General / Standard Specifications and Additional Specifications, and in particular Clause PSHA 5.2.15 Floating Boom

**C3.2.3 Drawings**

The following drawings are included in this Contract as Annexure G: Book of Drawings, based on the current information. Drawings may be updated (based on actual / prevailing site conditions uncovered during construction) and re-issued during the Contract period, as required.

**DRAWINGS FOR ELECTRICAL WORKS:**

**LAYOUTS:**

2021/04/E-L00	GENERAL LAYOUT PLAN OF BULK POWER SUPPLY
2021/04/E-L01	LAYOUT PLAN OF INTERNAL ELECTRICAL SUPPLY AND COMPONENTS

**DETAILS:**

2021/04/E-D01	ELECTRICAL SINGLE LINE DIAGRAM
2021/04/E-D02	ADMINISTRATION BUILDING LIGHTING, POWER, AND PV INSTALLATION LAYOUT
2021/04/E-D03	ELECTRICAL OUTLET BLOCK LIGHTING AND POWER LAYOUT - SHEET 1 OF 2
2021/04/E-D04	ELECTRICAL OUTLET BLOCK LIGHTING AND POWER LAYOUT - SHEET 2 OF 2
2021/04/E-D05	DRAINAGE COLLECTION CHAMBER LIGHTING AND POWER LAYOUT
2021/04/E-D06	OVERHEAD POWER LINE STRUCTURES

**DRAWINGS FOR ACCESS ROAD:**

**LAYOUTS:**

2021/04/R-L01	LAYOUT OF ACCESS ROADS TO GABOSCH DAM
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**LONGITUDINAL SECTIONS:**

2021/04/R-LS01	LAYOUT AND LONGITUDINAL SECTION FOR MAIN ACCESS ROAD CH0.000 - CH0.500
2021/04/R-LS02	LAYOUT AND LONGITUDINAL SECTION FOR MAIN ACCESS ROAD TO GABOSCH DAM CH 500 - CH 1 016
2021/04/R-LS03	LAYOUT AND LONGITUDINAL SECTION FOR EAST ACCESS ROAD CH 0.000 - CH 0.319

**CROSS SECTIONS:**

2021/04/R-CS01	CROSS SECTIONS OF MAIN ACCESS ROAD TO GABOSCH DAM CH0.000 - CH0.180 SHEET 1 OF 6
2021/04/R-CS02	CROSS SECTIONS OF MAIN ACCESS ROAD TO GABOSCH DAM CH0.200 - CH0.360 SHEET 2 OF 6
2021/04/R-CS03	CROSS SECTIONS OF MAIN ACCESS ROAD TO GABOSCH DAM CH0.380 - CH0.540 SHEET 3 OF 6
2021/04/R-CS04	CROSS SECTIONS OF MAIN ACCESS ROAD TO GABOSCH DAM CH0.560 - CH0.720 SHEET 4 OF 6
2021/04/R-CS05	CROSS SECTIONS OF MAIN ACCESS ROAD TO GABOSCH DAM CH0.740 - CH0.900 SHEET 5 OF 6
2021/04/R-CS06	CROSS SECTIONS OF MAIN ACCESS ROAD TO GABOSCH DAM CH0.820 - CH1.000 SHEET 6 OF 6
2021/04/R-CS07	CROSS SECTIONS OF EAST ACCESS ROAD TO GABOSCH DAM CH0.020 - CH0.180 SHEET 1 OF 2
2021/04/R-CS08	CROSS SECTIONS OF EAST ACCESS ROAD TO GABOSCH DAM CH0.200 - CH0.300 SHEET 2 OF 2

**DETAILS:**

2021/04/R-D01	DETAIL OF T-JUNCTION AND SIGHT DISTANCE OF MAIN ACCESS ROAD INTERSECTION ONTO R65
2021/04/R-D02	ROAD MARKING AND SIGNAGE LAYOUT FOR MAIN ACCESS ROAD INTERSECTION ONTO R65
2021/04/R-D03	RIVER CROSSING NO.1 LAYOUTS AND GENERAL DETAILS
2021/04/R-D04	RIVER CROSSING NO.2 LAYOUTS AND GENERAL DETAILS
2021/04/R-D05	RIVER CROSSING NO.3 LAYOUT AND GENERAL DETAILS OF LOW-LEVEL RIVER CROSSING
2021/04/R-D06	RIVER CROSSING HANDRAIL DETAILS AND NOTES

**TYPICAL DETAILS:**

2021/04/R-TD01	STANDARD NOTES
2021/04/R-TD02	PROJECT NAMEBOARD
2021/04/R-TD03	TYPICAL ROAD CROSS SECTION WITH LAYERWORKS SPECIFICATIONS
2021/04/R-TD04	ROAD CROSS SECTION WITH SIDE DRAIN DETAILS
2021/04/R-TD05	ROAD AND SURFACE DRAINAGE DETAILS FOR DRAINAGE STRUCTURES
2021/04/R-TD06	T-JUNCTION AND INTERSECTIONS- INTERSECTION WITH GRAVEL 2 ROADS SPECIFICATIONS
2021/04/R-TD07	GENERAL GUIDELINES FOR THE DESIGN OF SINGLE CARRIAGEWAY TARRED ROADS WITHIN 30M MIN ROAD RESERVE
2021/04/R-TD08	PRECAST CONCRETE CHUTE FOR FILLS
2021/04/R-TD09	ROAD RESERVE FINISHING
2021/04/R-TD10	T-JUNCTION AND INTERSECTIONS TYPICAL FARM ROAD ACCESSES
2021/04/R-TD11	AMORFLEX LINING DETAILS

2021/04/R-TD12	PIPE BEDDING DETAILS
2021/04/R-TD13	DETAILS OF OUTLETS AND GABION MATTRESSES
2021/04/R-TD14	GUARDRAIL ELEMENT: MOUNTING AND ERECTION DETAIL SHEET 1 OF 2
2021/04/R-TD15	GUARDRAIL ELEMENT: MOUNTING AND ERECTION DETAIL SHEET 2 OF 2
2021/04/R-TD16	DETAILS OF LOFFELSTEIN
2021/04/R-TD17	ACCOMMODATION OF TRAFFIC
2021/04/R-TD18	ROAD SIGN ERECTION DETAILS AND ROAD SIGNS
2021/04/R-TD19	DETAIL OF ROAD PAINT MARKING

**DRAWINGS FOR QUARRY:**

**LAYOUTS:**

2021/04/DW-L01	GENERAL LAYOUT PLAN OF DAM SITE AND ROADS
2021/04/DW-L11	QUARRY MANAGEMENT PLAN

**DRAWINGS FOR DAM:**

**LAYOUTS:**

2021/04/DW-L00	LAYOUT OF DAM AND ROADS
2021/04/DW-L01	GENERAL LAYOUT PLAN OF DAM SITE AND ROADS
2021/04/DW-L02	FLOATING BOOM PLACEMENT AND SECURITY LAYOUT
2021/04/DW-L03	LAYOUT PLAN OF POTENTIALLY HAZARD SLOPES
2021/04/DW-L04	ROCKFILL DAM EXCAVATION LAYOUT - SHEET 1 OF 3
2021/04/DW-L05	ROCKFILL DAM EXCAVATION LAYOUT - SHEET 2 OF 3
2021/04/DW-L06	ROCKFILL DAM EXCAVATION LAYOUT - SHEET 3 OF 3
2021/04/DW-L07	PHASE 1 OF RIVER DIVERSION FOR ROCKFILL DAM
2021/04/DW-L08	PHASE 2 OF RIVER DIVERSION FOR ROCKFILL DAM
2021/04/DW-L09	PHASE 3 OF RIVER DIVERSION FOR ROCKFILL DAM
2021/04/DW-L10	GENERAL LAYOUT OF MONITORING NETWORK
2021/04/DW-L11	QUARRY MANAGEMENT PLAN

**CROSS SECTIONS:**

2021/04/DW-CS01	ROCKFILL DAM CROSS SECTION DETAIL - SHEET 1 OF 2
2021/04/DW-CS02	ROCKFILL DAM CROSS SECTION DETAIL - SHEET 2 OF 2

**LONGITUDINAL SECTIONS:**

2021/04/DW-LS01	LONGITUDINAL SECTION AND DETAILS FOR ROCKFILL DAM WALL AND SPILLWAY - SHEET 1 OF 4
2021/04/DW-LS02	LONGITUDINAL SECTION AND DETAILS FOR ROCKFILL DAM WALL AND SPILLWAY - SHEET 2 OF 4
2021/04/DW-LS03	LONGITUDINAL SECTION AND DETAILS FOR ROCKFILL DAM WALL AND SPILLWAY - SHEET 3 OF 4
2021/04/DW-LS04	LONGITUDINAL SECTION AND DETAILS FOR ROCKFILL DAM WALL AND SPILLWAY - SHEET 4 OF 4

**DETAILS:**

2021/04/DW-D01	KEY PLAN OF DAM WALL
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2021/04/DW-D02	INTAKE TOWER DETAIL LAYOUT - SHEET 1 OF 6
2021/04/DW-D03	INTAKE TOWER DETAIL LAYOUT - SHEET 2 OF 6
2021/04/DW-D04	INTAKE TOWER DETAIL LAYOUT - SHEET 3 OF 6
2021/04/DW-D05	INTAKE TOWER DETAIL LAYOUT - SHEET 4 OF 6
2021/04/DW-D06	INTAKE TOWER DETAIL LAYOUT - SHEET 5 OF 6
2021/04/DW-D07	INTAKE TOWER DETAIL LAYOUT - SHEET 6 OF 6
2021/04/DW-D08	INTAKE TOWER DETAIL SECTION - SHEET 1 OF 6
2021/04/DW-D09	INTAKE TOWER DETAIL SECTION - SHEET 1 OF 6
2021/04/DW-D10	INLET PIPEWORK AND OUTLET DETAILS
2021/04/DW-D11	STOPLOG AND GATE DETAILS
2021/04/DW-D12	TYPICAL SECTION - RIGHT FLANK ROCKFILL EMBANKMENT
2021/04/DW-D13	TYPICAL SECTION - SPILLWAY
2021/04/DW-D14	TYPICAL SECTION - LEFT BANK CONCRETE EMBANKMENT, TYPICAL DETAILS – SHEAR KEYS, JOINT DETAILS, BALUSTRADES.
2021/04/DW-D15	ASPHALT KEY DETAILS
2021/04/DW-D16	UNDERFLOOR DRAINAGE LAYOUT AND DETAILS
2021/04/DW-D17	DRAINAGE COLLECTION CHAMBER DETAILS
2021/04/DW-D18	DETAILS 2.1M HIGH RAZOR WIRE SECURITY FENCE
2021/04/DW-D19	UNDERFLOOR DRAINAGE LAYOUT AND DETAILS

**REINFORCING DETAILS:**

2021/04/DW-RE01	DRAINAGE COLLECTION CHAMBER REINFORCEMENT DETAILS - SHEET 1 OF 2
2021/04/DW-RE02	DRAINAGE COLLECTION CHAMBER REINFORCEMENT DETAILS - SHEET 2 OF 2

**DRAWINGS FOR ADMIN BUILDING:**

**LAYOUTS**

2021/04/ADM-L01	SITE LAYOUT PLAN OF ADMIN BUILDING
2021/04/ADM-L02	GENERAL LAYOUT PLAN OF ADMIN BUILDING

**DETAILS**

2021/04/ADM-D01	ADMINISTRATION BUILDING SHEET 1 OF 2
2021/04/ADM-D02	ADMINISTRATION BUILDING SHEET 2 OF 2
2021/04/ADM-D03	DETAIL OF CONSERVANCY TANK
2021/04/ADM-D04	DETAIL OF POTABLE WATER SUPPLY AND STORAGE – SHEET 1 OF 2
2021/04/ADM-D05	DETAIL OF POTABLE WATER SUPPLY AND STORAGE – SHEET 2 OF 2
2021/04/ADM-D06	DETAIL OF GENSET ENCLOSURE - SHEET 1 OF 2
2021/04/ADM-D07	DETAIL OF GENSET ENCLOSURE - SHEET 2 OF 2

**LIST OF TYPICAL DETAILS:**

2021/04/DW-TD01	STANDARD NOTES
2021/04/DW-TD02	PROJECT NAMEBOARD

**Construction drawings**

The Contractor will be issued with three full sets of A1 sized drawings as well as instructions for commencement of the works. Additional copies of drawings will be issued at request, and for the cost of the Contractor.

One set of A1 drawings shall be used exclusively for the recording of as-built information on a daily basis and shall be:

- a) made available to the Employer's Agent within 24 hours from request; and
- b) submitted to the Employer's Agent with the Contractor's request for issue of the Certificate of Practical Completion.

Only dimensions, positions, levels, co-ordinates etc. that change from the original values will be required to be entered on the as-built drawings.

### **Shop drawings**

Where an item to be supplied in conformance with this contract specification has not been designed by the Employer, the Contractor shall be required to supply the Employer's Agent with 3 copies of detailed shop drawings prior to delivery of materials, including an electronic copy in drawing format that is compatible with the software packages (AutoCAD or DXF) used by the Employer's Agent.

**The Contractor shall only proceed with the manufacturing, supply, and installation of any design items after receipt of the Employer's Agent and/or its Representative's written approval of such shop drawings or any amended versions thereof.**



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

### C3.3 Procurement

#### C3.3.1 Socio-Economic Development and Targeted Procurement

The Employer intends to achieve the objective of promoting an environment that is safe, efficient, productive, harmonious, free from disruption, and which localises opportunities for communities in close proximity to the project. Such an environment will assist contractors in implementing the projects successfully.

All contractors, subcontractors (including SMME's) and service providers within the project have a role and responsibility in achieving this objective. Accordingly, the Contractor will be wholly responsible in ensuring the provision, implementation, and maintenance of the required socio-economic deliverables, as approved by the Employer.

The Contractor shall within 28 days of appointment, develop and finalise a plan with regards to Social Economic Development (SED) targets set by the Employer for each respective SED element. The SED Plan shall demonstrate how the Contractor intends to secure involvement of historically disadvantaged individuals (HDI's), as well as how he will execute his commitment to the respective SED elements.

The Employer's key performance areas and deliverables on SED are outlined as follows:

Item No.	Key Performance Areas	Deliverables
1	Participation of Local Enterprises	<ul style="list-style-type: none"><li>The Contractor shall ensure that the following subcontracting target is prioritised in the project implementation plan, and this must be clearly outlined in the declaration of intent:<ul style="list-style-type: none"><li><b>Subcontracting (priority being local-to-site):</b> At least 10% of the work shall be subcontracted to local black-owned SMME's. The Contractor shall specify in the SED Plan which work items shall be subcontracted to local black-owned SMME's. The plan shall also indicate the Rand-value and the respective scope(s) of work. The existing databases of local business for the target area/s will be made available by the Employer and the Local Municipality.</li></ul></li></ul>
2	Job Creation	<ul style="list-style-type: none"><li>The Contractor's workforce in the project shall consist of local HDI's as follows:<ul style="list-style-type: none"><li>Unskilled labour: 100% (50% women, 50% youth).</li><li>Semi-skilled labour: 60% (50% women, 50% youth).</li><li>Skilled labour: 70% (50% women, 50% youth).</li></ul></li><li>Recruitment shall be done via the Labour Desk and / or through other methods that will be coordinated and approved between the Employer and Contractor.</li><li>Employment shall be mostly on a part-time basis. Unskilled employees shall exit with a certificate of completion of accredited training.</li><li>A recruitment plan shall be submitted that will indicate how</li></ul>

		the employment of local labour will be achieved in comparison with the Contractor's existing permanent and seconded labour which will be assigned to the project.
3	Skills Development	<ul style="list-style-type: none"> <li>The Contractor shall compile a proposed skills development programme targeting the following levels: <ul style="list-style-type: none"> <li>Unskilled- to Semi-skilled labour: (50% women, 60% youth);</li> <li>Undergraduate labour: (50% women, 80% youth); and</li> <li>Graduate labour: (50% women, 80% youth).</li> </ul> </li> <li>The proposed programmes shall be accredited, giving credit value to the beneficiaries. The programmes must incorporate workplace learning and / or on-the-job training with the theoretical knowledge provided.</li> <li>Programmes may only be implemented once the Employer approved same.</li> </ul>
4	Social Responsibility	<ul style="list-style-type: none"> <li>A programme shall be structured to ensure effective delivery to address identified community needs in a significant and sustainable manner.</li> <li>The Contractor shall submit proposed social responsibility initiatives which should be rolled out across the project duration and must have impact beyond the project implementation. Examples may include: <ul style="list-style-type: none"> <li>Cooperative Development</li> <li>NGO Support</li> <li>School Support</li> </ul> </li> <li>Programmes may only be implemented once the Employer approved same.</li> </ul>
5	Social Facilitation	<ul style="list-style-type: none"> <li>A key component in aiding the realisation of the SED objectives is effective community liaison with all relevant role-players, structures, civic organisations, and the community at large.</li> <li>Provision shall be made for a Community Liaison Officer (CLO) for the duration of the project. The CLO shall be sourced locally.</li> </ul>

### **C3.3.2 Subcontracting**

#### **C3.3.2.1 Scope of mandatory subcontract works**

It is the intention of the Employer that specific portions of the Works be subcontracted to specialist subcontractors. Selection of specialist subcontractors shall be subject to the conditions of the Contract.

The scope of mandatory subcontract works identified by the Employer includes the following:

- Drilling and grouting;
- Blasting;
- Quarrying operations; and



- Instrumentation.

### **Drilling and grouting**

The Contractor shall procure the services of a specialist drilling and grouting subcontractor. The subcontractor will be responsible for all foundation and post concrete completion grouting operations including any grouting required during surface treatment of the foundation as well as curtain grouting in accordance with the grouting programme developed by the Approved Professional Person (APP).

The subcontractor will be responsible for preparing a detailed methodology for approval by the APP and/or Employer's Agent's Representative, detailing his proposed method of drilling, pressure water testing and grouting operations including proposed grouting mixes and pressures.

It is possible that grouting procedures may be adjusted during execution, pending the outcome in-situ grouting operations. Any adjustment to the method of grouting to be done in consultation with the APP, Engineering Geologist and/or Employer's Agent's Representative.

### **Blasting**

The Contractor shall procure the services of a specialist blasting subcontractor. The subcontractor will be responsible for all blasting operations and explosives management on the site pertaining to the Works.

All blasting operations shall be carried out strictly according to the Acts and Regulations listed under paragraph C3.5.3 Health and Safety Issues.

Blasting will not be allowed under any circumstance where a reasonable possibility exists of damage to any foundation, embankment, pipe, cable, or any structure, either complete or partly complete. Where the Employer's Agent considers blasting to be dangerous, the same shall not be permitted and his decision shall be final and binding.

Wherever blasting is permitted, it shall be executed with the necessary safety precautions in place which may entail any of the following as applicable i.e., cover of sufficient earth backfill, heavy wire mesh screens, or rubber matting of adequate weight and area to prevent the blasted material from being ejected from the trench.

If any damage should occur, the Contractor and/or subcontractor shall carry out remedial work arising from such damage and will be held to have allowed therefore in his price.

The subcontractor shall undertake such blasting so that the Peak Particle Velocity (PPV) as measured closest to the Works or other structures shall not exceed 25mm/s. Each blast shall be monitored, and the findings recorded by an appropriately qualified explosives expert using a suitably calibrated apparatus. The Contractor shall also timeously inform the relevant inspectorate and obtain the required blasting permit from the South African Police Services, Division of Explosives before proceeding with any blasting on site. Should the Employer's Agent be of opinion that the subcontractor makes careless use of explosives, he may instruct removal of the subcontractor.

Should blasting result in disturbing of material outside the foundation and/or quarry footprint, the Employer's Agent will require the Contractor to remove the disturbed material, backfill and compact it, to a compaction standard of the natural in-situ material. All work for correcting areas of disturbed material shall be done at the Contractor's cost.

The schedule rate for hard rock excavation shall cover all costs incurred in connection with supply, transportation, storage and handling of explosives, the related blasting costs and any remedial work should this be required.

### **Quarrying operations**

The Contractor shall procure the services of a specialist quarrying subcontractor. This subcontractor shall be responsible for the complete establishment, operation, maintenance, production, and de-establishment of the quarry complete with plant and equipment.

The Employer has applied to the Department of Mineral Resources for both a Mining Permit, as well as for exemption from a mining permit, authorising establishment and mining of the proposed quarry. Either the approved exemption, or Mining Permit (which ever will be approved/applicable at the time), shall be available on the site of Works for the duration of the project.

### **Crushed Rock Production**

The Contractor shall / may procure the services of an experienced aggregate production firm for the crushing and screening of concrete aggregate and embankment rockfill and filter zone material.

### **Instrumentation**

The Contractor shall procure the services of a specialist dam and flow measurement instrumentation subcontractor who shall be responsible for the design, supply and installation of all monitoring equipment required for the Works. The subcontractor shall provide full details of equipment proposed for installation as well as references of similar installations and shall proceed only after each type of instrument and method of installation has been approved in writing by the APP and Employer's Agent's Representative.

The subcontractor shall be responsible for the monitoring, interpretation, and maintenance of instrumentation for the duration of construction and of the Defects Liability Period stated in the Contract Data. Special reference shall be made to the timing of temperature monitoring during concrete placing and curing.

The subcontractor shall be responsible for the training of operational staff on monitoring, interpretation, and maintenance of all monitoring equipment during the commissioning and handover stage.

The schedule rate for this specialist subcontractor shall include the cost for design, supply, install, monitoring, interpreting results and training to operators. Refer to Part

C3.5.3 Particular Specifications, and in specific to specification PI: Monitoring Instrumentation and Equipment.

**C3.3.2.2 Preferred subcontractors / suppliers**

It is the intention of the Employer to promote the local area economy with the execution of the contract. The Contractor shall give preference to local and/or regional subcontractors and suppliers for the procurement of goods and services.

In this instance “local” shall mean within the boundaries of Mkhondo Local Municipality; and “regional” shall mean within the boundaries of Gert Sibande District Municipality.

**C3.3.2.3 Subcontracting procedures**

The appointment of nominated, selected and/or specialist subcontractors shall be in accordance with the requirements of Clause 4.4 of the Contract Conditions, and shall be established on a formal form of contract, which shall be based on the General Conditions of Subcontract for Construction Works, First Edition (2018) published by the South African Institute of Civil Engineering (SAICE). The Employer’s Agent must be supplied with a copy of the contract / agreement (s) for records purposes.

The Contractor shall determine the number of subcontractor(s), depending on the Scope of Work and the amount of work that shall be carried out under this Contract as outlined in the Bill of Quantities.

**The Employer’s Agent shall not negotiate directly with subcontractors and all problems relating to programming, workmanship, etc., shall be resolved between the Contractor and his subcontractors.**

In the execution of subcontract works, the Contractor shall ensure that the subcontractor(s) comply with all relevant legislation and regulations including, but not limited to the Acts and Regulations listed under paragraph C3.5.3 Health and Safety Issues.

The Contractor indemnifies the Employer against any loss, damage, or claim emanating from subcontracted works executed under the Contract and arising from the Contractor’s failure to comply with instructions issued to him in regard to these requirements.

**C3.3.2.4 Attendance on subcontractors**

The Contractor shall be responsible for attendance on nominated, selected and specialist subcontractors and shall ensure that his subcontractors shall supply sufficient, suitable resources i.e., equipment, labour, and material to execute all subcontract work.

The Contractor shall also ensure that the subcontractors shall execute the subcontract work in accordance with the Scope of Work and Programme to the reasonable satisfaction of the Employer’s Agent.

### **Laws and Regulations**

The Contractor shall ensure that the subcontractors comply with paying of all amounts due in respect of his employees and himself in terms of all relevant legislation and regulations including, but not limited to the:

- Income Tax Act;
- Compensation for Occupational Injuries and Diseases Act;
- Unemployment Insurance Act; and
- Basic Conditions of Employment Act.

### **Resources to complete subcontract work**

The Contractor shall ensure that his subcontractors supply all required resources such as labour, equipment, hand tools, and power-driven tools required for the execution of subcontract works.

The onus is on the Contractor to determine the extent of resources that the subcontractor shall supply to ensure that the works are completed within time, budget, and specification.

The Contractor is responsible for the agreements between himself and his subcontractors and indemnifies the Employer from any agreements entered between himself and his subcontractors.

### **Payment**

The Contractor shall ensure his subcontractors are paid within the stipulated time as per their respective subcontract agreements, failing which, the Contractor may be reported to the Employer's Supply Chain Department, and which may prejudice his future employment with the Employer.

### **Retention monies**

The Employer will deduct retention money for the overall works, including all subcontract work, as stipulated in the Contract Data.

### **Resolution of Disputes**

Should any dispute arise between the Contractor and any of his subcontractors, due to the provisions of the respective subcontracts or the execution of the subcontract work, both parties shall make every effort to resolve the matter amicably between themselves, without the intervention of the Employer's Agent or Employer. The contract agreement signed between the Contractor and his subcontractors shall detail appropriate dispute resolution procedures.

## **Contract dataC3.4: Construction**

### **C3.4.1 Works specifications**

#### **Applicable national standards**

The following national standards is applicable to the Works and is not issued with this document. The Contractor is advised to obtain the standards from the:  
South African Bureau of Standards (SABS) in Pretoria or online at [www.sabs.co.za](http://www.sabs.co.za);  
Department of Transport (DoT) in Pretoria or online at [www.transport.gov.za](http://www.transport.gov.za); and  
Department of Water and Sanitation in Pretoria or online at [www.dws.gov.za](http://www.dws.gov.za).

#### **Civil Engineering Works:**

SANS 1200	Standardized Specifications
COTO	Standard Specifications for Road and Bridge Works for South African Road Authorities.

#### **Mechanical Engineering Works:**

DWS 1130	Design, Manufacture and Supply of Steel Pipes, Specials and Fittings for Duties up to 4,6 MPa Design Pressure
DWS 1131	Lining and Coating of Steel Pipes and Specials
DWS 2510	Supply of Valves
DWS 9900 C1	Corrosion Protection of Steel Pipes and Specials for Pipelines

#### **Electrical Works:**

SANS 10280 Overhead Powerlines for Conditions Prevailing in South Africa

Details of the specific national standards and the required amendments to same is contained in Parts C3.5.1 and 3.5.2 of this document.

#### **Particular or generic specifications**

Details of the particular of generic specifications are contained in Part C3.5.3 of this document.

### **C3.4.2 General product requirements**

#### **Local content**

Preference shall be given to materials fully manufactured in South Africa with South African raw materials.

#### **Site service**

The manufacturer / supplier of applicably identified materials shall be expected to supply samples free of any other additional charge, and the services of a qualified technical representative to the site in order to train the Contractor's placing team in the correct application methods of the product during initial placing, upon 1 weeks' notice.

Circumstances may necessitate follow-up inspections.

#### **Shelf life**

The shelf life of the offered product shall be stated, and the expiry date displayed on each bag. The Contractor shall ensure that the product supplied will survive the Contract Period, or replace the product at his cost.

#### **Product references**

The Contractor shall submit names and locations of projects in South Africa where the offered product has been in successful use for a period of at least 5 years under similar conditions and at similar rates. The Contractor shall:

- a) arrange with the project owners for access for such visits, should the Employer's Agent request to inspect such reference project sites; and
- b) provide an acceptable alternative at the same accepted financial rate of the original proposed product, should the Employer's Agent find the product unacceptable.

#### **Approved products and proof of compliance with materials specifications**

Only products that have been tested, approved, and bears the official mark of standardisation issued by the South African Bureau of Standards shall qualify.

Where no SANS standard exists for a specified material, the nearest acceptable equivalent will be applicable i.e., BS or ISO mark of standardisation, as specified in the project specifications and / or verified by the Employer's Agent.

Where none of the above is available the Contractor shall provide the relevant available detail of the materials to the Employer's Agent for approval before use thereof

#### **Compliance with materials samples and finishes, and control testing**

Samples of materials complying to the requirements as specified, together with the relevant data sheet(s) applicable thereto shall be provided to the Employer's Agent for acceptance.

For geotechnical materials the applicable laboratory test results of the geotechnical materials shall be provided to the Employer's Agent for acceptance.

Control testing shall be required as and when requested by the Employer's Agent, proving the quality of the product used.

### **C3.4.3 Plant and materials**

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

### **C3.4.4 Engagement of labour**

#### **Provision of a Temporary Workforce for the Contract**

The Contractor shall adhere to the Expanded Public Works Programme (EPWP) principles and requirements as far as possible, and as required by the Regional Bulk Infrastructure Grant (RBIG), and shall source and employ suitable labour from the local community through the Labour Desk that has been established for this purpose. The Contractor shall be assisted with this by the appointed Community Liaison Officer (CLO).

The Labour Desk shall assist in identifying available local labour and, where available, semi-skilled labour as well as local subcontractors, and shall advise regarding conditions of employment, minimum wages, disputes, and disciplinary procedures.

The workforce that is employed on Site shall consist of local labour where applicable, except for approved key staff, to the extent that is compatible with the requirements of the Contract. The applicable Occupational Health and Safety Acts must be adhered to with reference to the safety of all temporary employees, irrespective of whether such employees are employed by the Contractor or by his local subcontractors.

Furthermore, a contract of employment must be signed between the Contractor and each of his temporary employees, and between the Contractor's subcontractors and each of their temporary employees, with clear reference to at least the following conditions:

- The minimum agreed wage rate per hour in respect of labourers;
- The agreed pay rate per unit of production where applicable;
- UIF and WCA payments;
- Minimum working hours per day;
- Start and end times of a daily shift;
- Lunch break times; and the
- Company Policy regarding the following:
  - Rain time;
  - No work no pay arrangements, including illness and absenteeism;
  - Disciplinary policy;
  - Grievance policy;
  - Method of payment; and
  - Workers' clothing and safety equipment to be issued.

The Contractor is required to show these temporary employment contracts to the Employer's Agent for approval before construction commences.

#### **Transportation of labourers**

The labour employed on this contract shall be local labour from the nearest local community. The Contractor shall arrange for the daily transportation requirements of the labourers between designated points and the Site.

#### **Minimum wage for local labour**

Please take note that the minimum wage rate shall be annually adjusted and confirmed by the Local Municipality.

It is accepted that the rates contained in the Bill of Quantities sufficiently allowed for minimum wage rate of the Mkhondo Local Municipality.

#### **Reporting of local labour**

The Contractor shall be responsible to provide the Local Municipality with a monthly report on labour in terms of the statutory reporting requirements i.e., providing details of names, ID numbers, gender, number of hours of days worked, and wage payments made.

**C3.4.5 Existing services**

**C3.4.5.1 Known services**

Existing known services, both underground and overhead, are indicated on the following listed drawings. The positions of existing services on the drawings are not guaranteed and the Employer does not accept any liability in this regard.

- 2021/04/DW-L01 General Layout Plan of Dam Site and Roads.
- 2021/04/E-L00 General Layout of Bulk Power Supply.

The known services to be indicated by the Employer's Agent are:

- Eskom Bulk Power Supply Point.
- The point of intersection to the access road to the Gabosch Dam, and from where the access road to the Gabosch Dam will be constructed.
- The points of connection of the main supply pipeline from the Dorps Dam to the Amsterdam Water Treatments Works.
- Any overhead Telkom and electrical powerlines along Road R65 past the access point to the Site.

**C3.4.5.2 Treatment of existing services**

All existing services on the site may not be shown on the drawings or be visible on the site. The Contractor must consult with all relevant local authorities to satisfy himself that all relevant services have been located.

At the commencement of the contract, the Contractor must hand excavate a distance of 0.5 m on each side of the located service to expose it. Once the exposed service is identified and recorded the excavation must immediately be backfilled. Re-excavation by hand at construction stage will not be measured in addition to normal trench excavation.

The Employer's Agent may order excavation by hand in order to search for and expose services. An item has been included in the Bill of Quantities to cover the cost of such work.

The Contractor shall retain full responsibility for establishing the exact positions of the existing services in advance of any construction work. No allowance for delays or disruption shall be entertained unless the Contractor complies fully with the provisions of this clause regarding the establishment of the exact positions of the existing services in advance of any construction work.

**C3.4.5.3 Use of detection equipment for the location of underground services**

The Contractor may decide to use detection equipment to locate any underground services. The Contractor will be responsible to provide his own equipment, at his cost, and shall locate and expose existing services by hand.

**C3.4.5.4 Recording of services**

All exposed services shall be identified, and their relevant detail and exact locations shall be recorded on a drawing. A copy of the drawing with all known services shall



be submitted to the Employer's Agent for approval before construction can commence.

In addition, the Contractor shall keep written record of when work was done close to, or on any known service. These records shall indicate signed off approval by the Employer's Agent and / or designated official from the specific local authorities.

All known services encountered shall be marked on the official final as-built plans.

#### **C3.4.5.5 Reinstatement of services and structures damaged during construction**

The Contractor shall take necessary steps to protect any existing services against damage which may arise as a result his operations on site and shall repair any unintentional damage to known services at his cost.

Where a known service is damaged because of the Contractors negligence he shall be liable for the cost involved in the repair of the services and any other consequential cost that may arise due to the interruption of the damaged services.

Where an unknown service is damaged due to the Contractor not being aware of the service, the Contractor shall endeavour to identify the service, locate the relevant owner, and coordinate the repair of the damage. The Employer shall be liable for the cost involved in the repair of the services and any other consequential cost that may arise due to the interruption of the damaged services.

The Contractor shall inform all relevant service providers immediately after damage to any existing service in order to arrange the required procedures for reinstatement of the affected service.

#### **C3.4.6 Site establishment: Facilities**

##### **C3.4.6.2 Notice boards**

Details of the required notice boards are located on the drawings under:

- 2021/04/DW-TD02 Construction Nameboard

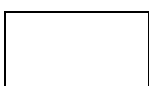
Two name boards shall be provided in positions as indicated by the Employer's Agent. One board shall be placed at the Amsterdam Water Treatment Works and the other at the entrance road to the Gabosch Dam Site.

The Employer's Agent will approve the draft lettering once the tender is awarded. Details of the respective main subcontractors may be applied once the respective sub-contracts have been finalised.

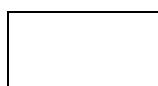
Notice boards shall be erected after signing of the Contract and before commencement with the Works, and removed at the end of the Defects Liability Period.

##### **C3.4.6.3 Facilities provided by the Contractor**

The following temporary facilities shall be provided by the Contractor and be serviced and maintained on a continuous basis for the duration of the project:



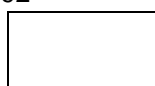
Contractor



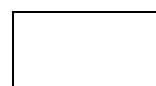
Witness 1



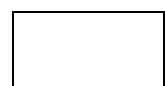
Witness 2



Employer



Witness 1



Witness 2

### **Location of construction camp**

The Employer's Agent shall point out the position of the Contractors camp to the Contractor during the site inspection. The Contractor may assume that the site camp will be within 1 km of the site.

The construction camp shall be suitably large enough to accommodate the facilities and movement of the Contractor, the Employer and Employer's Agent, as well as the weather station.

The construction camp shall be fenced off with suitable fencing and be access controlled.

### **Facilities for the Contractor:**

#### **Offices and storage sheds**

The Contractor shall provide suitable mobile offices for all his senior- and specifically designated employees at the main construction camp. Offices shall be lockable, isolated, and equipped with air conditioning and windows that can be opened. Offices shall be large enough to comply with the prevailing OHSA Covid-19 requirements.

The offices shall be provided with suitable safe, sheltered parking for smaller vehicles e.g., lite utility vehicles and sedans, have a contained crushed gravel parking space and at least a roof of shadow netting or galvanised sheeting.

The Contractor shall provide suitable mobile shipping containers for use as storage sheds at the main construction camp and along selected places across the Site as required by Contractor and the specific work package requirements. All storage sheds shall be lockable.

#### **Workshop facilities**

The contractor shall provide suitable mobile buildings or containers for use as workshop facilities at the main construction camp and along selected places across the Site as required by Contractor and the specific work package requirements. All workshop facilities shall be lockable.

#### **Laboratories**

The use of commercial laboratories will be allowed. The laboratory to be used shall be SANS accredited and is subject to the acceptance of the Employer's Agent, and may be established on site.

#### **Living accommodation**

No living accommodation will be allowed on Site. The Contractor shall make his own arrangements for the daily accommodation and transportation of his employees.

#### **Ablution and dining facilities**

The Contractor shall provide suitable mobile ablution facilities across the Site at each designated work package Site, with at least one toilet per 20 workers. There shall be separate ablution facilities for male and female employees, complete with hand washing facilities and potable water for drinking. Ablution facilities shall be screened from public view and their use shall be enforced.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

The Contractor shall provide a designated dining area on Site for use of its employee's during tea- and lunchtimes, and which shall be sheltered from the sun and provided with waste bins with lids and potable water for drinking, as well as hand washing facilities.

The facilities shall be kept in a clean and hygienic condition by the Contractor to the satisfaction of the Employer's Agent. All sanitary facilities are to conform to the by-laws of the Local Authority.

### **Facilities for use by the Employer and the Employer's Agent**

#### **Offices**

The Contractor shall provide suitable mobile offices and a conference/boardroom facility for the Employer, Employer's Agent and/or its Representatives and APP at the main construction camp. Offices shall be lockable, isolated, and equipped with air conditioning and windows that can be opened. The offices shall be large enough to accommodate Site- and other meetings, and to provide the Employer with a suitable venue to perform administrative functions at an ad hoc basis. Offices shall be large enough to comply with the prevailing OHSA Covid-19 requirements.

The offices shall be provided with suitable safe, sheltered parking for smaller vehicles e.g., lite utility vehicles and sedans, have a contained crushed gravel parking space and at least a roof of shadow netting or galvanised sheeting.

#### **Ablution facilities**

The Contractor shall provide suitable mobile ablution facilities at the main construction camp for exclusive use of the Employer's Agent's Representatives and the Employer. The facilities shall be lockable and complete with hand washing facilities and potable water for drinking.

The facilities shall be kept in a clean and hygienic condition by the Contractor to the satisfaction of the Employer's Agent. All sanitary facilities are to conform to the by-laws of the Local Authority.

### **C3.4.7 Site establishment: Services**

#### **C3.4.7.1 Services provided by the Contractor**

The Contractor shall provide the following temporary services to Site:

#### **Water supply**

The Contractor will be responsible for the cost of the connection to the municipal water supply, as well as the monthly cost of water consumed on Site. The Contractor shall note that the supply of potable water may be unreliable and should ensure that water is available on Site for general use, as well as potable water for human consumption, during all working hours.

Alternatively, the Contractor may choose to erect his own facilities for the extraction, handling, and supply of water from boreholes sunk on Site and / or from extraction

facilities erected in the Gabosch River. The Contractor shall ensure that water for construction purposes complies with the relevant SANS potable water specifications.

The Contractor shall ensure that the water supply is tested periodically / monthly by an accredited laboratory against the specifications and shall keep thorough referenceable water quality test results for same.

### **Sanitation**

The Contractor will be responsible for the cost of providing sanitation to all the established ablution facilities at the main construction camp and across the Site.

All facilities shall be maintained at a suitable interval, kept in a clean and hygienic condition by the Contractor to the satisfaction of the Employer's Agent. All sanitary facilities are to conform to the by-laws of the Local Authority.

### **Electricity**

There is no electricity available in close proximity to the site. The Contractor will be responsible for the cost of providing reliable electricity on site, as well as the monthly cost of electrical consumption across the Site.

The Contractor shall provide permanent electricity to the site as part of the Works, and may arrange with the municipality for a temporary connection to the existing electrical supply at the Amsterdam Water Treatment Plant. This connection may be maintained for the duration of the period taken to provide the permanent electrical supply to site. Thereafter the Contractor may arrange for the relocation of the temporary electrical connection to the point of termination at the construction site. The Contractor shall ensure that the electrical supply requirements comply to the statutory requirements and are maintained for the duration of the project.

### **Telecommunications**

The Contractor will be responsible for the cost of providing telecommunication services to his employees as well as to the Employer's Agent and his Representatives for the duration of the project.

The Employer's Agent will provide the Contractor with monthly invoices for the rental and servicing of mobile telephones to the designated Employer's Agent's Representatives.

### **Internet and Wi-Fi facilities**

The Contractor will be responsible for the cost of providing internet (ADSL) and Wi-Fi facilities to the main construction camp and across Site, as required, for use by the Contractor, the Employer, and the Employers Agent's Representatives for the duration of the project.

### **Security**

The Contractor will be responsible for the cost of providing full time security services to site to safeguard the facilities and works. All access control points should be manned, and all entry and egress should be recorded in a suitable register.

### **Medical facilities**

The Contractor will be responsible for the cost of providing full time first aid services to site during all working hours. The first aid facilities and services shall comply to the required OHSA and Safety File requirements. Permanent medical facilities for eventual use will be available in the local towns of Amsterdam and Ermelo, pending the urgency thereof.

### **Fire protection**

The Contractor shall be responsible for the cost of complying with statutory and local fire regulations across the entire Site for the duration of the project. The Contractor shall also take all necessary precautions to prevent any fires.

In the event of fire, the Contractor shall take active steps to limit and extinguish the fire and shall accept full responsibility for damages and claims resulting from such fires which may have been caused by him or his employees

### **Waste disposal**

The Contractor shall be responsible for the cost of providing waste disposal services across the Site for the duration of the project. Waste bins shall be sturdy, provided with lids to prevent littering, and be serviced weekly. The Contractor shall maintain a waste disposal log of all waste delivery to the local waste disposal site.

## **C3.4.7.3 Computers, furniture, and survey and testing equipment**

### **Requirements for computers**

The Contractor shall ensure that computers provided for use of the project are in working order and are able to operate at least a recent version of the MS Office suite of applications, including MS Word, MS Excel and MS Projects, or, in the event of the Contractor using an alternative programming package, that the project programme are compatible with MS Projects.

The Contractor shall ensure that there is printing, copying and scanning facilities available on Site and that all the necessary consumables are provided for the duration of the project.

### **Office furniture**

The Contractor shall ensure that all offices are provided with suitable sturdy desks, with at least two drawers and lockable cupboards. Every desk shall be provided with suitable chairs.

The Employer's Agent's Conference/Boardroom shall be provided with a suitably sized boardroom table and sturdy chairs for at least 16 people. The Contractor's office and Boardroom shall have a suitable plan cabinet or frame from which the construction drawings can be hung.

The Engineer's office and the Contractor's office shall be equipped with a small fridge / freezer combination and suitable tea- and coffee making facilities.

### **Survey and testing equipment and survey assistant**

The Contractor will be required to make survey equipment available specifically for the use of the Employer's Agent. The Contractor will make 2 survey assistants available to the Employer's Agent as and when required, as well as at least a theodolite and/or level plus accessories. All survey equipment shall be recently calibrated and maintained for the duration of the project.

#### **C3.4.8 Site usage**

##### **Work on private or state property, and access to the works**

The Contractor shall confine his activities strictly to the working area defined as depicted on the construction drawings. He shall not encroach upon any roadway except with the prior written approval of the Employer's Agent.

The Contractor shall further ensure that all public roads that are used for access to the site are kept free of debris at all times. Any rock or debris falling from trucks onto roads shall be removed immediately. Precautions shall be taken to prevent fouling of public roads or private surfaces. The Employer's Agent may order the Contractor to sweep / clean roads or surfaces where debris may constitute a danger to the public or a nuisance to the owners.

The Contractor shall, where necessary on or adjacent to any roadway, provide all the necessary barricades and signs in accordance with the stipulations of the South African Road Traffic Signs Manual.

Access to all public and private property in the direct vicinity of the Site must be maintained at all times. Where trenches cross the access point to any property, the Contractor shall arrange adequate and safe vehicular and pedestrian crossings over the trenches. The Employer's Agent must approve the method of providing access before any excavation commences.

##### **Care, damage, and protection**

The Contractor shall, throughout the Contract, take adequate precautions to protect all existing services from damage whether they have been pointed out to him.

Should the Contractor consider that damage to buildings and structures is unavoidable in the carrying out of any portion of the Works, he shall obtain the approval of the Employer's Agent before proceeding with the work.

Where damage is noticed before commencement of work on that erf, this should be reported to the Employer's Agent in order to prevent a possible liability claim from the owner.

Wherever excavations or loading of material is likely to form dust, the Contractor shall apply an effective method of dust control, to the satisfaction of the Safety Agent.

#### **C3.4.9 Permits and way leaves**

The Contractor will be required to obtain permits and wayleaves from all the applicable service providers within the jurisdiction of the Local Municipality, thus including the following services: roads and stormwater (Mpumalanga Department of Roads and Transport included), bulk- and internal water supply, electricity (Eskom included), telecommunications (Telkom included), and any additional service providers that may have services in the direct

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vicinity of the Site. This will also include any other permits required for gravel prospecting and extraction that shall be applied and obtained from the relevant authority for the purposes of securing borrow pits, other than those covered by the Mineral and Mining Permit.

The Employer will assist the Contractor to obtain clearance from the various departments with services that are likely to be affected by the Contract. It is, however, the Contractor's responsibility to obtain final permit and wayleave approval according to applicable procedures and specifications.

All associated costs to obtain permits and way-leaves as required for the carrying out of the works, where such affect other services, shall be deemed to have been included in the scheduled rates for SANS 1200A or SANS 1200AA or SANS 1200AB where pricing provision for such items have been allowed for in the pricing schedules, alternatively it shall be deemed to be included in the various scheduled activity rates or prices provided by the Contractor.

The Contractor will be responsible for maintenance of all permits and / or wayleaves for the duration of the Contract and will be kept responsible for any damages incurred due to deviation from the approved permit.

#### **C3.4.10 Alterations, additions, extensions, and modifications to existing works**

The Contractor shall, within 20 working days, or 10% of the construction period after taking possession of the site, whichever is the lesser, satisfy himself that the dimensional accuracy, alignment, levels and setting out of existing structures or components thereof are compatible with the proposed works, and notify the Employer's Agent of any areas of dissatisfaction.

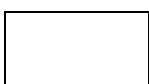
The Contractor shall, on becoming aware of a defect in existing works which will have an impact on the current works, notify the Employer's Agent of such a defect without delay.

#### **C3.4.11 Inspection of adjoining properties**

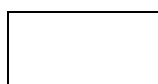
The Contractor shall, before commencing with works which have the potential to damage surrounding structures, services, buildings or property, arrange an inspection with the owners of such structures, services, buildings and property and representatives of local or controlling authorities, as appropriate, to determine the condition of buildings, structures, services, paved surfaces, roads, kerbs, channels and the like, that the works could affect, and document their current condition in sufficient detail to enable disturbances or damage which might be caused by the works to be evaluated. The Contractor shall furnish the Employer's Agent with copies of all such documentation and shall be held responsible for any disturbance and damage to such structures, services, buildings, and property arising from the performance of the Contract as well as any costs involved in refuting or processing such claims.

#### **C3.4.12 Water for construction purposes**

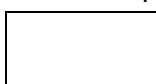
The Contractor shall make his own arrangements with the Employer / Local Municipality to obtain a **potable water** metered standpipe connection and shall give the Local Municipality



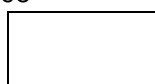
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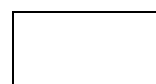
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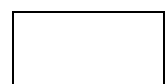
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at least 14 days' notice of this requirement. The size of the connection provided will be as specified in the Water and Sanitation By-laws.

The Contractor may only draw water from fire hydrants through means of a legal and metered standpipe owned by the Local Municipality. Failure to use such a metered standpipe(s), or using illegal, non-municipal owned equipment for purposes of drawing water from fire hydrants, will result in the Contractor having to pay an account to the Local Municipality, for an amount determined by the Local Municipality.

The metered standpipe(s) must be made available to the Local Municipality's water inspectors for purposes of reading and inspection. Failure to do so will result in the immediate withdrawal of such metered standpipe(s). The Contractor shall be responsible to return defective metered standpipe(s) if it is found to be not registering consumption, or to have any other defect. Failure to do so will result in an account being levied, payable to, and determined by the Local Municipality. Claims for delays caused where standpipe(s) are withdrawn and/or replaced will not be considered.

The current water tariffs applicable to the Contract are available from the Local Municipality.

Alternatively, the Contractor may choose to erect his own facilities for the extraction, handling, and use of construction water from boreholes sunk on Site and / or from extraction facilities erected in the Gabosch River. The Contractor shall ensure that water for construction purposes complies with the relevant SANS specifications (potable and others).

The Contractor shall ensure that all construction water, derived either from the Local Municipality or from Site, is tested periodically / monthly by an accredited laboratory against the specifications, and shall keep thorough referenceable water quality test results for same.

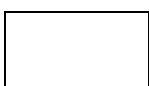
#### **C3.4.13 Survey control and setting out of the works**

Permanent survey beacons exist on the Site of the Works and are indicated on the layout and key plans issued with the tender. The Contractor shall use these survey beacons to set out the Works. The position and co-ordinates of the permanent survey beacons are shown on the drawings.

The Contractor shall be responsible for the protection of all survey beacons and reference points that he receives from the Employer's Agent and that are shown on the drawings, as well as any cadastral points (erf and block corner beacons) that are encountered, for the period from handing over of the Site to the Contractor to completion of the Works.

The Contractor shall be responsible for the detail setting out of the Works from the established beacons. A registered surveyor shall carry out such setting out as well as the replacement of disturbed beacons. In the event that the Contractor disturbs cadastral beacons, the registered surveyor shall issue a certificate to confirm the correct replacement of such beacons in accordance with the statutory requirements. No separate payment shall be made in respect of setting out or replacement of beacons, such work being deemed as included in the rates tendered for construction of the Works.

The Contractor's survey records shall be available for inspection by the Employer's Agent



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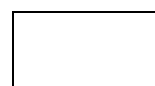
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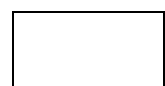
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during the duration of the project.

### **C3.5 Management**

#### **C3.5.1 Management of the works**

##### **Planning and programming:**

##### **Work Plan**

Seven days prior to commencing with any part of the Works, the Contractor shall submit to the Employer's Agent for review and approval, a work plan detailing the procedure and schedule to be used to carry out such works, detailing and substantiating any deviation from the originally proposed approach. Further, the work plan shall include a:

- a) time frame;
- b) description of all equipment and tools to be used;
- c) list of personnel and their qualifications and experience (including back-up personnel if an individual is unavailable);
- d) list of sub-contractors, schedule of work activity;
- e) safety plan (clearly highlighting any potentially hazardous substances to be used);
- f) traffic control plan (if applicable);
- g) environmental protection plan; and
- h) contingency plans for possible problems.

The approval given by the Employer's Agent shall in no way relieve the Contractor of the ultimate responsibility for the satisfactory completion of the work as prescribed under this Contract.

The Work Plan shall be comprehensive, realistic, and based on actual working conditions. Further it shall form the various sub-sections of the overall Contract programme and plan.

##### **No works shall be allowed to commence without an approved work plan.**

##### **Planning**

The Contractor shall ensure that he:

- a) is well informed regarding the Employer's RBIG capital expenditure commitments and commit resources as required to efficiently complete this contract; and
- b) delivers goods and services timeously to meet the Employer's performance standards, and not unduly delay any other contractors, service providers and suppliers.

##### **Programming**

In order to ensure a clear understanding, at the inception of the Contract, of the programming and documentation format requirements, the Contractor shall appoint a project programmer / planner for liaison during the Contract. The Contractor shall for the Contract Period provide and regularly update (maximum monthly) a Contract Programme in MS Project.

The programme shall at minimum contain:

- a) Time Scale (minimum):
  - i. Days, where the period does not exceed three months.
  - ii. Weeks, where the project exceeds three months.
  - iii. Months, where the project does not exceed one year.
  - iv. Years, when the project exceeds one year.
- b) Tasks: Where phases or stages are anticipated, this shall be the highest level of decision and all tasks related to the successful accomplishment of that phase of the area shall be grouped. Resources allocation and task dependency shall be indicated.



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- c) Start and Finish Dates: All tasks shall have specific start and finish dates.
- d) Critical Path: All tasks forming the programme line that will establish any delays in the overall Contract Period shall be clearly indicated and an indication of their sensitivity characteristics shall be provided.
- e) Progress Tracking: The Contract shall be required to periodically indicate progress per task graphically and on a percentage basis.
- f) Non-working Time: All South African public holidays, weekends and the local traditional builder's break shall be incorporated in the programme.

No deviation from the approved sequence of construction shall be accepted without prior written approval.

The programme shall not be in the form of a bar chart only, but shall show clearly anticipated quantities of work to be performed each month, together with the manner in which the listed plant is to be used, as well as the anticipated earnings for the various sections of work.

**A Contract Programme shall be submitted to the Employer's Agent no later than 28 days after Commencement of Contract.**

The Contractor shall provide the Employer's Agent with a method statement indicating the manner and sequence in which he intends to construct the works, for each work area, with the programme. In the method statement the Contractor must address as least the following items:

- a) sequence of the works for the relevant works area;
- b) target dates for the tasks identified in the sequence of the works for the relevant works area;
- c) materials requirements;
- d) construction plant to be used;
- e) services affecting construction; and
- f) any factor that could affect construction progress after commencement.

The method statement must be approved by the Employer's Agent before commencement of construction. In order to minimise the impact in traffic, pedestrians and business, the Contractor will be required to segment the works in such a manner that no portion of the works is more than one day ahead of the following position. The segments of the works shall be clearly defined in the Contractor's method statement for each work area.

If, during the progress of the work, the quantities of work performed per month fall below those shown on the programme, or if the sequence of operations is altered, or if the programme is deviated from in any other way, the Contractor shall, within one week after being notified by the Employer's Agent, submit a revised programme.

If the programme is to be revised by reason of the Contractor falling behind his programme, he shall produce a revised programme showing the modifications to the original programme necessary to ensure completion of the Works or any part thereof within the time for completion. Any proposal to increase the rate of work must be accompanied by positive steps to increase production by providing more labour and plant on the Site, or by using the available labour and plant in a more efficient manner.

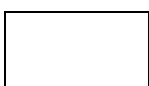
Failure on the part of the Contractor to submit or to work according to the programme or revised programme shall be sufficient reason for the Employer to take steps as provided for in the Contract.

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

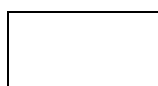
### **Sequence of the works**

Notwithstanding any changes that the Employer's Agent deems necessary the sequences should include the following:

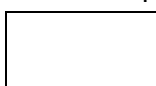
- Mobilisation, project planning and control and communications to stakeholders
- Setup site offices and workshops
- Construct access road to site including temporary access at river crossings for others to access for bulk power supply and quarry
- Construct 11kv overhead power line from bulk supply connection point to site
- Open quarry, strip topsoil to temporary stockpile areas and remove overburden to drainage bunds and crusher/aggregate plant platform area.
- Create platform for stockpile, concrete batch plant and crusher/screening plant.
- Set up crusher and screening plant.
- Mine lower grade rock for dam rockfill and stockpile. Mine higher grade rock for crushing and grading for concrete production.
- Erect concrete batch plant, silos and commission
- Produce and test concrete trial mixes
- Erect tower crane (s)
- Clear and strip dam solum area.
- Bulk excavation to upstream river coffer dam, intake channel foundation, blocks 6,7,8 & 9, left flank access to causeway, left flank to abutment blocks 9 to 14, retaining wall footprint Ch 100 & Ch170, Spillway blocks 2,3,4 & 5 and spillway floor area.
- Foundation preparation and first stage concrete.
- Bulk excavation to rockfill embankment riverine area left, centre and right flank.
- Construct upstream cofferdam culverts, diversion inlet culvert, cofferdam causeway, right flank approach and do first phase river diversion.
- Construct causeway right bank of river.
- Second phase river diversion.
- Construct left flank apron, gravity wall CH170, central spillway blocks 3,5,4 & 6, left bank causeway and left flank gravity wall blocks 9 to 14.
- Third phase river diversion
- Construct rockfill embankment in riverine area complete including retaining wall CH100, spillway block 2 and remaining right part of the apron.
- Quarry rehabilitation
- De-establishment of site, project close out and communication to stakeholders.



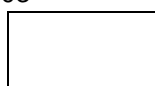
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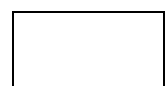
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Employer



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### **Software application for programming**

The construction programme shall be completed in Microsoft Project Standard 2010 or compatible software. The construction programme and updated versions thereof shall be made electronically available to the Employer's Agent.

### **Methods and procedures**

The Contractor shall submit to the Employer's Agent, within a period stated in the Contract Data, a detailed construction programme complying to the requirements of the Contract, as well as the dates, durations and extent of traffic accommodation, interruption of electrical supply and any other expected service interruptions to customers. The detailed programme shall be based on the preliminary programme submitted with the tender and shall make allowance for the following:

- Normal working hours shall be between 07:00 - 17:30, Mondays to Fridays, and between 07:00 - 13:00 on Saturdays, with no work allowed outside these working hours.
- Should the Contractor intend to work outside normal working hours, written permission shall be obtained from the Employer's Agent and all additional costs arising out of such work shall be for the Contractor's account.
- Only one side of a road or street may be affected by construction at any time.
- The Employer's Agent may require that the construction of certain road crossings be done outside normal working hours.

The Employer's Agent shall provide the Contractor with drawings and details of the Works that needs to be done.

Once a detailed programme has been approved, the Contractor shall not deviate from the planned operations.

General:

- The Contractor shall arrange for the advance warning to the public of any intended shutdown or interruption of services necessary in his opinion for the proper carrying out of the Works.
- All disconnections and reconnections, connections to existing mains / transformers / intersections, closing and opening of valves, and disruption of water- or electrical supply must be liaised with the Employer at least 7 working days prior to the action.
- The disruption of supply or service, and the duration of disruption, shall be kept to a minimum. Consumers are to be informed of any disruptions as described later in the specifications and / or as required by the Employer.
- Any claims from property owners and / or the community will be considered and evaluated by the Employer's Agent and, should he find a valid claim, and find that the Contractor has neglected his responsibilities and / or duties (which led to the claim), the Contractor will be responsible for settling the claim.

### **Quality plans and control**

The Contractor shall be responsible to produce work that conforms in quality and accuracy of detail to the requirements of the specifications and drawings. The Contractor shall (at his own expense) institute a quality control system and provide experienced personnel and all transport, instruments, and equipment to ensure adequate supervision and positive control of the works at all times.



Contractor



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Witness 2



Employer



Witness 1



Witness 2

The cost of supervision and process control will be deemed to be included in the rates tendered for the related items of work.

On completion and submission of every part of the Works to the Employer's Agent for examination, the Contractor shall furnish the Employer's Agent with proof of quality in the form of a data pack containing measurements, levels and all compaction and hydraulic test results to indicate compliance with the scope of work.

### **Environment**

The Contractor shall obtain and adhere to all the requirements and restraints pertaining to environmental conditions from the Environmental Management Plan / Specifications annexed to this document as Annexure C.

### **Accommodation of traffic on public roads occupied by the Contractor:**

#### **Accommodation of traffic (where applicable)**

The Contractor shall ensure the safe accommodation of traffic at all areas where the work may impact traffic and shall provide all delineators, watching, lighting, sign and barricades required by the road authorities, and in accordance with the South African Road Traffic Signs Manual.

#### **Access to properties (where applicable)**

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

At least 7 days before commencing any work affecting access to a property, the Employer's Agent and the occupier / owner of the each such property shall be notified of the Contractor's intention to commence work, the date of commencement, expected duration and arrangement which will be made regarding maintenance of access.

## **C3.5.2 Management of the works**

### **Other contractors on site**

The Contractor shall make adequate allowance for the possibility of other contractors working within the same area or in the direct vicinity of the project. The Employer will not allow any claims with respect to works being carried out by others.

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

The Contractor shall produce goods and services that shall conform in quality, and in accuracy of detail, to the requirements that is specified. The Employer's Agent and his representatives has no duty to act as foreman or surveyor of the Works.

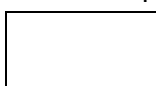
The Contractor shall provide (at his own expense) all experienced engineers, -foremen, -surveyors, and all transport, instruments, and equipment necessary to enable him to supervise, check, and control the work.



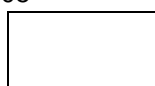
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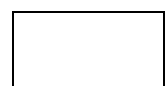
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Payment certification by the Employer's Agent of any completed work, accepted materials or goods, shall not signify approval or acceptance thereof. Failure by the Employer's Agent to reject defective work, -materials or -goods, shall neither relieve the Contractor of his obligations under the Contract, nor prevent later rejection when defective works or materials are discovered.

The Contractor shall satisfy himself (by tests, measurement and otherwise as may be necessary) that the work done meets the requirements of the Specifications prior to submitting any work to the Employer's Agent for examination. This information shall be submitted to the Employer's Agent together with the Contractor's request for examination.

The submission of the Contractor's test results shall not diminish the authority of the Employer's Agent to conduct any additional tests as he may consider necessary to determine the quality of the work performed by the Contractor. Should the Employer's Agent consider the Contractor's tests, measurements etc., to be either incorrect or not representative, he shall not be bound to consider same, and shall be authorised to decide on the number and type of tests, measurements etc. required, to enable him to judge the quality of the work.

Quality control and completion tests shall be in accordance with the relevant standard and amended specifications and additional specifications.

#### **Recording of the weather**

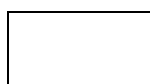
Rainfall records for the period of construction shall be taken on Site. The Contractor shall provide and install all the necessary equipment (including SANS approved rainfall gauge) for accurately measuring the rainfall. The Contractor shall also provide, erect, and maintain a security fence plus gate, padlock, and keys at each measuring station, all at his own cost, to prevent any undue interference by workmen and others. Measuring stations shall be erected on Site at locations approved of by Employer's Agent.

The Construction Manager or his representative shall take and record the daily rainfall readings and the Employer's Agent, or his representative, shall be permitted to attend these readings. Access to the measuring station(s) shall at all times be under the Construction Manager's control.

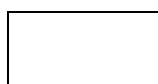
The gauge readings, as well as the date and time at which the reading was taken shall be recorded in a separate record book provided by the Contractor for this purpose. All entries in the rainfall record books shall be signed by the person taking the reading and the gauge shall be properly emptied immediately after each reading has been taken.

The rainfall records applicable to this Contract are those recorded at Amsterdam by the South African Weather Service. The following values of  $N_n$  and  $R_n$  shall apply:

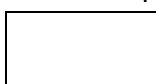
<b>Weather Station: NERSTON – POL (0444484 2), 1965 – October 2021, Amsterdam</b>		
<b>Lat: 26°34'08"S Lon: 30°47'28"E Height: 1525 m</b>		
<b>Month</b>	<b><math>R_n</math> (mm)</b>	<b><math>N_n</math> (Days)</b>
January	166,6	10,3
February	121,2	8,3
March	101,7	7,2
April	49,2	4,8
May	18,2	2



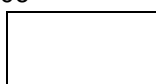
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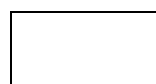
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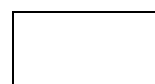
Witness 2



Employer



Witness 1



Witness 2

June	8	1,2
July	6,9	0,9
August	15,5	2
September	39,7	4,2
October	99,1	8,7
November	139,8	10,1
December	158,5	10,6
<b>TOTAL</b>	<b>924,5</b>	<b>70,2</b>

#### **Extension of time due to Abnormal Rainfall**

Extension of time for completion of the Contract shall be allowed in the event of abnormal rainfall in accordance with the following formula:

$$V = (N_w - N_n) + (R_w - R_n)/20$$

Where:

V = Extension of time in calendar days for the calendar month under consideration.

N<sub>w</sub> = Actual number of days during the calendar month under consideration on which a rainfall of 10mm and more is recorded.

R<sub>w</sub> = Actual total rainfall in mm recorded during the calendar month under consideration.

N<sub>n</sub> = Average number of days, derived from rainfall records, on which a rainfall of 10mm and more was recorded during the relevant calendar month as obtained from the South African Weather Service.

R<sub>n</sub> = Average total rainfall in mm for the relevant calendar month, derived from rainfall records, obtained from the South African Weather Service.

Where the extension of time due to abnormal rainfall has to be calculated for a portion of a calendar month, pro rata values shall be used. Should V be negative for any particular month, and should its absolute value exceed the corresponding value of N<sub>n</sub>, then V shall be taken as being equal to minus N<sub>n</sub>. The total extension of time to be granted shall be the algebraic sum of all the monthly extensions, provided that if this total is negative then the time for completion shall not be reduced due to subnormal rainfall.

#### **Format of communications**

The Employer and Contractor shall follow the communication protocol through the Employer's Agent and Construction Manager.

Communication media shall be site meetings, letters, e-mails, telephone calls, and standard forms incorporated into the document control system i.e., site instructions and inspection request forms. Verbal arrangements shall be transferred to the applicable communication media.

#### **Key personnel**

The Contractor shall provide detail of his key personnel (CV's, qualifications, and experience) to the Employer's Agent for approval prior to commencement of the works, and on each change of key personnel. Key personnel shall be of similar or higher qualification as provided at tender stage.

ContractorWitness 1Witness 2EmployerWitness 1Witness 2



The Contractor shall provide a staff organogram of the key personnel, containing their respective designations as well as their statutory appointments, and which shall be available for inspection on site.

### **Management meetings**

Fortnightly site meetings shall be arranged and facilitated by the Employer's Agent. Attendance by the Contractor's senior management staff shall be compulsory.

The Contractor shall report on project progress, financial progress, resources (human, plant, equipment, and materials), community issues, environmental issues, health and safety issues, payments, variations, penalties imposed, claims lodged and outcomes, and disputes and resolutions.

### **Forms for contract administration**

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

### **Electronic payments**

The Contractor shall ensure that electronic payments are made as far as practically possible. Proof of payments shall be obtained, reported on as required, and provided to the Employer's Agent for verification.

### **Daily records**

The Contractor shall keep daily site records as required by the Employer and Employer's Representative, and shall include labour, plant, materials, rainfall, health and safety issues, environmental issues, the daily diary, and any other record as may be communicated.

The records are the property of the Employer and shall be made available to the Employer and his appointed representatives within 24 hours of being requested.

### **Payment certificates**

The Contractor and Employer's Agent will measure the work on dates and times agreed upon, and will follow the following process:

- The Contractor shall provide a quantified payment certificate to the Employer's Agent on the 15<sup>th</sup> of each month.
- Quantification of completed work to measured in the presence of the Employer's Agent and/or his Representative and agreed by signed off quantification sheet.
- The Contractor shall provide proof of ownership of material on site (receipts or letter from supplier to state that ownership was transferred upon delivery).
- The Contractor shall provide a VAT Invoice after the Employer's Agent approved the payment certificate.
- The payment certificate shall be handed in to the Employer, accompanied by the monthly EPWP statistics.
- The payment certificate will be paid within 30 days from the date of receipt of the approved payment certificate.

### **Permits**



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

The Contractor shall ensure that a record of all permits and wayleaves are kept on site, maintained, and reported on as required.

**Proof of compliance with the law**

The Contractor shall provide proof of compliance to the Employer's Agent and his representatives, in terms of the applicable laws, regulations, statutory provisions, and agreements pertaining to the project.

**C3.5.3 Health & Safety**

The Contractor shall note the requirements of the following documents:

- Occupational Health and Safety Act (Act 85 of 1993);
- Construction Regulations (2014);
- Explosives Act (Act 26 of 1956) and Regulations;
- Explosives Act (Act 15 of 2003) (as soon as the Regulations is published);
- Minerals Act (Act 50 of 1991) and Regulations;
- Mine Health and Safety Act (Act 29 of 1996) and Regulations.

A copy of the approved Safety Plan shall be available on Site and be accessible to all permanent workers and appointed labourers.

The Contractor shall ensure legal compliance with Health and Safety issues, and he and his subcontractors shall remain registered and in good standing with the Workmen's Compensation Fund and maintain insurance indemnifying the Employer against penalties levied due to failure to comply with the respective acts and regulations.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

### **C3.5 Project Specification**

The Project Specification forms an integral part of the contract and supplements the standard specifications listed in Part C3.2 Construction under Item C3.2.1 Work Specifications. The Project Specification is made up of three portions as indicated here below.

#### **General / Standard Specifications**

This portion of the Project Specification contains general descriptions of the works, the site, and the requirements to be met. The standard specifications have been written to cover all phases of work normally required and may cover items not applicable to this particular contract.

#### **Amendments to General / Standard Specifications and Additional Specifications**

This portion of the Project Specification contains relevant information pertaining to choices and alternatives provided for in the Standard Specifications i.e., choices of materials or construction methods. It also contains some additional specifications and amendments to the Standard Specifications required for this particular contract.

The number of each clause and each payment item in this portion of the Project Specifications consists of the prefix PS followed by a number corresponding to the number of the relevant clause or payment item in the Standard Specifications. The item number of any new clause or payment item (that does not form part of an existing clause or a payment item in the Standard Specifications) is also prefixed by "PS" followed by a new number. The new numbers follow on the last clause or item number used in the relevant section of the Standard Specifications.

#### **Particular Specifications**

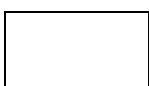
This portion of the Project Specification contains particular specifications applicable only to this project and consists of the prefix P followed by alphabetical numbering.

#### **Discrepancy between specifications**

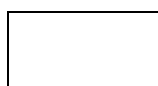
In the event of any discrepancy between a part or parts of the Standard- or Particular Specification and the Project Specification, the Project Specification shall take precedence. In the event of any discrepancy between the Specifications and the Drawings and / or the Bill of Quantities, the discrepancy shall be resolved by the Employer's Agent before the execution of the work under the relevant item.

#### **Numbering reference**

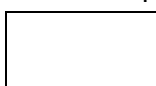
Where, in the Bill of Quantities, an item from a particular section of the Standard Specifications is used in another section, the item number of the source section is retained but prefixed by the number of the section where the item is used, (e.g., Item 61.03 used in Sect. 22, will be 22/61.03 which means that the provisions of Section 61 in respect of that item remain valid although the item is used in Section 22). This applies to new items introduced in the Project Specifications for a specific section but used in another section.



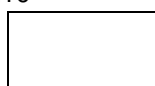
Contractor



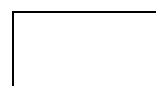
Witness 1



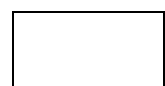
Witness 2



Employer



Witness 1



Witness 2

### **C3.5.1 General / Standard Specifications**

Part C3.4 Construction comprehensively cover the General and/or Standard Specification for the Project.

The road, quarry and dam works will primarily be based on standard specification SANS 1200 and COTO as listed below.

#### **Road, Quarry, and Dam Works:**

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 DE:	Small Dams
SANS 1200 DK:	Gabions and Pitching
SANS 1200 DM:	Earthworks (Roads, Subgrade)
SANS 1200 G:	Concrete (Structural)
SANS 1200 L:	Medium Pressure Pipelines
SANS 1200 LB:	Bedding (Pipes)
SANS 1200 LE:	Stormwater Drainage
SANS 1200 ME:	Sub Base
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
COTO Chapter 1.6:	Clearing and Grubbing
COTO Chapter 3.1:	Drains
COTO Chapter 4.1:	Borrow Materials
COTO Chapter 11.5:	Fencing
COTO Chapter 11.8:	Landscaping and Planting Plants
COTO Chapter 12.6:	Mechanically Stabilised Fill and Gabions
COTO Chapter 12.10:	Hard Excavation by Blasting
COTO Chapter 12.12:	Construction Dewatering

### **C3.5.2 Amendments to General / Standard Specifications and Additional Specifications**

#### **PS PROJECT SPECIFICATIONS RELATING TO THE STANDARD SPECIFICATIONS AND OTHER ADDITIONAL SPECIFICATIONS**

This portion of the Project Specifications deals with matters relating to the Standard Specifications.

Where reference is made in the Standard Specifications to the Project Specifications, this portion shall include the relevant information pertaining thereto, (e.g., the requirements where a choice of materials or construction methods is provided for in the Standard Specifications).

In certain clauses the Standard Specifications allow a choice to be specified in the Project Specifications between alternative materials or methods of construction, and for additional requirements to be specified to suit a particular contract. Details of such alternatives or additional requirements applicable to this contract are contained in this portion of the Project Specifications. It also contains some additional specifications and amendments to the Standard Specifications required for this particular contract.

The number of each clause and each payment item in this portion of the Project Specifications consists of the prefix PS followed by a number corresponding to the number of the relevant clause or payment item in the Standard Specifications. The item number of any new clause or payment item (that does not form part of an existing clause or a payment item in the Standard Specifications) is also prefixed by "PS" followed by a new number. The new numbers follow on the last clause or item number used in the relevant section of the Standard Specifications.

Where, in the Schedule of Quantities, an item from a particular section of the Standard Specifications is used in another section, the item number of the source section is retained but prefixed by the number of the section where the item is used, (e.g., Item 61.03 used in Sect. 22, will be 22/61.03 which means that the provisions of Section 61 in respect of that item remain valid although the item is used in Section 22). This applies to new items introduced in the Project Specifications for a specific section but used in another section.

## **AMENDMENTS TO SANS 1200 STANDARDIZED SPECIFICATIONS**

### **PSA PRELIMINARY AND GENERAL (SANS 1200 A)**

#### **PSA 3.1 Quality of Samples**

All materials used shall be suitable for the purposes for which they are intended. Materials shall comply with the requirements of the South African Bureau of Standards, where such standards are available.

### **PSA 5 CONSTRUCTION**

#### **PSA 5.1 Setting out of the work and protection of beacons (Sub-clause 5.1)**

The Contractor shall be responsible for the true and proper setting out of the Works from the basic control points shown on the Drawings or indicated by the Employer's Agent Representative on site and shall ensure the correct location of the Works in relation to such points. The Contractor has to ascertain himself of the correctness of the pegs and benchmarks in the field. Any discrepancy shall be immediately reported to the Employer's Agent. Any costs arising from failure to do so, shall be the responsibility of the Contractor. The Employer's Agent may alter any part of the works to suit local conditions if necessary. No claim for incorrect setting out will be considered. Clause PS 10.6 shall also apply.

##### **PSA 5.1.1 Services (Sub-clause 5.2)**

All excavations to expose existing known services shall be excavated by hand in all materials by the contractor. Any existing service in the road reserve or municipal servitude that is damaged as a result of negligence by the contractor will be repaired by the contractor to the satisfaction of the Employer's Agent at his own cost. Clause PS 10.1 shall also apply.

#### **PSA 5.2 Watching Barricading, lighting and traffic crossings, (Clause 5.2)**

All open excavations shall be properly demarcated with reflective tape, barricading and any other requirements that the Local Authority has.

#### **PSA 5.3 Protection of Structures (Clause 5.3)**

The contractor must contact house owners at least two weeks prior to working in close proximity to existing buildings and to inspect buildings before and after work had been completed.

#### **PSA 5.4 Protection of Overhead and Underground Services**

*REPLACE THE HEADING AND THE CONTENTS OF SUBCLAUSE 5.4 WITH THE FOLLOWING:*

#### **PSA 5.4 Location and Protection of Existing Services**

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

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

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

services existing in the area where it intends to work. Neither the Employer nor the Engineer offer any warranty as to the accuracy or completeness of such plans and because services can often not be reliably located from plans, the Contractor shall ascertain the actual location of services depicted on such plans by means of careful inspection of Site and the provision and utilisation of suitable detecting and testing equipment.

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 Sub-clauses 4.4 and 5.1.2.2 of SABS 1200D (as amended) 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 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 any such service is encountered or discovered on the Site.

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

- (a) Known Services, anywhere along the entire lengths of their routes, as may reasonably be deduced from the actual locations at which their positions were verified as aforesaid, due cognisance being taken of such deviations in line and level which may reasonably be anticipated.
- (b) any other service which ought reasonably to have been a Known Service in accordance with the provisions of this clause.
- (c) as well as for consequential damage, whether caused directly by the Contractor's operations or by the lack of proper protection.

Provided always that the Contractor will not be held liable in respect of damages occurring to services not being Known Services.

No separate payment will be made to the Contractor in respect of its 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

and these costs shall be deemed included in the Contractor's other bid rates and prices included in the Contract.

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

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

The Contractor shall take all reasonable precautions and arrange its operations in such a manner as to prevent damage occurring to all Known Services during the period which the Contractor has occupation and/or possession of the Site

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

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

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

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

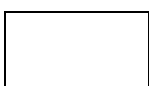
The Employer will accept no liability for damages due to a delay in having alterations or repairs affected by the respective service owners.

The Contractor shall provide all reasonable opportunity, access and assistance to persons carrying out alterations or repairs of existing services."

#### **PSA 5.7 Safety**

Add the following:

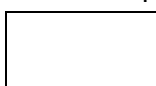
1. The Contractor shall at all times observe adequate safety precautions on Site to ensure the safety of his own staff as well as that of the public and other persons engaged in or about the Works. In this respect, he shall observe all laws, ordinances and regulations pertaining to his work.
2. The Contractor's attention is specifically drawn to the following Acts, and particularly to the relevant regulations under each Act, copies of which shall at all times be kept by him on the Site:
  - The Factories, Machinery and Building Work Act (Act 22 of 1941)
  - The Explosives Act (Act 26 of 1956)
  - The Mines and Works Act (Act 27 of 1956)



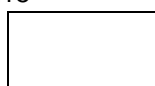
Contractor



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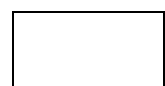
Witness 2



Employer



Witness 1



Witness 2



- The Occupational Health and Safety Act (Act 85 of 1993)
3. The Contractor is also required to comply with the safety precautions set out in the following publications, copies of which shall also be kept by him on the Site:
- The Code of Practice relating to the safety of men in civil Engineering inspection pits and small – diameter vertical shafts. (Transactions of the South African Institution of Civil Employer's Agents, Vol. 2, No. 11, November 1960, obtaining from the Secretary, S.A. Institution of Civil Employer's Agents, PO Box 93495, Yeovil, 2143).
4. The Contractor shall provide suitable and safe access by way of ladders, gangways, etc. to all parts of the Works as may be required for construction purposes or for inspection by the Employer's Agent or the authorised Inspectors in terms of the above-mentioned Acts.
5. All precautions shall be taken to protect workmen against falling material and/or objects and other dangers whilst they are carrying out their duties. Trenches shall in every way be made and kept safe for persons working therein.
6. All persons working, inspecting or supervising in places where falling material and/or objects could be encountered shall be provided by the Contractor with hard hats (which have not expired) of a type approved by the Inspector of Mines, the use of which shall be strictly enforced.
7. The Contractor shall provide a properly equipped first-aid box, which shall be accessible at all times.
8. Where adequate safety precautions are not being observed, the Employer's Agent may order the Contractor to comply with minimum safety requirements at the latter's expense. Compliance with such order will not absolve the Contractor from any of his responsibilities and obligations under the Contract.
9. The Contractor shall display on a prominent place the following emergency information:
- |                                      |                  |
|--------------------------------------|------------------|
| (a) Local Police                     | Telephone number |
| (b) Local Ambulance                  | Telephone number |
| (c) Local Fire Brigade               | Telephone number |
| (d) Nearest Doctor                   | Telephone number |
| (i) Name                             |                  |
| (ii) Telephone number (office hours) |                  |
| (iii) Telephone number (after hours) |                  |
| (iv) Consulting room street address  |                  |
10. The Contractor shall furthermore comply with the requirements of the "Safety Instructions" contained at the end of this document. (See Schedule 13)

#### **PSA 6.2 Degree of accuracy (Sub-clause 6.2)**

Degree of Accuracy shall apply to all components of the Works except where otherwise specified in the Schedule of Quantities and/or Drawings and provided that the minimum permissible deviation given for an element will prevail where more than one deviation can be interpreted in Clause 6.2.3(d).

#### **PSA 7 Testing (Sub-clause 7)**

The onus rests on the Contractor to produce work, which conforms in quality and accuracy of detail to the requirements of the Specifications and Drawings and the Contractor must at his own expense, institute a quality control system and provide experienced engineers,

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

foremen, surveyors, materials technicians and other technical staff, together with all instruments and equipment, to ensure adequate supervision and positive control of the works.

The cost of the all supervision and process control, including testing, so carried out by the Contractor, shall 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 sections of the Specifications regarding the minimum frequency of the testing that will be required for process control. The Contractor shall at his own discretion increase the frequency where necessary to ensure adequate control.

The Contractor shall submit to the Employer's Agent the results of all relevant tests, measurements and levels indicating compliance with the specifications on completion of every part of the work for examination.

Should the results of any of these tests fall below the required standards as specified in the specifications, the cost of any additional tests required by the Employer's Agent will be to the account of the Contractor.

**PSA 7.2 Laboratory (Sub-clause 5.2)**

A Laboratory for the use of the Employer's Agent Representative is not required on site. A commercial laboratory approved by the Employer's Agent and appointed by the Contractor shall do all acceptance control tests required in terms of the Contract. All tests must be done according to the tests prescribed in the SANS 1200 under the relevant sections.

**PSA 7.4 Statistical analysis of control tests (Sub-Clause 7.4)**

Statistical control methods will not be applied under this contract.

**PSA 8 MEASUREMENT AND PAYMENT**

**PSA 8.2.1 Fixed-Charge and Value-Related Items (Sub-clauses 8.2.1. and 8.3)**

The tendered sums for the fixed-charge and value related items in the P&G Section of the Schedule of Quantities shall not be subject to any variation if the actual value of the work done exceeds or falls short of the accepted tendered amount within the limit stated in Clause 6.3 of the General Conditions of Contract 2015, or if extension of time for the completion of the works is granted.

Payment for fixed-charged and value-related items will be done in three separate payments as follow:

40% of total cost after the Contractor has established and equipped the site office and after the Employer's Agent is satisfied that a substantial start of the actual construction work has been made;

40% of total cost after 50% of the actual work (excluding material on site) has been completed and approved by the Employer's Agent;

20% of total cost on issue of practical completion certificate by Employer's Agent, according to the guidelines of the GCC.

### PSA 8.2.2 Time-Related Items

The tendered amount for a time-related item will be increased if an extension of time for the completion of the works is awarded on the condition that the activity related to the item tendered for must be sustained during the extended period.

The ratio between the increased amount for a time-related item and the tendered amount must be the same as the ratio between the extension of the time period for the completion of the work and the original time period allowed for completion of the works.

If the works is completed before the end of the original time period allowed for completion of the works, the tendered amount of a time related item that is influenced by the earlier completion would be reduced similarly.

#### PSA 8.2.2.1 Standing time costs due to riot, etc. for the Contractor's total operation.

The unit for measurement shall be a working day, and a working week shall be held to consist of five working days and a working day of 9 hours, unless otherwise agreed upon. The sum per working day tendered under this time-related item shall represent that part of the Contractor's costs for standing time of whatever nature.

This payment item will only be applicable to delays in the execution of the Works and additional costs which in the opinion of the Employer's Agent are incurred as a result of riot, commotion, politically motivated sabotage and acts of terrorism, or disorder outside the control of the Contractor.

The provision of this clause shall in no way prejudice the right of the Employer or the Contractor to terminate the Contract under the provisions of Clause 9.8 of the GCC (2010).

#### PSA 8.3.2.2 Facilities for Employer's Agent

d) Conference/Boardroom.....Unit: Sum

#### PSA 8.4.2 Operation and Maintenance of facilities on site for the duration of construction, except where otherwise stated

The tendered sums for the fixed-charge and value related items in the P&G Section of the Schedule of Quantities would not be subject to any variation if the actual value of the work done exceeds or falls short of the accepted tendered amount within the limit stated in Clause 6.11 of the General Conditions of Contract (2015).

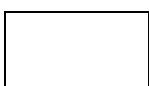
#### PSA 8.4.2.1 Facilities for Employer's Agent

##### a) Cellular Telephone

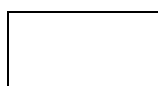
No cellular telephone has to be provided for the duration of the contract. However, the contractor is responsible for costs up to R 2850.00/month all-inclusive.

##### b) Name Boards

The amount of name board as specified in the bill of quantities shall be maintained for the duration of the contract.



Contractor



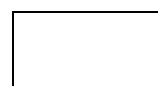
Witness 1



Witness 2



Employer



Witness 1



Witness 2

**c) Survey Assistants and Materials**

The Contractor shall provide the following survey equipment on the site from the commencement to the completion of the works, which shall also be for the use of the Engineer and his representatives.

- a) 2 x laser pocket measurement units to 20m max. or more;
- b) 2 x 100m steel and 2 x 5m steel measuring tapes;
- c) 50 x 10mm dia. Steel pegs, 400mm long;
- d) 2 x geological picks;
- e) Shovels, picks etc. which the Engineers representative may require during the contract;
- f) 1 Theodolite with aluminium tripod and 5m telescopic staff;
- g) 4 x 2m ranging rods; and
- h) One complete Troxler test unit, with proof of recent calibration.

The contractor shall provide two (2) survey assistants capable of noting and recording activities e.g., tape measurements, observing and recording time of concrete mixing and delivery and pass of compaction equipment on rockfill.

**d) Hotel or other accommodation required for the Employer's Agent and/or his representative**

These items will include the cost of rented office and/or accommodation and the provision of telecommunication facilities to the Employer's Agent. The Contractor will be responsible for this prime cost items up to the amount of R 15,000.00 per month.

These items will include all overhead costs, maintenance and insurance with respect to the provision of office accommodation and cellular- and landline telecommunication facilities. This item will be billed in advance and shall be payable to the Employer's Agent in advance prior to certification of the second construction payment certificate.

**e) Administrative assistance to the Contractor**

This item will entail the provision of administrative assistance to the Contractor by the Employer's Agent and will include assistance relating to the:

- Calculation and determination of project quantities;
- Compilation of construction payment certificates; and
- Copy and submission of construction payment certificate.

The Contractor will be responsible for this prime cost item to the amount of R 5,000.00 per month. This item will be billed in advance and will be payable to the Engineer prior to certification of the second construction payment certificate. This item will include all computer related / electronic work, facsimiles, printing and copying as well as travelling and time-based work in this instance.

**f) Health and Safety Inspections on Site**

This item will entail the provision for Health and Safety Inspection on Site.

**g) Environmental Management Plan Audits**

This item will entail the provision for Environmental Management Plan Audits.

**PSA 9.1 Submit detail as-built drawings of existing services and adjustments to construction drawings**

The contractor will be responsible for the submission of all as-built drawings of all existing services intersecting pipeline trenches as well as any applicable adjustments to the construction drawings. The lump sum tendered shall include full compensation for all information in the possession of the contractor as required above in order to complete the as-built drawings must be submitted to the Employer's Agent Representative before a certificate of completion will be issued for the works.

**PSA 9.2 Detailed setting out of the work**

The contractor will ensure that all the works be set out from existing survey beacons by a registered surveyor. The sum tendered shall be regarded as inclusive of all related survey work on site.

The Employer's Agent will provide survey beacons (of adequate type and in sufficient quantity) as bench marks. From information provided on drawings issued by the Employer's Agent, the Contractor shall be responsible to provide all positions and levels, of all intermediate points required for proper control of the works.

As bench marks may be disturbed during the execution of the works, all levels and setting out pegs shall be referred to at least two bench marks. The contractor will ensure that all works are set out from existing survey beacons by a professional registered land surveyor. The setting out data, including the elevation (obtain x, y, z coordinates) from these pegs shall be submitted to the Employer's Agent evaluate final natural ground levels (NGL) prior to the commencement of excavations. In the case of deviation from the original pipe route for whatever reason, the contractor will at his own cost survey the new proposed route, and submit the data to the Employer's Agent for approval.

Preservation and replacement of beacons and pegs will be subject to the Land Survey Act, 1927 (Act No 9 of 1927).

**PSA 9.3 Compile and submit Health and Safety Plan**

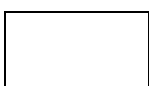
The lump sum tendered shall include full compensation for the provision and maintenance of a Health and Safety Plan, risk assessment, permit applications and notifications as called for in the Act and Regulations.

Eighty percent (80%) of this amount will be paid when an approved Health and Safety Plan has been achieved. A further 10% will be paid when the value of work certified by the Employer's Agent exceeds one half of the tender price and the remaining 10% will be payable upon issue of a completion certificate.

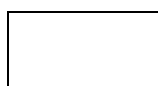
**PSA 9.4 Implement Health & Safety Plan**

The lump sum tendered shall include full compensation for the compliance with the approved H&S Plan and inter alia for the following:

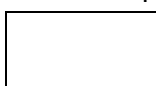
- (a) Provision and maintenance of Health & Safety File;
- (b) Provision of construction supervisors and safety officers;
- (c) Health and Safety training for employees and subs;



Contractor



Witness 1



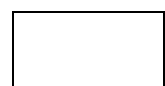
Witness 2



Employer



Witness 1



Witness 2

- (d) Provision of protective clothing;
- (e) Provision of safety fences, signs and barricades; and
- (f) Scheduling of monthly safety meetings and providing monthly reports accordingly, etc.

#### **PSA 9.5 Provision of realistic construction programme**

The lump sum tendered shall include full compensation for the compilation and submission of a realistic construction programme for approval by the Employer's Agent:

- (a) Within the stated period after appointment; and
- (b) Before commencement with any construction activities;
- (c) As and when so required / instructed by the Employer's Agent.

#### **PSA 9.6 Environmental Management Plan Obligations**

The lump sum tendered shall include full compensation for the provision and maintenance of an Environmental Management Plan in terms of the approved Environmental Management Programme as specified.

#### **PSA 9.7 Implementation of Environmental Plan and Environmental monitoring**

The lump sum tendered shall include full compensation for compliance with the conditions stipulated in the Environmental Authorisation as well as Environmental Management Programme (EMPr) for the duration of construction. A detailed schedule to be included as appendix to the Bill of Quantities, to demonstrate sufficient provision has been made in costing of item 1.51 to meet and maintain EMPr requirements for the duration of construction. The schedule to contain as a minimum the items allowed for in the Environmental Specifications (Annexure C), Clause, Measurement and payment, Sub Clause 9.2 Scheduled items. The tenderer is to ensure that sufficient provision is made to cover costs in complying with the provisions of the Environmental Specifications. No separate measurement and payment will be made for Environmental compliance, except for items 1.50 to 1.51 in Section 1: General Items and 3.38 to 3.46 Section 3: Temporary works in the Bill of Quantities.

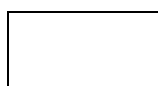
#### **PSA 9.8 Control of Water**

The Contractors are warned that the water table might be high due to the location of the construction site, fact that this site is situated in a high rainfall area and considering that the construction period may run into rainy season.

The Contractor shall at all times and in all respects be responsible for the handling of stormwater from higher-laying areas above the Works and for the handling of any sub-surface water especially in excavations for terraces and trenches that may affect the Works and for the handling of all spoiled water when disconnecting existing water connections or valves. All payments to be made in this regard and all costs related thereto, shall be deemed to be included in the relevant items that are included in the Schedule of Quantities.



Contractor



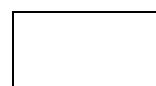
Witness 1



Witness 2



Employer



Witness 1



Witness 2

## **PSAB ENGINEER'S OFFICE**

The Contractor to provide one furnished site office for the use of the Employer's Agent and his representative safe to the requirements of SANS 1200 AB 3.2 or similar approved. A monthly time-related provisional sum has been included in the Schedule of Quantities to cover the rental costs of accommodation for the Employer's Agent Representative. These amounts shall be payable by the Contractor to the Employer's Agent according to the provisional sums allowed and upon receipt of a tax invoice for such amounts.

The Contractor shall provide and maintain a double carport with waterproof roofing for the duration of the Contract for the use of the Employer's Agent. The floor shall consist of crushed aggregate to alleviate dusty and muddy conditions or similar approved.

## **PSAB 3.2 Office Buildings**

See PSA 8.3.2.1 (a). The Contractor shall further ensure that adequate site meeting facilities are available, and that the Engineer's representative has full use of the Contractors ablution and other facilities.

## **PSAB 5.5 Survey Equipment**

The Contractor shall provide the necessary survey equipment for his own survey requirements on site. Equipment and personnel to be supplied to the Engineer's Representative are listed above in PSA 8.4.2.1.(c). The Engineer's Representative may also make use of the Contractor's survey equipment and assistants when required. The Contractor shall make allowance for such usage in his bid rates.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**PSC SITE CLEARANCE (SANS 1200C)**

**PSC 3.1 Disposal of Material**

*Add the following:*

"The Contractor shall obtain his own dumping sites for the disposal of material and all transport costs shall be included in the rates tendered for site clearance."

**PSC 8 MEASUREMENT AND PAYMENT**

**PSC 8.2.1 Clear and Grub.....Unit: ha, m, m<sup>2</sup>**

The removal of all rocks and boulders on site over 0,15m<sup>3</sup> will be paid under sub-clause DB 8.3.2(b).

**PSC 8.2.11 Take down, spoil or re-erect existing fences.....Unit: m**

The rate shall cover the cost of removal and stacking of all types of fencing material, including all gates, as well as the re-erection thereof with the existing material to the condition it was before removal. No payment will be made for the replacement of fence material that has been damaged by the Contractor and all costs for this are deemed to be covered by the rates for the appropriate items. Payment for new fencing installed only where instructed and approved by the Employer's Agent base on inspection of the fencing prior to removal.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2



## **PSD EARTHWORKS (SANS 1200 D)**

### **PSD 2 INTERPRETATIONS**

#### **PSD 2.3 DEFINITIONS**

*Replace the definition for "Specified density" with the following:*

"Specified density: The specified dry density expressed as a percentage of modified AASHTO dry density."

*Replace the definition for "stockpile" with the following:*

"Stockpile (verb): The process of selecting and, when necessary, loading, transporting and off-loading material in a designated area for later use for a specific purpose."

*Add the following definitions:*

"Commercial Source: A source of material provided by the Contractor, and including any borrow pit, provided by the Contractor.

Fill: An embankment or terrace constructed of material obtained from 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."

### **PSD 3 MATERIALS**

#### **PSD 3.1 CLASSIFICATION FOR EXCAVATION PURPOSES**

##### **PSD 3.1.2 Classes of Excavation**

Refer to PSDB 3.1

### **PSD 5 CONSTRUCTION**

#### **PSD 5.1 PRECAUTIONS**

##### **PSD 5.1.1 Safety**

###### **PSD 5.1.1.1 Barricading and Lighting**

Replace "Machinery and Occupational Safety Act, 1983 (Act 6 of 1983)" WITH "Occupational Health and Safety Act, 1993 (Act 85 of 1993)".

###### **PSD 5.1.1.2 Safeguarding of Excavations**

Replace "Machinery and Occupational Safety Act" WITH "Occupational Health and Safety Act, 1993 (Act 85 of 1993)".

###### **PSD 5.1.1.3 Explosives**

Replace the contents of this sub-clause 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:



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

The Employer's Agent 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 Employer's Agent does not entitle the Contractor to additional payment for having to resort to less economical methods of construction.

The Employer's Agent's prior written approval shall be obtained for each and every blasting operation. This approval may be withheld if the Contractor does not use explosives responsibly and carefully.

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.

Before blasting is undertaken, the Contractor shall satisfy the Employer's Agent 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 Employer's Agent 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.

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.

All accidents, injury to persons and animals and damage to property shall be reported to the Employer's Agent in detail and in writing as soon as is practicable. The Employer's Agent shall be given 24 hours' notice by the Contractor before each blasting operation is carried out.

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 over break allowances specified in the Project Specifications or given on any drawing.

Notwithstanding the Contractor's compliance with the above provisions, the Contractor shall remain liable for any injury to persons and animals and loss of or damage to property occurring as a result of blasting operations."

#### **PSD 5.1.2 Existing Services**

##### **PSD 5.1.2.2 Detection, Location and Exposure**

*Replace the contents of sub-clause 5.1.2.2 with the following*

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

"The exposure by the Contractor of underground services, as required in terms of Sub-clause 5.4 of SANS 1200 A (as amended) shall be carried out by careful hand excavation at such positions and to such dimensions as are agreed to by the Employer's Agent.

Unless otherwise instructed or agreed by the Employer's Agent, 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:

- In roadways: 93% Mod AASHTO density; and
- In all other areas: 90% Mod AASHTO density.

#### **PSD 5.1.2.3 Protection of cables**

*Replace sub-clause 5.1.2.3 with the following*

#### **PSD 5.1.2.3 Protection During Construction**

Further to the requirements of Sub-clause 5.4.2 of SANS 1200A (as amended), major excavating equipment and other Plant shall not be operated dangerously close to Known Services.

Where necessary, excavation in close proximity to Known Services shall be carefully carried out with suitable hand tools, excluding picks wherever their use could damage the services. No additional payment will apply to such more difficult work.

Should any service not being a Known Service be discovered or encountered during the course of the Contract, the Contractor shall, in addition to complying with the requirements of Sub-clause 5.4.2 of SANS 1200A (as amended), immediately notify the Employer's Agent thereof and implement such measures as will prevent damage of such service or, if it was damaged in the course of discovery, will prevent and minimise the occurrence of any further damage occurring."

#### **PSD 5.1.2.4 Negligence**

*Delete sub-clause 5.1.2.4.*

### **PSD 5.2 METHODS AND PROCEDURES**

#### **PSD 5.2.2.1 Excavation for General Earthworks and for Structures**

*Add the following to paragraph (b):*

"When the nature of the material precludes the above procedure, additional excavations shall be carried out to provide working space for the erection of formwork. In general, payment will be made for excavating a working width of 600 mm, but the Contractor may excavate a greater working width at no additional cost to the Employer."

Replace the first sentence of paragraph (e) with the following:

"Where excavations have been carried below the authorised levels, the Contractor shall backfill such excavations to the correct level with approved gravel compacted to 90% of modified AASHTO density or to the density of the surrounding material, whichever is the higher density.

Where excavations for structures have been carried out in hard material, the Employer's Agent may direct that over-excavation be backfilled with weak concrete if there is a danger of settlement or differential settlement of the foundations.

Where the sides of excavations against which concrete is to be cast have been over-excavated or have collapsed partially, the Contractor shall re-trim the excavations if necessary and, unless other remedial measures are agreed to by the Employer's Agent, shall cast the concrete for the structure, including the additional concrete that may be required as a result of the over-excavation or partial collapse. The cost of the additional concrete or remedial measures shall be for the Contractor's account."

#### **PSD 5.2.2.3 Disposal**

*Replace the second sentence with the following:*

"The Contractor shall, provide 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. Transport costs shall be included.

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.

Add the following sub-clause in sub-clause 5.2.2:

#### **PSD 5.2.2.4 Selection and Stockpiling**

Approval or designation of the material in a particular borrow pit or excavation for a particular purpose does not imply that all the material in the borrow pit or excavation is suitable for the particular purpose for which the said approval or designation relates, nor that all material in the borrow pit or 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 its 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 Employer's Agent's opinion, unsuitable for use in embankments or backfill as a result of contamination, shall be disposed of in a manner acceptable to the Employer's Agent and shall be replaced by the Contractor with materials acceptable to the Employer's Agent, all at the Contractor's cost.

When required, or when ordered by the Employer's Agent, material shall be stockpiled for later use.

#### **PSD 5.2.2.5 Utilization of excavated material**

All excavated material and material obtained from any temporary work shall, in so far it is suitable, be utilized for backfill of trenches or embankments where applicable. Material unsuitable for use as backfill or in excess of the required quantity to complete the backfill shall be spoiled or utilized as directed by the Employer's Agent. Excavated material may be stockpiled or used for temporary earth berms in order to control surface stormwater or to prevent flooding of the construction site as applicable. However, any and all such

temporary earthworks shall be removed, shaped, compacted, and treated etc. as specified and/or instructed by the Employer’s Agent on completion of the original Scope of Work.

#### **PSD 5.2.2.6 Excavation limits for payment purposes**

For measurement and payment purposes, the limits of the excavations for structures shall be as shown on the Drawings.

Where no excavation limits are shown on the Drawings and the Employer's Agent has decided that formwork has to be provided for the sides of a concrete member, the limits of the excavation for measurement and payment purposes shall be the vertical planes 0,5 m outside the perimeter of the concrete member for which the formwork is to be provided, and the founding level shown on the Drawings.

#### **PSD 5.2.2.8 Unsuitable material**

Any and all boulders, clay, logs, roots or any other unsuitable material identified during excavation, shall be transported and spoiled. Clause PSD 5.2.2.3 shall apply.

Where, in the opinion of the Employer's Agent, any unsuitable material is encountered at foundation level, such material shall be removed up to a level indicated by the Employer's Agent, and shall be replaced with suitable foundation fill or mass concrete as instructed or detailed, in accordance with the requirements of clause PSD 5.2.3.4 of this section.

#### **PSD 5.2.2.9 Preparation of the founding surface**

Where hard material suitable for founding is encountered at the founding level, it shall be cut and trimmed to a firm surface, either level, stepped or serrated, as may be required. Where there are indications that the material at the founding level will be soft material or hard material that will deteriorate rapidly on exposure, the excavation of the final layer with a thickness of 150 mm shall be postponed until just before the blinding layer is placed.

Where ordered by the Employer's Agent, excavations shall be extended to a specified depth below the given undersides of the slabs and footings to make provision for the placing of a concrete blinding layer.

#### **PSD 5.2.3.3 Backfill and fill near structures**

##### **General**

- When placing backfill and fill, the following precautions shall be taken:
- In so far as it is possible, the material shall be placed simultaneously to approximately the same elevation on both sides of a structure or structural member where appropriate. If conditions require that backfill or fill be placed appreciably higher on one side than on the opposite side, the additional material on the higher side shall not be placed until authorized by the Employer's Agent and preferably not until the concrete has been in place for 14 days, or until tests show that the concrete has attained sufficient strength to withstand any pressure safely that has been created by the backfill or fill or by the method of construction.
- The material behind structural members restrained at the top by the superstructure, e.g., portal-type structures shall be placed as stated on the Drawings or as directed by the Employer's Agent.
- The material behind the walls of concrete culverts shall not be placed until the top slab has been placed and cured, unless otherwise authorized by the Employer's Agent.

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Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

#### Backfill

- Excavated areas around structures, between the structure and the vertical walls of the surrounding excavation, shall be backfilled with approved material in horizontal layers not exceeding 150 mm in depth after compaction, to the level of the original ground surface or to the level specified on the Drawings. Each layer shall be moistened or dried to the optimum moisture content for the material and be compacted to a density of not less than 90 % of modified AASHTO density, except that, in a road prism, the material shall be compacted to a density of not less than 93 % of modified AASHTO density. In cases where structures are founded on backfill material, the density shall be as specified in the Project Specifications, but shall not be less than 95 % of modified AASHTO density.
- Prevention of wedge action
- Before the fill in the space between a structure and any adjacent sloping fill and the backfill between a structure and the sloping sides of the surrounding excavation is constructed, the slope of the fill and of the sides of the excavation shall be benched or serrated in order to prevent wedge action between the structure and the fill or the sides of the excavation during backfilling and compaction.
- The distance between the exposed face of the structure and the toe of the fill of the excavation side shall be sufficient to allow proper compaction.

#### PSD 5.2.3.4 Foundation fill

If, during the course of excavation, it is found that the material at the indicated founding depth does not have the required bearing capacity, the excavations shall be extended at the discretion of the Employer's Agent until satisfactory founding material is encountered. The Employer's Agent reserves to himself the right to order the Contractor to make up the difference in levels with foundation fill.

Foundation fill consisting of granular material shall be constructed in layers not exceeding 150 mm in thickness after compaction. Each layer shall be moistened or dried to optimum moisture content for the material and be compacted to a density of not less than 95 % of modified AASHTO density.

Mass concrete fill to be used shall be of the class or mix specified or directed by the Employer's Agent.

#### PSD 5.2.5 Transport for Earthworks

*Add the following new sub-clause in 5.2.5:*

##### PSD 5.2.5.1 Freehaul

*Add the following new sub-clause in 5.2.5.1:*

A Freehaul distance of 5,5km shall apply.

##### PSD 5.2.5.3 Special Cases Relating to Freehaul

When material is excavated and stockpiled on the Employer's Agent's instructions before being reloaded and transported to its point of final use, free-haul shall apply twice, firstly from the point of excavation to stockpile and secondly from stockpile to the point of final use.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2



#### **PSD 5.2.6 Dewatering of foundation excavations**

Over and above his general obligations in regard to dealing with water as specified in SANS 1200 A, the Contractor shall be responsible for preventing the ingress of water into the foundation excavations. The preventive measures shall include the construction of proper drainage channels, diversion channels, berms, sumps, and the supply, operation and maintenance of the necessary bailing and pumping equipment.

The dewatering measures, with the exception of pumping, shall be maintained until the backfilling has been completed, after which all settled silt, mud, etc. shall be removed from the exposed surfaces where necessary. Between the various construction stages, pumping may be interrupted as may be decided by the Employer's Agent. The draining or pumping of water from foundation excavations shall be so done that no concrete materials will be carried away and all discharges shall be to settlement ponds or through screening filters to ensure no environmental pollution. Clause PS 10.8 (Section 7) shall also apply.

#### **PSD 7 TESTING**

##### **PSD 7.2 TAKING AND TESTING OF SAMPLES**

Replace the contents of this sub-clause with the following:

"The Contractor shall arrange with the approved independent laboratory engaged by the Contractor to carry out sufficient tests on a regular basis as agreed between it and the Employer's Agent 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 Employer's Agent in a form approved by him. The compaction requirements for fills shall be deemed complied with when at least 75% of the dry-density tests on any lot show values equal to or above the specified density and when no single value is more than five percentage points below the specified value."

#### **PSD 8 MEASUREMENT AND PAYMENT**

##### **PSD 8.3 SCHEDULED ITEMS**

###### **PSD 8.3.1 Site Preparation**

REPLACE SUB-CLAUSES 8.3.1.1 AND 8.3.1.2 WITH THE FOLLOWING:

"Where Site preparation such as clearing, grubbing, the removal of large trees or the removal and stockpiling of topsoil is required, the provisions and scheduled items of SANS 1200 C shall apply."

###### **PSD 8.3.2 Bulk Excavation**

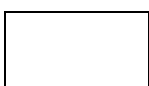
Add: "Refer to clause PSDB 8.3.2".

###### **PSD 8.3.3 Restricted Excavation**

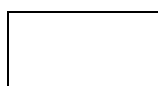
Add: "Refer to clause PSDB 3.1".

###### **PSD 8.3.6 Overhaul**

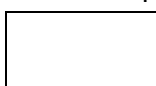
DELETE SUB-CLAUSE 8.3.6.



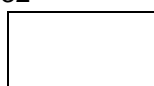
Contractor



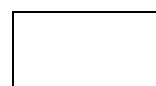
Witness 1



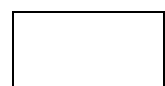
Witness 2



Employer



Witness 1



Witness 2

**PSDB EARTHWORKS (PIPE TRENCHES)**

**PSDB 3 Materials**

**PSDB 3.1 Classes of Excavation**

*Replace clause DB 3.1 with the following:*

Materials excavated from trenches will be classified as either soft and intermediate or hard material (rock) as follow:

Soft and intermediate excavation will be classified as soft excavation, as follow:

- All material that can be removed by a back-acting excavator or with picks and shovels in the case of hand excavation.

Hard material / rock excavation:

- Only material that cannot be removed without the use of explosives for blasting purposes, wedging and splitting or the use of pneumatic drillers. The removal of boulders, Class A and B shall be measured and paid separately from this item. This item shall be extra-over to all excavation.
- All blasting must be approved by the Employer's Agent in writing before commencement of such methods.

Restricted Excavations and Excavations for inter-connecting pipelines chambers as well as all excavations to exposing existing services shall be done by hand excavation methods by means of the employment of local labourers reside in the jurisdiction area of the local authority. Once the Contractor is of the opinion that material is too hard to excavate by hand, which shall include the use pneumatic tools, or once excavations exceed a depth of 2,0 m, the Contractor shall inform the Employer's Agent Representative. Only after the Employer's Agent's approval may other methods of excavation are used, which may amongst others include machine excavation or rock blasting as applicable.

Different rates for different excavation methods were allowed for. The rates for machine or hand excavation, where approved, shall be used for measurement and payment and shall not be an extra over item, while only the rate for blasting, the excavation of boulders and excavation by using pneumatic tools shall be measured and paid for as an extra over item to machine or hand excavation.

The Contractor shall obtain his own dumping sites for the disposal of material and all transport costs shall be included in the rates tendered for site clearance

**PSDB 5.6.1 Backfilling**

Pipe joints shall be left open for 300 mm to either side until the pipeline has successfully been tested and approved by the Employer's Agent.

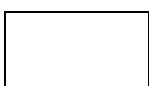
**PSDB 8 MEASUREMENT AND PAYMENT**

**PSDB 8.3 SCHEDULED ITEMS**

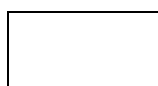
**PSDB 8.3.2 Excavation**

*Add the following:*

No additional payment will in terms of PSDB 3.1 be made for "intermediate excavation".



Contractor



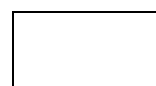
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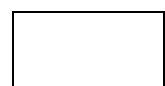
Witness 2



Employer



Witness 1



Witness 2

The cost of excavation of intermediate excavation shall be included in the rate of excavation in all materials.

**PSDB 8.3.7 Accommodation of Traffic**

The tendered sum shall, (except where particular items are scheduled to cover particular costs) include full compensation for compliance with the requirements of 5.1.3 of SANS 1200DB (as amended), including the construction and maintenance of bypasses and the use of existing roads as bypasses, during the construction period.

It shall also include full compensation for the provision, maintenance and removal of all traffic control measures, including temporary traffic signs, road markings, lighting, barricading, flagmen and, where necessary, communications equipment to regulate traffic, for the construction of temporary drainage works, for the maintenance of drainage works and arrangements for moving and subsequently reinstating services for the purposes of accommodating traffic, attending to traffic problems, and complying with the requirements of the Road Traffic Ordinance and the relevant local authorities.

The tendered Lump Sum shall not be adjusted in the event of any extension of time for completion being granted by the Employer's Agent in accordance with Clause 6.6 of the Conditions of Contract (2015).

Payment shall be made in equal monthly instalments over the entire period allowed for completion, provided that where any extension of time for completion is granted, the amount which shall be payable under this item in any subsequent monthly payment certificate, shall be the outstanding unpaid amount of the Lump Sum, divided by the number of months remaining until the Due Completion Date of the Contract, as revised



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**PSDE SMALL EARTH DAMS SANS 1200 DE**

**PSDE 3 MATERIALS**

**PSDE 3.2 CLASSIFICATION FOR PLACING PURPOSES**

*Add the following new sub-clause in 3.2:*

**PSDE 3.2.5 Selected Impervious Material – Asphalt Core**

The asphalt core shall be of impervious zero-void asphalt obtained from commercial sources specifically designed (Mix design to be approved by the Employer's Agent and APP) for the purposes of the dams' impervious zone (core).

For further details Refer to Clause **PL – ASPHALT CORE**

**PSDE 5 CONSTRUCTION**

**PSDE 5.2 METHODS AND PROCEDURES**

**PSDE 5.2.3 Placing and Compacting**

*Add the following new sub-clause in 5.2.3:*

**PSDE 5.2.3.5 Selected Impervious Material – Asphalt Core**

The asphalt shall be placed and compacted in layers of 350mm. The first layer shall be 2800mm wide on a tack coat on top of the concrete plinth. Subsequent layers shall be tapering to 800mm after the 10<sup>th</sup> layer. Following the placement of a layer of asphalt, a layer of asphalt support material shall be placed either side (upstream and downstream) of the asphalt core zone.

For further details Refer to Clause **PL – ASPHALT CORE**

**PSDE 5.2.3.6 Rockfill trial Embankment and Final Placing**

Refer to Clause **PK - ROCKFILL EMBANKMENT**

**PSDE 8 MEASUREMENT AND PAYMENT**

**PSDE 8.3 SCHEDULED ITEMS**

**PSDE 8.3.5 Forming Embankment**

Add: "i) Rockfill Embankment.....Unit: m<sup>3</sup>"

**PSG CONCRETE (STRUCTURAL) SANS 1200 G**

**PSG 3 MATERIALS**

**PSG 3.2 CEMENT AND CEMENTITIOUS MATERIALS**

All cement used on Site shall comply with SANS 50197-1 for CEM I 42.

**PSG 3.2.3 Storage of Cementitious Materials**

Cementitious material shall be used in the order in which it is received

Cementitious material kept in storage for longer than eight weeks shall not be used in the Works without the Engineer's permission.

Any cementitious material that contains lumps that cannot easily be crumbled to powder between the fingers shall not be used.

**PSG 3.4 Aggregates**

Concrete classification and cement factors for use in different locations, detailing stone sizes, strength requirements and cement content, is listed in table 7 below

The rates tendered for concrete mixes shall include for all costs of meeting the requirements of this clause.

**PSG 3.4.2 Use of Plums**

The use of plums shall not be permitted.

**PSG 3.5.1 Approval of Admixtures Required**

Admixtures may only be used with the prior approval of the Engineer.

**PSG 4 PLANT**

**PSG 4.3 Mixing Plant**

Stand-by mixers of adequate capacity and with an independent power unit shall be maintained on site for immediate use in the event of breakdown of the regular mixers or failure of the power supply.

**PSG 4.4 Vibrators**

All concrete shall be compacted using poker vibrators of sufficient size to efficiently carry out the work without causing delays in the placing process, but not causing segregation of the concrete mix.

Stand-by vibrators of adequate capacity and with an independent power unit shall be maintained on site for immediate use in the event of breakdown of the vibrators or failure of the power supply.

## **PSG 5 CONSTRUCTION**

### **PSG 5.1.2 Fixing**

Spacers of approved design include approved plastic or other proprietary spacers, or purpose made precast mortar blocks. Where mortar blocks are used, they shall be properly shaped so as not to slip out of position and shall be made of the same mix as the mortar of the concrete in which they are to be placed.

The mortar shall be well compacted by approved means into the moulds to result in blocks with a density of at least 2 300 kg/m<sup>3</sup> and which are free from honeycombing. The mortar blocks shall be cured in water for at least 7 days. Blocks which have not been manufactured and cured strictly in accordance with these requirements or which are in any other way considered unsatisfactory by the Engineer, will be rejected and shall be removed from the Site.

### **PSG 5.1.3 Cover**

The minimum cover to reinforcement shall be 50 mm. Steel fixing crews shall be supplied with cover gauges to minimise remedial fixing before approval of boxes to be concreted.

## **PSG 5.2 Formwork**

### **PSG 5.2.6 Preparation of surfaces to receive concrete**

Prior to concreting, the surface shall be cleaned of oil, deleterious coatings, loose or unsound rock fragments, mud, silt and clay, etc., by jetting with water or air and scrubbing with brooms, barring off, or by other methods demonstrated to be equally satisfactory. Standing water shall be removed before concreting, and flowing water shall be kept clear of the concreting works.

### **PSG 5.2.7 Formwork ties**

Where sleeves are used through the concrete for formwork ties, such sleeves are to be removed prior to grouting up of resulting holes. Ties, when cast in, shall have some form of positive shear key to prevent any rotation when loosening formwork. The formwork ties and bolt holes shall be placed with regularity and precision.

Where practical, tie cone recesses shall be plugged with well rammed, dry 3:1 mortar within 48 hours of casting the concrete. The surfaces of the recesses shall first be roughened by chipping and wire brushing.

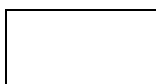
Tie cone recesses which cannot be plugged within 48 hours of casting shall be roughened by scabbling and an approved screed adhesive or a wet-to-dry epoxy shall be applied before plugging the recesses with mortar.

### **PSG 5.2.8 Fillets and chamfers**

All internal and external angles in concrete works shall have 20mm x 20mm fillets and chamfers unless shown otherwise on the drawings. Exceptions are the top edges of slabs that are to receive applied finishes. This edge shall not be chamfered. The unit rate tendered for formwork shall cover the cost of forming these chamfers and fillets.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

### PSG 5.5.1.7 Strength concrete

Except for mixes weaker than 15 Mpa, all concrete for the Works shall be considered to be strength concrete in terms of Sub clause 5.4.1.7.

Unless otherwise specified on the drawings or in the Bill of Quantities all structural concrete shall have a strength of 30 Mpa.

The maximum water/cement ratio of the structural concrete shall be 0,50.

Table 7: Concrete classification and cement factors for use in different locations

No.	Item	Max. Aggregate size (mm)	28-day Design Strength (MPa)*	Cement and Fly Ash (kg/m <sup>3</sup> )
(i)	Gravity Dam Sections			
	(a) Main Body			
	1. Bottom Layer	75	20	200
	2. Other Lifts	75	20	200
	(b) Outlet block, around galleries, waterstop and drain installations	20	25	320
(ii)	Spillway			
	(a) Main Body			
	1. Bottom Layer	75	20	200
	2. Other lifts of hearting	75	20	200
	(b) Around galleries, Shafts and Openings	40	25	270
	(c) Crest body and U/S reinforced face	40	25	270
	(d) Crest 400mm skim	25	35	450
	(e) Apron / floor and walls			
	1. Bottom Layer	75	25	200
	2. Surface layer	40	25	270
	3. Walls	25	25	300
(iii)	Construction sluices plugging and block-outs			
	(non-shrink type (a))	40	16	200
	(non-shrink type (b)) secondary concrete	25	25	270
(iv)	Retaining walls, Training walls			
	(a) Light rebar	20	25	320
	(b) Heavy rebar	20	25	320

No.	Item	Max. Aggregate size (mm)	28-day Design Strength (MPa)*	Cement and Fly Ash (kg/m <sup>3</sup> )
(v)	Causeway			
	(a) Deck	20	25	320
	(b) Split between precast units	20	16	300
(vi)	Small structures			
	(a) Seepage monitoring well	20	25	320
	(b) survey bollards etc	13	25	320
(vii)	No fines concrete	20	25	360

\* Design strength of concrete at 28 days from 150mm cube tests.

### PSG 5.5.7 Construction joints

*Add the following Sub Clauses:*

#### “PSG 5.5.7.4 Layer joints in concrete.

All fresh surfaces that will be covered by an additional layer of structural or mass concrete shall be cleaned off after initial set using an air and water jet, to remove all laitance and leave clean aggregate surface in the joint. Each joint shall be inspected by the Engineer before it is rendered inaccessible by the erection of further formwork.

Should a construction joint be older than 24 hours but less than 3 days, the entire area of each joint shall be cleaned using whatever mechanical devices are required and/or compressed air and water. All residual laitance and similar deposits shall be removed and the coarse aggregate in the hardened concrete shall be clearly visible.

The surface shall then be wetted and covered with a 20 mm thick layer of mortar, consisting of cement and sand to the same sand:cement ratio as that of the concrete. Each joint shall be inspected by the Engineer before it is rendered inaccessible by the erection of further formwork.

For horizontal and shallow inclined joints, the mortar layer specified in procedure (b) of Subclause 5.5.7.3 shall be 20 mm thick. The mortar shall be protected from drying out before the fresh concrete is placed against it. On large surfaces, the mortar layer shall be put down incrementally to avoid drying out before being covered by fresh concrete.

Fresh concrete shall be placed in layers within the anticipated casting depth to ensure no lateral joints and each cast layer shall be fully mixed with the previous layer of the same pour by deep vibration.

In the case where the construction joint is older than 3 days, the abovementioned procedure shall be followed, but the surface being prepared shall be wetted for a period of 24 hours prior to the application of the mortar layer.



#### **PSG 5.5.7.5 Vertical formed joints**

Vertical formed joints will often require the inclusion of formed shear keys and drainage pipes, as well as cast in waterstops(bars) and grout pipes. Surface waterbars may also be used and cold or warm (not hot) bituminous seals may be required.

Shear keys shall be formed into the thicker of two adjacent concrete blocks or the first to be cast.

Waterstops shall be continuous from bottom to top where possible, with the bottom end cast into a recess sufficient to hold it, at least 3 days before concrete commences. Vertical formwork shall be provided to hold the waterstop and shall prevent inaccurate encasement of half the waterstop in the initial pour. Waterstops shall be kept at right angles to the joint by wire ties to rebar and formwork.

Formed drain pipes shall be half in each block and may be circular section or hexagonal to the same section area. Removal of the form is essential. The use of materials that can be dissolved by petrol or other hydrocarbons will not be permitted.

Grout pipe with sleeves (tubes-a-manchette) may be jointed at just above pour levels but must be properly sealed against the ingress of mortar or other detritus."

#### **PSG 5.5.8 Curing and Protection**

*Add the following Sub Clause:*

##### **"PSG 5.5.8.1 Mass Concrete Temperature Observation and Control**

ICOLD advocates that mass concrete temperature drop during curing should not exceed 250C for blocks less than 18m wide. Where the block temperature rises to above 320C, post cooling shall be applied, particularly to layers in the bottom 3.5m. this shall be done by evaporative cooling, initiated when the internal temperature reached 300C. For blocks up to 18m wide and at levels above 20% and below 50% of the finished height, the relevant temperatures are 35°C/33°C. The top 50% shall be cooled if the temperature reaches 38°C/36°C."

#### **PSG 5.5.9 Adverse weather conditions**

No placing of concrete shall take place if the ambient temperature exceeds 32°C, or is likely to rise to above 32°C during the casting period or within eight hours after casting is completed, without the approval of the Engineer.

#### **PSG 5.5.10 Concrete surfaces**

##### **PSG 5.5.10.4 Wood-floated finish**

Where wood floating is ordered or scheduled, the surface shall first be struck off and tamped to bring mortar to the surface. After the concrete has hardened sufficiently, it shall be wood-floated, either by hand or machine, only sufficiently to produce a uniform surface free from screed marks.

#### **PSG 5.5.14.2 Repair of defects**

All defects to the concrete shall be attended to, in full, as soon as possible after the formwork is removed. Further concreting of the element concerned may be prohibited by the Engineer until he is satisfied that this remedial work has been satisfactorily attended to.

**PSG 6 TOLERANCES**

**PSG 6.2 Permissible deviations**

The general Degree of Accuracy III shall apply to all concrete in the Works.

**PSG 8 MEASUREMENT AND PAYMENT**

**PSG 8.1.3.1 e) Preparation of surfaces to receive concrete**

Preparation of surfaces to receive concrete will be measured by the area of surfaces excavated against which structural concrete is to be cast based on the neat planes defined by the dimensions shown on the drawings.

**PSG 8.1.4 Joints**

The cost of construction joints which are not formed will be deemed to be included in the unit rate for concrete.

Formed construction joints shall be measured according to the net area of a single surface making up the joint. The rate shall cover the cost of all materials, labour and plant required to construct each joint as well as to prepare it as specified.

**PSG 8.9 Weep holes**

The construction of the weep holes will be measured by number.

The rate shall cover the cost of supplying, transporting, off-loading and installing all materials as well as for cutting, wasting, installing of the materials and connection to the subsoil pipe where applicable.

**PSHA STRUCTURAL STEELWORK (SUNDRY ITEMS)**

**PSHA 2 INTERPRETATION**

**PSHA 2.1 Supporting Specifications**

(c) SABS 1200 H

**PSHA 3 MATERIALS**

**PSHA 3.1 STRUCTURAL STEEL**

Replace the reference to BS 4360 with SABS 1431. The grade of steel shall be 300W unless otherwise specified.

**PSHA 3.3 BOLTS, NUTS AND WASHERS**

**PSHA 3.3.1 Bolts and Nuts (Other than Friction Grip)**

*Add the following to this Sub-Clause:*

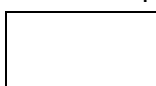
All bolts and nuts shall be of grade 4,6 steel unless otherwise specified. Washers shall be provided at each nut and shall be of the same material (or coating where applicable) to match the bolt and nut.



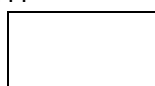
Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

Single coil square section spring washers shall be fitted to all nuts subject to vibration. Bolts other than jacking bolts shall project not less than 3 mm and not more than 10 mm from the heads of the nuts after tightening.

Holding down bolts to be built into concrete work as well as bolts to be installed above ground level directly above and under water shall all be of stainless steel grade 304. Bolts for flexible couplings and flanges for underground installation shall be hot-dip galvanized in accordance with the requirements of SABS 763. Bolts to be installed inside buildings shall be hot-dip galvanized in accordance with the requirements of SABS 763 and afterwards painted with the pipework and fittings as specified in the Standardized Corrosion and Painting Specification for Civil Engineering Works.

Suitable plastic sleeves and/or washers shall be used for protection against corrosion by metallic action.

## **PSHA 5 CONSTRUCTION**

### **PSHA 5.2.6 Handrails**

*Add the following to this Sub Clause:*

Stanchions for handrailing shall be of approved prefabricated ball type made in one piece without welding at ball joints to accept the hand and kneerails and shall have 150 x 75 x 10 mm baseplates drilled for M 12 bolts at 100 mm centres. Baseplates shall be floor mounted, except where shown on the drawings to be vertically mounted to the I-beams.

Hand and kneerails shall consist of 25 mm nominal inside diameter tubing cut and bent to shape. Stanchions shall be spaced not more than 1,5 metres apart. Unless otherwise shown, all handrailing shall be 900 mm above walkway level.

All tubing, stanchions and baseplates shall be manufactured in grade 304 stainless steel or hot dipped galvanized (heavy coating), as scheduled or shown on the drawings. All stainless steel components shall have a No. 1 surface finish and surfaces shall be pickled and passivated in accordance with the requirements of the Standardized Corrosion and Painting Specification for Civil Engineering Works.

### **PSHA 5.2.7 Ladders**

*Add the following to this Sub Clause:*

Ladders shall be of all welded construction. Materials used shall be as stated on the drawings. Stainless steel shall be finished with a No. 1 surface finish. Pickling and passivation shall be carried out in accordance with the requirements of the Standardized Corrosion and Painting Specification for Civil Engineering Works.

Vertical ladders shall comprise stringers at 600 mm centres made of 32 mm nominal bore pipes with 3,56 mm wall thickness and rungs spaced at 300 mm centres made of 16 mm diameter solid round bars. The stringers shall be drilled on one side only to provide a sliding fit for the ends of the rungs which shall protrude through these holes up to the opposite inside face of the stringer and be welded all around where they enter the holes in the stringers.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

Lugs for bolting ladders to walls shall consist of 20 mm nominal bore pipes with 2,87 mm wall thickness. Baseplates for stringers and lugs shall be 150 x 60 x 10 mm drilled for 2 No. M12 stainless steel bolts. Where safety cages are specified, the hoops shall be made of 50 x 6 mm flat bars and the longitudinals of 40 x 6 mm flat bars, all in accordance with the dimensions as shown on the Drawings.

#### **PSHA 5.2.8 Prefabricated open grid flooring**

##### **PSHA 5.2.8.1 Add the following to this Sub Clause:**

Open grid flooring shall be of square pattern type of approved manufacture with 40 x 4 mm minimum thickness bearer bars spaced at not more than 40 mm centres and shall be manufactured in grade 304 stainless steel or 3 CR 12 steel (as scheduled or as shown on the drawings). The tendered rate shall include for all cutting into the required panels, banding and for frames detailed below.

Open grid flooring shall be provided with welded frames as scheduled, made of 50 x 50 x 5 mm thick 3 CR 12 steel angle to provide a seating for the open grid flooring. The nett clearance between the side bars of the open steel flooring and the vertical leg of the frame or strip shall be 5 mm per side. The frames shall be complete with 100 x 40 x 3 mm 3 CR 12 steel anchors fixed at 500 mm centres for building the frame into the concrete work.

Pickling and passivation shall be carried out in accordance with the requirements of the Standardized Corrosion and Painting Specification for Civil Engineering Works.

#### **PSHA 5.2.9 Floorplate floors**

Floorplate shall have a thickness of 4,5 mm and shall be of the non slip type. The floorplate shall be made up as shown on the Drawing complete with handles, hinges and locating angles welded to the underside. The tendered rate shall include for all cutting into the required panels and for a frame described on the drawing.

Floorplate shall be manufactured in grade 304 stainless steel or 3 CR 12 steel (as scheduled or as shown on the drawings) and shall be pickled and passivated as specified in the Standardized Corrosion and Painting Specification for Civil Engineering Works.

#### **PSHA 5.2.10 Protective treatment**

Delete this Clause and refer to the Standardized Corrosion and Painting Specification for Civil Engineering Works.

*Add the following Sub Clauses:*

#### **PSHA 5.2.11 Pipe Supports**

Straps for holding down pipes to concrete surfaces shall be manufactured in the material stated on the drawing and to the dimensions as shown on the drawing. If no dimensions are shown, same shall be 50 mm wide by 3 mm thick. The strap shall be slotted and shall be fixed to the concrete by means of M12 stainless steel self drilling anchor bolts. The material between the strap and pipe shall be 8 mm thick neoprene sealing material 50 mm wide.

Pickling and passivation shall be carried out in accordance with the requirements of the Standardized Corrosion and Painting Specification for Civil Engineering Works.

#### **PSHA 5.2.12 Straps for pipes**

Straps for holding down pipes to concrete surfaces shall be manufactured in the material stated on the drawing and to the dimensions as shown on the drawing. If no dimensions are shown, same shall be 50 mm wide by 3 mm thick. The strap shall be slotted and shall be fixed to the concrete by means of M12 stainless steel self drilling anchor bolts. The material between the strap and pipe shall be 8 mm thick neoprene sealing material 50 mm wide.

Pickling and passivation shall be carried out in accordance with the requirements of the Standardized Corrosion and Painting Specification for Civil Engineering Works.

#### **PSHA 5.2.13 Penstock Gates**

The unseating load rating of the penstock gates shall be more than 0.5MPa or 50m hydraulic head. The force required at a handwheel or crank to raise a penstock gate shall be not more than 100 Nm.

The penstock gates and frames shall be made of grade 304 stainless steel with a thickness suitable for the duty required but shall not be less than 3,5 mm thick.

All gates shall be well guided with no possibility of jamming. The gates of wall mounted types shall be held uniformly against the side facings of the frames by the action of adjustable wedges and shall provide drop-tight closure under the conditions as shown on the drawings. Penstocks (any seating condition) shall not spill water over the top or sides of the frame other than through the opening provided in the penstock for the water to pass through. All penstocks shall be of the level invert type fitted with renewable seals of a non-biodegradable material on the invert.

Penstocks shall have rising spindles protected by suitable transparent nylon sleeves, the latter providing convenient visual inspection and greasing facilities. Handwheels shall be of cast iron with diameters to suit operating either directly on the head frame or on a grade 304 stainless steel tubular pedestal to suit the installation depth, as shown on the drawings. Where necessitated by the mass of the gate and/or the pressure against the gate, suitable gearing shall be provided.

All penstocks measured in the Schedules of Quantities shall be supplied and installed by the Contractor under this Contract. In the case of penstocks to be fixed against concrete walls, holding down bolts made of 304 stainless steel must be supplied and installed into the concrete work. The Contractor shall also execute the complete grouting of the gates and carry out all necessary adjustments to ensure proper and smooth operation of the gates.

#### **PSHA 5.2.14 Weir Plates**

The 90° V-notch weir plates shall be made of 304 stainless steel with a thickness suitable for the duty required but shall not be less than 4.0 mm thick. Weir V-notches shall be bevelled at 45° on the downstream face to provide an edge thickness of 2 mm in the V.

Water tightness of weir plates shall conform to the requirement that leakage at full water level will not exceed 0.5 litre per minute.

All weir plates shall be supplied and installed by the Contractor under this Contract. The Contractor shall also execute the complete installation, fastening and sealing of weir plates.

#### PSHA 5.2.15 Floating Safety Boom

The Department of Water & Sanitation (DWS), its delegated public sector partners and delegated water management institutions have the responsibility to implement the required Aids to Navigation (AtoN), both fixed and floating; and demarcation markers, on all Government Waterworks (Dams) for general navigation.

In terms of international conventions and national legislation, DWS has to ensure compliance to the South African Maritime Safety Authority (SAMSA) AtoN Standards and Directive of all maritime AtoN and Demarcation Markers, both fixed and floating; on all Government Waterworks in the Republic of South Africa (RSA).

In addition to the DWS, Local Accountable AtoN Parties (LAAP) providing access to Waterworks, watercourses, privately owned dams and other navigable watercourses, or requiring a specific demarcated area for specific recreational usage, have an obligation to ensure that the required AtoN is in accordance with the recommendation of DWS and approval of SAMSA.

These specifications form an integral part towards compliance to SAMSA's AtoN Standards and Directives:

- SAMSA Marine Notice No. 8 of 2016 - ***"Standards for Aids to Navigation in South African waters and Inland Waterways"***.
- SAMSA Directive on the ***"Standardisation of fixed and floating Aids to Navigation and Demarcation Markers on all navigable Inland Waterways in the Republic of South Africa"***; as published in April 2014.

The Dam Floating Safety Boom shall be installed as detailed on the drawings. The installation shall consist of orange demarcation and yellow special water markers (foam filled) connected with a combination mooring accessories including D-Shackles, Quick Links, Chains, Cables (Strand Wire Rope) and Crosby Clamps (Sizes as specified on drawings).

Special water markers (AtoN) shall be roto-moulded polyethylene pillar type buoy (including self-contained ballast and foam) with "NO ACCESS" mould in graphics. All pillar buoys to have a rigid mooring eye / fixing point at the bottom with a stainless steel insert with an diameter of not less than 15mm. The width of the plastic mooring eye / fixing point shall have a minimum thickness of 20mm. Special water markers shall further have 3-D Yellow Diagonal Cross "X" top marks. Special water marker shall be numbered according to DWS regulations.

Demarcation markers shall be roto-moulded polyethylene round buoy (including foam). All round buoys to have a rigid mooring eye / fixing point at the bottom with a stainless



Contractor



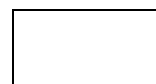
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Employer



Witness 1



Witness 2

steel insert with an diameter of not less than 15mm. The width of the plastic mooring eye / fixing point shall have a minimum thickness of 20mm. Demarcation markers shall further be fitted with a screwable hexagon watertight plug.

Data sheets and shop drawings must be submitted by the contractor for approval by the Engineer.

All steel components shall be marine grade steel and/or stainless steel Grade 304 L unless specified otherwise.

Strand Wire Rope shall be stainless steel 10mm 7x19 with Cables Eyes thimbled with machine swagged brass crimped ends.

Possible suppliers are listed below:

Company	Contact	Email and Website	Comment
Pioneer Plastics (Pty) Ltd, Rosslyn, Pretoria	Mr. Shaun Dean 083 277 9151 012 541 6000	<a href="mailto:shaun@pioneerplastics.co.za">shaun@pioneerplastics.co.za</a> <a href="http://www.pioneerplastics.co.za">www.pioneerplastics.co.za</a>	Specializes in Roto-Moulding; Manufacturing of Cone Shape Pillar Buoys, Top Marks, Cylindrical Markers & Round Markers.
Nauti Buoys (Pty) Ltd, Joostenbergvlakte, Cape Town	Mr. Jacques Kasner 074 818 7763	<a href="mailto:jacques@nautibuoy.co.za">jacques@nautibuoy.co.za</a> <a href="http://nautibuoy.co.za">http://nautibuoy.co.za</a>	Specializes in Design & Manufacturing of Surface & Subsea Mooring Systems; Distributes a 700 mm Ø Cylindrical Pillar Buoy.
Marine Radio Acoustic Devices (MRAD) CC, Monte Vista, Cape Town	Mr. Edison Sawyer 083 677 8207 021 559 4003	<a href="mailto:edison@mrاد.co.za">edison@mrاد.co.za</a> <a href="http://www.mrad.co.za">www.mrad.co.za</a>	MRAD Specializes in Marine Electronics; Appointed Distributor for Sealite (Australia / USA); Sealite – Design and Manufacture of Marine AtoN Equipment.
Kaymac Structural Foam (Pty) Ltd, Edenvale, Johannesburg	011 922 3300	<a href="http://www.kayroto.co.za">www.kayroto.co.za</a>	Incorporating Kaymac Rotomoulders; Manufacturer of Original 220 mm Ø Round Demarcation Markers; Still need to get Contact Details.
East Coast Instruments CC, Berea, Durban	Mr. Clyde de Marigny 082 491 8742	<a href="mailto:clyde@ecinsts.co.za">clyde@ecinsts.co.za</a> <a href="http://www.ecinsts.co.za">www.ecinsts.co.za</a>	Appointed as a Distributor for Pioneer Plastics AtoN & Demarcation Markers
Monitoring & Control Laboratories (Pty) Ltd, Sandton, Johannesburg	Mr. Peter Wigzell 083 271 1190	<a href="mailto:pwigzell@moncon.co.za">pwigzell@moncon.co.za</a> <a href="http://www.moncon.co.za">www.moncon.co.za</a>	
Havenga Industries CC, Brakpan, Johannesburg	Mr. Wouter Havenga 082 455 0216	<a href="mailto:wouterhavenga@gmail.com">wouterhavenga@gmail.com</a>	



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2



#### **PSHA 5.2.16 Geodetic Measurement**

The matrix shown on drawing 2021/04/DW-L10 should be set up, with five reference beacons. These should be used to monitor lateral movement of ten or more targets on the downstream face of the dam as well as two beacons in the upstream left bank landslip area.

#### **PSHA 5.2.17 Lifting Gear for Equipment**

##### **PSHA 5.2.17.1 Manual Lifting Gear for Equipment**

Manual lifting rigs (Crawl beam, travelling trolleys and blocks and tackle) shall be installed as detailed on the drawings.

The hot dipped galvanised crawl beam for the lifting gear (203 x 133 x 30 kg/m) shall be supplied and installed with the suitable manually operated lifting gear. Full detail and specifications of the lifting gear shall be provided to the Engineer for approval. The contractor should note the vertical distance of from the crawl beam to the ground and allow for sufficient chain length for the block and tackle.

The total installation must in all respects comply with the Machinery and Occupational Safety Act and be to the satisfaction of the Engineer.

A safe load notice of 1 ton shall be fixed to the crawl beam.

##### **PSHA 5.2.17.2 Electrical Lifting Gear for Equipment**

Electrical lifting rigs (Crawl beam, travelling trolleys and hoists) shall be installed in the positions as indicated on the drawings.

The crawl beam for the lifting gear (Size to be suitable for 2-ton load at 5300mm furthest load centre) shall be supplied and installed with the suitable multi directional operated lifting gear. The contractor shall confirm suitability of the members of gantry structure as specified on the drawings. The electrical motors powering the rig (Trolleys and hoist) shall be rated for at least 20 starts per hour.

Full detail of the lifting gear shall be provided to the Engineer for approval. The contractor should note the vertical distance of from the crawl beam to the ground and allow for sufficient chain/hoist cable length for the electrical hoist.

The total installation must in all respects comply with the Machinery and Occupational Safety Act and be to the satisfaction of the Engineer.

A safe load notice of 2 ton shall be fixed to the crawl beam.

#### **PSHA 5.3.7 Repairs to paint and site painting**

Delete this Sub Clause and refer to the Standardized Corrosion and Painting Specification for Civil Engineering Works.

## **PSHA 8 MEASUREMENT AND PAYMENT**

### **PSHA 8.3.2 Handrails**

#### **PSHA 8.3.2(b) Handrail assembly complete.....Unit: Linear metre (m)**

Delete the reference to "details given" and add: as specified in Sub Clause PSHA 5.2.6 (state material to be used).

The tendered rate shall include handrails comprising hand and kneerails installed complete as specified.

#### **PSHA 8.3.3 Cat ladder and safety cage.....Unit: Sum (refer to drawing and Clause PSHA 5.2.7)**

The tendered rate shall include full compensation for the manufacture, delivery and installation of the ladder, including supply and installation of stainless steel self drilling anchor bolts, complete as shown on the drawing.

#### **PSHA 8.3.4 Flooring, complete and installed with frames.....Unit: Square metre (m<sup>2</sup>)**

Delete the reference to "details given" and add: as specified in Sub Clause PSHA 5.2.8 (state material to be used).

#### **PSHA 8.3.7 Staircase.....Unit: Sum (refer to drawing)**

The tendered rate shall include full compensation for the manufacture, delivery and installation of the galvanised steel staircase with handrailing and resting platforms, including supply and installation of self drilling anchor bolts, complete as shown on the drawing.

#### **PSHA 8.3.8 Pipe Supports – with 3CR12 steel brackets.....Unit: Number (No) (refer to drawing)**

The unit of measurement shall be the number of brackets and holding down brackets installed.

The tendered rate shall include full compensation for the manufacture, delivery and installation of the baffles and holding down brackets, including supply and installation of M12 stainless steel self-drilling anchor bolts. Complete as shown on the drawing.

#### **PSHA 8.3.9 Straps for pipes (refer to drawing).....Unit: Number (No)**

The unit of measurement shall be the number of straps installed.

The tendered rate shall include full compensation for the manufacture, supply and installation of straps to the details as shown on the drawing, including stainless steel bolts and 8 mm thick neoprene seals between pipe and strap.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**PSHA 8.3.10 Grade 304L Stainless Steel Penstocks.....Unit: Number (No)**  
**(refer to drawing and clause PSHA 5.2.13)**

(size of clear opening, height to handwheel and whether channel or wall mounted - on seat or off seat as detailed)

The tendered rate shall include full compensation for the manufacture, delivery and installation of the penstock to suit the position described and shown on the drawing.

**PSHA 8.3.11 Weir Plates.....Unit: Number (No)**  
**(refer to drawing and clause PSHA 5.2.14)**

The tendered rate shall include full compensation for the manufacture, delivery and installation of the weir plate to suit the position described and shown on the drawing.

**PSHA 8.3.12 Floating Safety Boom**  
**(refer to drawing and clause PSHA 5.2.15)**

**a) Markers complete as per drawings.....Unit: Number (No)**

**b) Cables.....Unit: Linear metre (m)**

The tendered rate shall include full compensation for the manufacture, delivery and installation of the markers and cables as detailed and to the positions as shown on the drawings. The rate shall further include compensation for all mooring accessories including D-Shackles, Quick Links, Chains, Cables (Strand Wire Rope) and Crossby Clamps (Sizes as specified on drawings).

**PSHA 8.3.13 Geodetic Measurement**

**a) Survey Beacons.....Unit: Number (No)**

**b) Measuring Point Targets.....Unit: Number (No)**

The tendered rate shall include full compensation for the manufacture, delivery and installation of the beacons and targets to suit the position described and shown on the drawing.

**PSHA 8.3.14 Lifting Gear for Equipment (Also refer to PM5 & PM6)**

**a) Manual Lifting Gear for Equipment..... Unit: Number (No)**

**b) Electrical Lifting Gear for Equipment .....Unit: Number (No)**

The tendered rate shall cover the cost of preparing shop details (where applicable), the supply of all material required, fabrication, corrosion protection, quality control, loading, transporting to site, off-loading, erections and grouting. The rate shall also include the cost of all nuts, bolts, HD bolts, chemical anchors, washers, cutting to waste and all temporary bracing necessary.

## **PSL MEDIUM PRESSURE PIPELINES SANS 1200 L**

### **PSL 2 INTERPRETATION**

#### **PSL 2.4 ABBREVIATIONS**

*Add the following to this Sub-Clause:*

AC or FC - (Fibre reinforced cement)

HDPE – High-density polyethylene

### **PSL 3 MATERIAL**

#### **PSL 3.1 GENERAL**

*Add the following paragraph:*

"Each type of pipe delivered to the Site shall have a standard length corresponding with the standard lengths offered by the pipe manufacturer in his catalogue, with a maximum permissible variation in length of  $\pm 2\%$ .

A pipe that is a shorter or longer than the defined standard will be rejected by the Employer's Agent, except when such non-standard lengths are required in terms of the Contract and have been specifically manufactured or cut as such by the pipe manufacturer or supplier."

#### **PSL 3.3 CI PIPES, FITTINGS AND SPECIALS**

*Add the following to this Sub-Clause:*

All cast iron pipes and fittings shall comply with the requirements of BS 2035 and unless otherwise specified, pressure class K9 and shall be of class D quality for straight pipes and of class CD quality for fittings. Materials used shall comply with the requirements of SANS 1034 grade 300 for "Grey Iron Castings".

#### **PSL 3.7 Other types of pipes (Sub-Clause 3.7)**

##### **PSL 3.7.1 uPVC Water Pipes**

Water pipes that must be supplied shall be Class 16 uPVC spigot and socket or similar approved pipes unless otherwise specified, complying with SANS 996-1-2010 and diameters as set out in the Schedule of Quantities.

##### **PSL 3.7.2 Galvanised Pipes**

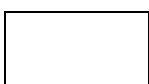
Galvanised steel pipes shall be supplied for inside isolation valve and bulk water meter boxes (diameters as indicated), unless otherwise indicated on drawings. Materials to be in accordance with SANS 62.

##### **PSL 3.7.3 Steel (ERW) Pipes**

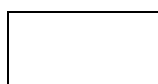
Steel (ERW) pipes with a wall thickness 4mm shall be supplied for all above ground applications. Pipe material to be in accordance with SANS 719. Flanges to be used for joining steel pipes. Underground joints to be DENSO wrapped to protect the joints against corrosion. DENSO material to be bitumen mastic tape or similar approved.

#### **PSL 3.8.3 Flanges and Accessories**

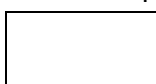
*Add the following to this sub clause:*



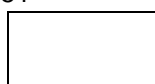
Contractor



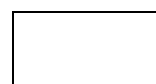
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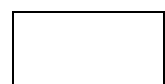
Witness 2



Employer



Witness 1



Witness 2

The dimensions and drilling of standard flanges shall comply with the requirements of SANS 1123 table 16 for pipes and fittings with a diameter of 150 mm and smaller and in accordance with table 10 for diameters exceeding 150 mm unless stated otherwise. Flanges shall be machined flat, i.e. without a raised joint face. Puddle flanges shall have the same dimensions as standard flanges but shall be undrilled.

Faces of flanges which will be in contact with jointing gaskets shall receive a protective coating similar to the corrosion protection specified for the internal surface of the pipes and fittings of such thickness and consistency as will not impair the air/gas/water tightness of the joint.

The jointing gaskets shall comply with the requirements of BS 3063 and shall be cut to the full width of the flange and holed for bolts.

### **PSL 3.9 CORROSION PROTECTION**

#### **PSL 3.9.2.2 Steel pipes of nominal bore over and including 100 mm**

Grit blasting finish to comply with a SA3 finish. Protection of steel pipes to be Hot Dip Galvanized.

#### **PSL 3.9.5 Joints, Bolts, Nuts and Washers**

*Add the following to this sub clause:*

Bolts and nuts for standard flanges shall comply with the requirements of SANS 1123 for a working pressure as specified for the flanges in conjunction with which they are to be used.

The jointing gaskets shall comply with the requirements of BS 3063 and shall be cut to the full width of the flange and holed bolts.

All other bolts and nuts shall comply with the requirements of SANS 136 and shall be of grade 4,6 steel. Washers shall be provided at each nut and shall be of the same material (or coating where applicable) to match the bolt and nut.

Bolts shall project not less than 3 mm and not more than 10 mm from the heads of the nuts after tightening.

Bolts to be installed above ground level directly above and under water shall all be of stainless steel grade 304. Bolts for flexible couplings and flanges for underground installation shall be hot-dip galvanized in accordance with the requirements of SANS 763. All other bolts shall be hot-dip galvanized in accordance with the requirements of SANS 763 and afterwards painted with the pipework and fittings as specified in Clause 3.9.

Suitable plastic sleeves and/or washers shall be used for protection against corrosion by metallic action.

### **PSL 3.10 VALVES**

All valves must be painted according to an approved method with an epoxy paint (KSIR 88 – JYA 90 [Blue] or similar approved) after manufacturing and testing. Complete



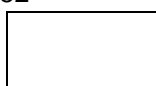
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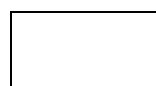
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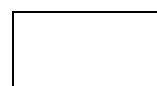
Witness 2



Employer



Witness 1



Witness 2

technical information of all valves must be submitted to the Employer's Agent for approval before purchase thereof.

**Before leaving the factory, valve bodies shall be treated as follows:**

- Internally: Manufacturer's standard corrosion protection treatment
- Externally: Contractor to specify protection which must be approved by the Employer's Agent. Refer to specifications PQ as guidance.

**PSL 3.10.1 Gate Valves**

All gate valves shall be standard waterworks pattern comply with the requirements of SANS 664 and shall be suitable for a working pressure of 1.6 MPa (Class 16) as specified. All gate valves must be supplied with a square spindle nut, suitable to be used with a valve key. One valve key per nut size must be provided and will be included in the rate for valves.

Gate valves shall be clockwise closing. The direction for opening and closing shall be permanently displayed on the valves. Valves shall have non-rising spindles.

Compression shut-off valves with rubber protected gate and smooth finish without recess inside, may be used. The body and bonnet shall be epoxy coated internally and externally.

The spindle seal shall consist of at least two O-rings located in a corrosion resistant housing. A wiper ring to prevent ingress of dirt shall be provided. The spindle nut may be loose or fixed in the gate.

The valves shall be provided with a straight, unobstructed body passage without any pocket and the gate shall be completely clear of the waterway in the fully open position. The sealing and gate guide areas shall be designed to eliminate deposits in the valve body. The gate guide areas shall be designed to eliminate deposits in the valve body. The gate guides shall be of substantial design to support the gate until the point of closure.

All components shall be interchangeable between valves of one size. The rated working pressure shall be 16 or 25 bar as specified. The valve shall be capable of being opened and closed under an unbalanced pressure equal to the rated working pressure.

All flanged gate valves shall be drilled according to SANS 1123 Table 1600/3 or 2500/3. Pipes shall not be tested against a closed valve. Thrust blocks for test sections shall be approved by the Employer's Agent prior to testing of pipes.

**PSL 3.10.2 Air Valve**

Air valve for potable water shall have a class 16 pressure rating as specified. All air valves shall be double action air valves of Vent-o-mat RBX, or similar approved.

The branch of the tee on the main pipe shall be minimum 0.67 (2/3) of the diameter of the main pipe.

Double-acting air valves shall have large as well as small orifices. The large orifice shall have a rubber bed, and the small orifice a brass bed on which the balls can shut. Double-acting air valves shall be flanged and supplied with flanged isolating valves. Air valves shall be designed into remain open until all the air has escaped and shall not close due to the speed of the escaping air.

The valve shall incorporate an integral "Anti-Shock" orifice mechanism which, during the pipeline filling operation and when a separated water column proceeds to re-join, shall operate automatically to limit transient pressure, rise induced by large orifice closure to a maximum of 2 x valve rated working pressure.

### **PSL 3.10.3 Scour Valve**

Scour valves shall have a class 16 pressure rating as specified.

Scour valves for the bulk supply mains shall consist of a flanged gate valve of 100mm dia. or 150mm dia., depending on the main pipe size, coupled to a flanged tee. The outlet pipe shall be a 100mm or 150mm nominal diameter copon epoxy protected steel pipe with 4mm wall thickness.

The outlet shall discharge above ground level in the direction of the fall of the natural ground surface, perpendicular to the main pipe. The outlet end of the pipe shall be cut diagonally and supplied with a cover that is hinged and that will remain closed unless it is forced open by the water. The hinge shall be non-removable.

### **PSL 3.10.4 Reflux Valves (Non-Return)**

Reflux valves shall have a class 16 pressure rating as specified and, unless otherwise indicated, shall be flanged, drilled to SANS 1123, Table 1600/3 or 2500/3. The casing and flap shall be manufactured from close-grained cast iron with a brass face on the flap that close onto a corresponding brass plane in the casing.

The hinge pin shall swivel freely in bearings on both sides of the casing. Cone-shaped rubber-seal reflux valves with stainless steel may be used if approved by the Employer's Agent.

### **PSL 3.10.5 Bulk Water Meter (Where applicable)**

New bulk water meters shall be installed as shown on drawings. Meters at the dam outlet block shall be according to **clause PI4.2**

#### Functional Requirement of Bulk Water Meters

DESCRIPTION	METER
Detail of Pipeline	315mm uPVC
End Connections	Flanged, SANS 1123 (Class 1600/3)
Flow Rate	Varies (m <sup>3</sup> /h)
Size of Meter	315mm NB

### Technical Requirements for the Meters

The bulk water meters shall be combination cold water meters (type C3200 by ABB, Kent or similar as approved by Employer's Agent) and flanged on both sides. A distance of 5 times the diameter of the pipe before and 3 times the diameter after the water meter must be kept free of any obstructions such as bends, reducers, etc. unless it is approved by the Supplier that above conditions is not required, to be approved by Employer's Agent.

The flow reading shall be given on a dial face and totalizing shall occur by means of a roller counter and shall be accurate within  $\pm 2\%$ . The body shall be manufactured from spheroidal graphite iron.

The meter shall be manufactured in such a way that all moving parts can be removed and replaced from the top without removing the whole meter. Replacement parts should be freely available. Each water meter installation shall be supplied with a gate valve on the upstream side of the water meter. This gate valve shall be provided for under the relevant item in the schedule of quantities. The water meter shall have provision to log the records manually and electronically (Data Logging).

### Installation of Meter

The meter shall be installed by a person approved by the supplier in order to validate the guarantee.

All accessories for the complete installation shall be supplied by the Contractor.

All metal work shall be painted according to specifications after the testing and completion of the installation. Each meter must be supplied with a blind flange. The meter mechanism may only be installed after the pipeline has been completely constructed, flushed and tested.

## PSL 5 CONSTRUCTION

### PSL 5.12 Marker Blocks

Marker blocks shall be manufactured as shown on the Drawings. Positions of marker blocks to be confirmed by the Employer's Agent.

#### PSL 5.1.4 Covering Required

The minimum covering measuring from the soffit of the pipe to the final prepared ground level shall not be less than 1000mm. Where applicable (Road Crossings etc.) the Employer's Agent may order pipe encasing to protect shallow pipelines.

### PSL 5.11 Connection to new or existing

Connections shall be done within accordance to SANS 1200L and PSL material sizes and positions as specified and verified on site by the contractor in conjunction with various Sub Contractors, the Employer's Agent and suppliers. Where connections to existing



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2



pipes are made, pipes shall be exposed by the Contractor at his costs and connection methodology approved by the Employer's Agent.

## **PSL 7 TESTING**

### **PSL 7.3.1.2 Test Pressure**

The test pressure shall be 1,5 times the maximum allowable working pressure for the class of pipe being tested.

## **PSL 8 MEASUREMENT AND PAYMENT**

### **PSL 8.2.11 Anchor blocks/Thrust blocks and pedestals**

Insert "concrete" before "and" in the last line of the last paragraph

Add the following:

"The tendered rates shall also include the wrapping of uPVC pipes and fittings with Densopol 80 or a similar approved material where the pipes and fittings come into contact with concrete."

### **PSL 8.2.13 Valve and Hydrant Chambers.....Unit: No.**

Supply and install complete, as indicated on the drawings, concrete structure / manhole ring structure as specified. The tendered rate shall include full compensation for all pipework, specials, fittings, reinforcement, concrete, shuttering, finishing, labour, plant and materials necessary for installation as specified to the satisfaction of the Employer's Agent. The main valve is measured separately. Specification PSH (Structural Steelwork) shall apply.

### **PSL 8.2.16 Building Pipes into Masonry with 20/19 Concrete.....Unit: No.**

The Tendered rate shall include full compensation for all concrete/masonry work inclusive of special provision in formwork, labour, delivery and installation as per drawing complete to suit the positions as described and shown on the drawings.

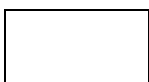
### **PSL 8.2.17 Marker blocks:**

#### **a) Concrete marker block.....Unit: No.**

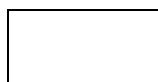
The tendered rate shall include full compensation for all excavation and backfill, labour, equipment and materials to manufacture and install the blocks as shown on the Drawings.

### **PSL 8.2.18 Connect to New or Existing Pipework.....Unit: No.**

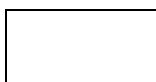
The tendered rate shall include full compensation for the excavation, pipes fittings, labour, welding delivery and installation to suit the position described and shown on the drawing.



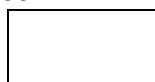
Contractor



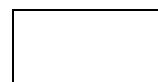
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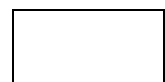
Witness 2



Employer



Witness 1



Witness 2

## **PSLB BEDDING (PIPES) SANS 1200 LB**

### **PSLB 3.1 Selected Granular Material**

*Reword sub-clause 3.1 to read:*

Selected granular material shall be material with a PI not exceeding 6, grading modulus not less than 1.5 free from organic material, clay or stones retained on a 26.5 mm sieve and having a compatibility factor not exceeding 0.4.

### **PSLB 3.2 Selected Fill Material**

For "PI not exceeding 6" read "PI not exceeding 12". A compaction of not less than 90% of Modified AASTHO density will be reached in midblock conditions and not less than 93% in any street reserves.

### **PSLB 3.3 Bedding**

All PVC pipes shall be bedded in a Class Flexible bedding for flexible pipes as indicated on the drawings. All Ductile Iron pipes shall be bedded in a Class B bedding for rigid pipes as indicated on the drawings.

### **PSLB 5.4 Concrete Casing to Pipes**

Pipes which are to be encased in concrete, shall be encased in grade 10/20 concrete to the dimensions as shown on the drawings or as instructed by the Employer's Agent.

### **PSLB 5.5 Draining of Trenches**

Where ground water is present to such an extent that, in the opinion of the Employer's Agent, it would hamper the placing and consolidation of the fine granular bedding or the placing of the concrete bedding in the bottom of the trench, as the case may be, or would cause buoyancy of the pipes, the Employer's Agent may order the provision of a drain in the bottom of the trench to assist in dewatering during construction and until the trench has been backfilled to such an extent as to prevent buoyancy of the pipes. At certain points along the trench, depending upon the amount of water to be handled, sumps shall be formed from which the water may be pumped to prevent a build-up of water in the trench to a level above that of the top of the layer of stone forming the underdrain.

The stone in the underdrain shall consist of nominal 40 mm crushed stone complying with the grading as specified for 'Stone for Concrete' in Table 5 of SANS 1083, and shall be well compacted to provide a uniform support for the pipe bedding to be placed on top of it. Before placing the concrete bedding, the underdrain shall be covered with building paper to prevent ingress of mortar into the interstices of the underdrain.

## **PSLB TOLERANCES**

### **PSLB 6.1 Moisture Content and Destiny**

Grade II accuracy will apply.

## **PSLB 8 MEASUREMENT AND PAYMENT**

### **PSLB8.1.3 Volume of Bedding Material**

*Add the following to this sub-clause:*



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

The volume of bedding and selected blanket material shall be measured net, i.e., the volume of the pipe shall be deducted.

**PSLE STORMWATER DRAINAGE**

**PSLE 3 MATERIALS**

**PSLE 3.4 MANHOLES, CATCHPITS, AND ACCESSORIES**

**PSLE 3.4.1 Bricks**

*Add the following:*

"Bricks shall be engineering bricks complying with the requirements of SABS 227."

*Add the following to this sub-clause:*

**PSLE 3.4.5 Inlet and outlet structures**

Manhole covers and frames, and any other accessories shall be supplied and/or manufactured in accordance with the details shown on the drawings. Road and pavement manhole covers and frames shall comply with the requirements of SABS 558 and shall be of the size and type Indicated.

Before fixing manhole covers and frames, they shall be dipped in an approved preservative and gratings and frames painted with two coats of bituminous paint. Manhole frames shall be set firmly in a cement mortar to leave the covers flush with the final surface.

**PSLE 5 Construction**

**PSLE 5.2 Bedding and Laying**

**PSLE 5.2.2 Pipe Culverts**

*Add the following:*

"The class of bedding required for the various pipe culverts is shown on the Drawings."

**PSLE 5.8 CONSTRUCTION OF SUBSOIL DRAINAGE**

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 be sealed off with a loose concrete cap of class 20/19 concrete, 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 stormwater 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."

## **PSLE 8 MEASUREMENT AND PAYMENT**

### **PSLE 8.2 SCHEDULED ITEMS**

*ADD THE FOLLOWING ITEMS:*

#### **PSLE 8.3 Subsoil Drainage**

##### **PSLE 8.3.1 Pipes in Subsoil Drains**

- a) Perforated or slotted uPVC pipes complete with couplings (state size).....**Unit : m**
- b) uPVC fitting (state size and type of fitting).....**Unit: No**

The rate shall cover the cost of supplying and installing the pipe or fitting in a stone bed or no-fines concrete, as indicated on the drawings.

##### **PSLE 8.3.2 Crushed Stone in Subsoil Drains.....Unit: m<sup>3</sup>**

The rate shall cover the cost of supplying, transporting irrespective of the distance and placing the stone in the subsoil drain, as indicated on the drawings.

##### **PSLE 8.3.3 Geo textile Blanket in Subsoil Drains.....Unit : m<sup>2</sup>**

The rate shall cover the cost of supplying the geo textile blanket and of placing it in the subsoil drain, as indicated on the drawings.

**PSLE 8.3.4 CCTV Camera inspection of pipes**

CCTV camera inspections shall be for:

- ii. Short (stormwater) pipes up to 20m long and
- iii. Long drainage pipes up to 125m long.

Rates to include establishment, camera inspections and submission of inspection report for approval by the Engineer

- a) All pipes and box culverts.....Unit : No.
- b) Long pipes.....Unit : No.

The bid rates per inspection of one pipe/box culvert shall include full compensation for site establishment, inspection, equipment, reporting, cleaning and submission of results to Engineer for approval.

**PSLG PIPE JACKING**

**PSLG 8 MEASUREMENT AND PAYMENT**

**PSLG 8.2 SCHEDULED ITEMS**

*ADD THE FOLLOWING ITEMS:*

**PSLG 8.2.2 Supply of pipes to be jacked/drilled.....Unit: m**

Provisional 315mm HDPE PE100 PN12.5 to be used. The Contractor/Sub-Contractor responsible for the pipe jacking/drilling needs to design and specify the size and material to be used for pipe jacking. To be approved by Employer's Agent.

**PSLG 8.2.11 Application of Way Leave for the crossing of R65 Provincial Roads...Unit: PSum**

A provisional sum has been included as an allowance for pipeline crossings across National and Provincial Roads. These special road crossings may include pipe-jacking, horizontal drilling or even conventional trenching, but must still be confirmed with the authorities. A percentage mark-up will be applicable to any payments made in this regard other than those included in prices for variations determined in terms of clause 40 of the conditions of contract.

Pipe jacking shall conform with all standards as set out in SANS 1200 LG. Allowance has been made for the work to be done by a specialised nominated sub-contractor. Assistance for the application will be given by the Employer's Agent but it is the responsibility of the Contractor to have approval before any construction commences. Additional requirement as set out by the Mpumalanga Roads and Transport Department must be adhered to.

Formal application shall be made to this office. This office requires the exact crossing point related to our kilometre marker boards. These marker boards appear every 200 metres along the Provincial Road. The kilometre distances increase towards the North.

Two (2) copies of a layout plan and cross- sections and signed wayleave form must be submitted for approval. Depth to the top of the sleeve must be not less than 2 metre under road or natural ground level.

No access manholes shall be allowed within the road reserve. The sleeve pipes in which services are laid must extend across the full width of the road reserve (fence to fence). Isolation valves shall be placed in close proximity to the road reserve in order to isolate the road crossing.

After construction the road crossing needs to be marked so as not to interfere with routine maintenance work.

Furthermore:

- No jacking/drilling pit shall be closer than 3 metres from the road prism.
- A reputable contractor shall be used.
- Other standard conditions relating to the maintenance, construction, removal and indemnity clauses will be included in the final approval.

**PSME SUB-BASE**

**PSME 3 MATERIALS**

**PSME 3.2 PHYSICAL PROPERTIES**

**PSME 3.2.1 Sub-Base Material**

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 unsterilized material as well as for stabilised material prior to stabilisation."

**PSME 5 CONSTRUCTION**

**PSME 5.2 EXCAVATION**

**PSME 5.2.2 Borrow Pits**

Insert the words "designated by the Engineer and" between the words "pits" and "established" in the first line.

**PSME 5.7 TRANSPORT**

REPLACE THE CONTENTS OF THIS CLAUSE WITH THE FOLLOWING:

"The provisions of Sub-clause PSD 5.2.5 of SABS 1200 D, as amended, shall apply."

**PSME 8 MEASUREMENT AND PAYMENT**

**PSME 8.1 BASIC PRINCIPLES**

INSERT A SEMI-COLON IN THE FIRST LINE OF PARAGRAPH (b) AFTER THE WORDS "will be paid for once only" AND DELETE THE REST OF THE PARAGRAPH. AMEND PARAGRAPH (d) AS FOLLOWS:

"(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 stabilising), or overhaul."

**PSME 8.3 SCHEDULED ITEMS**

**PSME 8.3.2 Construct the sub-base course with material from designated excavations**

REPLACE THE CONTENTS OF SUBITEM (a) WITH THE FOLLOWING:

"The rate for (a) shall include full compensation for excavating and selecting sub-base material, for loading and transporting the material within the free-haul 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."



**PSME 8.3.9 Overhaul (Haul Exceeding 2 km):**

REPLACE THIS ITEM WITH THE FOLLOWING:

**"PSME 8.3.9 Overhaul (Haul Exceeding 2 km):"**

Delete this item as no overhaul will be paid on material for the purposes of this contract and all the costs for transporting material shall be included in the applicable bid rates and amounts.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**PSMF BASE**

**PSMF 3 MATERIALS**

**PSMF 3.3 PHYSICAL AND CHEMICAL PROPERTIES**

**PSMF 3.3.2 Graded Crushed Stone**

REPLACE THE CONTENTS OF PARAGRAPH (a) WITH THE FOLLOWING:

"(a)The maximum particle dimension of the gravel shall not exceed 63 mm."

**PSMF 5 CONSTRUCTION**

**PSMF 5.3 PROCESSING**

REPLACE THIS SUBCLAUSE WITH THE FOLLOWING:

**"PSMF 5.3 CHEMICAL MODIFICATION**

The base material shall be prepared, broken down and spread. Road lime complying with the requirements of SABS 824 shall then be spread over the prepared base material at a rate of 3,0%. The materials shall then be mixed dry using road graders, ploughs and other suitable equipment until the lime is mixed thoroughly and uniformly with the base material. The mixed material shall then be watered, mixed and lightly compacted.

After 24 hours have elapsed the material shall be ripped, worked in the normal manner and compacted to 98% of modified AASHTO density."

**PSMF 5.9 TRANSPORT**

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

"The provisions of Sub-clause PSD 5.2.5 of SABS 1200 D, as amended, shall apply."

**PSMF 8 MEASUREMENT AND PAYMENT**

**PSMF 8.3 SCHEDULED ITEMS**

**PSMF 8.3.9 Overhaul:**

REPLACE THIS ITEM WITH THE FOLLOWING:

**"PSMF 8.3.9 Overhaul:"**

Delete this item as no overhaul will be paid on material for the purposes of this contract and all the costs for transporting material shall be included in the applicable bid rates and amounts.

**PSMH ASPHALT BASE AND SURFACING**

**PSMH 5 CONSTRUCTION**

**PSMH 5.5 DESIGN OF ASPHALT**

**PSMH 5.5.1 General**

*REPLACE THE CONTENTS WITH THE FOLLOWING:*

"The design of the asphalt mixes shall be in accordance with the design guidelines of TRH 8."

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Contractor

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Witness 1

--

Witness 2

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Employer

--

Witness 1

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Witness 2

**PSMK KERBING AND CHANNELLING**

**PSMK 3 MATERIALS**

**PSMK 3.1 CONCRETE**

*ADD THE FOLLOWING:*

"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."

**PSMK 5 CONSTRUCTION**

**PSMK 5.11 TRANSITION SECTIONS AND INLET AND OUTLET STRUCTURES**

DELETE THE WORDS "and with the requirements of the Project Specification" IN THE SECOND PARAGRAPH.

*ADD THIS SUB-CLAUSE.*

**PSMK 5.13 Amorflex**

The contractor shall ensure the product is installed correctly as per manufactures specifications and requirements indicated below.

- Step 1: Site preparation, excavation, trimming & compaction
  - Prior to laying Amorflex, the base material must be profiled to line and level and should be compacted to a firm and even finish. Obstructions, such as roots and projecting stones should be removed as the quality of the preparation will be reflected in the finished surface. The angle of repose of the in-situ material must not be exceeded. Maximum desired slope is 1:1,5
- Step 2: Handling & placing by manual labour
  - Amorflex loose block should be placed in a stretcher bond pattern to achieve the mechanical interlock. At areas such as culvert inlets and outlets, the blocks should be placed to allow for access to the cable ducts.
- Step 3: Wiring up in situ
  - The wire is easily pushed through the cable ducts in the blocks and secured as detailed below. The choice of wire will depend on the application. A 3,1 mm diameter galvanized fencing wire or a 5 mm diameter polyester rope can be used. In certain situations, wiring up may not be necessary. Generally, the wire will be threaded perpendicular to the flow.
- Step 4: A final twist to the wire
  - Galvanized wire can be twisted across the block joint for a length of minimum. 100mm or a suitable knot used on the polyester cable.
- Step 5: Anchorage
  - Amorflex placed on steep slopes may slide on the geotextile until the system has settled. Temporary or permanent anchorage can be achieved with steel or wooden pegs through the top cable loops.
- Step 6: Finishing



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

- Armorflex subject to wave attack should be blinded with a sand/gravel mixture. Above normal waterline, the voids should be soiled and seeded to develop natural vegetation.

The engineer shall approve the installation which must be installed as per contract drawings or otherwise indicated by the engineer.

## **PSMK 7 TESTING**

### **PSMK 7.2 CAST-IN-SITU AND EXTRUDED KERBING AND CHANNELLING**

#### **PSMK 7.2.1 General tests**

DELETE THIS SUB-CLAUSE.

#### **PSMK 7.2.2 Alternative tests**

REPLACE THE HEADING AND CONTENTS OF THIS SUB-CLAUSE WITH THE FOLLOWING:

##### **"PSMK 7.2.2 Tests**

The Contractor shall carry out a minimum of one cube crushing tests per 500 m of kerbing or channel placed. The cost of such tests shall be deemed included in the rates bid for kerbing and channels.

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 three cubes of any set of six cubes have been tested after 28 days in an approved laboratory, the average crushing strength is found to be more than 3MPa below the specified strength, the kerbing represented by the cubes will be rejected.

The Contractor may apply for resubmission of the rejected section on the basis of 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."

## **PSMK 8 MEASUREMENT AND PAYMENT**

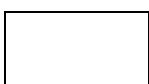
### **PSMK 8.2 SCHEDULED ITEMS**

**PSMK 8.2.14 Supply, Handle and install Amorflex 180 complete with galvanised steel wire including anchors as per drawings.....Unit: m<sup>2</sup>**

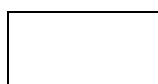
Only units installed and approved by the engineer will be measured.

The tendered rate shall include full compensation for covering the cost of supplying the units with sand including wire and anchors, placing, laying, compacting, filling, locking up the pavement and finishing the product as required and specified.

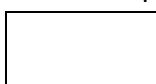
**PSMK 8.2.15 Supply, Handle and install Loffelstein or similar complete as per drawings.....Unit: m<sup>2</sup>**



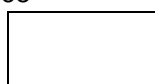
Contractor



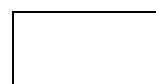
Witness 1



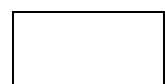
Witness 2



Employer



Witness 1



Witness 2

Only units installed and approved by the engineer will be measured.

The tendered rate shall include full compensation for covering the cost of supplying the units with reinforced anchors, placing, laying, compacting, filling, locking up the blocks and finishing the product as required and specified.

**PSMM ANCILLARY ROADWORKS**

**PSMM 3 MATERIALS**

**PSMM 3.2 ROAD SIGNS**

**PSMM 3.2.2 Structural Steel**

*ADD THE FOLLOWING:*

"All steel sign supports shall be hot-dip zinc coated (galvanised)."

**PSMM 3.2.8 Paints and Protective Coatings**

**PSMM 3.2.8.1 Structural Steel Sign Supports and Sign Face Frames**

*REPLACE THE CONTENTS OF THIS SUBCLAUSE 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 galvanised surfaces shall be thoroughly scrubbed down with an approved galvanised 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."

**PSMM 8 MEASUREMENT AND PAYMENT**

**PSMM 8.3 SCHEDULED ITEMS FOR GUARDRAILS**

*ADD THE FOLLOWING:*

**PSMM 8.2.6 (b) Renovating guardrail material**

The unit of measurement shall be the metre of single guardrail, whether straight or curved, or end units painted as specified, the length of which shall be measured in accordance with the measurements of the guardrail elements after dismantling.

The unit of measurement shall be the number of treated posts.

The tendered rates shall include full compensation for the work as follows:

- If so, directed by the Engineer, guardrails and end treatments suitable for re-use shall be taken to a workshop for cleaning and painting. Renovated guardrail dimensional tolerances shall comply with SANS 1350. Painting of guardrails shall be executed as specified in Clause A13.10.7.6 of Chapter 13. Damaged guardrails should not be used or retrofitted. Re-rolling of guardrails shall not be permitted.
- Timber posts suitable for re-use shall be cleaned and treated by applying a coating of creosote. Bolts, nuts and washers to be reused shall be cleaned and all rust removed and shall then be oiled.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Further the surface preparation, applying all the coats of paint, repairing any damaged surfaces, and all materials and construction plant necessary for completing the work including the loading, transporting to and from the workshops, offloading and storing of the material.

*ADD THE FOLLOWING:*

**PSMM 8.2.6 (c) Re-erection of Guardrails with recovered or provided material**

The unit of measurement for item shall be the metre of guardrail system erected with holes specified to be excavated using labour enhanced methods.

The tendered rates shall include full compensation for re-erecting the guardrails as follows:

- The guardrails shall be erected in the positions as indicated, and all the removed material suitable for re-use and as much supplementary new material as may be necessary shall be used. Re-erection shall be as specified for new guardrails, including fixing the retro-reflective plates.

Further including the loading, transporting between any two points on the site and off-loading the material and providing new fixing material. Payment shall be made separately for any new material required, including spacer blocks, but not for other fixing materials. Where sections are made entirely from new material, payment therefore shall be made under the appropriate items for new guardrails.

The tendered rate shall include full compensation for excavating the necessary holes using labour enhanced construction methods

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2



## AMENDMENTS TO COTO STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE WORKS FOR SOUTH AFRICAN ROAD AUTHORITIES

### COTO CHAPTER 1: GENERAL

#### SECTION 1.6: CLEARING AND GRUBBING

##### PART C: MEASUREMENT AND PAYMENT

*Replace C1.6.8.1 with the following new pay item:*

"Item	Description	Unit
PSC1.6.8.1	Establishment of a temporary nursery	
	a) Fixed Cost – Establishment.....	Sum
	b) Time Related – Operate and Maintain.....	Month
	c) Fixed Cost – De-Establishment.....	Sum

The unit of measurement for item PSC1.6.8.1 a & c shall be Sum and item PSC1.6.8.1 b shall be months. The contract rate (PSC1.6.8.1 a) shall include full compensation for clearing and levelling the nursery site, installing fencing, shade netting and wind breaks, for providing plant containers where necessary and for installing a water supply system. The contract rate (PSC1.6.8.1 b) shall include a rate to be paid monthly for the operation and maintenance of the nursery. The contract rate (PSC1.6.8.1 c) shall include full compensation for de-establishing, removal from site and rehabilitation of the temporary as established in PSC1.6.8.1 a."

*Add the following new pay item:*

"Item	Description	Unit
PSC1.6.8.7	Specialist to identify and mark all plants to be conserved.....	Sum

The unit of measurement for item C1.6.8.7 shall be Sum. The contract rate shall include full compensation for all work necessary appoint a specialist to identify and mark all plants to be conserved including the application for and obtaining of relevant permits and the like."

### COTO CHAPTER 11: ANCILLARY ROADWORKS

#### SECTION 11.5: FENCING

##### PART C: MEASUREMENT AND PAYMENT

*Add the following new pay item:*

"Item	Description	Unit
PSC11.5.11	Supply and erect new fencing material complete for new fence and for supplementing material in existing fences which are being repaired or removed.....	metre (m)

The unit will be measured in meters (m). The fence needs to be supplied and installed complete as specified in item C11.5.1 of COTO.”

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

COTO CHAPTER 12: GEOTECHNICAL

SECTION 12.12: CONSTRUCTION DEWATERING

PART C: MEASUREMENT AND PAYMENT

Add the following new pay item:

"Item	Description	Unit
PSC12.12.9	Installing and commissioning all requisite plant and equipment to undertake dewatering by well system offered.....	Sum

The unit will be measured as a Sum. The well system needs to be established, installed, commissioned, operated and maintained as per items C12.12.1, C12.12.2, and C12.12.3 of COTO."

**C3.5.3 Particular Specifications**

<b>PA:</b>	<b>FENCING</b>
<b>PB:</b>	<b>GENERAL BUILDING WORK</b>
<b>PC:</b>	<b>STANDARD SPECIFICATION FOR THE ERECTION AND COMMISSIONING OF OVERHEAD POWER LINES UP TO 33KV</b>
<b>PD:</b>	<b>STANDARD SPECIFICATION FOR ELECTRICAL – PLANT AND INSTALLATION</b>
<b>PE:</b>	<b>DETAIL TECHNICAL SPECIFICATION FOR 11KV OVERHEAD LINE</b>
<b>PF:</b>	<b>DETAIL TECHNICAL SPECIFICATION FOR PHOTOVOLTAIC POWER SUPPLY SYSTEM</b>
<b>PG:</b>	<b>STANDARD SPECIFICATION FOR SUPPLY, DELIVERY TO SITE, INSTALLATION, TESTING AND COMMISSIONING OF A STANDBY DIESEL GENERATOR</b>
<b>PH:</b>	<b>ELECTRICAL PROJECT SPECIFICATION</b>
<b>PI:</b>	<b>MONITORING INSTRUMENTATION AND EQUIPMENT</b>
<b>PJ:</b>	<b>FOUNDATION DRILLING AND GROUTING</b>
<b>PK:</b>	<b>ROCKFILL EMBANKMENT</b>
<b>PL:</b>	<b>ASPHALT CORE</b>
<b>PM:</b>	<b>SUPPLEMENTARY MECHANICAL SPECIFICATIONS</b>
<b>PN:</b>	<b>HYDRAULIC PACK</b>

**PA FENCING**

**PA 1 SCOPE**

This section covers the erection of new fences, the moving of existing fences, the erection and later removal of temporary fences and the dismantling of existing fences.

**PSA 1.1 TYPES OF FENCES**

The following types of fence shall be erected in accordance with the dimensions indicated:

- a) Modular hot dipped galvanised high strength welded mesh fence (De-Fence NJR or Clear-Vu), swing and pedestrian gates or similar approved.

**PSA 2 INTERPRETATIONS**

The following Specifications shall, inter alia, form part of the Contract Document:

- a) SANS 1200A
- b) SANS 1200C
- c) SANS 1200G
- d) The Standardized Specification for Corrosion Protection and Painting for Civil Engineering Work.

**PSA 3 MATERIALS**

**PSA 3.1 POSTS**

Depending of the supplier and manufacturer, posts are typically be made of rectangular tubular steel, profile 60 x 80 x 2mm or tapered 85-45mm. Post shall be hot dipped galvanised. Length of post shall be panel height + 600mm. Top of post shall be capped with a PVC cap.

**PSA 3.2 PANEL MESH**

Panels shall be min 2900mm wide and 2200-2400mm high. The mesh aperture shall be 76.2 x 12.7mm with horizontal and vertical wire diameters to a minimum of 3mm. Panels shall have 4 strengthening wave bends in the horizontal direction. Panels shall be hot dipped galvanised. Topping shall be galvanised spike rails.

**PSA 3.3 FIXING SYSTEM**

An interlocking fixing system shall be used. Typical systems consist of a flat bar fix over the interlocking section with shear bolts.

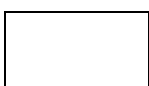
**PSA 3.4 GATES**

Gates shall be manufactured to the dimensions shown below and/or in Schedule of Quantities.

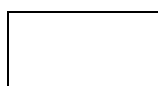
Dimension of the required gates are as follows:

- Vehicle Gate: Double Leaf Swing Gate, 5m wide (Total Width) 2.2-2.4m high.
- Pedestrian Gate: Single Leaf, 1m wide, 2.2-2.4m high

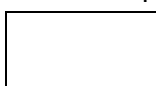
Gates shall be of similar construction and per specifications of the fence supplier.



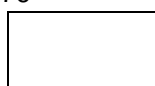
Contractor



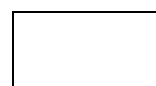
Witness 1



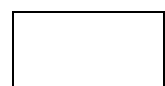
Witness 2



Employer



Witness 1



Witness 2

Gates shall be complete in every respect, and shall include hinges, bolts with nuts and washers, locking devices, which shall be attached to the gate with padlock and three keys. Gates shall be hot dipped galvanised. The contractor shall submit general arrangement drawings for approval by the Employer's Agent.

**PA 3.5 CONCRETE**

Concrete used for fencing shall comply with the requirements of SANS 1200 G.

**PA 4 CLEARING OF FENCE LINE**

Strip clearing for the fence shall be carried out in accordance with SANS 1200 C.

**PA 5 INSTALLING POSTS**

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.

All posts shall be accurately aligned and set plumb. After posts have been firmly set in accordance with the foregoing requirements, the fencing material shall be attached thereto as specified.

**PA 6 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.

**PA 7 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. 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.

**PA 8 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 to leave the fence with a neat and finished appearance.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**PA 9 MEASUREMENT AND PAYMENT**

**PA 9.1 GENERAL**

All items in this section will be measured by number, square metre or linear metre completed and the tendered rates shall include full compensation for the supply, delivery, handling and installation of all materials, the provision of all necessary labour and supervision, transport, plant, equipment and incidentals necessary to complete, protect and maintain the works as specified or as shown on the drawings.

**PA 9.2 SCHEDULED ITEMS**

**PA 9.2.1 Clear fence line.....Unit: m**

Clearance will be measured on the centre line of the fence. A strip of at least 2m wide shall be cleared. The rate shall include as specified in SANS 1200C 8.2.1

**PA 9.2.2 Supply and Erect New Security Fence.....Unit: m**

The tendered rate shall include full compensation for a complete fence installed per linear meter. Fencing will be measured on the centre line of the fence.

**PA 9.2.3 Supply and Erect New Security Gates.....Unit: No.**

The unit of measurement shall be the number of new gates erected. A pair of gates shall be measured as one.

The tendered rate shall include full compensation for gate posts, hinges, bolts, concrete, and locking mechanism, and for the erection of the gates complete as specified and as shown on the Drawings. It shall further include compensation for any fencing wire or mesh used on the gate.



**PB GENERAL BUILDING WORK**

**PB 1 SCOPE**

This section specifies the general requirements for the construction of buildings.

**PB 2 INTERPRETATIONS**

**PB 2.1 SUPPORTING SPECIFICATIONS**

- a) Project specification;
- b) SANS 1200 A or SANS 1200 AA as applicable;
- c) SANS 1200 C;
- d) SANS 1200 D or SANS 1200 DA as applicable;
- e) SANS 1200 G or SANS 1200 GA or SANS 1200 GB as applicable.

**PB 2.2 GENERAL**

Building work shall be carried out in accordance with the National Building Regulations and Building Standards Act, 1977, and these specifications.

References to specifications and codes of practice of the South African Bureau of Standards shall be taken to be references to the latest edition of such specifications and codes of practice as amended. Where possible the SANS mark shall appear on all articles, materials or items where it is required to comply with such SANS specification.

**PB 2.3 COMMERCIAL PRODUCTS**

In all instances where the Contractor handles, stores, uses, applies or fixes commercial products, the work shall be strictly carried out according to the instructions of the manufacturer of such products.

**PB 2.4 SAMPLES**

The Contractor shall furnish without delay, such samples as called for or may be called for by the Employer's Agent. Materials or workmanship not corresponding with approved samples, may be rejected by the Employer's Agent and shall be removed from the works at the cost of the Contractor.

**PB 3 MATERIALS**

**PB 3.1 CEMENT**

Cement for masonry work comply with the requirements of SANS EN 431 1 and cement for concrete work shall be CEM I Portland cement or CEM III blast-furnace cement complying with the requirements of SANS EN 197 1.

Separate storage facilities shall be provided for the various types of cement.

**PB 3.2 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 mortar, plaster or floor screed.

**PB 3.3 LIME**

Lime shall be hydrated bedding mortar lime complying with the requirements of SANS 523.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**PB 3.4 AGGREGATE**

Sand for plaster and mortar shall comply with the requirements of SANS 1090, whereas the aggregates for normal and granolithic floor creeds shall comply with the requirements of BS1199 and BS1201 respectively.

**PB 3.5 BURNT CLAY BRICKS**

Burnt clay bricks shall comply with the requirements of SANS 227 and shall also be equal in all respects to the three samples of each type of brick furnished by the Contractor prior to commencement of the works and as approved by the Employer's Agent.

General purpose (special) bricks shall be used in foundation walls and lintels.

The colour and texture of face bricks shall be as specified in the project specifications. Care shall be taken to avoid damage to arise and faces during transport and handling.

Fire bricks shall be of well burnt refractory fire clay, resistant to spalling and cracking and of same size as the ordinary bricks.

**PB 3.6 CONCRETE MASONRY UNITS**

Pre-cast concrete masonry units shall comply with the requirements of SANS 1215 and shall be solid unless specified otherwise in the project specifications.

**PB 3.7 CALCIUM SILICATE MASONRY UNITS**

Calcium silicate masonry units shall comply with the requirements of SANS 285.

**PB 3.8 WALL TIES**

Wall ties shall comply with the requirements of SANS 28.

**PB 3.9 AIRBRICKS**

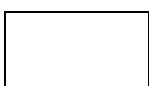
Airbricks shall be well-burnt terra-cotta air bricks in external faces of walls and 250 mm x 150 mm rectangular gypsum air bricks covered with copper mosquito gauze in internal faces.

**PB 3.10 BRICK REINFORCEMENT**

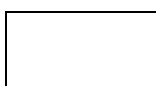
Brick reinforcement shall be hard drawn mild steel comprising two 3,15 mm diameter wires spaced 75 mm apart and 2,8 mm diameter cross wires CONCRETE PAVING SLABS.

Concrete paving slabs shall be precast units of grade 25 MPa/13 mm concrete and shall be of approved manufacture, at least 50 mm thick and sizes 250 mm x 250 mm minimum and 600 mm x 600 mm maximum.

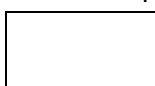
Concrete slabs shall be even in thickness, truly square, free from cracks, twists and blemishes, with a uniform natural cement colour and surface finished smoothly in the mould and shall also be equal in all respects to the samples furnished by the Contractor prior to commencement of the works and as approved by the Employer's Agent.



Contractor



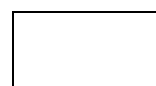
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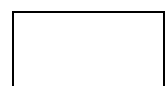
Witness 2



Employer



Witness 1



Witness 2

**PB 3.14 DAMP-PROOF MEMBRANE**

Damp-proof membrane under floors, unless otherwise specified, shall be of polyethylene sheeting complying with the requirements of SANS 952 as Type C plain surfaces specified therein, 250 microns in dry areas and 375 microns in wet areas.

**PB 3.15 DAMP-PROOF COURSE IN WALLS**

Horizontal and vertical damp-proof course, unless otherwise specified, shall be of bituminous sheeting complying with the requirements of SANS 248 and as Type FV (Fibre Base) sheeting or as Type GH (Hessian Base) sheeting specified therein, or of polyethylene sheeting complying with the requirements of SANS 952 and as Type A plain surfaces 450 microns or as Type B embossed surfaces 375 microns as described therein.

**PB 3.35 HOT-DIP GALVANISING TO STEELWORK**

Where prescribed, all steelwork built in as the work proceeds, shall be hot dip galvanized after fabrication and before leaving the manufacturer's works, in accordance with SANS 763.

Where they occur, site welds shall be zinc sprayed in order that the zinc coating be even and continuous over all surfaces.

**PB 3.36 PRESSED STEEL DOOR FRAMES**

Pressed steel door frames shall comply with the requirements of SANS 1129 and shall be constructed of 1,6 mm thick mild steel sheeting, pressed or rolled to the required shapes, properly mitred, welded and reinforced.

Frames shall be of widths required to suit the thickness of walls into which they are built and shall be fitted with suitable tie-bars and braces at bottom, and lugs for building in, three to each jamb of frames without fanlights and four to each jamb of frames with fanlights.

Where fanlights are shown over doors, the frames shall be fitted with transoms of pressed or rolled steel sheet as above and rebate for fanlights and for doors if required.

The rebates in frames and transoms for doors and fanlights shall be of width required to suit the thickness of doors and fanlights.

Frames shall each be fitted in the rebate of one jamb with a pair of approved 100 mm steel butt hinges, and transom to opening fanlights hung at bottom shall each be fitted with a pair of approved 75 mm steel butt hinges, all set flush into recesses in frames and either fixed with countersunk screws or securely welded on.

Frames shall be holed as and where required for screws fixing fanlight openers, keeps of spring catches, etc. Where fanlights are shown to be fixed into frames, the frames shall be holed in the rebates, for screws, securing the fanlights, four to each frame.

Frames shall each be fitted in one jamb, with approved chromium plated or stainless steel (unless otherwise specified) adjustable striking plate keep, boxed in at back of frame with sheet metal box welded on, and not less than two rubber buffers.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

All welding shall be cleaned off smooth and flush on exposed faces and frames shall be cleaned and primed as described for steel windows before leaving the manufacturer's works.

### **PB 3.37 STEEL DOORS, SIDELIGHTS AND FANLIGHTS**

Steel doors, sidelights and fanlights shall, in the case of stock types, comply with the requirements of SANS 727, and in the case of purpose made types with the constructional and other requirements of the above specification wherever applicable, and shall in addition be equipped with the following:

- a) Suitable weather bars where required to render doors, etc., perfectly watertight;
- b) Suitable lugs, or holes at the same spacing as the standard fixing lugs, for screwing frames to plugs in the concrete, where frames of doors, etc. are to be fixed to concrete columns, beams, etc.; and
- c) A primer as described for steel windows, except where hot-dip galvanizing is prescribed.

Doors, sidelights and fanlights, unless otherwise shown shall be of "one piece" construction, but where shown to be in two or more "one piece" units, the units shall be coupled together with standard coupling-mullions and/or transoms.

Bottom openings in doors and sidelights shall be fitted with kicking plates of one thickness of 1,6 mm thick mild steel sheet fixed with metal beads.

Frames of outward opening doors shall be fitted at bottom with sills of door framing section (stepped sills) and of inward opening doors with metal ties, welded to frames, for embedding in thresholds (flush sills).

Stock doors, sidelights and fanlights shall be of the types shown on drawings and purpose made doors, sidelights and fanlights shall be constructed to the forms and sizes shown on drawings.

Unless otherwise specified, the doors shall be of not less than 33 mm universal sections and the sidelights and fanlights of standard 25 mm sections.

Fanlights shall be hung and fitted as described for steel windows in clause 3.39.

### **PB3.38 BALANCE TYPE STEEL DOOR**

The balance type steel door shall be of the "back track" type tip-up door, constructed of not less than 0,8 mm thick mild steel sheeting, pressed to form troughed or fluted pattern horizontal panels, each approximately 200 mm wide, all strongly reinforced at back with 1,2 mm thick top hat section mild steel braces and/or stiffeners and provided all round exposed edges with 1,2 mm thick mild steel channels, all properly welded together and with all welding cleaned off smooth and flush.

The door is to be hung on two galvanized flexible steel cables of not less than 5 mm diameter, connected at lower ends to 125 mm diameter steel encased counterweights of such length and mass as will balance the door in the fully open position and connected at upper ends to door unit by passing cables over 140 mm diameter bushed cast aluminium pulleys, securely fixed to 2,50 mm thick mild steel top plates.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

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Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

The movement of door is to be controlled by means of sintered metal rollers, (nylon rollers are not acceptable) securely fixed at top and centre of outer edges to door unit to operate in horizontal and vertical runner guides respectively.

The guides are to be formed of 37 mm x 32 mm x 25 mm mild steel channels and with vertical channels fitted at upper ends with horizontal channels, welded on to form back track for top rollers. Each vertical channel is to be four times bolted to jamb of door opening and each horizontal channel is to be secured in position to internal wall with mild steel angle bracket, twice bolted to wall to form rigid construction.

The counterweights to door to be encased with 2,50 mm thick mild steel cover plates, each the full height of door and securely fixed to wall and channel guide.

Door to be fitted near bottom with cast aluminium lifting handle for operating the door and with chromium plated locking handle, complete with control rods and with striking plate bolted to lintel, over door opening. The locking handle is to be operated from outside and is to be provided with two keys.

Before leaving the manufacturer's works, all metal is to be given a protective priming coat of paint in accordance with the requirements of SANS 909.

### **PB 3.39 STEEL WINDOWS**

Stock residential and industrial type steel windows shall comply with the requirements of SANS 727 and all other types both stock and purpose made shall comply with the constructional and other requirements of the above specification wherever applicable, and shall in addition be equipped with the following:

- a) Suitable weather bars where required to render the windows perfectly watertight;
- b) Suitable lugs, or holes at the same spacing as the standard fixing lugs, for screwing frames to plugs in the concrete where frames of windows are to be fixed to concrete columns, beams, etc;
- c) Windows and components, except where specified to be hot-dip galvanized, shall before leaving the manufacturer's works, be cleaned by acid pickling rinsing and drying, as laid down in SANS code of practice 064, or by other approved means, to remove all scale, rust, grease, oil and foreign matter and then primed with red oxide zinc chromate primer complying with the requirements of SANS 909, applied by dipping or by means of spray gun.

Ventilators hung at side to open out in windows above ground floors and not accessible for cleaning from an adjoining opening ventilator in the same window or from verandas, balconies and the like, shall be hung on projecting hinges.

Windows, unless otherwise specified, shall be of "one piece" construction, but where shown to be in two or more "one piece" units, shall be coupled together with standard coupling mullions and/or transoms.

Windows shall be fitted with solid brass handles, stays, catches and other fittings, those to windows constructed of universal sections having polished finish and to all other

windows rumbled finish. The fittings shall be fixed in such a way as to be removable after windows are glazed.

**PB 3.40 RESILIENT FLOOR FINISHINGS**

Semi-flexible vinyl (vinyl-fibre) floor tiles shall comply with the requirements of SANS 581; flexible vinyl (PVC) floor tiles and sheeting shall comply with the requirements of SANS 786 and thermoplastic (asphaltic) floor tiles shall comply with the requirements of SANS 586. Unless otherwise described, the flooring shall be of marbled pattern and of approved light colour and tiles shall be 230 mm x 230 mm or 250 mm x 250 mm in size.

Vinyl cove skirtings shall be of approved manufacture and colour and unless otherwise stated, 70 mm in height.

**PB3.41 GLASS FOR GLAZING**

Glass for glazing shall comply with the requirements of CKS 55.

Glass not exceeding 0,75 square metre surface area of glass pane, shall be flat drawn clear sheet glass of "QQ" quality (ordinary glazing quality) and of 3 mm thickness.

Glass exceeding 0,75 square metre and up to 1,5 square metres surface area of glass pane, shall be clear float glass of "GG" quality (glazing quality) and of 4 mm thickness.

Laminated safety glass for glazing shall be of "SQ" quality (selected glazing quality) and of 6 mm thickness unless otherwise specified. If high impact strength glass is used, whether cut to size or not, the stencil mark is to appear in a prominent place on the glass.

Toughened safety glass for glazing up to 3 square metres shall be, unless otherwise specified, of 4 mm thickness and must be ordered to the correct size as toughened glass cannot be cut, and each piece of glass to be marked in a clear and permanent fashion. (For bigger sizes, manufacturer's instructions are to be followed).

Any pane of glass installed in any door shall, where not made of safety glass, be not more than 1 m<sup>2</sup> in area and shall have a nominal thickness of not less than 6 mm.


Obscure glass for glazing, unless otherwise specified, shall be Arctic or other similar approved figured rolled glass, of a nominal thickness of not less than 3 mm for glass panes up to a surface area of 0,75 square meter and not less than 5 mm over 0,75 square meter.


Putty for glazing shall comply with the requirements of SANS 680, of Type I for glazing in wood and of Type II for glazing in steel windows, doors, etc. Putty used for glazing in unpainted hardwoods, shall be tinted to match the colour of the wood.


**PB 3.42 PAINTS**


All materials for paint work for which South African Bureau of Standards specifications have been published, shall comply with the requirements of such specifications and shall bear the standardization mark of the South African Bureau of Standards on the container


or packing. Materials for paint work for which no SANS specifications have been published shall be of brand and manufacture approved by the Employer's Agent.


  
Contractor

  
Witness 1

  
Witness 2

  
Employer

  
Witness 1

  
Witness 2



All materials for paint work must be brought on to the site in unopened containers and no adulteration will be allowed.

Undercoats for paint work shall be as supplied by the manufacturer of the paint being used for the finishing coat.

Paints shall be suitable for application on the surfaces on which they are to be applied, and those used externally shall be of exterior quality or suitable for exterior use.

If necessary, paints shall be strained free from skins and similar impurities immediately before application.

The various primers, undercoats, paints and distempers shall comply with the requirements of the specifications quoted hereunder and shall be of the type of grade stated, viz:

a) Primers

i. For Wood:

SANS 678. Type I shall be used on exterior woodwork and Type III on interior woodwork.

ii. For Metal:

Dip or spray application (red oxide zinc chromate). For steel windows, doors, door jambs, and other articles normally dip or spray primed in the manufacturer's works: SANS 909.

Brush application (zinc chromate). For all metal surfaces primed on site and then painted: SANS 679, Type I.

iii. For Structural Steel (red lead)

SANS 312, Type II, Grade I

iv. For Galvanized Iron

SANS 912

v. For Galvanized Metal Surfaces and Surfaces of Non-Ferrous Metals

Wash primer (metal etch primer): SANS 723.

b) Undercoats

For all surfaces under HIGH GLOSS, OIL GLOSS, FLAT and EGGSHELL finishing paints: SANS 681, Type II.

c) Paints

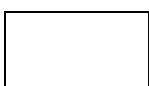
i. High Gloss : SANS 630

ii. Oil Gloss : SANS 631

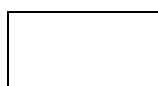
iii. Flat and Eggshell : SANS 515

iv. Emulsion Paint (Interior) : SANS 633, Grade I

v. Emulsion Paint (Exterior) : SANS 634, Synthetic Polymer Base Type, but pure acrylic resin base for fibre cement surfaces



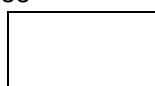
Contractor



Witness 1



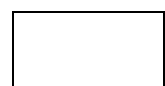
Witness 2



Employer



Witness 1



Witness 2

- |                              |   |                               |
|------------------------------|---|-------------------------------|
| vi. Aluminium Paint          | : | SANS 682, Grade II            |
| vii. Roof Paint              | : | SANS 683, Type B              |
| viii. Structural Steel Paint | : | SANS 684, Type B              |
| ix. Epoxy Tar                | : | SANS 801 (types as specified) |

d) Distemper  
SANS 322

e) Varnish for interior use  
SANS 887, Type I with eggshell finish.

**PB 4 PLANT**

**PB 4.1 GENERAL**

The Contractor shall have at his disposal the normal plant necessary for the proper and neat completion and rounding off of all facets of the building work.

**PB 4 CONSTRUCTION**

**PB 4.1 BRICKLAYER**

**PB 5.1.1 Cement Mortar**

Cement mortar shall, unless otherwise specified, be composed of four parts by volume of sand and one part by volume of cement for normal brickwork, and three parts by volume of sand and one part by volume of cement for reinforced 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.

Care shall be taken in mixing cement mortar to remove from the mixing machine or platform any old mortar that has already set, as such mortar must not be incorporated in any new batch.

Cement mortar shall be produced in such quantities as can be used before commencing to set, as no cement mortar that has once commenced to set shall be used in any way.

**PB 5.1.2 Brickwork**

Brickwork, wherever practicable and not otherwise specified, shall be built in English bond. No false headers shall be used, and none but whole bricks employed, except where legitimately required to form bond.

The brickwork, unless otherwise specified, shall be built in 4:1 cement mortar. Brick arches and brick lintels shall be built in 3:1 cement mortar.

The bricks shall be laid on a solid bed of mortar and all joints thoroughly grouted up solid throughout the whole width of each course.

The brickwork shall be carried up in a uniform manner, no portion being raised more than 1,2 m above an adjacent portion.

The bricks shall be well saturated with water, in the stack or dump, approximately two hours before being used. The tops of walls left off, shall be well wetted before work is recommenced.

All rough and fair cutting and cutting of splays, skew backs, chamfers, etc., shall be properly performed.

All necessary openings for pipes, etc., shall be formed or left and made good after pipes, etc., are fixed in position.

Walls generally shall be taken up two courses above panelled ceilings in the same mortar as the wall below and cut between ties, etc.

Where hollow concrete masonry units are used brick-force shall be built into the walls every third course. Mortar for hollow concrete masonry units shall consist of one-part cement, two parts lime and nine parts sand by volume. All cavities below floor level shall be filled with Grade 15 MPa/19 mm concrete.

#### **PB 5.1.3 Mortar Joints**

Mortar joints to brickwork generally shall be 10 mm in thickness.

The joints in brickwork receiving plaster, tiling or similar finishing's, shall be raked out whilst the mortar is soft to form key for the plaster or mortar backing. The depth of the raking out will depend on the condition of the bricks; the rougher the bricks on face the shallower the raking out and the smoother the bricks the deeper the raking out.

The joints in brickwork shall be flushed off where walls are to be bagged, in readiness for the bagging.

#### **PB 5.1.4 Brickwork in Thicknesses**

Walls built in two or three thicknesses shall be tied together with and including metal ties of sufficient length to allow not less than 75 mm of each end to be built into brickwork and shall be spaced not more than 1 m apart to every third course and staggered.

#### **PB 5.1.5 Brickwork in Linings**

Linings to concrete shall be tied with and including 4 mm diameter galvanized crimped wire ties of necessary length to allow 75 mm to be bedded into concrete and 75 mm of the other end to be built into brickwork and evenly spaced 1 m apart to every third course and staggered.

#### **PB 5.1.6 Half Brick Thick Walls**

Half brick thick walls shall be built in 4:1 cement mortar and reinforced with 75 mm wide brick reinforcement, one row to every eighth course in height, and built 100 mm into main connecting walls. The reinforcement shall be lapped 150 mm at end joints, where these are necessary, and 75 mm at angles.

#### **PB 5.1.7 Cavity Walls**

Cavity walls, unless otherwise specified, shall be built with two half brick thicknesses of brickwork in stretcher bond with 50 mm cavity between, and the two thicknesses tied together with 200 mm long metal wall ties of the butterfly type, spaced at not more than 1 m centres alternately to every third course of brickwork.

Unless otherwise specified, the brickwork shall be built in 4:1 cement mortar.

The cavities shall be carried up from one course of brickwork below damp course level up to two courses below wall plate level, unless otherwise shown or specified. The brickwork above cavities shall be built solid, and where 270 mm thick shall be cut and well bonded where possible. Cavities in foundation walls of cavity walls shall be filled with Grade 15 MPa/19 mm up to 150 mm below the damp-proof course level.

The cavities shall be kept free of all rubbish, mortar droppings and projecting mortar.

The tops of walls shall be covered with planks or sacking during wet weather to prevent rain from entering the cavities.

The cavities shall not be ventilated.

At door, windows and other openings, the cavities shall be stopped 110 mm back from jambs of openings with the inner thickness of brickwork returned and stopped against the outer thickness and not bonded to same.

A 110 mm wide strip of damp-proof sheeting as described for damp-proof course in clause 3.15 shall be built in between the two thicknesses in the joint formed by the return and the outer thickness. The damp-proof strip shall be lapped at least 50 mm on to the sheeting between the two thicknesses of sills and between the two thicknesses of lintels. Sills to windows shall be divided into external and internal thicknesses with strips of damp-proof sheeting as above, built in line with the damp-proof sheeting in jambs and extending 100 mm beyond the jambs of openings.

The lintels shall be provided with damp-proof sheeting as described under lintels.

Unless otherwise specified, cavities shall be stopped one course below and one course above and 110 mm from sides of openings for air bricks and the like.

#### **PB 5.1.8 Reinforced Brick Lintels**

Reinforced brick lintels shall be built with sound machine made bricks, in 3:1 cement mortar, with all vertical and horizontal joints filled solid with mortar throughout the required number of courses and to a distance of at least 330 mm on either side of the clear opening.

The number of courses in lintels over the various size openings shall be as specified in table hereunder, and reinforcing steel wires or rods shall be built into the first horizontal joint over the bottom course as laid down therein, viz.:

Lintel Span	Number of Courses	Reinforcement
Not exceeding 1m	4	One row of 75 mm wide brick reinforcement for each half brick width soffit.
Over 1 m to 1,5 m	6	One row of 75 mm wide brick reinforcement for each half brick width soffit.
Over 1,5 m to 2,1 m	7	Three 6,3 mm diameter mild steel rods for each half brick width of soffit.

The reinforcing wires and rods shall be of length at least equal to the width of the clear opening plus 330 mm at each end. The reinforcement shall be evenly spaced in the brick joints, with the outer wires or rods having at least 20 mm cover from face of brickwork.

Brick lintels in 270 mm thick cavity walls shall be built in two half brick thicknesses in stretcher bond, with inner face of outer thickness for a depth of three courses above soffit, covered with sheeting as for damp-proof course, the full length of lintels, and space between the two thicknesses for the depth of the sheeting filled in solid with Grade 15 MPa/19 mm concrete. Where cavities continue above lintels, the sheeting shall be taken up and turned on to top of first course of brickwork to inner thickness of wall, above the concrete filling in lintels.

The lintels, except where built over pressed steel door frames and the like, shall be supported on temporary formwork left in position for at least fourteen (14) days.

#### **PB 5.1.9 Beam Filling**

Beam filling, unless otherwise specified, shall be half brick thick, built-in similar mortar as used in the walls below, cut in between roof timbers and carried hard up to underside of roof covering, and flushed up in mortar.

#### **PB 5.1.10 Bagged Finish to Brickwork**

Bagged finish to brickwork, if done whilst the mortar in joints is still soft, shall be formed by rubbing over the wall surfaces with wet rough sacking, until all joints and crevices are filled up and an even surface is obtained. Mortar, as used for building the brickwork, shall be added as may be necessary.

If bagging to walls is done after the mortar in joints has set the wall surfaces shall be rubbed over with wet rough sacking as above, but cement grout shall be added as necessary to fill up the joints and crevices and to obtain an even surface.

#### **PB 5.1.11 Building in Brickwork**

Ends of timbers, hold-fasts, cramps, gratings, air bricks, dowels, etc., shall be built-in in cement mortar.

Door and window frames and the like shall be set up in positions for building in and securely strutted to prevent distortion whilst the brickwork, lintels, etc., are being built.



Pressed steel door frames shall be grouted in solid at back with cement mortar as the work proceeds.

Wood slips, fixing bricks, hoop iron, roof ties, etc., shall be built in as the work proceeds.

Ventilators shall be built into openings formed in the walls, in 3:1 cement mortar, and grouted in solid with similar mortar and wall finishes made good if disturbed.

Wood frames to doors, windows, etc., shall be set up in position for building in as described and built in as the work proceeds with cramps to jambs of 1,6 mm thick galvanized hoop iron, 32 mm wide, with ends turned 50 mm up against stiles of frames and each twice screwed to frame, and built 450 mm into wall with end turned up into brickwork joint. Cramps shall be built in approximately 0,3 m up from bottom and approximately 0,3 m down from head of frames and intermediately at not exceeding 0,85 m apart. No frame shall have less than two cramps to each jamb irrespective of height.

Cramps to frames in 270 mm thick cavity walls shall be cranked as necessary and built into inner and outer thicknesses of walls alternately.

The stiles of wood door frames, and similar frames not having sills framed in, shall be doweled to concrete, brick, stone and similar thresholds with 10 mm diameter mild steel dowels 75 mm long, one to each stile.

#### **PB 5.1.12 Securing of Roofs**

Roof trusses shall be fixed at each support to walls with ties of 1,2 mm thick galvanized hoop iron, 30 mm wide, built 750 mm deep into brickwork or embedded 300 mm deep into concrete or wrapped around bottom layer of reinforcing in a reinforced concrete beam and, unless otherwise specified, wrapped over truss and fixed with four galvanized nails, 60 mm long and taken up to and lapped round the nearest purling and well spiked thereto.

#### **PB 5.1.13 Bedding and Pointing**

All door, window and similar frames shall be bedded and pointed in 3:1 cement mortar. All wall plates shall be set true and level and bedded in 4:1 cement mortar.

Steel door and window frames shall be carefully pointed all round and made perfectly watertight.

Where steel door and window frames are specified to be pointed with mastic compound, they shall be pointed all round externally with an approved waterproof compound, of such composition that it will not stain surrounding surfaces, and that it will adhere tenaciously, remain plastic without sagging or running, be capable of accommodating any normal movement of the joint sealed, and will receive paint without "bleeding". The pointing material shall be forced into the joints, which shall have been previously prepared to receive same, by means of a pressure gun, or by other suitable method, all in accordance with the manufacturer's instructions.

#### **PB 5.1.14 Faced Brickwork**

Faced brickwork shall be built fair and the joints shall be square recessed to a depth of approximately 6 mm, formed with a square jointing tool well pressed into the joints as the work proceeds.

The Contractor shall construct a test section of 10 m<sup>2</sup> which shall be approved by the Employer's Agent, before continuing with faced brickwork.

Face bricks shall be sorted by the brick manufacturer at his yard or by the Contractor on the site, to ensure that proper mixing of the bricks within the colour range of each type of facing brick being used is obtained; sudden changes in the general colour of face work in any one type of facing brick will not be acceptable.

Sand in mortar for all faced brickwork shall all be from one source.

Faced brickwork shall be kept perfectly clean and rubbing down of the brickwork shall not be allowed. Scaffold boards shall be turned back during rain to avoid splashing. Soiled brickwork shall be cleaned at the Contractor's expense, and the cleaning method shall be approved by the Employer's Agent.

#### **PB 5.1.15 Fibre Cement Sills**

Sills shall be in single lengths cut between reveals, fitted with fixing lugs and solidly bedded in 3:1 cement mortar with a slight projection beyond the finished wall face below.

Internal sills shall be level. External sills shall be set sloping on cut brickwork or on fine concrete filling under.

#### **PB 5.1.16 Laying of Quarry Tiles**

Joints to paving shall be continuous in both directions.

Tiles shall be solidly bedded and jointed in 3:1 cement mortar with joints, unless otherwise specified, 6 mm wide and slightly pointed with a round jointing tool. Tiles shall be well soaked in water before fixing and thoroughly cleaned off after fixing.

Tiles in sills, copings, etc., shall be set with slight projection over finished wall face, and where full tiles do not fit into the length, two cut tiles shall be used, symmetrically placed as directed.

#### **PB 5.1.17 Installation of Electrical Service**

The Contractor shall embed in the concrete and/or brickwork, as the work proceeds, all conduits, boxes, etc., which will be fixed in position by the electricians, and must cut all necessary chases and holes in walls for conduits and form recesses in walls for distribution boards, all in the positions directed, notwithstanding whether the installation of the electrical service is carried out by the Contractor or under a separate contract. Alternatively, distribution boards may be built into walls as the work proceeds, providing prior approval are obtained from the Employer's Agent.



The Contractor shall afford every facility and shall render reasonable assistance to the electricians in carrying out their work, and shall make good where necessary, in all trades, after installation has been completed.

**PB 5.1.18 Installation of Mechanical Equipment**

Where the installation of mechanical equipment is carried out under a separate contract the Contractor shall arrange for the building in of special fittings, leaving holes and openings or forming chases in floors, walls, etc., for pipes, cables etc., and for the building in of pipes, sleeves, pipe clips, bolts, etc., as required or directed.

All cutting of holes through finished floors, walls, etc., after the concrete or mortar has set, must be avoided as far as possible, and the Contractor must give ample notice to the Employer's Agent who will ascertain the exact positions where pipe sleeves, pipes, pipe clips, etc., are to be built in.

**PB 5.1.19 Protect and Clean Down Brickwork, Etc.**

Angles of face brickwork, reveals, steps, etc., liable to damage shall be covered up and protected during the progress of the remaining work, and any damage done shall be made good at the Contractor's expense and to the satisfaction of the Employer's Agent.

Face brickwork and brick and tile sills, copings, etc., shall be cleaned down as the work proceeds, and surfaces liable to be soiled by mortar or plaster splashes during the progress of the remaining work shall be covered with paper, pasted on, or by other approved means. At completion of the works the coverings shall be removed and the surfaces again cleaned down to the satisfaction of the Employer's Agent.

Any detergent or other materials used in the cleaning down of face brickwork, etc., shall be of such nature that will not harm adjoining paint and other finishing's in any way.

All tile and other paving's shall be thoroughly cleaned off after laying to remove all traces of mortar and other substances, covered up and protected from damage during the progress of the works, and again cleaned off at completion.

**PB 5.2 TILER**

**PB 5.2.1 Laying of Glazed Ceramic Wall Tiles**

The tiles shall be fixed direct to walls in 3:1 cement mortar with horizontal and vertical joints continuous and shall have all joints rubbed in solid with neat white cement grout. Tiles shall be well soaked in water before fixing and thoroughly cleaned off after fixing.

Unless otherwise specified, the wall tiling shall project approximately 4 mm beyond face of adjoining plaster with all exposed edges finished with glazed rounded edge tiles.

Tiling shall be returned into reveals of openings and on to windowsills, and shall be butted at internal angles and provided with glazed rounded edged tiles to external angles, unless otherwise specified.

All necessary cutting to tiles shall be properly performed.

Walls shall be well wetted before tiling is commenced.

**PB 5.2.2 Laying of Ceramic Floor Tiles**

Ceramic tiles shall be bedded to a true and even surface on 3:1 cement mortar and with joints not exceeding 2 mm wide.

After the tiles have been allowed to set for a period of not less than twenty-four hours the joints shall be grouted in to with approved epoxy compound, or acid proof cement mortar.

**PB 5.2 PLASTERER AND PAVIOUR**

**PB 5.3.1 Cement Plaster**

Cement plaster for one coat work on walls shall be composed of four parts of sand and one part of cement for internal work, and five parts of sand and one part of cement for external work, all by volume, and mixed as described for cement mortar in clause 5.1.1.

Cement plaster on concrete surfaces shall be composed of three parts by volume of sand and one part by volume of cement.

**PB 5.3.2 Forming Key to Concrete for Plaster Finish**

All surfaces of concrete receiving plaster, or similar finishing's, shall be well wetted and wire brushed immediately after the formwork is removed and slashed over with 2:1 cement grout to form key for the finish, to the approval of the Employer's Agent. The slashing to be allowed to set hard before the finish is applied.

Other methods may be used if approved by the Employer's Agent.

Particular care shall be taken in forming the key for plaster where steel shuttering is used, and if considered necessary the surface of the concrete shall be hacked.

**PB 5.3.3 Thickness of Plaster**

Plaster on walls shall be not less than 12 mm or more than 20 mm in thickness, and plaster on concrete ceilings and beams shall be not less than 9 mm or more than 16 mm in thickness, unless otherwise specified.

**PB 5.3.4 Application of Plaster**

Walls shall be well wetted before plastering is commenced.

The surfaces of internal plaster shall be steel trowelled to a smooth, even and true finish. External plaster shall be finished to a true and even surface with a wood float. All plaster surfaces shall be free from blemish.

Plaster shall be returned into reveals and soffits of openings, and all angles shall be true and straight with salient angles slightly rounded.

The rendering coat of plaster in two coat work shall be approved by the Employer's Agent before the setting coat is applied, and notice shall be given to the Employer's Agent when it is ready for inspection.

All cracks, blisters and other defects shall be cut out and made good and the whole left perfect at completion.

NB - See clause 5.3.2 for forming key for plaster on concrete.

**PB 5.3.5 Normal Screeds to Floors**

Concrete sub-floors finished with wood mosaic, vinyl sheeting and tiles, and similar finishing's, shall be screeded with 3:1 cement mortar, of thickness required, but in no case less than 12 mm, and steel trowelled to a true and smooth surface suitable to receive finishing's.

The screeding shall be laid before the concrete sub-floors have matured otherwise the exposed surfaces of concrete shall be thoroughly cleaned with a wire brush, and a coat of neat cement grout applied immediately before the screeding is laid.

The screeding shall be laid in good time to allow of it being perfectly dry when the finishing is laid.

No traffic shall pass over nor shall any building operations take place on the screeding without proper covering first being provided.

**PB 5.3.6 Granolithic Screeds**

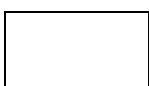
Granolithic screeds shall be composed of two parts by volume of cement and three parts by volume of aggregate with sufficient water added to obtain a consistency as dry as may be practicable. The screed shall be rendered with a wood float and struck off with a steel trowel after set has commenced.

Granolithic screeds to floors, treads of steps, thresholds, and similar horizontal surfaces unless otherwise specified, shall be not less than 25 mm thick. Granolithic screeds to stair risers, sides of kerbs, and other vertical surfaces, shall, unless otherwise specified, be not less than 20 mm thick. Exposed salient angles of granolithic screeds shall be neatly rounded to approximately 20 mm radius, unless otherwise specified.

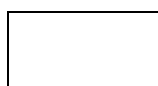
The granolithic screeds shall be laid before the concrete sub-floor has matured otherwise the exposed surface of concrete shall be thoroughly cleaned with a wire brush, and a coat of neat cement grout applied immediately before the granolithic screed is laid.

The granolithic screeds shall be laid in panels not exceeding 9 m<sup>2</sup> in area and joined to lines of panels and lined into smaller squares as directed with sunken V-joints. The joints between the panels shall coincide with joints in the concrete sub-floor where possible.

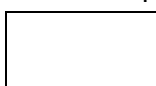
Where granolithic screed is to be tinted it shall be laid in two layers, a lower layer laid to within 6 mm of the finished level, and an upper layer into which the requisite quantity of approved colouring pigment shall have been mixed. No dusting on of colouring material will be allowed.



Contractor



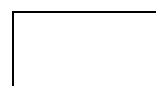
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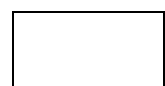
Witness 2



Employer



Witness 1



Witness 2

All granolithic work shall be done by experienced workmen, and shall be protected from injury caused by rain or other extreme weather for twelve hours after being laid, and against too rapid drying whilst hardening, by being covered with wet sacks, or other suitable material, and shall be protected from injury and discoloration during the progress of the remaining work.

Edges of granolithic floors butting against different floor finishing's, and edges of margins, etc. shall be true and sharp, and shall be protected by fixing temporary wood strips, which shall remain, in position until the commencement of the laying of the adjoining flooring material.

**PB 5.3.7 Readings to Steps, Etc.**

The treads of granolithic finished steps and upper surfaces of granolithic finished external thresholds shall be rendered non-slip by reading same near front edges for a width of 100 mm stopped 100 mm from ends.

**PB 5.3.8 Power Floated Finish**

Power floated finish to floors etc., unless otherwise specified, shall be floated mechanically to smooth and even surfaces before the concrete has set. Small surfaces and inaccessible places to be floated by hand in a similar way. Under no circumstances is cement mortar to be added while floating the concrete.

**PB 5.3.9 Laying of Concrete Paving Slabs and Paving Bricks**

Concrete paving slabs and paving bricks shall be bedded and jointed on a layer of 30 mm clean dry river sand. Joints shall be 6 mm wide, continuous in both directions, filled solidly with 3:1 cement mortar and slightly pointed with a round jointing tool. Lengths in excess of 10 meters shall be provided with expansion joints.

**PB 5.4 WATERPROOFING**

**PB 5.4.1 Damp-Proof Course in Walls**

The damp-proof course shall be the full thickness of walls above foundations and shall be laid without longitudinal joints. At end joints, angles and intermediate junctions the sheeting shall be lapped 150 mm.

Where so specified all laps in the damp-proof course shall be sealed over the whole area of laps, to an approved method. Care shall be taken not to tear or otherwise damage the sheeting.


**PB 5.4.2 Damp-Proof Membrane**


The damp-proof membrane under floors, etc., shall be laid in the widest practical widths to minimize joints and shall be turned up, dressed to load bearing walls and if applicable lapped with the damp-proof course in the walls. All joints shall be sealed with pressure sensitive tape applied over the leading edge of the joint.


**PB 5.4.3 Expansion Joints**


Expansion joints shall be at least 10 mm wide and filled in with approved bitumen impregnated soft board or closed cell expanded polyethylene strip. Expansion joints shall


be sealed with a two-component poly-sulphide joint sealer, 12 mm deep, according to instructions of the manufacturers.


  
Contractor

  
Witness 1

  
Witness 2

  
Employer

  
Witness 1

  
Witness 2

**PB 5.5 CARPENTER AND JOINER**

**PB 5.5.1 Protection of Timber on Site**

Timber stored on site shall be properly stacked when received, and adequately protected against extremes of weather and exposure to the sun, until required for use.

**PB 5.5.2 Wrought Faces**

Exposed woodwork, unless otherwise specified, shall be wrought to a smooth surface, and properly sand-prepared to remove all machine or other tool marks.

For each wrought face on structural timber, an allowance will be made off the "nominal" dimensions specified or stated on the drawings, as follows:

- (a) 2,5 mm for "nominal" dimensions up to and including 76mm;
- (b) 3,5 mm for "nominal" dimensions over 76 mm.

For each wrought face on joinery timber, an allowance will be made off the "nominal" dimensions specified or stated on the drawings, as follows:

- a) 3 mm for "nominal" dimensions up to and including 76mm;
- b) 5 mm for "nominal" dimensions over 76 mm.

The above will be the net allowances permitted off the "nominal" dimensions specified or stated on the drawings and will not be additional to the tolerances specified for sawn timbers.

All exposed angles of wrought woodwork, unless otherwise specified, shall be arise rounded. The term "arise rounded" denotes that the angles shall be rounded off to approximately 3 mm radius.

Angles of wrought woodwork specified to be angle rounded shall be rounded off to 6 mm radius, unless otherwise shown on the drawings, and shall include, in framed joinery, for housed and metered joints.

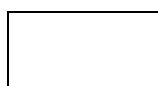
**PB 5.5.3 Lengths of Timbers and Methods of Jointing**

Plates, purlins, battens, laths, slats, etc., shall be in single lengths, but where this is not possible the end joints will be formed as described below. The jointing of plates, battens, etc. at junctions and angles shall also be formed as stated hereunder, viz:

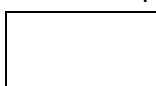
- a) Wall plates shall be halved at joints and well spiked together, and also at junctions and angles;
- b) Purlins shall be splayed or spliced at joints and, unless otherwise specified, using timber side plates of the same dimensions as purlins, not less than 600 mm long and four times bolted with M10 mild steel bolts, with two washers each. Adjacent purlins shall not be splayed or spliced in the same bay or on the same rafter;
- c) Sawn battens, laths, slats, etc., shall be butt jointed at heading joints and angles, and wrought battens, laths, slats, etc., shall be splayed at heading joints and metered at angles, all over points of support and where adjacent, shall not be jointed on the same rafter.



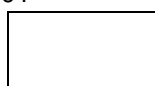
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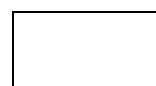
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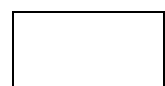
Witness 2



Employer



Witness 1



Witness 2

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Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

### **PB 5.5.22 Framed Joinery**

Where the word "Framed" is used it is to include for all mortice and tenon joints, dovetail joints, grooves, stop grooves, rebates, stop rebates, housings, notching's, etc., including housing ends of shelves, divisions, etc.

### **PB 5.5.23 Joinery**

Joinery work shall be put in hand immediately after the order has been given to commence work, or after the receipt of detail, where such are to be supplied, and shall not be wedged or glued up until just before fixing in the building.

No framed joinery for services situated inland shall be manufactured in the humid coastal belt, and no framed joinery for the services situated in the coastal belt shall be manufactured inland. This applies to both purpose made and stock joinery.

All exposed softwood timber in joinery which is not to be painted shall be free from large, loose or dead knots, knot holes, checks, splints, wane or other defects, and in joinery which is to be painted shall be free from all defects other than those which can be filled or otherwise made good in such a way as will not impair the paint finish. All exposed hardwood joinery timber shall be free from all knots, knot holes, checks, splints or other defects and, unless otherwise specified, shall also be free of sapwood.

Purpose made joinery shall be manufactured strictly in accordance with detail drawings. Stock joinery shall be of approved quality. Joinery shall not be primed until it has been inspected and approved.

Skirting, rails and the like shall be in long lengths. Heading joints where necessary shall be splayed. Counter tops, table tops, drainers, and the like, shall be formed with wide boards, jointed with grooved, cross-tongued and glued joints or with grooved rebated and glued joints of approved type; cross-tongues shall be stopped 25 mm back from ends where ends are exposed to view. The boards shall be in single lengths to top, etc., but where this is not possible the heading joints shall be staggered and jointed as above.

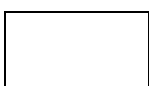
Skirting, rails, angle moulds and beadings of all kinds, shall be close fitted, mitred or scribed at angles, and securely fixed; skirtings, rails and the like shall be fixed with hardened steel or other suitable nails driven into the brickwork or shall be nailed to wall plugs spaced at not more than 700 mm apart. Glazing beads and the like shall be mitred at angles and, unless otherwise specified, shall be fixed with panel pins.

## **PB 5.6 METALWORK**

### **PB 5.6.1 Manufactured Steelwork Generally**

Welding is to be done electrically in the most up to date manner by skilled workmen and cleaned off on completion.

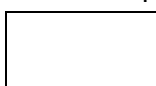
All welds are to be welded with welding rods of the same chemical composition as the tubes, rods, bars, etc., to be welded and all external welds are to be filed clean and smooth.



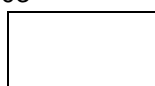
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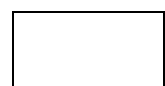
Witness 2



Employer



Witness 1



Witness 2



Welding to be continuous fillet welding to all exposed edges unless otherwise described.

No scaffolding shall be allowed to rest on or fixed to steel windows, doors, frames, etc., in any way.

**PB 5.7 RESILIENT FLOOR FINISHINGS**

**PB5.7.1 Laying and Fixing**

Vinyl sheeting and tiles and such like floor finishing shall be laid in strict accordance with the manufacturer's instructions, on a perfectly dry and clean screeded surface, using an adhesive supplied or recommended by the manufacturer of the flooring material, and rolled with a suitable roller to ensure complete adhesion of the material. The flooring shall be cut where required and neatly fitted against adjoining floors, thresholds, etc. Vinyl skirtings shall be close fitted to floors and walls, butted at end joints, neatly mitred at internal angles and dressed round external angles, and fixed with adhesive as for flooring.

Unless otherwise described, sheet flooring shall be in standard widths with cut sheets at sides of floors as necessary.

**PB 5.8 GLAZIER**

**PB 5.8.1 Fixing of Glass**

Glass fixed with glazing beads in unpainted hardwood doors shall be bedded on strips of rubber, velvet, leather, or felt turned over on to both sides of glass in the rebates to form a soft packing between the glass and the woodwork. In all other cases the glass shall be well bedded in back putty in the rebates.

Glass rebates, other than in unpainted hardwood doors, shall be primed before glazing.

Glass panes exceeding 0,5 m<sup>2</sup> in surface area and fixed with putty only in wood doors, sashes and the like shall be secured in addition with glazing sprigs, and in steel windows and doors with glazing pegs or clips inserted in holes in the steel framing.

Glass panes shall have adequate clearance between the edges of glass and the rebates.

Putty shall be carefully trimmed and cleaned off with front putty worked to within 3 mm of the sight lines.

**PB 5.9 PAINTER**

**PB 5.9.1 Preparatory Work**

a) General

All floors must be swept clean and walls dusted down, and surfaces not being painted such as face brickwork, sills, floors and stained woodwork covered up and protected against spotting, before any painting is commenced.

No sweeping or dusting shall be done whilst painting is in progress or whilst paint is still wet.

b) On woodwork

Woodwork being painted shall be well brushed down, knots treated with knotting, and all surfaces primed, stopped with hard stopping and rubbed down to an even surface ready to receive the paint.

Woodwork being oiled or stained shall have all plaster stains, pencil marks and other surface discolorations and blemishes carefully removed and stopped with tinted stopping and well rubbed down.

c) On metalwork

All metal surfaces being painted, except steel structures shall be cleaned of all rust, scale and dirt by scraping or by means of steel wire brushes; also, all oil and grease shall be removed, and a perfectly clean surface obtained. If necessary, the surface shall be decreased immediately before applying the priming coat, by the use of a suitable grease-removing solvent; any salt deposits on the metal surfaces as may occur in industrial and marine atmospheres shall be removed by the use of a suitable detergent and the surface then thoroughly rinsed and allowed to dry.

New galvanized metal surfaces and surfaces of all non-ferrous metals, which are to be painted, shall be cleaned down as above and given one coat of wash primer (metal etch primer).

Protective coatings on new galvanised metal surfaces, applied by the manufacturers to prevent storage stain and white rust, shall be completely removed by the use of a suitable cleaning agent and the surfaces thoroughly rinsed and allowed to dry, before the surfaces are primed or painted.

After cleaning off rust on metalwork those portions so affected shall be treated with an approved rust inhibitor.

d) On Plaster:

All plastered wall, ceiling and such like surfaces being painted or distempered shall be filled where necessary with suitable stopping or patching plaster and the whole rubbed down ready to receive the finishing's.

e) On Ceilings:

Boarded ceilings, cover strips and cornices being painted or distempered, shall be filled where necessary with suitable stopping and all nail heads in ceilings, cover strips and cornices being distempered shall be primed with flat paint.

**PB 5.9.2 Surfaces to be Dry**

All plastered wall, ceiling and similar surfaces shall be perfectly dry and in a fit state to receive the finishing's, before the work is put in hand.

**PB 5.9.3 Priming**

Wood, metal and other surfaces normally primed before being painted shall be prepared and primed as before described in readiness to receive the specified paint system.

Backs of wood door and similar frames and surfaces of other new or re-fixed joinery in contact with brickwork, etc., and built in as the work proceeds, shall be primed before building in whether the articles are to be painted or not, to prevent moisture seeping into the wood from the mortar bedding.

Wood surfaces shall be knotted, primed and stopped before being coated with emulsion paint or distemper.

Tongued and grooved and rebated edges of boards in batten doors, and other suchlike inaccessible parts of joinery shall, before the joinery is assembled, be primed or where the joinery is to receive a finish other than paint, be given one coat of such other finishing material.

Priming to external structural timbers shall be applied before the timbers are fixed in position and shall include all wrought surfaces, such as backs of fascia and barge boards.

**PB 5.9.4 Application of Paint**

All coats of paint shall be thoroughly dry before subsequent coats are applied and rubbed down where necessary.

All work shall be finished to colour approved by the Employer's Agent. The tints of undercoats shall approximate those of the finishing colour and in order to indicate the number of coats applied and to avoid misses when applying a succeeding coat, a slight difference shall be made in tint of each coat.

Priming on wood surfaces shall be by brush application. Priming on surfaces other than wood shall be by brush application or if in the opinion of the Employer's Agent, the primer and the surfaces are considered suitable for roller application, the primer may be so applied. Priming applied by brush application shall be well brushed in to obtain maximum penetration.

Undercoat and finishing coats may be applied by brush or roller.

The use of spray gun on site for application of paint will not be permitted, except in the case of cellulose and other special cases where spraying is the accepted method of application; in cases where spraying is permitted all surrounding surfaces shall be properly masked.

The finishing coat on woodwork and metalwork, unless otherwise specified, shall be of high gloss paint. All materials shall be used in strict accordance with the manufacturer's instructions.

#### **PB 5.10 PROTECTION AND CLEANING OF WORKS**

The Contractor shall provide all necessary dust sheets, covers, etc., and shall exercise all necessary care to prevent marking surfaces of walls, floors, ceilings, glass, electrical fittings, etc., and shall keep all parts of the works perfectly clean and free at all times from spotting, accumulation of rubbish, debris or dirt arising from the operations. Any surface disfigured or otherwise damaged shall be completely renovated or replaced as necessary, to the Employer's Agent's approval, by the Contractor at his own expense.

The Contractor shall test all doors, fanlights and windows and all other fittings for proper operation and effect the required rectification prior to the handing over of the building. The premises shall be left clean and fit for occupation at the completion of the work.

#### **PB 6 TOLERANCES**

##### **PB 6.1 BASIS OF MEASUREMENT**

###### **PB 6.1.1 General**

Permissible deviations will apply in the case of linear dimensions, position, and level. The Contractor shall construct each of the various parts of the works within the limits of the applicable permissible deviations set out in clause 6.2 unless some other degree of accuracy is required in terms of the project specification or is shown on the drawings.

###### **PB 6.1.2 Methods of Measurement of Deviations**

Certain deviations will be measured as set out below:

Any deviation from flatness of a plane surface, will be measured as the maximum deviation of the surface from any straight line of length 3 m 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 one over each of the points.

Any abrupt change in a continuous surface, including a local depression or peak in a floor or wall, will be measured as specified in (a) above.

Out-of-squareness of a corner or an opening or an element such as a column will be measured by taking the longer of two adjacent sides as the base line, and determining any departure from the perpendicular of the side at either end of this base line.

## **PB 6.2 PERMISSIBLE DEVIATIONS**

The permissible deviations for elements or components shall be as follows:

### Elements or Components Permissible Deviation

Position on plan of any edge or surface measured from the nearest grid line or agreed centre line	± 25 mm
Linear (other than cross-section) dimensions	± 30 mm
Cross-section dimensions	-10 + 20 mm

Level (deviation from designed level with reference to the nearest transferred datum (TD) of the upper or lower surface, as may be specified, of any slab or other element or component) ± 10 mm

Out-of-squareness of a corner or an opening or an element such as a column (See clause 6.1.2(c)) for short side of length:

- |                                     |         |
|-------------------------------------|---------|
| • up to and including 0,5m          | ± 5 mm  |
| • over 0,5 m up to and including 2m | ± 15 mm |
| • over 2 m up to and including 4m   | ± 20 mm |

Exposed surface (including floor slabs and paving):

- |  |        |
|--|--------|
| • Flatness of plane surface              | ± 5 mm |
| • Abrupt changes in a continuous surface | ± 5 mm |

Exposed surface to be plastered or receive normal or granolithic screeds:

- |  |         |
|--|---------|
| • Flatness of plane surface              | ± 10 mm |
| • Abrupt changes in a continuous surface | ± 5 mm  |

Surface of plaster and normal or granolithic screeds ± 5 mm

## **PB 7 TESTS**

### **PB 7.1 GENERAL**

The Employer's Agent shall have free access to the works for taking samples and carrying out tests. The Contractor shall render any assistance necessary. If so required, the Contractor shall provide storage and protection of such samples on site.

## **PB 8 MEASUREMENT AND PAYMENT**

### **PB 8.1 GENERAL**

PB 8.1.1 All items in this section will be measured by number, square metre or linear metre completed and the tendered rates shall include full compensation for the supply, delivery, handling and installation of all materials, the provision of all necessary labour and supervision, transport, plant, equipment and incidentals necessary to complete, protect and maintain the works as specified or as shown on the drawings.

PB 8.1.2 Where a lump sum is required for a complete structure the tendered rate shall include all items and contingencies, as specified in this section or as shown on the drawings.

---

**PB 8.2 SCHEDULED ITEMS**

**PB 8.2.1 Brickwork.....Unit: m<sup>2</sup>**

Brickwork will be measured on the centre line of the walls. Areas occupied in walls by windows and doors will be excluded from the areas measured, and corners and intersections common to more than one brick wall will be measured once only.

The rate shall cover the cost of brickwork complete as specified, including test sections where specified, pointing, providing brick lintels, brick reinforcement and ties, etc., the building in of conduits, beams, pipe sleeves, doors and windows, the raking out of joints and the filling of cavities in cavity walls and walls constructed of hollow concrete masonry units, below floor level and elsewhere where specified.

The test section for faced brickwork as specified in clause 5.1.14 shall only be paid for if approved by the Employer's Agent and, if rejected, shall be removed at the Contractor's expense.

**PB 8.2.2 Air Bricks**

- a) External air bricks.....Unit: No  
b) Internal air bricks.....Unit: No

The rate shall cover the cost of providing and building in the air bricks as specified.

**PB 8.2.3 Bagged Finish to Brickwork .....Unit: m<sup>2</sup>**

The rate shall cover the cost of providing rough sacking, additional cement grout as required and finishing the bagging as specified.

**PB 8.2.4 Windowsills**

- a) External (describe).....Unit: m  
b) Internal (describe).....Unit: m

The rate shall cover the cost of providing and building in face bricks, fibre cement sheets or any other material prescribed, as well as all accessories specified.

**PB 8.2.5 Tiling.....Unit: m<sup>2</sup>**

The rate shall cover the cost of providing all material and the laying and grouting of tiles, complete as specified.

**PB 8.2.6 Plaster Work .....Unit: m<sup>2</sup>**

The rate shall cover the cost of the construction of the plaster work, including the supply of all materials, mixing, applying, finishing, forming reveals, joints, etc., complete as specified.

**PB 8.2.7 Floor Screeds**

- a) Normal screeds.....Unit : m<sup>2</sup>  
b) Granolithic screeds.....Unit : m<sup>2</sup>

The rate shall cover the cost of the construction of the floor screeds, including the supply of all materials, mixing, laying, finishing, the forming of nosings, readings, skirtings, etc. and, where the concrete sub-floor has matured, of the brushing and applying a cement grout, complete as specified.

**PB 8.2.9 Waterproofing**

- a) Damp-proof course in walls.....Unit: m  
b) Damp-proof membrane under floors.....Unit: m<sup>2</sup>

The unit shall be the net length or area of waterproofing installed. The length or area of overlaps shall not be measured for payment.

The rate shall cover the cost of providing and laying all material as specified, including the sealing of all laps and joints, complete as specified.

**PB 8.2.10 Expansion Joints.....Unit: m**

The rate shall cover the cost of providing and installing all filling and sealing material and of the forming of expansion joints, complete as specified.

**PB 8.2.11 Structural Timber**

- |   |           |
|---|-----------|
| (a) Wall plates (indicate size)                     | Unit: m   |
| (b) Beams (indicate size)                           | Unit: m   |
| (c) Joists (indicate size)                          | Unit: m   |
| (d) Rafters (indicate size)                         | Unit: m   |
| (e) Purlins (indicate size)                         | Unit: m   |
| (f) Branderling (indicate size)                     | Unit: m   |
| (g) Roof trusses complete (indicate drawing number) | Unit: No. |
| (h) Battens (indicate size)                         | Unit: m   |

The rate shall cover the cost of the supply of all materials, manufacture, cutting, waste, laps, joints and fixing of the timber as indicated, including nails, bolts, nuts, washers, hoop irons, ties and other fixtures required, complete as specified.

**PB 8.2.12 Roof Covering.....Unit: m<sup>2</sup>**

The rate shall cover the cost of providing and fixing all roof covering material as prescribed, including all flashings, soakers, valleys, ridge coverings, roofing screws and all other fixtures required to complete the work, as specified.

**PB 8.2.13 Fascia's and Barge Boards.....Unit: m**

The rate shall cover the cost of providing and fixing of all material, fixtures, screws, bolts, nuts, washers and other accessories required to complete the work, as specified.

---

**PB 8.2.14 Gutters and Rainwater Down pipes**

- |                         |          |
|-------------------------|----------|
| (a) Gutters             | Unit: m  |
| (b) Rainwater downpipes | Unit: No |

The rate shall cover the cost of supply and building in of all material including angles, stopped ends, outlet nozzles, gutters, gutter brackets, etc. for gutters and swan necks, branch pieces, plinth bends, radius bends, shoes, brackets, etc. for rainwater downpipes, including all bolts and sealants, complete as specified.

**PB 8.2.15 Ceilings**

- |                          |                      |
|--------------------------|----------------------|
| (a) Ceilings             | Unit: m <sup>2</sup> |
| (b) Cornices to ceilings | Unit: m              |

The rate shall cover the cost of supply and installation of all material including cover strips to joints, nails, trapdoors and gypsum plaster where prescribed, complete as specified.

**PB 8.2.16 Ceiling Insulation.....Unit: m<sup>2</sup>**

The rate shall cover the cost of supply and installation of all material, as specified.

**PB 8.2.17 Joinery**

- |   |               |
|---|---------------|
| (a) Doors (type and size indicated)                   | Unit: No      |
| (b) Skirtings (size indicated)                        | Unit: m       |
| (c) Other items (describe or indicate drawing number) | Unit: No or m |

The rate shall cover the cost of the supply of all material, manufacture, cutting, waste, fixing and installation of the joinery items, complete as specified.

The rate for doors shall also cover the cost of the door frames and all accessories, such as hinges, hooks, bolts, locks, latches, etc., and of damp-proof course on both sides and above door frames in cavity walls, as specified.

**PB 8.2.18 Metalwork.....Unit: No**

The rate shall cover the cost of supplying all material, manufacture, applying priming coat of paint or galvanising, as specified, delivery and building in of units, including burglar proofing where specified, locks, catches, glazing, etc., and of damp-proof course under all windows and on both sides and above frames in cavity walls, as specified.

**PB 8.2.19 Floor Finishing's**

- |  |                      |
|--|----------------------|
| (a) Ceramic Tiles  | Unit: m <sup>2</sup> |
| (b) Epoxy  | Unit: m <sup>2</sup> |
| (c) Vinyl-fibre, PVC, or thermoplastic floor tiles (specify) | Unit: m <sup>2</sup> |
| (d) Vinyl cove skirting                                      | Unit: m              |

The rate shall cover the cost of supplying all material and adhesives required and the laying of the floor finishing's.



---

**PB 8.2.20 Painting.....Unit: m<sup>2</sup> or Sum or No**

Only the surface covered by the final finishing coat shall be measured.

The rate shall cover the cost of surface preparation, supplying and applying all the coats of paint, repairing any damaged surfaces, and all materials necessary for completing the work.

**PB 8.2.21 Electrical Installation.....Unit: Sum or P/Sum**

The rate shall cover the cost of supplying and building in of all equipment such as switchboards, conduits, wires, cables, sockets, light fittings, etc., cutting recesses, chases and holes in walls as required and repairing any damaged surfaces after installation, including testing of the installation.

On completion of an installation a Certificate of Compliance will be issued for the electrical installation as required by SANS 10142.

**PB 8.2.22 Miscellaneous.....Unit: No, Sum or m**

The rate shall cover the cost of all workshop detail drawings, where prescribed, material, plant, tools and labour to complete the scheduled items complete, as detailed, including corrosion protection and/or painting, as specified, and building in.

**PB 8.2.23 Fire Extinguishers, First Aid Kits, Danger Signs and Notices.....Unit: Sum**

The rate shall cover the cost of:

- All danger signs and safety notices shall be in two of the official languages, operating notices, signs and labels that are not safety related need only be in English. Signs / notices with approved symbols may be used in the place of text signs.
- Fire extinguishers shall be provided alongside the entrance.

And if specified:

- First aid kits shall be provided at the entrance/exit of the room at a position to be agreed with the Engineer. The kit will be in a metal first aid box, at an appropriately demarcated and sign posted first aid station, on a wall mounted shelf or other approved mounting.
- "Burn shield" Dressings" shall be provided in each kit.

**PC STANDARD SPECIFICATION FOR THE ERECTION AND COMMISSIONING OF OVERHEAD POWER LINES UP TO 33KV**

**PC1. SCOPE**

This general technical specification describes the usual materials and methods required for the erection and commissioning of a complete overhead transmission line which comprises either bare or insulated overhead conductor, wooden, steel, or concrete poles, stay assemblies, insulators, strain, and suspension clamps. Where the detailed technical specification and/or the drawings differ from this general technical specification, the detailed specification and the drawings shall take preference.

This section covers the supply, delivery, erection, and commissioning of overhead transmission line connections of up to 33 kV.

All materials and fittings shall be new and of high quality.

**PC2. STATUTORY REQUIREMENTS**

The installation of electrical equipment shall always comply with the requirements, stipulations and regulations contained in the following Acts:

- Occupational and Health Safety Act 85 of 1993;
- the Post Office Act, No. 85 of 1991 and the Postmaster General's Requirements issued in terms of the Act;
- the Mines and Works Act, No. 27 of 1956 and subsequent amendments and regulations issued thereunder;
- the Electricity Act, No. 41 of 1987;
- the Forest Act, Article 34 of Act No. 72 of 1968;
- the Explosive Act, No. 26 of 1956 as amended; and
- the South African Transport Services Safety Regulations.

**PC3. STANDARDS**

**PC3.1 General**

Overhead lines shall be erected in accordance with SANS 10280: OVERHEAD POWER LINES FOR CONDITIONS PREVAILING IN SOUTH AFRICA.

**PC3.2 Reference Standards**

Unless otherwise specified all materials must comply with the SABS and NRS specifications as stipulated below.

- NRS 033: Electricity Distribution – Guidelines for the application design, planning and construction of medium voltage overhead power lines up to and including 33kV, using wooden pole structures and bare conductors.
- NRS 034: Guidelines for the provision of electrical distribution networks in residential areas.
- NRS 043: Code of practice for the joint use of structures for power and telecommunication lines
- NRS 059: Recommendations to minimize problems associated with the theft of transformer neutral and neutral earthing copper conductors
- NRS 060: Code of practice for clearances for electrical systems with rated voltages



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

up to and including 145kV, for the safety of persons

- NRS 082: Recommended maintenance policy for electricity networks

#### **Overhead Conductors**

- SANS 182-1: Conductors for overhead electrical Transmission line part 1: Copper wires and stranded copper conductors (metric units)
- SANS 182-2: Conductors for overhead electrical Transmission line part 2: Stranded aluminium conductors
- SANS 182-3: Conductors for overhead electrical Transmission line part 3: Aluminium conductors, steel reinforced
- SANS 182-5: Conductors for overhead electrical Transmission line part 5: Zinc-coated steel wires for conductors and stays.
- SANS 1418-1: Aerial bundled conductor system Part 1: Cores
- SANS 1418-2: Aerial bundled conductor system Part 2: Assembled insulated conductor bundles
- SANS 1713: Electric cables –Medium voltage aerial bundled conductors for voltages from 3.8/6.6kV to 19/33kV
- NRS 020: Cable ties for use with ABC
- NRS 018: Fittings and connectors for low voltage overhead power lines using ABC.

#### **Insulators**

- NRS 066 : Medium voltage insulators
- SANS 60273 : Characteristics of indoor and outdoor post insulators for systems with nominal voltages greater than 1000V.
- SANS 60305: Insulators for overhead lines with nominal voltage above 1000V – ceramic or glass insulator unit for a.c. systems – characteristics of insulator units of the cap and pin type.
- SANS 60383-1: Insulators for overhead lines with nominal voltage above 1000V. Part 1: Ceramic or glass insulator units for a.c. systems – definitions, test methods and acceptance criteria.
- SANS 60383-2: Insulators for overhead lines with nominal voltage above 1000V. Part 2: Insulator strings and insulator sets for a.c. systems – definitions, test methods and acceptance criteria.
- BS EN 60305: Insulators of ceramic material or glass for overhead lines with a nominal voltage greater than 1000 V.
- SANS 60720: Characteristics of line post insulators
- SANS 60815: Guide to the selection of insulators in respect of polluted conditions
- SANS 61109: Composite insulators for a.c. overhead lines with a nominal voltage greater than 1000V – Definitions, test methods and acceptance criteria.
- SANS 61462: Composite insulators – Hollow insulators for use in outdoor and indoor electrical equipment – Definitions, test methods, acceptance criteria and design recommendations.

#### **Poles**

- NRS 038: Concrete poles
- SANS 470: Concrete poles for telephone, power, and lighting purposes
- SANS 753: Pine poles, cross arms and spacers for power distribution, telephone systems and street lighting
- SANS 754: Eucalyptus poles, cross-arms and spacers for power distribution and



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

telephone systems

### **Wood Preservatives**

- SANS 592: Wood preservatives containing high temperature creosote and coal tar
- SANS 593: Wood preservatives containing low and medium temperature creosote and coal tar
- SANS 10005: The preservative treatment of timber
- Earthing
- SANS 10199: The design and installation of an earth electrode
- SANS 1063 Earth rods and couplers
- SANS 10200: Neutral Earthing in medium voltage industrial power systems
- SANS 1029: Earthing of low-voltage (LV) distribution systems
- ESKCAAB4: Zinc coated earth conductor, guy and stay wire for transmission lines.
- SANS 10313: The protection of structures against lightning

### **Paint and Finishing**

- NRS 002: Graphical Symbols and Labelling for electrical diagrams
- SANS 1091: National colour standards for paints
- SANS 935: Hot dip galvanised zinc coatings on steel wire
- SANS 121: Hot dip galvanised coatings on fabricated iron and steel articles.
- SANS 10064: The preparation of steel surfaces for coating
- SANS 679: Zinc chromate primers for steel.
- BS 183: Specification for galvanized steel wire.
- BS 381: Paint
- BS 2569: Zinc Metal Spraying

### **Assemblies and associated accessories**

- NRS 022: Electricity Distribution – Stays and associated Components
- NRS 051: Suspension and strain fittings for insulated supporting structures used in medium voltage aerial bundled systems.
- NRS 053: Accessories for medium voltage power cables (3.8/6.6 kV to 19/33 kV)
- SABS 178: Non-current-carrying line fittings for overhead power lines;
- SABS 171 : Low voltage lightning arresters.

### **PC3.3 Clearances of Power Lines**

In positioning lines and equipment, fixing connections and setting of jumpers, the minimum clearances shall be in accordance with SANS 10280 as shown below.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

Maximum r.m.s phase to phase voltage for which insulation is designed kV	Minimum safety clearance Phase to earth m	Minimum safety clearance Phase to phase m	Above ground outside townships m	Above ground in townships m	Above roads in townships, proclaimed roads outside townships and railways m	To communication lines, other power lines or between power lines and cradles m	To building, poles and structures not forming part of power lines m
1.1 or less	-	-	4.9	5.5	6.1	0.6	3.0
7.2	0.15	0.2	5.0	5.5	6.2	0.7	3.0
12	0.20	0.3	5.1	5.5	6.3	0.8	3.0
24	0.32	0.4	5.2	5.5	6.4	0.9	3.0
36	0.43	0.5	5.3	5.5	6.5	1.0	3.0
48	0.54	0.61	5.4	5.5	6.6	1.1	3.0
72	0.77	0.89	5.7	5.7	6.9	1.4	3.2
100	1.00	1.14	5.9	5.9	7.1	1.6	3.4
145	1.45	1.68	6.3	6.3	7.5	2.0	3.8
245	1.85	2.7	6.7	6.7	7.9	2.4	4.2
300	2.35	3.6	7.2	7.2	8.4	2.9	4.7
362	2.90	4.3	7.8	7.8	9.0	3.5	5.3
420	3.20	4.8	8.1	8.1	9.3	3.8	5.6
800	5.50	8.9	10.4	10.4	11.6	6.	8.5

Where the clearances are likely to vary due to the flexibility of connections or the remoteness of fixed supports, the abovementioned clearances shall be increased to suit the conditions pertaining, allowing for swing due to wind etc.

#### **Power line and communication line crossings**

Power lines shall cross communication lines as nearly as possible to right angles. Where this is impractical, the deviations from right-angle crossings as are permitted in accordance with SANS 10280 shall be implemented.

#### **PC4. NOTICES AND PRECAUTIONS**

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

The Contractor shall take all the necessary precautions and provide the necessary warning signs and/or lights to ensure that the public and/or employees are not endangered.

The Contractor will be held responsible for damage to any existing services and infrastructure prior to commencing the installation.

Lightning type danger notices shall be fitted to all structures with transformers, mechanically operated switchgear, and fuses, as well as a notice indicating the nominal operating voltage.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

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Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

## PC5. LINE IMPULSE LEVEL

The line Basic Impulse Level (BIL) shall be maintained at the full voltage recommended in SANS 10280 as follows:

Line Voltage (kV)	Impulse Voltage withstand level (kV)
Up to 6,6	75
11	95
22	150
33	200

## PC6. POLES

### PC6.1 General

- The line configuration and support structure shall be suitable for the proposed route.
- Poles shall always be planted in a straight line as far as possible.
- All pole marking tags shall face the roadside or all shall face the same direction, 3.5m from the butt.
- Planting of poles next to roads or streets shall comply with the specifications of the responsible road's authority.
- LV, MV and street lighting (i.e., electrical services) shall not share a pole with telephone services.
- Care must be taken so that the required clearances are adhered to.
- Should MV and LV installations share the same pole, a taller pole shall be used to keep LV connections on the same height as if for a LV pole.

### PC6.2 Pole spacing

- The spacing of poles shall nominally be 70m.
- In urban areas pole spacing shall follow the planned erven layout. The normal pole spacing for low voltage lines shall be 35m while for medium voltage lines it shall be 70m.

### PC6.3 Pole planting

Poles shall be planted vertically plumb and in line and sufficiently stayed to maintain that position where necessary. Proper compacting of the ground around a pole is essential and shall be achieved with a 1:10 cement/sand (soilcrete) mixture for the backfill, if specified by the Engineer.

### PC6.4 Pole earthing

An earth down lead conductor (stranded galvanised steel wire, size 3 /4.00mm) shall be stapled to each MV pole in a straight line from 500mm below the lowest conductive part at the top of the pole to the bottom. The conductor shall not be wrapped around the pole at any point since this will increase the reactance of the down lead. The interval between staples shall not exceed 500mm.





## PC6.5 Wooden poles

### PC6.5.1 General specification

The wooden poles shall comply with the following specifications:

**Type:** Pine or Eucalyptus poles approved by the Engineer.

**Standards**

- a) The poles shall comply with SANS 753 (Pine Poles) and SANS 754 (Eucalyptus Poles) shall bear the SABS/SANS mark of approval.
- b) The creosote preservative for the poles shall comply with the requirements for type A1 of SANS 592.
- c) The impregnation of the preservatives shall be carried out in accordance with SANS 10005 using the empty cell vacuum pressure process.

**Sizes: Wooden poles**

Pole length	Pole top	Application	Planting depth
5m	80-99mm	Service connections	1.0m
7m	120-139mm	ABC	1.3m
8m	120-139mm	ABC	1.3m
9m	140-159mm	ABC	1.5m
10m	160-179mm	MV	1.7m
11m	160-179mm	MV	1.8m
11m	180-199mm	MV transformer structures	1.8m
12m	180-199mm	MV	2m
13m	180-199mm	Special MV application	2.2m
14m	200-219mm	Special MV application	2.2m
15m	200-219mm	MV	2.2m

**Strength:** The minimum group strength of the poles shall be 55Mpa.

**Finish of top end:** The top end shall be square cut single.

**Banding:** Poles shall be loop tension banded at both ends.

**Plant tags:** The poles shall be provided with identification tags bearing:

- (i) the identification mark of the plant at which the pole was treated e.g., 5x
- (ii) the year during which the pole was treated e.g., "2020"
- (iii) the class of wood preservative used (see SANS 10005) e.g. A1
- (iv) the number of the charge in which the pole was treated e.g., 137
- (v) the group strength or maximum fibre stress in bending e.g., 55Mpa.

### Drilling of poles

Templates shall be used for drilling holes required to fix cross-arms, brackets, indicators, etc. to the poles.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

## **PC6.6 Concrete poles**

### **PC6.6.1 General**

Concrete poles shall be one of the following types, as specified by the purchaser and approved by the engineer and in accordance with SANS 470:

- a) Reinforced concrete pole,
- b) Partially prestressed concrete pole, or
- c) Prestressed concrete pole

Poles shall be manufactured in accordance with NRS 038

### **PC6.6.2 Design**

#### **PC6.6.3 Length, tip, and butt dimension**

The overall length of the pole shall be as specified or approved by the Engineer and shall be one of the following standard lengths: 4m, 7m, 9m, 10m, 11m, 12m, 15m, 18m, 21m and 24m. The tip and butt dimensions of the 4m up to 11m poles shall be as per the detailed figures in NRS 038.

#### **PC6.6.4 Cover of reinforcement**

The minimum thickness of the overall reinforcement in the case of centrifugally spun poles shall be not less than 15mm over the entire length of the pole. In the case where poles are manufactured by any other process the cover shall not be less than 20mm. When poles are required for use in aggressive soils the special additional requirements may include one or more of the following: Protective coatings; Additional concrete cover to reinforcement; Replacement of cement with slagment; Higher factor of safety (to limit crack widths)

#### **PC6.6.5 Finish**

The finished product will have a smooth external surface free from honeycombing. All corners shall be clean, straight, and rounded to a radius of at least 5mm.

#### **PC6.6.6 Holes**

Holes shall be provided in the poles during the manufacturing of the poles. These holes shall be used for the attachment of strain or suspension and other equipment. The holes shall be positioned as specified in the relevant figures detailed in NRS 038. Drawings indicating the specified poles with pole holes shall be furnished to the Engineer for approval prior to ordering thereof. On all transformer poles, the integral earthing facility EW 2900 and EW 8700 shall be replaced with a PVC conduit embedded in the concrete to protect the earth conductor in order to allow for separate earthing of the MV and LV earth in accordance with SANS 10292 and SANS 10200 respectively. This separate earthing is necessary when the earth resistivity value of the transformer structure is above 1 ohm. On all other MV poles the earthing ferrules (EW 2200 and EW 8000) shall be provided for earthing of the poles.

#### **PC6.6.7 Pole Strength**

Pole strengths shall comply to table 1, NRS 038 and SANS 470.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

## **PC7. STEEL STRUCTURES, CONFIGURATION AND CROSS-ARMS**

### **PC7.1 General**

#### **PC7.1.1 Galvanizing**

Except where specified to the contrary, all iron and steel used in the construction of the Contract Works shall be galvanized in accordance with SANS 121 after all sawing, shearing, drilling, punching, filling, bedding, and machining are completed. Galvanizing shall be applied by the hot process (except the electro-galvanizing shall be permissible for steel wires), and for all parts other than steel wires shall consist of a suitable thickness of zinc coated or not less than 0.61kg/m<sup>2</sup> of surface. The zinc shall be smooth, clean, or uniform thickness and free from defects. The preparation for galvanizing and the galvanizing itself shall not adversely affect the mechanical properties of the coated material.

#### **PC7.1.2 Bolts and nuts**

All metal parts shall be secured by means of bolts and nuts whose minimum diameter shall be 12mm. All bolts, nuts and screw threads shall comply with SABS 135 (there is no SANS equivalent) and galvanized in accordance with SANS 121 unless otherwise approved. Bolts and nuts shall be of steel with hexagonal heads. The nuts of all bolts for attaching to the tower plats, brackets or angles supporting insulator sets or droppers to earth conductor clamps shall be locked by approved means. No screwed threads shall form part of the shearing plane between members. Unless otherwise approved, all bolts and screwed rods shall be galvanized including the threaded portions; all nuts shall be galvanized with the exception of the threads, which shall be greased. When in position all bolts or screwed rods shall project through corresponding nuts, but such projection shall not exceed the diameter of the actual bolt. Where different grades of steel are used, bolts of any given diameter and length shall conform to the same grade of steel.

#### **PC7.1.3 Paint and Finishing**

Painting and finishing shall be in accordance with BS 2569 and SANS 1091. Where the galvanised coating has been damaged during erection and after all assemblies have been attached to the structure, zinc metal paint in accordance with BS 2569 shall be applied to the areas for protection against corrosion.

### **PC7.2 Line Configuration**

#### **PC7.2.1 A-frame configuration**

##### **PC7.2.1.1 Strain A-frame**

A-frames shall be manufactured from mild steel standard profiles. A-frames shall be completely bolted to pole with two M20 x 200 bolts threaded 80mm, or threaded rod, complete with curved washers, spring washers and hexagonal nuts and locknuts. All holes drilled on A-frame to 22mm diameter.

##### **PC7.2.1.2 Intermediate A-frame**

A-frames shall be manufactured from mild steel standard profiles. Frames shall be completely bolted to pole with 2 off M20 x 200 bolts threaded 80mm, or threaded rod, complete with curved washers, spring washers and hexagonal nuts and locknuts. All holes drilled to 22mm diameter.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

## **PC7.2.2 Vertical staggered delta configuration**

### **PC7.2.2.1 Strain Staggered Delta**

Longrod insulators with thimble clevis in accordance with the standards referenced in section 1 shall be used and installed in accordance with approved Engineering detailed drawings. Minimum clearance between insulators shall be 600mm. Insulators shall be bolted to the pole using M20 x 250 Eye Bolts, complete with curved washers, spring washers and hexagonal nuts and locknuts. All holes drilled on structure to be 22mm.

### **PC7.2.2.2 Intermediate Staggered Delta**

Longrod insulators with thimble clevis in accordance with the standards referenced in section 1 shall be used and installed in accordance with approved Engineering detailed drawings. Minimum clearance between insulators shall be 600mm. Insulators shall be bolted to the pole using M20 x 250 Eye Bolts, complete with curved washers, spring washers and hexagonal nuts and locknuts. All holes drilled on structure to be 22mm.

### **PC7.2.3 Horizontal Configuration with Wooden Crossarms**

Strain and intermediate wooden crossarms shall comply with SABS 754: Eucalyptus poles and crossarms for power transmission, low voltage reticulation and telephone systems. Intermediate wooden crossarms shall have a length of 2,5 m and a minimum diameter of 100 mm for 11kV and 3,5 m with a minimum diameter of 100 mm for 33kV.

Strain wooden crossarms shall have a length of 2,5 m and a minimum diameter of 120mm for 11kV and 3,5 m with a minimum diameter of 120 mm for 33kV.

Crossarms shall be cut and drilled prior to preservative treatment. A template shall be used for drilling holes to ensure the correct spacing and alignment. The crossarms shall be pressure impregnated with creosote complying with the requirements of SABS 538 or SABS 539. The moisture content at the time of impregnation shall not exceed 170 g/kg. Crossarms shall be of strength group A. Maximum fibre stress shall be 55 MPa. All crossarms shall be marked with the approving authority mark and in accordance with SABS 754, Section 4.

## **PC8. STAYS, STAY INSULATORS AND ASSEMBLIES**

### **PC8.1 Stays**

The position of stays may or may not be indicated in the instructions for the service, but it is the responsibility of the Contractor to provide staying adequate to maintain correct tension of the line and the vertically position of every pole in line, with or without the additional use of kicking blocks as he may decide.

Wind stays must also be provided for straight lines in exposed positions. Struts shall not be used if this can be avoided by the use of aerial stays and pillar stays.

Stay wires shall be spliced and bound in, in the accepted manner. Approved preformed materials may also be used.

The angle between the stay and the pole must be between 35° and 45°. The stay must be made off on the pole, as near as practicable to the point of resultant stress, with one and a half complete turns around the pole, supported by a suitable clamp.

For terminal poles of vertical line arrangements, at least two stays shall be used to prevent deformation of the pole, with the stay plates buried at least 1,5m apart.



Contractor



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Witness 2



Employer



Witness 1



Witness 2

Stay holes shall be vertical, not less than 1,5m deep and no wider than necessary to accommodate the baseplate, with a narrow side channel cut to embed the rod at the correct angle.

The baseplate and portion of rod within the stay hole shall be firmly packed with hard material or concrete where necessary. Stay pillars shall be concreted into the ground with top and bottom kicking blocks where required by the nature of the soil.

Porcelain stay insulators shall be installed in the stay wire as high as possible above ground level but far enough away from the structure to ensure that the portion of the stay below the insulator does not become alive. Stay wire shall be galvanised steel and the individual steel strands shall have a breaking stress of not less than 695 MPa and shall comply with BS 183 or SABS 182, Part 5. Stay wire make-offs shall be painted with bitumastic paint on completion. Stay rods shall comply with BS pattern 2 shall be of circular section with tubular type turn buckles. Heavy duty construction, deep contoured type thimbles shall be used. Galvanised steel stay plates shall be used.

Stay guards are required in the vicinity of public paths and roadways.

## **PC8.2 Staywire**

### **PC8.2.1 General**

Stay wires shall comply with SANS 182-5 and shall be manufactured from zinc-coated stranded steel wires. Generally, stay wires shall be galvanized steel strand of the type with BS 183 Grade 700. Strength shall be a minimum of 450kPa for both MV and LV line stays. Stay wires and their associated fittings shall be tested in the manner specified for conductors, and the breaking load shall not be less than 95% of the stay wire breaking load. Any deviation from the above required stay wires strand sizes shall be determined in accordance with SANS 185-5. Thimbles shall be used with guy grips to support wired through the stay-rod eye. A combination of guy grips and pole top make offs shall be used as indicated in the drawings.

#### **PC 8.2.2 Stay wire for MV line**

The number and standard diameter of wires shall be 7 /4.00mm or nearest complying with 450 kPa. The overall diameter shall be 12.19mm (min.) in accordance with SANS 182-5.

#### **PC8.2.3 Stay wire for LV line**

The number and standard diameter of wires shall be 5 /4.00mm or nearest complying with 450 kPa. The overall diameter shall be 10.97mm (min.) in accordance with SANS 182-5.

## **PC8.3 Stay rod**

Stay rods for LV installations shall be 12mm in diameter and 1500mm long, for MV installations the stay rod shall be 16mm in diameter and 2000mm long. Both MV and LV stay rods shall be non-adjustable. Stay rod sizes may be reduced as long as compliance to 450kPa strength is maintained.

Stay rods may not be bent when installed in sandy soil conditions, special permission must be acquired from the Engineer to bend the rods i.e., in hard rock conditions where stay rod holes were drilled. Cold bending of stay rods shall not be acceptable. Coastal and corrosive



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

environments may require sleeving and extra material according to required specifications, for the protection of stay rods and stay plates.

#### **PC8.4 Stay rod base plate**

##### **PC8.4.1 Base plate for MV line stay rod**

Stay rod base plates shall be 350mm x 350mm x 6mm hot dipped galvanized steel. Base plates may be cut round to a diameter 375mm or octagonal to a width of at least 375mm but shall after being cut still be galvanized to SANS 935 and BS 2569 standards.

##### **PC8.4.2 Base plate for LV line stay rod**

Stay rod base plates shall be 300mm x 300mm x 6mm hot dipped galvanized steel. Base plate may be cut round to a diameter of 300mm or octagonal to a width of at least 300mm but shall after being cut still be galvanized to SANS 935 and BS 2569 standards.

#### **PC8.5 Preformed stay fittings**

##### **PC8.5.1 General**

All material used for the stay work shall be galvanized. The minimum number and size of stays shall be used with each type of line support. All stays shall be taken down at an angle to the pole of approximately 30-45 degrees consistent with adequate stay tension.

##### **PC8.5.2 Pole top make off**

Pole top make off - galvanized guy grip pole top dead end – double wire guy grip, complete to SANS specifications for pole diameter of 130mm to 200mm. LV pole top make off shall be approved by the Engineer. MV pole top make off shall be approved by the Engineer.

##### **PC8.5.3 Preformed guy grips**

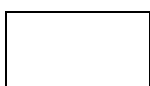
Preformed galvanized steel guy grip with thimble and stay insulator dead ends shall be used. LV stay guy grips shall be approved by the engineer in accordance with NRS 053. MV stay guy grips shall be approved by the engineer in accordance with NRS 053.

#### **PC8.6 Stay insulator**

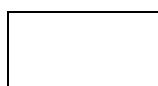
In each MV stay assembly, a fully glazed brown porcelain stay insulator having minimum dry or wet flash-over voltage of 30kV shall be fitted. The MV stay insulator shall be of the 100kN type for 7 /4.00mm stay wire and of the 34kN type for 5 /4.00mm LV stay assemblies, where specified, and shall be in accordance with NRS 022. Glass fibre rod stay insulators of the 100kN type may be used instead of the fully glazed porcelain insulator on MV stay assemblies. Porcelain insulators shall not be installed upside down.

#### **PC8.7 Stay guards**

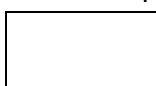
- a) Because stays are vulnerable to mechanical damage and be a danger to pedestrians and traffic, all stays in the vicinity of public paths and roadways shall be fitted with stay guards.
- b) Where a stay is very exposed to traffic, these guards shall be 2m long (minimum) wooden poles of minimum diameter 120mm, buried to a minimum depth of 1m and protruding at least 1m out of the ground. The exposed part shall be painted yellow road marking paint. Arrangement of stay guards shall be such that the stay is adequately protected.
- c) On less vulnerable stays, a stay warning pipe will be sufficient. These stay guards



Contractor



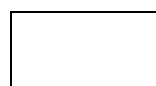
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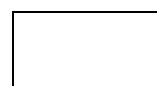
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Witness 2

should enclose the stay wire from the top of the stay rod  $\pm 2\text{m}$  above ground and should have a minimum diameter of 32mm. Stay warning pipes shall be painted a bright yellow colour with black stripes to be easily visible during day or night-time. A cable clamp shall be fitted to the stay wire above the warning pipe to prevent any sliding of the pipe along the stay wire. The thread of the cable clamp shall be damaged after installation.

- d) Where the stay wire passes between low voltage conductors the stay wire must be insulated with a plastic sleeve and clamped at the ends.

## **PC8.8 Stay assemblies**

### **PC8.8.1 Cable clamps**

Galvanized cable clamps suitable for use with a double 9.75mm and 10.97mm diameter stay wire shall be supplied and installed.

### **PC8.8.2 Eye-bolt assembly**

M20 x 250mm eyebolt with 240mm thread connected, complete with 2 curved washers, 60 x 60 x 2 washers, spring washers and hexagonal nuts. Minimum breaking load shall be greater than 60kN.

## **PC9. LINE INSULATORS AND FITTINGS**

### **PC9.1 General**

#### **PC9.1.1 Types of insulators**

Long rod, Class A insulators shall be used at all cross arms for medium voltage strain, terminal, and pole mounted transformer structures. The cycloaliphatic long rod or porcelain insulator shall be puncture proof and of the type as specified in design Detail Specifications as approved by the Engineer. The end fitted attachment shall be of the aluminium alloy clevis and tongue twisted type. The insulator shed material shall have a high resistance to tracking by surface leakage currents and operate normally under adverse weather conditions. All insulators shall conform to the standards referenced in section 1.

Line post type insulators shall be installed on straight line structures and the insulating material shall be a cycloaliphatic resin or porcelain complete with 20mm spindle including nuts and washers. Line post insulators shall furthermore be of the capless, solid-core type, be puncture proof, radio interference free and shall display superior performance in polluted environments. They shall have a basic insulation level of either 135kV or 150kV as specified in the Detail Specification in accordance with standards and the approval of the Engineer. All standards referenced in section 1 shall be adhered to. Glass type insulators shall where possible not be used due to vandalism. However, glass insulators can be used if the Supply Authority feels it necessary and is in accordance with the standards listed in section 1. Glass insulators are permitted in coastal regions up to 40 km in land from the coastal region, due to corrosion and heavy pollution.

#### **PC9.1.2 Electrical design**

Insulators together with their fittings shall comply with SANS 60305, SANS 60383, BS EN 60305, BS 3288, and IEC 1109 and shall offer a high resistance to damage, caused by malicious vandalism. Insulator material shall be Cycloaliphatic resin. As an alternative, high grade porcelain insulators shall be used. The flashover and puncture voltages shall not be less than the values stated in the table below. Insulator flashover voltage, wet and dry, shall



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

be less than the puncture voltage. Shackle insulators shall be used on all low voltage overhead conductors. The shackle insulators suitable for mounting to the pole with a D-bracket shall be of the type specified in the Project Detail Specification in accordance with the Engineer.

### **PC9.1.3 Mechanical design**

The strength of the insulator shall be such that at the maximum working load of 4kN for line post insulators and 40kN for strain insulators shall be afforded.

### **PC9.1.4 Clamps and conductor fittings**

Tension conductor clamps shall be of types approved by the Engineer and shall be as light as possible and shall be designed to avoid any possibility of deforming the stranded conductor and separating the individual strands. All fittings shall comply with the stranded coupling dimensions specified in the standards listed in section 1.

Intermediate pole conductor binding shall be carried out by means of wrap lock ties complete with neoprene cover. Tension fittings shall be the preformed wire type, specially designed for the ACSR conductor used together with suitable fittings for securing the tension insulators. Tension insulator sets and fittings shall be approved by the Engineer to give the minimum required clearances between the jumper conductor and the rim of the live end insulator units. Adequate bearing area between fittings shall be provided and „point“ or „line“ contacts shall be avoided. All split pins for securing the attachment of fittings of insulator sets shall be of stainless-steel material and shall be backed by washers. D-shackles between insulator and eye shall be installed at all strain positions in accordance with SANS 10280.

### **PC9.2 Strain insulators**

Strain insulators of the twisted clevis tongue type are required for strain and terminal poles. The insulators shall be cycloaliphatic resin or high-grade porcelain material as specified in the detailed project specification and approved by the Engineer. Strain insulators shall be complete with galvanized clevis pin (to SANS 121) c/w washer and stainless-steel split pin (304 s/steel), for preformed dead end. Strain insulators shall be installed and connected to cross-arms and A-frames, with D- shackles, clevis thimble and preformed dead end for conductor as per design specifications.

#### **PC9.2.1 Porcelain disc insulator**

High grade porcelain, 70kN mechanical strength. Nominal voltage – 11kV, 22kV or 33kV as specified and approved by the Engineer.

#### **PC9.2.2 Long rod insulator**

Cycloaliphatic long rod, min. failing load 70kN, with clevis tongue twisted arrangement with corrosion resistant end caps, complete with galvanized clevis pin (to SANS 121) c/w washer and stainless-steel split pin (304 s/steel), preformed dead end type for conductor size as specified – nominal voltage of 11kV, 22kV or 33 kV as specified.



Contractor



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Witness 2



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Witness 2



### **PC9.3 Intermediate insulators**

Line post insulators are required for the intermediate poles on A-frames and for staggered vertical delta configurations. Complete installed and connected to A-frame, with spindles or on poles c/w spindles, curved washer (50 x 50), spring washer and nut. A-frame mounting: short spindle – Type M2 threaded to 44mm complete with washer, nut, and locknut, for mounting bracket, complete with line tie for specified the specified conductor. Pole-mounting: long spindle – Type M2 with 178mm shank threaded to 100mm, 250mm for mounting through pole, c/w curved washer (50 x 50), spring washer and nut. Complete with line tie for specified conductor.

#### **PC9.3.1 Porcelain line post insulator**

High grade porcelain for 11kV, 22kV or 33kV, 4kN lateral mechanical strength. Complete installed with line ties for specified conductor.

#### **PC9.3.2 Cycloaliphatic line post insulator**

For A-frame mounting cycloaliphatic line post insulator – cantilever failing load 4kN, for M20 spindle – for 11kV and 22kV as specified.

All insulators and equipment shall conform to the requirements stipulated in the standards referenced for insulators in section 1.

### **PC10. CONDUCTORS**

#### **PC10.1 General**

Steel reinforced aluminium conductors to SABS 182, part 3 and SANS 1713 shall be used for overhead lines. Should copper conductors be specified, they shall comply with SABS 182, Part 1. The cross-sectional area shall comply with the Detail Technical Specification.

The spacing between phase conductors shall be increased by 20% over the spacing determined according to the formula in SANS 10280 to compensate for stay movement and other factors and to maintain the BIL as specified earlier herein.

The minimum conductor spacing are:

<b>Pole Spacing</b>	<b>Conductor Spacing in mm at a specific Supply Voltage</b>			
<b>(m)</b>	<b>Up to 6,6kV</b>	<b>11kV</b>	<b>22 kV</b>	<b>33 kV</b>
60	575	635	790	960
70	635	700	850	1 020
80	700	750	910	1 080
90	750	810	975	1 040

Manufacturer's stringing and tensioning charts shall be used to erect conductors. Conductors shall not be tensioned to more than 25% of the breaking strength of the conductor at -5,5°C with no wind.

Conductor running blocks shall be installed on all pole positions to run out the conductors. Conductors shall not be dragged along the ground. The three conductors shall be tensioned simultaneously using suitably rated chain-ratchet pullers and "come-alongs" specially designed for the particular conductor.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

The minimum conductor to ground clearances as stipulated in the Machinery and Occupational Safety Act shall be closely observed as specified in Clause 1.4. Allowance shall be made for conductor creepage and subsequent increased sag after a period.

Conductors shall be prestressed for not less than one hour before binding in.

Conductor joints at non-tension points shall be made with two bolt parallel groove clamps of a type approved by the Engineer. The current carrying capacity of the clamps shall be at least equal to that of the conductor.

Non-oxidising conducting paste shall be liberally applied to the inside of these clamps.

Strain structures as well as the appropriate pole lengths shall be utilised in accordance with SANS 10280 at road and railway crossings, in order to meet the required clearance requirements.

Where aluminium to copper connections is made, suitable bi-metal clamps shall be used. ("Dulmison Preformed Line Products Type G" or equal).

#### 10.2 Conductor size

The following conductor sizes shall be used as a standard:

Code name	Equivalent Cu area mm <sup>2</sup>	Stranding and wire diameter mm	Overall diameter mm	Aluminium area mm <sup>2</sup>	Ultimate Tensile Strength N	Current rating Amps
Squirrel	12.9	6/1/2.11	6.33	20.98	8020	130
Gopher	16.3	6/1/2.36	7.08	26.25	9610	150
Rabbit	32.26	6/1/3.35	10.05	52.88	18500	240
Mink	38.71	6/1/3.66	10.98	63.13	21900	260
Hare	64.52	6/1/4.72	14.16	104.98	36000	360

Any other conductor requirements not listed in the table above will be subject to the approval of the Engineer and in accordance with SANS 10280.

#### PC10.3 Line joints

Joints for connecting line conductors shall be types approved by the Engineer and unless otherwise approved, tension joints shall be of the preformed wire type. The electrical conductivity and current carrying capacity of each joint shall not be less than those of the line conductor. Tension joints shall not permit slipping off or cause damage to, or failure of the complete line conductor or any part hereof, at a load less than 95% of the ultimate strength of the line conductor as stated.

#### PC10.4 Power line and communication line crossings

Power lines shall cross communication lines as nearly as possible to right angles. Where this is impractical, the following deviations from right – angle crossings are permitted in accordance with SANS 10280.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

### **PC10.5 Conductor Terminations**

Cold compression, bolted snail clamps or preformed terminations shall be used. Suitable thimble clamps shall be used with the preformed terminations.

The conductor shall be bound in at pin insulators by a single stirrup and binding. A chafer tape of soft aluminium shall be wrapped around the conductor at the insulator contact area. The conductor shall be bound to the stirrup for a distance of 50mm on either side of the insulator. 5mm diameter hard drawn aluminium wire shall be used for binding.

Suitably sized preformed wrap lock ties with pads may be used as an alternative method to the process specified.

Trails and bridge wires must be neatly disposed and connected with clamps or line taps with a minimum of two per connection or by means of other approved mechanical connectors.

### **PC11. FUSE LINKS**

Fuse-links shall be a type approved by the Engineer.

Details of fixing methods and mounting shall be submitted to the Engineer for approval.

Fuse-links shall be installed at all transformers as specified in the Detailed Technical Specification.

### **PC12. LIGHTNING ARRESTERS**

#### **PC12.1 General**

Lightning arresters shall be placed on all the phase conductors at the following points in addition to those specified in the Detail Technical Specification:

- As near as possible to the transformer terminals on the line side of the protection where applicable.
- At each termination of a cable on the overhead line.
- At every line sectionaliser or re-closer.
- Lightning arresters shall be mounted below the overhead conductors in order to reduce the length of the discharge path.
- The arresters shall be connected to the overhead conductors by 35mm<sup>2</sup> (minimum) copper conductors and suitable parallel groove clamps.
- One earth shall be supplied and installed at each point where lightning arresters are installed in accordance with the Section on Earthing.

## **PC12.2 High voltage lightning arresters**

Surge diverters for installations with a rated voltage above 660 Volt shall conform to IEC 99-1 for "NON-LINEAR RESISTOR TYPE ARRESTERS FOR AC SYSTEMS" and shall be 10kA Series A arresters of the heavy-duty type.

Lightning arresters must be of zinc oxide type (ZnO) which is built up from one or more hermetically sealed units, each containing valve resistor blocks fixed into a porcelain housing. The lightning arresters must be vertically mounted on a horizontal surface.

The line and earth connections shall consist of terminal lugs, complete with bolts, nuts, stainless steel washers and cable washers.

The mounting bracket which will be supplied with the lightning arrester shall be hot-tip galvanised steel brackets complete with damping band, bolts, nuts, and washers. The mounting bracket shall have the dimensions of and comply with the NEMA bracket 1. All the bracket accessories shall be hot dip galvanised.

Lightning arresters for system voltages up to 33 kV shall be of the 25 kA Class or equivalent.

## **PC13. CONSTRUCTION**

### **PC13.1 Pegging the Route**

The Contractor shall peg out the positions for the overhead line poles but shall maintain close liaison with the Engineer's representative to obtain approval of the route before construction and a ruling be obtained if necessary for any deviation.

The Engineer reserves the right to alter the line position at any time prior to the installation of the overhead wires. Payment in respect of any additional or wasted work involved shall be at the documented rates.

The removal of obstructions along the route shall be subject to the approval of the Engineer.

### **PC13.2 Tree Cutting**

- a) A tree shall only be cut with the landowner as well as the Employer's approval.
- b) All cut ends of branches or trunks on the standing tree shall be treated with a sealing compound as soon as possible after the cut has been made.
- c) All cut-offs shall be properly removed from site.

### **PC13.3 Excavations**

#### **PC13.3.1 General**

Excavations for poles, strays and trench earths shall remain open for as short a period as possible. The Contractor shall erect and maintain guards, warning notices and lights, if required by the Engineer, at open excavations and soil heaps.

#### **PC13.3.2 Classification of Excavations**

Excavations shall be classified as follows:

Very hard rock - shall mean rock that can only be excavated by means of explosives.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

Hard rock - shall mean granite, quartzitic sandstone, slate, and rock of similar or greater hardness, solid shale and boulders in general requiring the use of jack hammers and other mechanical means of excavation e.g., compressor.

Soft rock - shall mean rock or hard material that can be loosened and removed, such as boulder with nominal diameters between 300 mm and 1 000 mm.

Earth - shall mean material more easily excavated by means of hand-picking or shovelling such as gravel, earth, turf, scale, sand, silt, and clay.

After poles and stays have been planted, the holes shall be backfilled and well compacted. Compaction shall be executed in layers of not more than 300 mm to obtain a high compaction density.

### PC13.3.3 Rates for Excavations

- a) Rates for excavation shall include all labour, tools, and plant, refilling and compacting, restoration of surfaces, removal, or surplus material, bearing in mind the possible need to re-instate existing facilities where these are damaged and hire a registered land surveyor to calculate the position and to replace any surveyed pegs removed in the process of excavation or refilling.
- b) Rates shall also include, where necessary, timbering and shoring.
- c) In case where more than one billed rate is applicable to any single excavation, or to a group of such excavations, the quantity or excavation at each separate rate shall be measured and form the basis for payment. The Engineer may, however, in his discretion, determine an intermediate rate based on the average proportion of each applicable rate and may use such intermediate rate for evaluation of the prices of such excavation.
- d) Tenders shall be based on billed quantities and any variations shall be measured on site during the course of excavation work.
- e) The contractor shall advise the Engineer before backfilling excavations, to enable the Engineer to determine the applicable rates. Sufficient notice shall be given to the Engineer to enable the Engineer to arrange a visit to site to determine the applicable rates.
- f) The soil type shall be identified and classified in accordance with project specifications and the discretion of the Engineer.

### PC13.3.4 Pole hole excavation

The poles shall be planted at the following minimum depths:

Pole length	Planting depth
5m	1.0m
7m	1.3m
8m	1.3m
9m	1.5m
10m	1.7m
11m	1.8m
11m	1.8m
12m	2m
13m	2.2m
14m	2.2m
15m	2.2m

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Care must be taken to excavate holes such as to let the undisturbed side of the excavation wall take the load.

#### **PC13.3.5 Stay hole excavation**

Stay holes shall be vertical, not less than 1.5m deep and no wider than necessary to accommodate the base plate, with a narrow side channel cut to embed the rod at the correct angle. The base plate and portion of rod within the stay hole shall be firmly packed with hard material, soilcrete or grout in accordance with design specifications and approval of the Engineer.

#### **PC13.3.6 Compacting of holes**

- a) The soil used for backfilling the hole after the pole has been planted shall be slightly damped for good compaction purposes.
- b) When filling up a hole, layers of 300mm soil shall be added at intervals and compacted with a mechanical compactor or with a hand-stomper, weighing more or less 25kg.
- c) Proper compacting of the ground around a pole is essential and may be achieved with a 1:10 cement/sand mixture (soilcrete) for the backfill.

#### **PC13.3.7 Rock Anchors**

Rock anchors shall be utilised in areas of soft and hard rock. Rock anchors shall be 1500mm long by 12mm in diameter at 450kPa. Anchors are installed utilising drilling machinery and high-pressure grouting cement.

Contractor

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## **PD STANDARD SPECIFICATION FOR ELECTRICAL – PLANT AND INSTALLATION**

### **PD1.1 ELECTRICAL INSTALLATION**

#### **PD1.1.1 Scope**

This Section is used as a standard specification for electrical plant installations and shall be read in conjunction with the Project Detail Section that is used to cover particular installation requirements and design standards.

#### **PD1.1.2 Installation Materials and Finishing**

##### **PD1.1.2.1 Responsibility**

It is the responsibility of the Contractor to correctly position and securely install conduits, wiring channels, cables, cable racks and trays, distribution boards, fittings and accessories as required for the installation. The Contractor shall supply and install all supports, brackets, hangers etc.

##### **PD1.1.2.2 Painting of brackets and supports**

All steel support brackets, lugs, etc., shall be painted in accordance with this Section before installation. All such items with damaged paintwork shall be repaired before final securing of the plant or cables. Galvanized articles and all galvanized trays need not be painted unless otherwise specified, but shall be clean and free of paint spot, grease, or any other foreign matter.

##### **PD1.1.2.3 Fixing to structural steel and machinery**

Supports, brackets, hangers, etc., may only be welded or drilled and bolted to structural steel members where prior permission from the Engineer has been obtained. "CADDY" or similar fasteners may not be used to fix plant to structural steel or machinery.

Welding of brackets or straps onto machinery, hoppers, chuting or pipework will not be permitted.

##### **PD1.1.2.4 Screws and bolts**

Where holes exist in plant to be fixed, bolts and fixing screws as specified shall be used. Where sizes are not specified, the largest bolt or screw that will fit into the hole shall be used.

##### **PD1.1.2.5 Wall plugs**

Where the fixing holes in brick or concrete walls are smaller than 10 mm diameter and where the mass of the plant is less than 10 kg, wall plugs may be used to fix fittings and accessories. "Fischer" or equal approved plastic plugs shall be used. Plugs installed in joints between bricks are not acceptable. A masonry drill of the correct recommended size shall be used to drill holes for plugs. Screws of the correct diameter and type to match the specific plug shall be used throughout.

##### **PD1.1.2.6 Anchor bolts**

Where the fixing holes are 10 mm and larger or where the mass of the plant is 10 kg or larger plant shall be fixed by means of expanding anchor bolts or by means of bolts cast into the concrete or built into brick walls.

##### **PD1.1.2.7 Galvanized plant**

Only brass screws, bolts, washers and nuts shall be used to fix galvanized fittings and plant.



Contractor



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#### **PD1.1.2.8 Shot-fired type fixing**

Shot-fired type fixing will only be permitted for specific purposes and provided written permission has been obtained from the Engineer.

The Engineer will state precisely for which purpose shot-fired type fixing is allowed and what control and precautionary procedures must be followed.

#### **PD1.1.2.9 Fixing of cable trays and racks**

All trays and ladders shall be fixed to rigid steel brackets. Trays shall not be fixed directly against any mounting surface but shall be spaced away from surfaces by approximately 25 mm. Brackets shall be fixed to ceilings or walls at regular intervals to ensure no noticeable deflection of the trays between support points.

The widths of cable trays shall be adequate for the number of cables with spacing as specified (including provision for future extension).

All fixings to concrete surfaces shall be by means of screws into drilled and plugged holes or Anchor Bolts, depending on the size of tray or rack.

Cables run along sections of structural steelwork and/or chuting or pipework shall also be run on trays with suitable supporting members which may be bolted to flanges of the pipework, chuting or structural steelwork. Where cables are run on any part of machinery these shall not interfere with the operation of the machine or access to it for maintenance or dismantling for repair.

Clamps and brackets used to fix or support plant such as cable trays, racks, ducts, etc., shall be of a purpose-made type suitable for the specific application.

Short lengths (i.e., up to 2 metres) of PVC/SWA/PVC cables may be installed inside conduits for fixing to structural steel or machinery. Where this occurs, the conduit shall be fitted at each end with a female bush and the ends of the conduits totally sealed after installation.

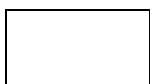
#### **PD1.1.3 Painting of Articles of Steelwork**

##### **PD1.1.3.1 General**

The following requirements are for the surface preparation and subsequent painting of all steelwork associated with electrical plant except mass produced and proprietary items. It is accepted that detailed painting procedures cannot be insisted upon in the case of mass produced and proprietary items but details of the surface preparation and treatment of any such items must be submitted to the Engineer for final approval.

Where control of surface finish and protective coatings is essential and the painting procedure of the Contractor does not comply fully with Section 37 – Painting and Corrosion Protection the resultant finish must give an equivalent life performance.

The Contractor must state compliance or otherwise with Section 37 – Painting and Corrosion Protection.



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#### **PD1.1.3.2 Surface preparation**

Refer to the Section – Painting and Corrosion Protection.

#### **PD1.1.3.3 Priming**

Refer to the Section – Painting and Corrosion Protection.

#### **PD1.1.3.4 Finishing**

Refer to the Section – Painting and Corrosion Protection.

#### **PD1.1.3.5 Repairing paintwork**

Refer to the Section – Painting and Corrosion Protection.

### **PD1.1.4 CABLES AND CABLING**

All cables and cable installations shall comply with the following standards:

- SANS 97: 2010, Impregnated paper insulated metal sheathed. (PILC).
- SANS 1339:2010, Cross linked polyethylene cables (XLPE).
- SANS 1057 1-6, LV cables with extruded solid dielectric insulation.
- SANS 10198 1-13, Selection, handling & installation of electric power cables.
- NRS 012/SANS 876.2009, Cable terminations & live conductors in air-filled enclosures
- NRS 053, Accessories for medium voltage power cables

#### **PD1.1.4.1 Cable types**

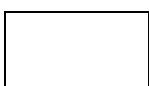
- a) All cable jointing and termination accessories used for MV power distribution shall be approved by the Engineer.
- b) All unarmoured cables shall be installed in metal trunking, sleeves or conduit unless otherwise directed by the Engineer.
- c) XLPE cables shall be of the type with individually screened conductors and steel wire armoured.
- d) Mineral insulated cables shall comply with the relevant standards and shall be provided with a seamless copper sheath.
- e) All accessories, tools, termination and jointing kits shall be of an approved type and in accordance with the cable manufacturer's recommendations.
- f) Aluminium sheathed cables shall be PVC insulated and protected by a seamless aluminium sheath and PVC outer sheath and shall be of "SURFIX" type or equal approved.
- g) Any other cables to be used by the Contractor, i.e., telephone, control, flexible cords, etc., will be specified in detail by the Engineer on the relevant cable schedule or data sheet.

#### **PD1.1.4.2 Competence of personnel**

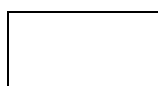
The Contractor shall only employ personnel fully conversant with the cable manufacturer's recommendations for jointing and terminating of cables rated greater than 1000 Volts.

#### **PD1.1.4.3 Identification of cables**

Each cable shall be clearly marked at both ends with the correct cable number with cable marking tags of "Bowthorpe Hellerman" type or equal approved.  
The use of PVC tape with punched characters is not acceptable.



Contractor



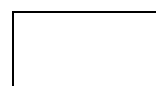
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The identification numbers of cables shall be shown on all "Record (as built)" Drawings and cable schedules for the complete installation.

#### **PD1.1.4.4 Cable trenching**

The Contractor shall, before trenching commences, familiarise himself with the cable routes, site conditions and the procedures to be followed. All such work shall be planned in conjunction with the construction programme for other services and building requirements.

#### **PD1.1.4.5 Routing of cables**

The routes of the main cables and approximate positions of the motors and electrical plant are indicated on the Drawings. The routes of all secondary cables shall be determined in consultation with the Engineer.

Where cables are subject to mechanical damage, they shall be run in a galvanized conduit or pipe, or protected with metal covers or guards to the approval of the Engineer.

Where cables have to cross a floor area to a connection or termination point, the cables will be run so as not to obstruct any passage way. Metal covers or guards bolted to the floor will not be acceptable; the cable shall be run in underfloor conduits or ducts.

#### **PD1.1.4.6 Installation of underground cables**

##### **(a) Installation depths**

Unless otherwise indicated on the installation Drawings, cables shall be installed at the following minimum depths below final ground level:

Up to 1 kV : 600 mm

Above 1 kV : 800 mm

All cable depth measurements shall be made to the top of the cable when laid directly in ground or to the top of the duct or sleeve where these are provided.

The above depths shall apply to the top layer where cables are installed in layers.

The Contractor may only deviate from the above depths provided approval in writing has been obtained from the Engineer.

##### **(b) Cable spacing**

Cables installed in the same trench shall be laid parallel to each other with the following spacing between cables.

Between LV cables : 50 mm

Between LV & MV : 300 mm minimum

Between MV & MV : 300 mm minimum



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Where MV and LV cables have to be installed in the same trench, the MV cable shall be laid on the one side of the trench at the correct depth and then partly covered. The LV cable shall then be laid on the other side of the trench and at the correct depth, i.e., not above the HV cable, and then the trench completely backfilled.

Cables for telephones, communication systems and control systems shall be separated from power cables by at least 300 mm.

Cables shall not be buried on top of each other but in layers. The minimum vertical spacing between layers shall be 200 mm.

**(c) Cable laying**

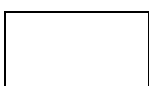
Except where ducts, tunnels or pipes are provided, cables shall be laid directly in the ground.

When laying cable in trenches excavated in soft or hard material or containing sharp stones, rocks or other items likely to damage cables, the following precautions shall be taken:

- a) Before laying the cables all items that could damage the cable shall be removed from the bottom of the trench. The floor of the trench shall be evenly covered with a layer of sifted backfill or sand to a level which is 150 mm above the highest unevenness of the trench. Sifted backfill shall mean ground having been sifted through a 5 mm size sieve.
- b) The laying of cable shall not commence until the trenches have been inspected and approved. The cable shall be removed from the drum in such a way that no twisting, tension or mechanical damage is caused, and shall be adequately supported at short intervals during the whole operation. Particular care shall be exercised where it is necessary to draw cables through pipes and ducts to avoid abrasion, elongation or distortion of any kind. The ends of such pipes and ducts shall be sealed to approval after the cables have been installed.
- c) The cable shall be covered with a 150 mm layer of sifted backfill or sand and then backfilled. The backfill shall be well consolidated to a minimum density of 93% Mod. AASHTO density.

The laying and handling of cables shall be performed in accordance with the following:

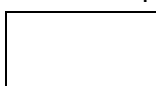
- a) Drums of cable shall not be dropped off trucks. The Contractor shall provide approved off-loading facilities at Site.
- b) Cable drums shall be rolled on the ground in the right direction.
- c) Care shall be taken not to damage cables when stripping battens from a drum.
- d) When winding off a drum, the drum shall at all times be supported on cable jacks or a cable trailer of sufficient strength to support the weight.
- e) When winding off a drum, the drum shall not be allowed to overwind and stress the cable. The maximum speed with which a cable is unwound shall not exceed 10 m/min.
- f) Cable rollers shall be used as far as possible to run out cables. Rollers shall be spaced so that the length of cable in the trench will be suspended during the laying operation so as to prevent undue sagging and prevent the cable from touching the ground.
- g) Cable rollers shall have no sharp projecting parts liable to damage cables.



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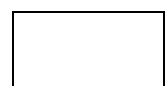
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- h) Where cables have to be drawn around corners, well-lubricated skid plates or vertical rollers shall be used, and shall be securely fixed and constantly examined during cable laying operations.
- i) Where cables have to be drawn through pipes or ducts, an approved type of cable sock shall be used and particular care shall be exercised to avoid abrasion, elongation or distortion of any kind.
- j) The maximum allowable tension when pulling a cable shall be in accordance with the cable manufacturer's recommendation.
- k) The inside radius of all bends shall be greater than 12 times the overall diameter of the cable.
- l) The Contractor shall further note the following:
  - i) Cables shall be laid in such a way that the start of a run always joins the end of the run preceding it, so that the rotation of the cores is consistent throughout.
  - ii) The Contractor shall ensure that adequate slag is allowed for the proper termination of jointing of cable.
  - iii) The Contractor shall ensure that all cable ends are protected against moisture ingress as in standard practice.
  - iv) The Contractor shall be required to keep accurate records of each drum of cable used. The following information shall be provided to the Engineer:  
**Drum number**
    - Cross sectional area of cable;
    - From which reference point to which reference point the cable is laid;
    - Length of cable left over; and
    - Date when cable was laid.
- v) Where MV & LV cables are installed in the same trench the Contractor shall install the MV cable at 800 mm B.G.L. and the LV cables at 600 mm B.G.L. as indicated on the detail Drawings.
- vi) A continuous PVC warning tape with the wording "Buried Electrical Cable Below - Danger" shall be laid along the full length of the trench approximately 300 mm below ground level.
- vii) Cable route markers shall be laid, flush with the finished surface at 50 m intervals along straight runs and at each bend or deviation. The markers shall consist of 150 x 150 x 300 mm high concrete blocks with 100 x 100 x 2 mm aluminium plates clearly stamped or engraved "LV Cable" or "HV Cable" as specified or as directed by the Engineer.
- viii) The Contractor shall not fill or close up any trench until it has been examined and approved by the Engineer.

**(d) Road crossings**

All ducts shall be laid to have a minimum depth of cover of not less than 800 mm between the top of the pipe and the surface of the road.

All duct crossings shall be continued at least 500 mm behind the kerb face.

All duct crossings shall be marked with paint on kerb faces with the code as indicated on the Drawings. In addition, duct markers shall be installed in the soil.

All duct ends shall be blocked off with rubber end caps to prevent the ingress of water and mud.

Particular care shall be taken to keep the ducts clear of concrete or any substance during construction.

A draw wire shall be provided in each duct.

Where work requires the installation of ducts/cables under tarred or made-up sections of roads, streets or side-walks, reinstatement of the surface shall be carried out as directed by the Engineer. Full reinstatement costs shall be borne by the Contractor. The Contractor shall execute and maintain interim restoration.

Where ducts or cables are laid in the slopes of road cuttings or in the fill of embankments, the surface and slope shall be restored to the satisfaction of the Engineer.

#### **PD1.1.4.7 Installation of cables in service ducts**

##### **(a) General**

The following requirements are for the installation of cables in purpose-built brick or concrete trenches, service ducts, etc.

##### **(b) Installation**

Cables shall be installed using the following methods:

- i) On horizontal cable trays or racks;
- ii) On horizontal or vertical metal supports with suitable clamps;
- iii) On vertical cable trays or racks fixed to the side of the trench;
- iv) In all cases the cables shall be clamped or strapped in position; and
- v) Cables shall not be bunched and laid on the floor of the service ducts or trenches.

##### **(c) Covers**

The Contractor shall be responsible for the cutting or drilling and smoothing of holes for cables through chequer plates, concrete or other coverings as required including reinstatement of corrosion protection to the satisfaction of the Engineer.

##### **(d) Filled trenches**

Where specified, service ducts shall be filled with sand.

If a sand filling is specified, the cables shall be fixed to non-corroding supports.

Sand-filled trenches other than in substations shall be covered as follows:

- i) Reinforced concrete covers. (Where vehicles cross service ducts).
- ii) Sand and cement screed.
- iii) Removable chequer plates.

#### **PD1.1.4.8 Cables installed on cable racks and trays**

##### **(a) Installation**

Cables may be installed and supported as follows and will be indicated on the Drawings:



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- i) On horizontal cable racks or trays;
- ii) On vertical cable racks or trays;
- iii) On horizontal or vertical metal supports or brackets with approved type clamps; and
- iv) On special "cleats" or clamps which are fixed to the structure.

**(b) Clamps**

Approved type clamps or cleats which will secure cables without damage may be used. Drilled hard wood blocks are acceptable. The correct clamp size to fit the cable shall be used. Cables of different sizes shall not be fixed by a common clamp.

**(c) Spacing correction factors**

Cables shall be spaced a minimum of two cable diameters apart, for which no grouping correction factor need be applied.

**(d) Cables on different levels**

Where parallel cable runs are installed at different levels (e.g., on parallel cable trays) and where the spacing of the layers is not specified, a minimum vertical spacing of 300 mm shall be maintained.

**(e) Single core cables**

Where single core cables are installed along a three- phase circuit, the cables shall be installed in trefoil formation and strapped together at 300 mm intervals.

**(f) Medium voltage cables**

Medium voltage cables shall be separated from other cables and services throughout the installation and shall as far as possible be installed in separate service ducts, pipes or racks and trays. Where this is not possible a minimum spacing of 300 mm shall be maintained.

**(g) Cables for other services**

Cables for telephones, communication and control systems shall be separated from power cables. In service ducts a metal barrier shall be provided between power cables and cables for other services. Where armoured cables are used for such other services, they shall be installed on separate cable trays or shall otherwise be at least 300 mm away from power cables.

**(h) Method of installation**

Cables shall be laid neatly on trays and racks with a minimum of cross-overs. The Engineer reserves the right to condemn any cabling that does not reasonably conform to acceptable practical standards. Multicore cables shall be run on cable trays or racks and shall not be permitted to be run in power trunking.

Cables shall be fixed and supported by means of approved clamping devices or cable ties. These devices shall not damage the cable in any way and shall ensure that the cable remains in the installed position. They shall be spaced at adequate intervals to prevent any sagging of the cable.

Cables of 25 mm diameter and larger shall be saddled or clamped individually. Cables of 15 mm diameter to 25 mm diameter may be saddled or clamped in pairs provided such cables



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are of identical diameter. Cables smaller than 15 mm diameter may be saddled or clamped in groups not exceeding three provided such cables are of identical diameter.

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**(i) Cable racks and trays**

**Cable trays**

Perforated cable trays with a minimum thickness of 1.6 mm shall be provided to support all power, control, indication and main lighting cables. All cable trays and associated accessories shall be of an approved manufacture and the material shall be as specified in the Detail Specification.

**Cable racks**

Heavy duty cable ladder shall be used and shall be of an approved manufacture. The material shall be as specified in the Detail Specification.

**Curves and sets**

Where sets and changes of direction occur in the cable routes, curved sections of trays and racks shall be properly radiused to suit the cables being carried. All special sets and curves required in the trays shall be neatly executed to the satisfaction of the Engineer.

**PD1.1.4.9 Termination and jointing of cables**

**(a) L.V. PVC/SWA/PVC cables**

Cable ends shall be terminated with approved type cable glands complete with shrouds, earth tags etc., similar or equal to those supplied by "Pratley".

All cable ends shall be bonded to the main earth connection.

Cable cores shall be marked with approved type marking sleeves where necessary to identify the phases and/or core numbers.

Cables shall be terminated in accordance with the recommendations laid down by the manufacturers of the cables and cable glands and the correct size of gland for the particular size of cable shall be used in accordance with the recommendations.

Where cables are terminated at a distribution board, control desk or motor control centre, sufficient space shall be allowed between each gland to allow for accessibility of tools to tighten/loosen relevant lock nuts and for the installation of cable markers as specified. Spacing shall be a minimum of 50 mm between the outside diameters of locknuts unless specified in the Detail Specification.

All glands shall be properly installed and effectively earthed to the satisfaction of the Engineer. Each gland for armoured cables shall be complete with neoprene shrouds and earth tags.

Earthing tags on glands shall be securely clamped to the enclosure by means of a brass screw which passes through the inside of the enclosure. The brass screw shall be effectively connected to the earth terminal inside the enclosure in order to maintain earth continuity.

Glands used for E.C.C. armoured cables shall be provided with suitable accessories to facilitate a bolted lug connection of the earth continuity conductor. Grooves cut into the barrel or cone bush to accommodate the earth continuity conductors shall not be permitted.

**(b) XLPE cables**

XLPE cables shall be terminated in accordance with the manufacturer's instructions.

The copper tapes of the earth screen on the cable shall be bonded to the main earth bar of the switchgear or transformer and shall be easily removable for testing the efficiency of the earth connections.

The cable shall be firmly secured by means of a clamp to prevent mechanical stress on the cable and terminations.

**(c) Connection of cable conductors**

Conductors of cables shall be connected to plant with approved lugs, which shall be crimped, using mechanical or pneumatic tools designed for the purpose.

Contact surfaces shall be thoroughly cleaned and smoothed and fixing bolts shall match the whole size of the lug.

Cables that are connected to clamp type terminals, where the clamping screws are not in direct contact with the conductor, shall be fitted with pin-lugs suitable for the cross-sectional area of the relevant cable.

When cutting away insulation from cable conductors to fit into lugs, care shall be taken that no strands are left exposed. Under no circumstances shall any of the conductor strands be cut away to fit into lugs.

**(d) Joints**

Joints in cables will not be permitted unless approved by the Engineer or detailed on a schedule or Drawings.

Where jointing is permitted it shall be carried out in accordance with the manufacturer's recommendation and by personnel competent in jointing the types of cables used. Approval of the type of jointing kit for MV and LV cables shall be obtained from the Engineer.

During outdoor jointing operations, the jointing area shall be covered by tents of waterproof material suitably supported. Where necessary a trench shall be excavated around the area to prevent the ingress of water. The sides of the excavation shall be draped with tarpaulins or plastic sheeting to keep the area clean during jointing operations.

The Contractor shall notify the Engineer whenever jointing is to be carried out so that an inspection may be undertaken if required. Any cable joint installed by the Contractor without the knowledge or approval of the Engineer may be rejected and may result in a new length of cable being installed at the Contractor's expense.

The crossing over of cores in joints will not be permitted.

**(e) Testing**

Each cable shall be 'Megger' tested after installation for insulation damage. MV cables, joints and terminations shall be pressure tested by a specialist Contractor. (XLPE cables shall be tested in accordance with the manufacturer's recommendations).

The Contractor shall make all arrangements, pay all fees and provide all plant required for these tests.

The Contractor shall notify the Engineer within the time as specified in the Detail Specification so that he may witness the tests.

On completion of the tests on any cable, the Contractor shall submit three copies of each certified Test Report to the Engineer.

**PD1.1.5 CONDUITS AND ACCESSORIES**

**PD1.1.5.1 General**

The type of conduit shall be as specified in the Detail Specification.

**(a) Conduits may be installed as follows:**

- i) In open roof spaces;
- ii) Cast in concrete;
- iii) Chased into brick walls; and
- iv) Surface mounted against walls, concrete and steel structures etc.

Where conduits are to be installed in concrete, this shall be undertaken while the building work is still in progress. Conduits may only be surface mounted where specified or indicated on Drawings.

**(b) Other Services**

Conduits may not be installed closer than 150 mm to pipes and services containing gas, steam, hot water etc., which may damage the conduits or conductors. Conduits may not be installed in contact with pipes of other service installations.

**PD1.1.5.2 Screwed steel conduit**

In general, heavy duty solid drawn or welded screwed steel conduit shall always be used in the wiring installations.

**(a) Galvanized Conduit**

Galvanized conduit and accessories shall always be used in the following areas as a minimum requirement:

- i) Damp areas;
- ii) Outside buildings;
- iii) Areas exposed to the weather;
- iv) All inside and outside installations within 50 km of the coast;
- v) Plenum chambers containing humidifying plant;
- vi) Surface mounted conduit installations in kitchens and boiler rooms; and
- vii) Screeds resting directly on soil.



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**(b) Terminations**

**(i) Spouted Connections**

Conduits shall be connected directly to draw-boxes with spouted connections. Conduits shall be screwed tightly home and no threads shall be visible.

**(ii) Distribution Boards, Power Skirting, etc.**

Conduits shall be terminated by means of a brass female bush and two locknuts in pressed steel switchboards and distribution boxes, cable ducts, power skirting, etc. The conduit end shall only project through the entry hole to accommodate the bush and locknut.

Conduits showing exposed threads within enclosures and conduits having insufficient threads to enable the complete tightening of the locknuts and bush shall be rejected.

**(iii) Draw-boxes**

A female bush and two locknuts shall be used to terminate conduits at draw- boxes and outlet boxes without spouts, should there be sufficient room in the box. Where there is insufficient room, a coupling, brass male bush and locknut may be used with sufficient allowance for the reduction of the internal diameter by the male bush.

**(c) Screws, bolts and nuts**

Steel locknuts of thick gauge steel with milled sides shall be used in all cases. Cadmium-plated bolts and nuts shall be used except where the installation is exposed to the weather in which case brass bolts and nuts shall be used.

Screws shall be installed in all tapped holes in fittings and accessories to prevent damage to the screw thread by concrete or plaster. The screws shall be screwed completely down to prevent damage to the thread on the screw.

**(d) Conduit ends**

Conduit ends shall be cut at right angles to ensure that ends butt squarely at joints. Threads shall not be visible at joints and connections except at running joints. The total length of the thread on the two conduit ends shall not exceed the length of the coupling.

All exposed threads shall be properly painted with a zinc chromate primer.

**(e) Joints**

All conduit ends shall be reamed and all joints tightly screwed. Only approved couplings shall be used. Running joints with long threads shall be provided to ensure a strong mechanical and a continuous electrical joint.

**(f) Draw-in boxes**

Accessible draw-in boxes shall be provided so that wires may be easily drawn in after the conduit system is completed. They shall be installed every 20 metres in straight runs and after bends.

**(g) Outlet boxes and accessories**

Conduit outlet boxes shall be hot dip galvanized. Conduit ends shall be fitted with brass bushes with rounded mouth and under-cut threads so that the bushes can be screwed home.

All conduit fittings, boxes and accessories shall be screwed to receive the conduits. Conduit shall be fixed to socket outlets and switches by means of galvanized locknuts and female bushes or by means of coupling and male bushes.

**(h) Finish**

All joints shall be painted with red lead to prevent rusting in damp areas, areas within 50 km of the coast and in cases where the Installation is exposed to the weather for any length of time. Where the galvanizing or black enamel paint has been damaged, the area shall first be cleaned and a coat of zinc chromate primer applied. The final coat of enamel or galvanized paint shall only be applied after the undercoat has completely dried.

**(i) Continuity**

Mechanical and electrical continuity shall be maintained throughout the conduit installation.

**PD1.1.5.3 Plain-end steel conduit**

As an alternative to the screwed conduit, plain-end conduit may be installed subject to the Engineer's written approval and under the following conditions:

Bending and setting of plain-end conduit shall be undertaken with special benders and apparatus manufactured for this purpose.

Plain end steel conduit shall not be used in the following instances:

- a) In flameproof installations.
- b) Load bearing conduit.
- c) For the suspension of luminaires.
- d) Surface mounted conduit.

Plain-end conduit and associated accessories shall be manufactured of mild steel having a minimum thickness of 0.9 mm.

**PD1.1.5.4 P.V.C. conduit**

**(a) Installation Conditions**

Where specified for a particular service, PVC conduits shall be installed under the following conditions:

- i) Insulated heat-resistant boxes shall be used for outlets to totally enclose luminaires and other fittings where excessive temperatures are likely to occur.
- ii) Luminaires and other fittings shall not be supported by PVC conduit or conduit boxes. These fittings shall be secured to the surrounding structure in a way that is to the approval of the Engineer.
- iii) Conduit shall be supported and fixed with stand-off saddles at a maximum spacing of 1 m. The Contractor shall supply and install all additional supports required.
- iv) It shall be possible to rewire a completed installation without difficulty.
- v) PVC conduit and fittings shall not be used under the following conditions:

- Outside a building (unless protected, or sheltered under eaves);
- For load bearing;
- Where the conduit is subjected to temperatures below -10°C or above 70°C; and
- In areas where the conduit may be subject to mechanical damage.

**(b) Painting of PVC conduits**

Exposed conduit may be painted with normal oil paints, but care shall be taken to ensure that the paint used does not contain any component that will have a detrimental effect on the conduit and fittings.

**(c) Connecting of PVC conduit to metal plant/components**

When any part of a PVC conduit system has to be connected to metal plant or components (e.g. distribution boards, socket outlet or switch boxes, existing steel conduit system, etc.) fittings and joints manufactured specifically for this purpose shall be used. PVC conduit shall not be threaded to fit steel conduit connectors.

**(d) Bends**

In conduit of nominal size not exceeding 25 mm, bends may be cold bent by hand provided that the radius of the bend is greater than six times the outside diameter of the conduit, and that the angle of the bend does not exceed 90 deg. The bending procedure shall be with the correct size of bending spring. In all other cases bends shall be made with the use of accessories that are introduced into the conduit run.

**(e) Adhesive joints**

All adhesive joints shall be made in a clean dry area. The surfaces of all components to be bonded shall be dry and clean.

The joint shall be made immediately after the application of the adhesive by pushing the prepared parts squarely together with a twisting motion to the full insertion depth. Care must be taken to avoid squeezing adhesive into the cableway. All excess adhesive shall be wiped off.

**(f) Cutting of conduit**

Special PVC conduit cutting shears shall be used for cutting 20 mm and 25 mm conduit to the required length. For the larger sizes, a fine-tooth hacksaw may be used. Each cut end shall be square and free from burrs and loose material.

**PD1.1.5.5 Flexible conduit**

Flexible conduit shall be used for the final connection to plant that has to be moved frequently to enable adjustment, the connection of motors or any vibrating plant, and for the connection of thermostats, sensors on plant, and stoves.

Flexible conduit shall preferably be connected to the system 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 connection point.

Flexible conduit shall be of the following approved types or equal approved, provided samples are submitted to the Engineer for inspection:

- a) Domestic type installations – “Spiralock” from Plastiflex (SA) (Pty) Ltd.
- b) Industrial and Mining Installations – “Adaptaflex” from Reyrolle Ltd. or “Kopex”

#### **PD1.1.5.6 Conduit installation**

##### **(a) General conduit installation requirements**

Draw-boxes shall not be installed in positions where they will be inaccessible after completion of the installation. Draw-boxes shall be installed in positions subject to the approval of the Engineer, and shall be indicated on the Record Drawings.

Galvanized steel draw-wires shall be installed in all unwired conduits e.g. conduits for future extensions, telephone installations and other services.

A maximum of two 90° bends or the equivalent displacement will be allowed between outlets and/or boxes.

Draw-boxes shall be installed at maximum intervals of 20 m in straight runs.

Excess holes in draw-boxes or other conduit accessories shall be securely blanked off by means of brass plugs.

No facebrick or other finished surfaces may be chased without the permission of the Engineer.

##### **(b) Conduit for telephone and other systems**

Where conduit is used for services other than electrical e.g., telephones, intercoms, fire alarms etc., the methods of installation as previously specified shall also apply with the following additions:

The telephone conduit system shall comply with the requirements of the Telecommunications Authority and shall be 25 mm O/D minimum unless otherwise specified;

- i) Galvanized draw wires shall be left in all conduits; and
- ii) All protruding conduits outside the building shall be terminated into a 50 x 100 mm draw box.

##### **(c) Installation of conduit in concrete**

Conduits set in concrete slabs or beams shall be firmly fixed in position before concrete is cast. Where groups of conduits are brought to distribution board positions, the conduits shall be fixed with spacers between them equal to at least one conduit diameter. Conduits in floor slabs shall be run wholly in the concrete and not in the soil. All conduit and accessories shall be efficiently cleaned out to remove all traces of condensation before wires are drawn. Partially completed runs and open ends shall be effectively plugged to prevent the ingress of dirt or moisture while work is not in progress or when concrete is being cast. All conduits shall be covered by at least 25 mm of concrete.

Elbows for conduits of 32 mm diameter and smaller and sharp bends shall not be permitted in cast concrete structures.



Contractor



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Employer



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Witness 2



Conduits will not be allowed in concrete floor slabs of boiler rooms (or boiler houses), laundries or other damp areas. All socket outlets and three-phase outlets in damp areas shall be supplied from above with galvanized conduit and accessories.

Conduits shall not be installed across expansion joints. Where this is unavoidable a conduit expansion joint shall be provided for the approval of the Engineer.

**(d) Surface installations**

All conduits shall be installed horizontally or vertically as determined by the route and all measures shall be taken to ensure a neat installation.

All surface mounted conduit shall be securely mounted to steelwork, brick, concrete or timber surfaces by means of approved galvanized steel saddles, of the stand-off type with all screws and nuts galvanized.

Conduits shall be secured within 150 mm before and after each 90° bend.

Where an offset is required at conduit terminations or cross-overs, the conduit shall be saddled at the offset.

Cross-overs of conduits shall be in purpose-made boxes.

**(e) Conduit in roof spaces**

In open spaces (no ceiling) conduits shall be run along the wall plates and the rafters. The installation of conduits suspended between rafters will not be acceptable.

Conduit in roof spaces shall be installed parallel or at right angles to the roof members and shall be secured at intervals not exceeding 1.5 m by means of saddles screwed to the roof timbers.

Nails or clamp type fixings will not be permitted.

Under flat roofs in false ceilings or where there is less than 900 mm clearance, or in instances where the ceilings are insulated with glass wool or other insulating material impeding access, the conduit shall be installed in a manner which allows for wiring from below the ceilings.

Conduit runs from switchboards shall terminate in fabricated sheet steel draw-boxes installed directly above or in close proximity to the boards. Spare conduits covering the total number of spare ways on switchboards, shall be provided between the boards and the roof draw-box.

Only approved types of fixings and round-head screws shall be used when fixing saddles, switches, plugs, etc., to walls.

**PD1.1.6 Installation of Luminaires**

All luminaires required shall be positioned as shown on the Drawings. All luminaires shall be provided with lamps, fluorescent tubes, ballasts, chokes and all other plant required for the

satisfactory operation of the luminaire. Alternative luminaires offered shall be submitted for the Engineer's approval.

The layout as shown on the Drawings shall generally be adhered to but any discrepancies or clashes with structural or other features shall be referred to the Engineer, before commencing the installation.

All luminaires shall be equipped with an earth terminal and shall be effectively earthed.

The following standard colour code shall be observed in the wiring of lighting circuits:

- Red : Line conductor
- Black : Neutral conductor
- Green or bare copper : Earth conductor
- Grey : Return conductor from switches
- Yellow : Interconnecting conductors between 2-way switches

The distribution of discharge lamps over the 3 phases shall be arranged to avoid stroboscopic effects. Loads shall be evenly distributed over the 3 phases at every distribution board.

Where provision has not been made for the fixing of luminaires, the Contractor shall supply the necessary supports, hangers, conduit extensions, angle brackets or any other fixing method approved by the Engineer.

#### **PD1.1.7 Light Switches and Socket Outlets**

Switches and socket outlets shall be accurately positioned in accordance with the Drawings. All Industrial type single phase socket outlets shall be 16A, 220/250V and shall be IP65 rated. All 3-phase socket outlets shall have a minimum rating of 25 Amp. They shall be of the five-pin industrial surface-mounted, switched socket type and each shall be supplied complete with matching plug. The outlets shall be interlocked to prevent switching on if the plug top is not installed and to prevent the removal of the plug-top in the "ON" position.

Mounting heights of socket outlets shall be as indicated on the Drawings, if not indicated on drawings at 300mm from finished floor level.

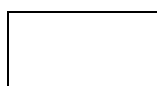
Generally, unless otherwise specified in the Detail Specification, light switches shall be installed 1.4 m above finished floor level. Mounting heights given shall be measured from the finished floor level to the centre of the switch. All single switches shall be installed with the switch vertical.

Unless otherwise specified, switches adjacent to doors shall be installed on the side containing the lock. If the position of the lock is not shown on the Drawings, the position shall be verified before the switch-box is installed. Switch boxes in brick or concrete walls shall be installed 150 mm from the door frame. Light switches installed in partitions or door frames shall be of the type designed for that purpose.

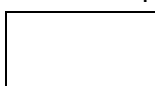
Switches that are exposed to the weather or are installed in damp areas, shall be of the watertight type and have IP65 enclosures.



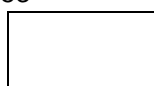
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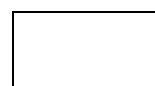
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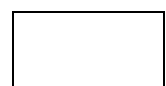
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Employer



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### PD1.1.8 Power Connections

Where sufficient space for conduit entries as well as adequate space for future conduit entries is available, conduits may be terminated directly to the gland plate on the distribution board.

Alternatively, conduits connected to distribution boards shall terminate in a common fabricated sheet steel draw-box installed in the vicinity of the switchboard. In open roof spaces this draw-box shall be placed in a roof space of not less than 900 mm clearance.

Lighting and socket outlet circuits shall be separately grouped in common conduits or metal trunking from the distribution board to the draw-box. The draw-box shall be of sheet steel with a minimum thickness of 1.6 mm and shall be fitted with a removable cover plate.

Where conduits from a distribution board run into a false ceiling space above the board, a minimum of two 25 mm and two 20 mm spare conduits shall be installed into the ceiling space immediately above the board.

Where underground cables are to be connected to distribution boards, it shall be the responsibility of the Contractor to ensure that sleeves are built in correctly to enable installation and connection of the main cable to the distribution board.

Sleeves shall be installed with a fall from inside to outside of the building to facilitate drainage. The sleeves shall be sealed with a non-hardening compound after installation of the cables to render the installation vermin-proof and water-proof.

Where an isolator, emergency stop, or starter containing an isolator is to be installed within 2 m of a motor, and cannot be installed on a wall, switchboard or other suitable place, an approved free-standing pedestal shall be provided. The pedestal shall be 1 m high and away from normal walkways, access routes, etc.

### PD1.1.9 Photo-Electric Switches

The outside lighting of each individual building shall be controlled by photo-electric sensitive switches. A by-pass switch, enabling the lights to be turned on at any time, shall be provided.

Standard control circuits are indicated in the standard assembly Drawings.

The operational level shall be factory pre-set for "ON" at a light level of approximately 54 lux and "OFF" at approximately 108 lux. Voltage variations shall not affect the operational levels.

A time delay of not less than 15 seconds shall be provided to prevent the unit from functioning due to short period changes in illumination.

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.

### **PD1.1.10 Earthing and Lightning Protection**

#### **PD1.1.10.1 General**

Earth electrodes and earthing methods shall be designed and installed according to the requirements of this Section and the latest revision of the following:

- a) SANS 10313 Code of Practice for The Protection of Structures Against Lightning and IEC/SANS 62305; and
- b) SANS 10142 Code of Practice for Wiring of Premises.

The earthing of the entire electrical installation shall be installed by the Contractor and shall consist of electrical earthing, instrument earthing and lightning protection. Each earthing system shall be installed in accordance with the requirements laid down and as directed by the Engineer and shall be connected to 1 main earth bar as shown on the Drawings. The main earth bar shall be connected to a main earth electrode system.

The Contractor shall carry out all the earth resistance testing as specified in accordance with the Engineer's requirements. All additional earthing requirements resulting from the tests shall be installed by the Contractor.

#### **PD1.1.10.2 Main earth electrode system**

The earth electrode system shall consist of a completely buried trench earth of 70 mm<sup>2</sup> stranded copper cable and earthing rods as shown on the Drawings.

The depth of the trench earth shall be 500 mm minimum below finished grade. All trench earths shall be interconnected and connected to earthing rods as shown on the Drawings.

A sufficient number of electrodes shall be driven at each selected location to obtain a system earthing resistance of one (1) ohm or less. If more than one rod is required at a location, the rods shall be spaced 3 m apart.

The earth electrode system shall be connected to the main earth bar with un-insulated 70 mm<sup>2</sup> stranded copper conductor.

#### **PD1.1.10.3 Main earth bar**

One main earth bar shall be installed per area, in the location, as shown on the Drawings. The earth bar shall be a 12.5 x 50 x 900 mm tinned copper earth bar mounted to the wall by three substantial stand-off spacers and bolted to the wall with brass bolts.

The following steel structures and plant shall be bonded to the main earth bar via the site earthing system: tanks, vessels, heat exchangers, pipeways, buildings, fences, transformers, switchgear, motor control centres, cable racks, motors, lightning arrestors, lightning panelboards, lightning masts and other items requiring earthing.

Lead sheath, continuous metallic sheath, wire armour or armour tape of cables shall be bonded to the frame of plant at each end of the cable. All properly prepared cable glands shall provide an acceptable earth bond on cables. All plant frames shall be bonded to the earthing system.



Contractor



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Witness 2



Employer



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Witness 2

#### **PD1.1.10.4 Electrical earthing**

The earth bar in each switchboard shall be connected to the main earth bar by a 70 mm<sup>2</sup> un-insulated stranded copper conductor and bolted to the earth bar by an 8 mm brass bolt.

All auxiliary panels smaller than 25 kW shall be earthed to the earth bar by 16 mm<sup>2</sup> un-insulated stranded copper conductor and bolted to the earth bar by an 8 mm brass bolt.

#### **PD1.1.10.5 Lightning protection of buildings**

Air finials, earth conductor and down conductor installations shall be as per IEC/SANS 62305:2007 parts 1, 2, and 3.

Down conductors shall be of a standard copper or aluminium down conductor installation type, installed with the correct brackets and saddles for that specific conductor. The down conductor shall take a vertical path down from the conductor without any bends or kinks to the earth electrode. The conductor shall be supported at 1 m intervals by copper saddles and brass screws down the length of the building. The saddles shall be fixed by drilling the masonry and installing plastic plugs.

The earth electrode system shall have an earthing resistance of 10 ohms or less. The earth electrode system shall be connected to the main earth bar as shown on the Drawings. Wherever possible the lightning conductor shall be connected to all local earth points (e.g., metal roofs, gutters, etc.).

Television aerials shall be earthed as above but only aluminium or aluminium alloys may be used for the down conductor, jointing and supporting materials and earth electrode.

All down conductors shall be routed outside the building and away from flammable material.

#### **PD1.1.11 Works Tests and Inspection**

All plant shall be fully tested in the Contractor's workshops before despatch to site. Provision shall be made for the necessary plant for a complete test. The Engineer shall be invited to witness such tests and to inspect the plant before despatch. The Contractor shall give the Engineer written notice of plant being ready for test and shall not commence testing without confirmation from the Engineer.

All costs and charges for the tests and inspection shall be included in the prices for the respective items.

#### **PD1.1.12 Site Tests and Inspection**

##### **PD1.1.12.1 Field installation check lists (FICL)**

The Contractor shall complete field installation check lists (FICL) for each individual portion of the installation, progressively. FICL shall include visual inspection notes and tests results, which shall be signed by the Engineer's Representative on site. Progress payments will be made based on FICL.



Contractor



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### PD1.1.12.2 Tests and Tests on Completion

The complete field check-out, testing and Tests of Completion of the electrical plant and systems shall be in accordance with the following procedure:

- a) Before primary and secondary connections are made to the transformer, megger primary-to-tank, secondary-to-tank and primary-to-secondary;
- b) Megger all outgoing circuits to earth and for electrical continuity;
- c) Tighten all accessible bolts on circuit breakers, isolators, etc.;
- d) Check that phasing of existing system corresponds to any additions;
- e) Switch on main incoming circuit breaker with all outgoing circuit breakers open;
- f) Switch on each circuit and check for correct operation of the circuit, and that the circuit breaker is suitably rated for current drawn;
- g) Check all control circuits (motor, interlock remote, auto-transfer, auto-restart, etc.) for correct operation; and
- h) Loop test all I/O circuits to the PLC, before functional testing of the software and programming.

All electrical plant shall be field tested and Tested on Completion by the Contractor, under full load conditions, after completion of the electrical installation and all costs for Tests on Completion and testing are to be allowed for under the relevant Items of the Bill of Quantities.

In the event of the Time for Completion not being met by the Contractor and should there be no official extension of the Time for Completion given by the Engineer, the Taking-Over Date shall be the date when the Installation has been fully completed to the approval of the Engineer. No provisional dates for Taking-Over will be given unless uncompleted work is beyond the Contractor's control. No separate Taking-Over Certificate will be issued for the Electrical, Control and Instrumentation Work.

### PD1.2 LOW VOLTAGE SWITCHBOARDS AND MOTOR CONTROL CENTRES (MCC)

This section covers the manufacturing and testing of flush mounted and floor standing switchboards and motor control centres for general installations in normal environmental conditions and for system voltages up to 1 kV.

MCC's and switchboards shall comply with the following standards:

SANS 10142 Part 1.	: The Wiring of Premises, Part 1: Low-voltage installations
SANS 1195.	: Busbars
IEC 60044	: Current transformers
IEC 60439 Part 1	: Factory built assemblies for low voltages
IEC 60529	: Degrees of Protection.
IEC 60947 – 2	: Low voltage switchgear & controlgear – circuit breakers
IEC 60947 – 4-1	: LV switchgear & controlgear – contactors and motor starters
IEC 60947 – 5	: Control circuit devices
SANS 1091	: National colour standards for paint



Contractor



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Witness 2

All switchboards and MCC's shall be manufactured and supplied from manufacturers who have equipment that has been tested by a recognized testing institution to withstand the fault level stated in the Detail Specification. Relevant test certificates for equipment of the same size and rating as that specified for this project shall be provided.

### **PD1.2.1 Switchboards**

#### **PD1.2.1.1 General**

**(a) Sizes**

All switchboards shall be of ample size to accommodate all the specified switchgear and provide space for future switchgear. For every 6 (or part of 6) circuit breakers of a type and size on a switchboard, space for an additional circuit breaker of similar size shall be allowed unless future space requirements are clearly specified.

**(b) External dimensions**

Prior to manufacture, the dimensions of the switchboards and MCC's must be checked for adequate space for installation, and compliance with the regulations, with respect to the control room drawings depicting the locations where the switchboards and MCC's are to be installed. This also applies to access doors and openings for the control rooms.

**(c) Positions**

The Contractor shall ascertain the exact position of switchboards and shall arrange timeously for the installation of cable sleeves, opening in the structure, flush draw trays behind switchboards and supports over cable trenches.

**(d) Mounting heights**

In general flush and surface wall mounted switchboards shall be mounted 1.4 m above finished floor level - measured to the centre of the switchboard. The upper ends of switchboards may not be higher than 2.3 m above finished floor level.

#### **PD1.2.1.2 Construction of flush wall mounted switchboards**

**(a) Bonding tray**

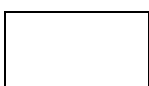
Bonding trays for flush mounted switchboards shall be rigidly constructed 1.6 mm thick galvanized steel, braced and reinforced. Formed gussets shall be provided at the corners. All the tray joints shall be properly welded. A brass or cadmium plated steel earth connecting stud and nut shall be provided.

**(b) Expanded metal**

Where switchboards are to be built into 114 mm thick walls expanded metal shall be spotwelded to the rear of the bonding trays. The expanded metal shall protrude at least 75 mm on each tray side to prevent the plaster from cracking.

**(c) Knock-outs**

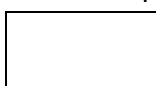
Ample knock-outs shall be provided in the top and bottom ends of each switchboard tray to allow for the installation of conduits for the specified and future circuits. Knock-outs shall be allowed for any size of specified conduit. Provision shall however, be made for termination of at least 2 x 25 mm dia. conduits at the top and 2 x 25 mm dia. conduits at the bottom of each tray.



Contractor



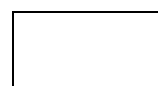
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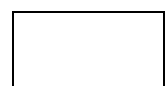
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**(d) Architrave frame**

The architrave frame shall be of 1.6 mm thick sheet steel with bevelled edges. The architrave frame shall accommodate the chassis, panels and doors. The architrave shall overlap the bonding tray by at least 25 mm on each side. The architrave frame shall be fixed to the tray in such a manner to allow for depth adjustment and irregularities in the wall.

**(e) Extension frames**

Semi-flush mounted switchboards shall be equipped with extension frames. Generally, the frame depths shall be 40 mm but may be altered to suit each application.

**(f) Chassis**

The chassis for mounting of switchgear and plant shall be of rigid construction and shall be fixed securely to the architrave frame or bonding tray by means of bolts screwed into tapped holes or bolts and nuts. Self-tapping screws are not acceptable. The chassis position shall be adjustable in the horizontal plane.

**(g) Panel (Faceplate)**

A suitably stiffened faceplate manufactured of 2.0 mm thick sheet steel shall be installed in the architrave frame for flush mounting of switchgear. The panel shall have machine punched slots for housing the specified and future switchgear, instruments, fuse holders, isolating switches, indicator lamps, etc. In exceptional cases contactors will be allowed to protrude through the panel. Blanking plates shall be provided in positions where future switchgear will be installed.

The distance between the inside of the closed doors and the panel shall not be less than 40 mm.

No plant may be mounted on the panel (faceplate) unless it is permanently hinged to the switchboard frame.

**(h) Fixing of panels**

The panel for each switchboard shall be secured to the architrave frame by means of 6 mm studs and chromium plated hexagonal domed nuts. Alternatively, the panel may be secured to the architrave frame by means of two pins at the bottom and a latch or lock at the top of the panels. Self tapping screws will not be allowed. Where it is required that plant be mounted on the panel, the panel shall be securely hinged to the switchboard frame.

**(i) Hinged panels**

Two chromium plated handles shall be provided on each front cover. The handles shall be mounted at the top and bottom of each panel.

**(j) Doors**

All switchboards shall be equipped with doors unless otherwise specified. The doors shall be of a smooth flat finish suitably braced to ensure stiffness and when in the closed position shall be flush with the architrave frame. The doors shall be of 1.6 mm sheet steel. The door width shall not exceed 600 mm. The corners shall be welded and smoothed.



**(k) Door handles and catches**

All switchboard doors shall be equipped with handles and catches. Locks shall only be provided when specified. In all cases where lockable doors are required, the switchboard doors are higher or wider than 450 mm, handles consisting of a push-button-and-handle combination with spring loaded latch or rotary handle-and-catch combination shall be installed. Switchboard doors smaller than 450 mm in height and width may be equipped with spring loaded flush mounted ring type latches. Square key operated catches are not acceptable unless specified in the Detail Specification.

**PD1.2.1.3 Construction of surface mounted switchboards**

This section refers to surface mounted sub-switchboards and not to floor standing main switchboards in substations or sub-main switchboards.

**(a) Switchboard tray**

Surface mounted switchboards shall be equipped with a 1.6 mm sheet steel reinforced tray. Securing lugs shall be provided to fix the tray to walls or any other structure. A solid brass or cadmium plated steel earth connection stud and nut shall be provided.

**(b) Construction**

All joints shall be securely welded. The tray shall be square and neatly finished without protrusions. The front tray sides shall be rounded with an edge of at least 20 mm to accommodate flush doors.

The requirements of chassis, panels and doors shall be as specified for flush mounted switchboards. The doors shall be hinged and shall fit flush in the frame in the closed position. Knock-outs shall not be provided unless specifically called for.

**PD1.2.1.4 Construction of floor standing switchboards**

**(a) Frame**

Free standing switchboards shall be manufactured from a solid angle iron, channel iron or 2 mm minimum folded metal framework and a solid U-channel base frame, sufficiently braced to support all plant and span floor trenches and access holes. Care shall be taken to prevent distortion due to localised heating during welding. All welds shall be ground smooth and the joint wiped with plumber's metal in order to provide a smooth finish. The design of the frame shall provide for the mounting of main circuit breakers, busbars and other plant.

**(b) Side panels**

The side, top and rear panels shall be removable and shall be manufactured from 2 mm minimum sheet steel. The panels shall have upturned edges which fit over lips on the switchboard frame. The panels shall be fixed to the frame by means of studs and chrome plated hexagonal domed brass nuts. Where switchboards are installed in vertical building ducts or against walls, the rear and side panels may consist of a single folded sheet which is either bolted or welded to the frame or which forms part of the folded metal frame.

**(c) Front panels**

The front panels of floor standing switchboards shall be hinged. The panels shall be arranged in multi-tiered fashion to allow for the logical grouping of plant.



Contractor



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Witness 2

The hinged front panels shall have a dished appearance with 20 mm upturns which fit over a lip on the switchboard frame. Alternatively, the hinged panels shall be folded edges and shall be fitted flush or slightly recessed in the switchboard frame. The latter method shall be used where doors are required. Corners shall be welded and smoothed.

The panels shall be of 2 mm minimum sheet steel with machine punched slots to allow for the flush mounting of all instrumentation, switchgear toggles and operating handles. A minimum clearance of 50 mm shall be maintained between the rear (taking into account terminals and other projections) of plant mounted on the panels and the frame chassis of the switchboard.

Separate panels shall preferably be provided for the mounting of instrumentation and for covering flush mounted switchgear.

Hinged panels shall be suitably braced and stiffened to carry the weight of flush mounted plant and to prevent warping.

Long pedestal type hinges with two fixing bolts per hinge shall be used to support hinged panels with flush mounted protection relays and similar plant and panels higher than 600 mm. 16 mm Pedestal hinges or similar hinges with single fixing bolts may be used on small panels.

Pedestal hinges shall be arranged in opposed fashion so that panels cannot be lifted off.

A tubular chromium plated handle shall be fitted on each panel.

Blanking plates shall be fitted over slots intended for future plant. These plates shall be fixed in such a fashion that fixing holes do not need to be drilled through the front panel.

Panels shall be fitted with rubber or neoprene seals.

**(d) Securing of front panels**

Hinged panels shall be secured in position by means of square key operated non-ferrous fasteners designed to draw the panels closed. Self-tapping or captive screws are not acceptable. When non-hinged removable panels are specified, they shall be secured in position by means of 6 mm studs and hexagonal chromed brass domed nuts and washers. Non-hinged removable panels may alternatively be secured in position by means of two pins at the bottom and a latch or lock at the top. The handles of these panels shall be at the top and bottom.

**(e) Chassis**

A suitably braced chassis for the mounting of switchgear and plant shall be firmly secured to the frame of the switchboard. Circuit breakers and isolating switches which are not of the moulded case air break type and the insulators of busbars for ratings of 200A and above may be secured directly to the framework.

**(f) Sections**

The Contractor shall verify the position of all switchboards on site. For ease of transportation and to facilitate access to the allocated accommodation, the switchboards may be manufactured in sections. The section of the boards shall be of suitable size to pass through doorways, passages, etc. Each section shall be rigidly manufactured to ensure that damage

to the switchgear will not occur during transportation and handling. When positioned the sections shall be bolted together.

**(g) Grouping of switchgear**

The switchgear shall be logically arranged and grouped. Depending upon the number and size of components a common front panel may be installed over one or more groups of plant.

**(h) Busbars**

Solid copper busbars shall be provided in the switchboard.

**(i) Earth busbars**

An earth busbar shall be provided in a suitable position in the switchboard.

**(j) Cable gland plate**

A cable gland plate shall be installed 300 mm above the bottom of the switchboard to house the cable glands. The gland plate shall be suitable for the type of gland or end boxes to be used. Cable glands for top exit cables shall be secured to the top non-removable panel of the switchboard. A P4000 channel or other approved support shall be provided to carry the weight of the cable and remove mechanical stress from the cable glands.

**(k) Termination of conduits**

Conduits shall be terminated on the gland plate or top non-removable panel. It (If?) the panel is removable it shall be welded to the switchboard frame before conduit or cable terminations are made.

**(l) Securing**

Switchboards shall be firmly secured to the floor and/or wall and shall be equipped with the necessary securing lugs.

**(m) Ventilation**

Switchboards shall be properly ventilated, especially cubicles containing contactors, transformers, motor starters and other heat producing components.

**(n) Storage**

Switchboards which cannot be installed and put into service immediately shall be stored so as to maintain the plant in a clean and dry condition and shall be placed on a level surface.

**PD1.2.2 Motor Control Centres (MCC)**

**PD1.2.2.1 Design**

Motor Control Centres shall be designed to suit the system fault level as specified or shown on the Drawings and which shall be deemed to be the maximum currents occurring at the motor control centres under symmetrical short circuit conditions on the line side of any limiting device.

The duration of the maximum short circuit currents shall be deemed to be 3 seconds.

Evidence, in the form of certificates by a recognised testing authority, of the ability of the motor control centres offered to withstand satisfactorily the prospective fault conditions shall be available and submitted if requested by the Engineer.

#### **PD1.2.2.2 Construction**

Motor Control Centres shall be of the floor-standing, indoor dust-protected and vermin-proof type, manufactured from sheet steel having a minimum thickness of 2.0 mm.

Motor Control Centres shall be made up of one or more, modular, bolted construction, free-standing vertical panel assemblies, hereinafter referred to simply as "panels", bolted together to form an extensible composite switchboard of uniform appearance, and mounted on a steel plinth of minimum height of 75 mm.

Each panel shall consist of a metal-enclosed, deadfront, extendible, vertical steel structure capable of housing power buses, an earthing bus, motor starters, fused switches, metering and control plant, etc. Each panel shall be capable of being divided into segregated compartments, each with a separate door, for the housing of motor starters or other plant.

Unless otherwise specified, each panel shall be 610 mm wide and 600 mm deep, and the height above finished floor level shall not be more than 2.3 m.

Three basic types of Motor Control Centre construction will be required and will be detailed in the Detail Specification. The types of construction are as follows:

- Standard construction - having front access to control gear and other electrical plant, and rear access for the termination and connections of cables;
- Front access only construction; and
- Back-to-back construction - where access to control gear and cable zone are on the same face.

A cabling zone cubicle shall be provided for each panel. The cabling zone cubicle shall be provided with the necessary cable gland plate and hinged doors and shall have a minimum width of 300 mm.

Segregated or non-segregated compartments may be specified for any of the above types of construction.

Motor Control Centres shall have front-mounted plant, except in the case of back-to-back construction.

Panels shall be constructed so that the different zones for control gear and/or horizontal and vertical busbars, incoming feeders, bus-wires and cable terminations, are completely isolated and segregated from each other by means of steel barriers and in such a manner that prospective damage resulting from faults will be minimised and confined to the zone in which the fault occurs.

Where starters or feeders are each required to be housed in a separate compartment, each panel shall be constructed so that dividing plates will ensure a totally enclosed and separate

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compartment ensuring that access from one compartment to its adjacent compartment is totally prohibited, other than through specified orifices intended for inter connecting control wiring where necessary.

Each separate compartment shall be provided with a hinged door which shall be arranged so that it cannot be opened while the apparatus contained therein is alive, unless this apparatus is fully shrouded or screened to prevent inadvertent contact.

Where the apparatus contained in the compartment is provided with an isolating switch or MCB, the door shall be mechanically interlocked so that it cannot be opened unless the switch is in the "OFF" position.

Empty panels and compartments shall be equipped with fundamental horizontal and vertical busbars to enable easy additions to be made to the motor control centre once it has been installed.

Each completed Motor Control Centre shall be divided into transportable sections, each section provided with removable lifting lugs which shall be bolted to the main framework of the transportable section. The framework shall be designed so that no distortion of the board will take place when hoisted and handled.

All screws, bolts and nuts shall be hexagonal cadmium plated and in accordance with Metric Commercial Standards and shall be rust-proof. Nuts protruding from exterior surfaces shall be domed.

Self-tapping screws shall not be used under any circumstances, unless approval to do so has been given by the Engineer in writing before manufacture has commenced.

Panels shall be provided with hinged doors for access to cable termination zones. Bolted on covers will not be acceptable. Hinged doors shall be provided with "Perano" or "Barker-Nelson" 6 mm catches and "Barker-Nelson" pedestal hinges.

Each Motor Control Centre shall be provided with a suitable enclosure or pocket on the inside for housing one full set of Drawings and a maintenance and instruction manual.

#### 1.2.2.3 Busbars

Horizontal power busbars and vertical busbar droppers shall be copper, of constant cross-sectional area throughout their length, and shall be mechanically braced for the short circuit current value as specified. All busbars shall be of suitable rating and not more than 1.8 Amps per mm<sup>2</sup>.

Contact surfaces of busbars at splices and bolted joints shall be silver plated or chemically cleaned by a process approved by the Engineer.

Busbars shall be colour coded.

Holes in busbars shall be jig-drilled or punched so that they are perfectly round and only with sufficient clearance to suit the correctly size of bolt. All busbar ends behind the blanking off covers shall be pre-drilled for fishplates.

The main horizontal busbars shall be completely isolated from the other zones. The vertical power busbar droppers on each panel shall be insulated or isolated so that with the compartment door open or the main cableway door open, access cannot be gained to live busbars.

Main horizontal and vertical power busbars shall have continuous Amp ratings as specified. However minimum ratings for MCC shall be applicable as follows:

- Main horizontal busbars - 600 Amps
- Vertical busbar droppers - 300 Amps

Horizontal and vertical busbars are to be fixed on non-tracking hazite insulators or equal approved, at suitable intervals to withstand the dynamic forces under the full short circuit conditions. Bolted joints in busbars are to be joined using copper fishplates of equal section to the busbars and using high tensile bolts and lock-washers.

#### **PD1.2.2.4 Wiring**

##### **(a) Cabling**

Cables connected to incoming or outgoing circuits shall terminate on the gland plate supplied for this purpose. The cable conductors shall be connected directly to the appropriate switchgear or to busbars.

##### **(b) Terminal strips**

External wiring for low voltage, control interlocking alarm, measuring and D.C. circuits shall terminate on numbered terminal strips of the "KLIPPON" or equivalent manufacture. The correct terminal size as recommended by the manufacturer for each conductor to be connected shall be used throughout. The terminal numbers shall appear on the wiring diagrams of the switchboards. Terminals for power wiring shall be separated from other terminals. Terminals for internal wiring shall not be interposed with terminals for external circuits.

##### **(c) Current ratings**

The current rating of conductors for the internal wiring shall be sufficient to carry the maximum continuous current that can occur in the circuit.

Conductor ratings for PVC insulated, single core conductors are specified in Table 1.2.2/1 for maximum internal switchboard ambient temperatures of 30°C. These values shall be derated for ambient temperatures that are likely to exceed 30°C. Where currents exceed the rating of 70 mm<sup>2</sup> conductors, busbars shall be used.

**TABLE 1.2.2/1**

**PVC INSULATED CONDUCTOR RATINGS**

NOMINAL CROSS SECTION (mm <sup>2</sup> )	CONDUCTOR RATING (A)				
	NUMBER OF CONDUCTORS BUNCHED TOGETHER				
	1	2 – 3	4 - 5	6 - 9	10 or more
1.5	13	12	10	9	8
2.5	17	16	14	12	10
4	22	20	18	16	13
6	29	26	23	20	17
10	40	36	32	28	24
16	55	49	44	38	33
25	74	67	59	52	44
35	93	74	74	65	56
50	119	107	95	83	71
70	148	133	119	104	89

**(d) Internal wiring**

Standard 600 V grade PVC insulated stranded annealed copper conductors to SANS 1507 shall be employed for the internal wiring of switchboards. Current ratings are specified in c) above. If the internal ambient temperature of the switchboard is likely to exceed 60°C, stranded 600 V grade copper wiring shall be insulated with heat resistant insulation.

**(e) Load end connections**

The supply end connections to plant shall as a rule be at the top and the load end connections at the bottom. Where the load and supply ends of the mains circuit breaker of a switchboard are not indicated the load may be connected to the top end only if the wording "TOEVOER/LINE" and "LAS/LOAD" is correctly indicated on the circuit on the circuit breaker.

**(f) Wiring to circuit breakers**

Plant with a rating exceeding 200 A shall be connected by means of busbars to main busbars.

**(g) Identification**

The colour of the conductors for all 220 V circuits shall correspond to the colour of the supply phase for that circuit. Neutral conductors shall be black. All other conductors in the board supplying control circuits, etc., shall be coded in colours other than those specified above. A colour code shall be devised for each board and the colour code shall be shown on the wiring diagrams. All conductors that terminate at terminal strips and all conductors used for the internal wiring shall further be identified at both ends by means of double cable marking ferrules. PVC or other tape is not acceptable. The numbers on the markers shall also be shown on the wiring diagrams.

**(h) Control and instrumentation wiring**

All internal wiring shall be carried out in PVC insulated wire with a minimum size of 1.5 mm<sup>2</sup> flexible conductors. Each end of every wire shall be marked with the wire number by means of plastic cable markers of the "Partex-Haley" or "Klippon" type. All wiring shall be neatly grouped and run-in plastic wiring channels of adequate size with covers and additional spare capacity of at least 25% shall be allowed for in the wiring channels. All wiring shall be brought out to terminal blocks for connections to external wiring and shall enter or exit from the slots which are provided in the wiring channel.

All panel wiring shall be terminated by means of correctly sized compression lugs of the TELEMECANIQUE type DZ5-CE or equal approved unless otherwise specified.

The wire used shall comply with the following colour coding:

- |                         |                      |
|-------------------------|----------------------|
| • Red                   | 24V DC (+ 24 V line) |
| • Black                 | 24V DC ( 0 V Line)   |
| • Brown                 | 220 V Line           |
| • Blue                  | 220 V Neutral        |
| • White                 | Current Transformers |
| • Green or Green/Yellow | Earth                |

The minimum voltage rating of the control wiring shall be 300 V AC.

Split or clip-on wiring markers shall not be used under any circumstances.

**PD1.2.2.5 Circuit breakers**

Circuit breakers shall comply with the requirements laid down in SANS 156.

The incoming terminals of single pole miniature circuit breakers shall be suitable for connection to a common busbar.

Circuit breakers used on any one particular service shall be supplied by a single manufacturer.

The continuous current rating, trip rating and rupturing capacity of the circuit breaker shall be as required by plant.

All Miniature Circuit Breakers (MCB's) shall be of minimum kA rating as per Drawings and shall be of the thermal magnetic trip free type.

Moulded Case Circuit Breakers (MCCBs) shall have a fault rating as specified. MCCBs shall be of the manually operated and trip free type with thermal as well as instantaneous magnetic trips on each pole.

Where MCCBs are used as back-up in motor starters, these shall be mechanically interlocked with vari-depth handles on the compartment door to prevent the door being opened while the apparatus inside the compartment is alive.



#### **PD1.2.2.6 Earth leakage relays**

Single phase or three phase earth leakage relays with associated double, triple pole or 4 pole circuit breakers shall be supplied and installed in all circuits feeding socket outlets and other general power circuits in compliance with SANS 10142.

The relays shall operate on the core balance (current balance) principle. The operation shall be independent of mains voltage and shall function with any of the supply conductors (and neutral) disconnected or broken.

The sensitivity and operating response of the relay shall be such that instantaneous tripping will occur at a total earth leakage current as per Drawings. The unit shall have compensation for ambient temperature variations, and the sensitivity and operating response time shall be maintained over the range of normal frequency variations. Stability of operation, long life and retention of characteristics are essential.

The unit shall be provided with integral test facilities by means of which the correct functioning of the unit may be tested.

The circuit breaker and earth leakage relay shall be suitable for operation on a 220 - 250 Volt, 50Hz supply on single circuits and 380 - 440 Volt, 50Hz supply on three phase circuits. Internal earth leakage units may be used as an alternative.

For motor starter circuits, Earth leakage relays are to be as follows:

0 to 75 Kw	: 250mA instantaneous EPC type E1 Sec X and Transcore X.
90 kW up	: 375mA EPC AEL Sec T Curve 1 and Transcore T.

#### **PD1.2.2.7 On-load, fault-making switches**

On-load, fault-making switches shall be of the triple pole, hand operated, panel mounting, airbreak type suitable for operation on 380 - 440 Volt, 50 Hz A.C. systems.

The contacts shall be of silver alloy and the switch mechanism shall be of the quick-make, quick-break type.

The switches shall be capable of opening and closing the full current rating of the switch. The current rating of the switch shall be in excess of the full load current of the circuit which the switch will be required to open. In the case of motor circuits the switch shall be capable of breaking the "stalled rotor current" of the motor.

The switches shall further be capable of being closed onto a fault. The switches shall be adequately rated to withstand the maximum fault current that can occur at the point in the circuit for a sufficient time to allow the back-up protection (circuit breakers or fuses) to open the circuits.

The switches shall be suitable for mounting behind switchboard panels.

To distinguish the switches from circuit breakers, the operating handle shall have a distinctive colour, preferably green, or other clear indelible indication.

#### **PD1.2.2.8 Rotary switches**

The switches shall be of the cam actuated or wiping air break type with two breaks per pole. The required number of poles and number of functions shall be provided by the assembly of switch units on a common spindle. Unless specified to the contrary the switches shall be constructed for mounting behind a flush panel, and shall be provided with a suitable faceplate and operating handle.

The contacts shall be of silver alloy and the latching mechanism shall ensure positive accurate positioning of the handle in relation to faceplate markings. The voltage and current ratings shall be as required by the circuit and control function and the making capacity shall be at least three times the normal current rating.

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#### **PD1.2.2.9 Combination fuse switch unit**

The fuse switch shall be of the triple pole type.

The fuse type cartridges shall comply with BS 88, Category of Duty AC 16, 33, 46 or 80 suitable for a 415 V 50 Hz system. Category of duty shall be matched to the fault level at the point where the fuses are installed.

The fuse switch shall have a hand operated lever and the “ON” and “OFF” positions shall be clearly marked.

Fuse switch units shall be of the double air-break, quick-make, quick-break type and shall have a spring mechanism smoothly driven by springs on both sides of the mechanism.

The fuse links shall be fully isolated when the switch is in the “OFF” position, and interlocks shall be provided to prevent the cover being opened when the switch is closed and to prevent the switch being operated with the cover open.

#### **PD1.2.2.10 Fuses and fuse holders**

High rupturing capacity fuses (HRC fuses) shall comply with the requirements of SANS 60269 with a fusing factor of 1.5.

Fuses which are not mounted integrally with switches shall be mounted on insulated draw-out carriers (holders) which hold the fuses positively after withdrawal.

Each fuse link and holder shall incorporate a visual inspection eye for fault location. Should live terminals become exposed after the withdrawal of fuses, rigid barriers shall be provided between adjacent sets of terminals to prevent accidental contact during withdrawal or insertion of the fuses.

Control circuits shall be protected by suitably rated fuses. Instrument fuses shall be mounted in close proximity to the relevant instrument. These fuses shall be clearly labelled with engraved “TRAFOLYTE” or similar strips indicating use, rating and duty (where applicable).

#### **PD1.2.2.11 Contactors**

Contactors shall be of the open or totally enclosed, triple or double pole, electromechanically operated air-break type suitable for 380 – 440 V or 220 – 250 V.

Contactors shall be of modern design with the following characteristics:

- a) Enclosed coil;
- b) A permanent air gap in the magnetic circuit to prevent sticky operation;
- c) Provision for quick and simple inspection of contacts; and
- d) Clearly marked main and auxiliary terminals.

Contactors which are not located in switchboards shall be housed in enclosures which comply with IP 54 of SANS 60529.



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The current rating of the contactors shall be as specified for the circuit with a switching duty in accordance with the IEC Publication 158 - 1, utilisation category AC1 for lighting and power circuits and utilisation category AC3 for motor starting.

The magnetic system of the contactor shall be carefully designed and all laminations tightly clamped to ensure that when the armature is closed and full voltage at normal frequency is applied to the coil, the contactor will not emit more noise than the hum associated with any properly constructed laminated core with tightly clamped laminations. Noisy contactors will not be accepted.

Non-current carrying metallic parts shall be solidly interconnected and a common screwed earth terminal shall be provided. The contactor shall be earthed to the switchboard earth bar. Latched contactors shall be provided with a trip coil and a closing coil. The contactor shall remain closed after de-energising the trip coil.

Contactor operating coils shall have a voltage rating as required by the control circuitry and shall have the limits of operation and temperature rise as specified in clause 7.5 and Table IV of the IEC Publication 158-1. Latched contactors shall be capable of being tripped at 50% of the rated coil voltage.

Contactors for normal/standby change-over circuits shall be electrically and mechanically interlocked.

Contactors with provision to add auxiliary contacts on site are preferred. Contactors with permanently fixed auxiliary contacts shall have at least 1 x N/O and 1 x N/C spare auxiliary contacts. Where the number of auxiliary contacts required is greater than the contacts that can be accommodated on the contactor, an auxiliary relay or additional contactor shall be provided to supply the additional contacts.

Auxiliary contacts shall be capable of making, carrying continuously and breaking 6 A at 220 V A.C., unity power factor.

Spare auxiliary contacts shall be wired to numbered terminal strips in the switchboard and shall appear on the switchboard Drawings.

#### **PD1.2.2.12 Indoor surge arrestors**

Surge arrestors shall be of the single pole indoor type suitable for mounting on a meterbox or switchboard and suitable for the protection of electrical appliances.

In case of damage caused by very severe overloads, the arrestor shall be automatically disconnected from the mains and a visual indication given to show that the arrestor has been disconnected.

The arrestors shall be suitable for systems with an earthed neutral and voltages up to 250 Volts to earth.

#### **PD1.2.2.13 Voltmeter selector switches**

Voltmeter selector switches shall be suitable for a three phase 50 Hz system and rated for the system voltage.

Voltmeter selector switches shall be arranged to provide one "off" position and six metering positions in order that the phase-to-phase voltage and phase-to-neutral voltages can be read on the voltmeter. The switches shall be break-before-make type.

The operating knob and indicator plate shall be manufactured of a suitable insulation material. The switch positions shall be clearly and indelibly marked thereon.

Switches shall be suitable for panel mounting with the operating knob and indicator plate on the front of the panel and the switch and contacts behind the panel.

The selector switch shall be situated immediately below or adjacent to the voltmeter. An engraved label shall be fixed below the selector switch indicating its function.

#### **PD1.2.2.14 Ammeter selector switches**

A single ammeter with selector switch shall only be allowed in exceptional circumstances. As a rule, 3 ammeters shall always be provided unless specified to the contrary.

Where ammeter selector switches are specified, they shall be make-before-break types. The wiring shall be arranged so that the current transformer terminals are short circuited when the ammeter is not connected across them.

#### **PD1.2.2.15 Pushbuttons**

Push buttons shall be of robust construction and shall be suitably rated for the switching duty with provision for the control functions specified.

Push buttons shall be suitable for flush mounting on switchboards.

Red push buttons shall generally be used for tripping, stopping or switching off functions and green push buttons for starting or switching on functions.

Push buttons installed in walls or on other non-metallic surfaces, shall be mounted in purpose-made flush or surface mounted boxes equipped with a mounting plate with slotted holes and suitable cover plate.

Illuminated push buttons, key-operated push buttons, button plates, legend plates etc., shall be supplied as specified.

Push buttons shall comply with the requirements of the relevant clauses of BS EN 60730 or VDE 0660.

#### **PD1.2.2.16 Relays**

The coil, contacts and operating mechanism of all relays shall be contained in a transparent, dust proof enclosure of plastic or other suitable synthetic material.

Relays shall be supplied with plug-in bases.

Relay bases shall be fitted with wire-spring type retaining clips to ensure positive relay contact even when the switchboard is subjected to severe vibrations.

Relay contact ratings shall be adequately rated for the intended duty.

Relays shall provide the type of switching function specified. Late-make or late-break functions, etc., shall be inherent in the design.

#### **PD1.2.2.17 Time switches**

Time switches shall be suitable for use at the system voltage.

Time switches shall be fitted with a manual over-ride switch. An external by-pass switch shall be provided in all time switch circuits.

#### **PD1.2.2.18 Voltmeters**

Voltmeters shall be 400 Volt moving iron, suppressed zero type, scaled from 0 - 500 Volts. The 400 Volt mark shall be clearly indicated with a red line on the scale.

Voltmeters shall be suitable for flush mounting on vertical switchboard panels and shall be provided with studs for rear connection. The terminals of voltmeters mounted on hinged front panels shall be shrouded or covered to prevent accidental contact when the panels are open.

Voltmeters shall be suitable for operation on a 50 Hz system and shall be manufactured in accordance with the requirements of BS 89 (current) for industrial grade accuracy. The voltmeters shall withstand a test voltage of 2 kV.

Voltmeters shall be fitted with zero adjustment screws.

Voltmeters shall be screened to prevent magnetic interference and shall be fitted with anti-static glass.

Each voltmeter shall be marked to indicate the appropriate phase to which it is connected. Where 3 voltmeters are provided, they shall be installed in a horizontal line. The voltage which is being measured shall be clearly marked.

Where voltmeters are connected to potential transformers, the ratio of the potential transformers shall be marked on the voltmeter faceplate.

#### **PD1.2.2.19 Ammeters**

Ammeters shall be of the moving iron type suitable for flush mounting on vertical switchboard panels and shall be provided with studs for rear connection. The terminals of ammeters



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mounted on hinged front panels shall be shrouded or covered to prevent accidental contact when the panels are open.

Ammeters shall be of 72 mm or 96 mm square format unless specified to the contrary. Voltmeters, ammeters, frequency meters, etc., shall have the same dimensions for a particular application.

Ammeters shall be manufactured to the requirements of BS89 (current) for instrumentation of industrial grade accuracy. Where the calibration and current transformers are to be specified, ammeters shall have a full-scale deflection of 125% of the rated current of the circuit. Full load ratings shall be indicated with red line. Ammeters shall withstand a test voltage of 2 kV.

Ammeters used in motor circuits shall cater for motor starting currents by condensed over scales up to 100% overload scaling.

Ammeters shall be fitted with zero adjustment screws.

Ammeters shall be screened to prevent magnetic interference and shall be fitted with anti-static glass.

Each ammeter shall be marked to indicate the appropriate phase to which it is connected. Where 3 ammeters are provided, they shall be installed in a horizontal line. The current being measured shall be clearly marked.

The ratio of current transformers shall be marked on the ammeter faceplate.

Ammeters shall be suitable for the environment in which they are installed.

#### **PD1.2.2.20 Maximum demand ammeters**

Maximum demand ammeters shall comply with the requirements of ammeters except that in addition to the moving iron ammeter indicating instantaneous current, a maximum demand ammeter employing a bi-metallic spiral device which indicates mean current value integrated over a 15-minute period and a residual pointer to indicate the maximum mean current reached during any period between manual resettings, shall be combined in the same housing.

All three indications shall be given on concentric scales. Instruments having small moving iron ammeters with window cut-out scales are not acceptable.

The bi-metallic system shall incorporate ambient temperature compensation.

The residual pointer shall be resettable from the front glass panel.

#### **PD1.2.2.21 Kilowatt hour meters**

The kilowatt hour meter shall be manufactured in accordance with the requirements of BS 5685. The meter shall be suitable for operation on a 50 Hz AC system with commercial grade accuracy.

The meter shall provide a direct reading in kWh without the use of multiplication factors.

All meters driven by current transformers shall have a 5 A nominal current input.

#### **PD1.2.2.22 Current transformers**

Current transformers shall comply with the requirements of the latest edition of IEC 60044 Where the current value of the primary side is more than 50 A (irrespective of ratio), the current transformer shall be of the ring type with an opening to suit the dimensions of the conductor or busbars.

Current transformer ratios shall match the rating of the circuit and the scaling factor and saturation points required on instruments or by circuit protection plant.

Unless specified to the contrary, current transformers shall have a class 1 accuracy, a capacity of 5 VA and be suitable for operation on 50 Hz AC systems up to 660 V.

Each current transformer shall be provided with a robust mounting bracket and proper terminal studs on the circumference of the coil for connections.

A nameplate shall be fixed to the coil circumference in such a position that it can easily be read from outside the switchboard after removal of the access panels. The nameplate shall clearly indicate class, rating, ratio and function.

Current transformers shall be mounted on rigid supports in such a fashion that the connections to the switchgear and connections to the coil terminals can be installed without difficulty.

Current transformers shall be capable of withstanding the maximum fault current that can occur at the point in the system for the time taken by the circuit protection devices to clear the fault.

#### **PD1.2.2.23 Hour meters**

Electrically operated cyclometer type hour meters suitable for flush mounting on vertical switchboard panels shall be provided where specified. The meters shall be provided with studs for rear connection. The terminals of meters mounted on hinged front panels shall be shrouded or covered to prevent accidental contact when the panels are open.

Numerals shall be white on a black background and shall be clearly defined.

Hour meters shall comply with the requirements specified in BS 89 for instruments of "Industrial Grade" accuracy.

Hour meters shall be suitable for a system voltage of 220 V, 50 Hz AC unless specified to the contrary. The meters shall be protected by HRC fuses.

#### **PD1.2.2.24 Indicator lights**

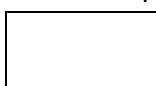
Red indicator lenses shall generally indicate that the circuit is "ON" and green that the circuit is "OFF".



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All indicator lamps shall be clearly labelled.

#### **PD1.2.2.25 Cable gland plates**

Removable cable gland plates shall be provided on each panel and fixed by means of captive nuts or screws. The gland plates shall be located not less than 375 mm above floor level so that ample space is provided for the satisfactory making off of cables.

If gland plates are to be pre-drilled, drilling details will be provided in the Detail Specification.

All cable entries shall be from the bottom of the panel unless otherwise specified in the Detail Specification.

#### **PD1.2.2.26 Motor protection**

Overload and single-phase protection shall be provided for all motors. These devices shall have ADJUSTABLE overcurrent settings. The range of adjustment shall be at least 80% to 115% of normal full load current. The overload protection devices shall be suitable for all starting duties required.

Overload and single phasing relays shall be of the manual resetting type with reset buttons mounted in an easily accessible position.

##### **Motors rated up to 75 kW:**

All 3 phase motor starters shall be provided with thermal overload relays that are selected for each applicable motor rating.

The overload relays shall have inverse time current characteristics which comply with IEC 60947 trip class 10. Where motors have exceptional long starting times the trip class shall be selected to ensure that tripping doesn't occur during motor starting.

The relay shall provide protection against:

- Single phasing.
- Phase reversal.
- Phase angle errors.
- Unbalance supply voltage.

Where relays are mounted inside panels and the trip indicators on the relays are disabled due to the loss of control voltage when cubicle doors are opened, additional signal lamp indicators shall be provided on the cubicle doors otherwise the relays shall be flush mounted on the doors.

##### **Motors rated 75 kW and above:**

Motors larger than 75 kW shall be protected with electronic motor protection relays. The relay shall make provision for the minimum protection functions as follows:

- Thermal overload with thermal capacity memory.
- Unbalance current and Single phasing.
- Phase sequence.

- Restart control (The cooling characteristics of the motor shall be accurately simulated to block starting until the motor has cooled down sufficiently for both hot and cold starts).
- Stall and Jam protection.
- Earth leakage protection
- Earth fault protection
- Local/remote LED fault indication

When earth fault and short circuit currents exceed the rupturing capacity of the contactors, trip signals shall be delayed by the motor protection relay to ensure that the fuses blow before the contactor is tripped.

#### **PD1.2.2.27 Labelling**

All MCCs and switchboards shall be identified with labels in accordance with the Drawings. The label shall have black characters at least 10 mm high on a white background.

All doors and removable covers shall be provided with a traffolite label on the outside, indicating the panel number or other identification. The label shall have black characters at least 10 mm high on a white background.

Warning labels shall be provided on all doors and removable covers where the apparatus contained inside the enclosure is alive when the door or cover is removed.

The warning labels shall be adequately sized and shall have red letters on a white background giving adequate warning to the operator or user that in the event of the door being opened or the cover being removed the apparatus contained inside the enclosure is alive and dangerous.

All components contained in compartments and panels shall be labelled with the same designations corresponding with those used in the schematic and wiring diagrams. These labels are required for recognition purposes and are to be engraved on traffolite labels. The size of these labels shall be to the discretion of the manufacturer but shall be easily identifiable.

All fuses including instrument fuses shall have labels stating function, fuse rating and duty or type where applicable.

Labelling shall be in English. All labels shall be fixed with screws or approved type rivets. Glueing on of labels will not be permitted unless approved by the Engineer.

Distribution board circuits shall be identified on a legend card which shall be installed on the inside of the door, or in any other position where it can conveniently be observed.

#### **PD1.2.2.28 Control circuit voltage supplies**

The control circuit voltage supplies will be specified in the Detail Specification for the respective motor control centres required.

Where control circuit transformers are required, these shall be of the single-phase double wound natural air-cooled type manufactured in accordance with SANS standards.

Where control transformers are required to be housed in compartments, the primary windings shall be connected to the main busbars via protective fuses and a suitable isolating switch. The secondary windings shall be connected to the control busbar or bus wire system by a protective device in the line side and an isolating link in the neutral. The central pole of the control circuit transformer shall be earthed.

Control transformers shall be rated at least 25% greater than the actual power requirements of the control circuit devices.

#### **PD1.2.2.29 Isolators**

All isolators shall be of the fault-make, load-break type and where used in combination with motor starters, shall be mechanically interlocked with the compartment doors to prevent the doors being open while the isolator is in the "ON" position.

#### **PD1.2.2.30 Air circuit breakers (A.C.B.'s)**

All air circuit breakers shall be of the withdrawable type unless otherwise specified in the Detail Specification. A.C.B.'s shall be provided with manual operating mechanisms and fitted with thermal overload protection devices as well as instantaneous acting protection responding to short circuit currents.

Air circuit breakers shall be installed in all circuits rated at 1000 amps and greater.

#### **PD1.2.2.31 Earthing**

A continuous copper main earth bar shall be run for the full length of the Switchboard or Motor Control Centre with a minimum cross-sectional area of 70 mm<sup>2</sup>.

All plant requiring earthing shall be effectively earthed to this main earth busbar.

Manufacturers shall ensure that all cable gland plates are effectively earthed via the steelwork of the panel or provided with individual bonded conductors.

#### **PD1.2.2.32 Shrouding**

Shrouding shall be fitted to the following:

- To the live side of all isolating devices within each compartment or panel; and
- On all terminals which could become live due to backfeeds from other starters or feeders.

All shrouds shall be of suitable insulating materials to the approval of the Engineer, and labelled where necessary.

More detailed descriptions of shrouding requirements will be given in the Detail Specification where necessary.

#### **PD1.2.2.33 Painting and protective finishes**

All steelwork shall be satisfactorily cleaned to remove all traces of grease, oil, rust and mill scale as well as any other contamination present. Surfaces shall be prepared for painting in

accordance with paint manufacturer's recommendations and in accordance with environmental conditions as specified. After this initial preparation has been carried out, priming, intermediate and finishing coats as prescribed, shall be applied.

The Contractor shall submit the proposed painting Specifications with their offers and preference will be given to paint finishes having baked enamel or epoxy powder coated finish.

Exterior paint colour will be specified in the Detail Specification. All internal removable chassis plates shall be painted with a white enamel gloss. The boxed channel base shall be painted black.

All painting and protective finishes shall comply with Section 37 – Painting and Corrosion Protection. Should an ambiguity exist clarification from the Engineer will be required in writing.

#### **PD1.2.2.34 Inspection and testing**

The Engineer may carry out periodic inspections of the Motor Control Centres during various stages of manufacture.

Final factory tests of the Motor Control Centres shall be carried out before despatch from the works.

These tests shall include, but be limited to, the following:

- a) Tests to determine that the apparatus fully and strictly complies with the requirements of the Specifications;
- b) Comprehensive primary injection tests of all current transformers and associated circuitry;
- c) Comprehensive pressure tests to prove insulation quality; and
- d) Functional tests of all control gear and the feeders.

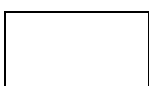
The Manufacturer shall make provision for all power supplies, testing plant, simulating apparatus, and competent personnel to carry out the tests.

At least two weeks' notice of the manufacturer's intention to carry out final tests shall be given to the Engineer. All test results shall be recorded on standard test sheets and three copies shall be provided to the Engineer within one week of satisfactory tests being completed.

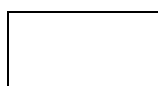
Once plant has been erected on site the following tests and field check-outs shall be performed:

- Random primary and injection tests to check that the functioning of control current transformers and associated circuitry has not been disturbed;
- Random checks on the functioning of control gear; and
- Comprehensive insulation resistance tests to prove that the quality of the insulation has not deteriorated during the erection of the Motor Control Centres.

Particulars of the site tests and field check-outs and the results shall be recorded and incorporated on site reports. Three copies of the site reports, signed by the Contractor, shall be provided for the Engineer.



Contractor



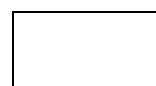
Witness 1



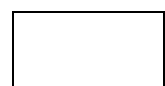
Witness 2



Employer



Witness 1



Witness 2

### **PD1.2.2.35 Drawings**

#### **(a) Drawings for approval**

A set of three prints of the shop Drawings shall be submitted to the Engineer for approval before the boards are manufactured. The following information shall be presented:

- A complete wiring diagram of the plant on the boards;
- Schematic diagrams depicting all power and control circuits for each starter. The schematics shall be fully cross-referenced so that the inter-connection between all circuits may easily be determined. Also, the relationship with all external field devices and the PLC control
- A complete termination diagram showing all the terminals and wiring detail;
- A complete layout and arrangement of the switchboards indicating all plant dimensions and the constructions of the boards. The positions and methods of fixing busbars shall be shown;
- All labelling information on a separate sheet; and
- The make, catalogue number and capacity of all plant such as isolators, circuit breakers fuses, contactors, etc.

The approval of Drawings shall not relieve the Contractor of his responsibility to supply the switchboards according to the requirements of the Specification and Drawings.

#### **(b) Final Drawings**

A complete set of Record Drawings shall be submitted to the Engineer immediately after completion of the Installation. Drawings shall be submitted as electronic copies on CDs as well as paper copies.

#### **(c) Manuals**

Three sets of Operating and Maintenance Manuals for all main and other switchboards shall be forwarded to the Engineer at no extra cost. These manuals shall include the following information:

- Complete information on the operation of the plant;
- Complete information for maintenance of the plant;
- Brochures and ordering information, and
- A complete material list indicating quantities and relevant catalogue numbers.

### **PD1.2.2.36 Service tools**

A set of any special tools or devices required for the operation and maintenance of the plant shall be provided complete with a suitable, lockable tool box.

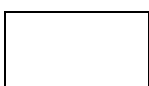
## **PD1.3 LOW VOLTAGE INDUCTION MOTORS**

### **PD1.3.1 Scope**

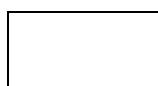
This Section defines the design, manufacture, inspection, testing and delivery of low voltage single speed, three phase, AC, induction motors.

### **PD1.3.2 General**

Motors shall have a maximum continuous rated output not less than 20% above the maximum operating load, after site derating.



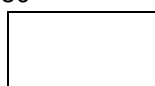
Contractor



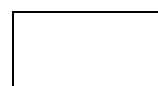
Witness 1



Witness 2



Employer



Witness 1



Witness 2

If thermistor or RTD winding protection is used, the maximum continuous rated output of the motor shall be not less than 10% above the maximum operating load.

Motors greater than 45 kW and variable speed drive motors shall be fitted with PTC thermistor over-temperature protection and be rated accordingly.

Motors to be used in conjunction with Variable Speed drives (VSD's), shall be further derated as necessary to account for harmonic currents and low speed operation. The rating of motors shall be determined in accordance with the VSD drive manufacturer's recommendation.

Motors shall be a Type Tested standard product design, from a recognised electric motor manufacturer with an accredited Quality Management System to ISO 9001 or equivalent.

### **PD1.3.3 Standards**

The motors shall comply with the requirements of the following standards:

SANS 1804 part 1-2 : Induction motors

SANS 60034 (relevant parts) : Rotating electrical machines.

Where motors are to be controlled by VSD's, particular attention must be given to parts 17 and 31 of SANS 60034

### **PD1.3.4 Rating**

The motors shall have maximum continuous rated outputs for an S1 classification of duty in accordance with SANS 60034.

### **PD1.3.5 Method of Starting**

The motors shall be suitable for full voltage starting direct on line.

### **PD1.3.6 Power Factor**

Power factor of the motors shall not be less than 0.8 at  $\frac{3}{4}$  full load for motors rated greater than 30 kW.

### **PD1.3.7 Efficiency**

Motors shall be of a high efficiency design, with a minimum efficiency, 1E2, at full load not less than the following values:

**TABLE 1.3.7: MINIMUM MOTOR EFFICIENCY**

<b>Rated kW</b>	<b>4 pole</b>	<b>6 pole</b>	<b>8 pole</b>
0.75	74	71	63
1.1	78	74	65
1.5	79	78	70
2.2	81.5	81	75
3	84	83	80
4	86	84.5	82.5

Rated kW	4 pole	6 pole	8 pole
5.5	86.5	86	83.5
7.5	88	87	84
11	89	88	88
15	90	90	88
18.5	90.5	89	88.5
22	91.5	90	90
30	92.5	90	91
37	93.5	93	92.5
45	94	94	94
55	93.5	94	94
75	95	94	95
90	94.5	95	95
110	95.5	95.5	94.5
132	95.5	95.5	95.5
150	96	96	96

For a VSD controlled motor, an alternative motor efficiency shall be accepted if the Contractor can demonstrate that the motor is more efficient at the duty of the variable speed drive than the efficiency specified above.

#### **PD1.3.8 Thermistors and Temperature Sensors**

All motors rated greater than 45 kW shall have 2 temperature sensors embedded into each phase of the three stator windings. Temperature sensors shall be of the 100 ohm (at 0 deg C) platinum resistance detector type (RTD), or shall be of the positive temperature coefficient (PTC) type.

The requirements for each motor shall be provided in the Detail Specification.

Thermistor connections shall be brought out to terminals in the main terminal box or a separate terminal box.

#### **PD1.3.9 Enclosure**

Motors shall have a degree of protection of at least IP54.

#### **PD1.3.10 Cooling**

Motors shall be fan cooled.

When controlled by a variable speed drive, the motor cooling shall be designed for the load and the lowest duty speed that the motor will operate at.

#### **PD1.3.11 Motor Terminal Box**

The motor terminal box shall be located on the right side of the motor when viewed from the drive end. The motor terminal box shall be arranged for cable entry from any of four directions.

#### **PD1.3.12 Insulation**

Motor winding insulation shall not be lower than Class 155 (F). Temperature rise shall not exceed Class B limits.

#### **PD1.3.13 Bearings**

Bearings shall be sealed and shall have a nominal life rating of 60 000 hours.

The bearing system of motors with vertical shafts shall be capable of carrying an axial thrust equivalent to not less than twice the weight of the rotor.

For motors with horizontal shafts, the bearing system shall be capable of carrying sufficient axial thrust to allow the motor to be run disconnected from the load.

#### **PD1.3.14 Fans**

Motors shall be fitted with bi-directional fans where practical.

#### **PD1.3.15 Lifting Eyes**

Motors shall be supplied with lifting eyes to enable each motor to be lifted by an overhead crane. The lifting eye shall be suitably rated for the mass of the fully assembled motor.

#### **PD1.3.16 Nameplates**

The motor shall be fitted with the following stainless-steel nameplates:

- Motor rating plate with a unique serial number; and
- Temperature sensor data plate, including the manufacturer, type number, tripping temperature, resistance of each sensor at the tripping temperature, and the number of sensors embedded per winding.

#### **PD1.3.17 Factory Tests**

Motors shall be subjected to routine tests and a copy of the test certificates shall be supplied to the Engineer, within 7 days of the test.

The Engineer shall be informed in writing 14 days before testing commences to arrange to witness the tests.

### **PD1.4 POWER FACTOR CORRECTION**

The specifications for the power factor correction equipment shall be fully described in the Section 2, Electrical Project Plant.

## **PD1.5 MEASUREMENTS AND PAYMENT**

### **GENERAL INFORMATION**

The schedule of Prices must be read in conjunction with all the documentation and with the specifications and drawings applicable to this Contract.



General directions and descriptions of work and material given in the Specification are not necessarily repeated in the Schedule of Quantities and Prices. Reference is to be made to the Specification for this information.

Should there be any doubt or obscurity as to the meaning of any particulars in the Schedule of Quantities and Prices, the Tenderer must obtain an explanation of the same, prior to submitting his tender.

No alterations or erasures may be made by the Tenderer in the text of this Schedule of Quantities and Prices and should any such alterations or erasures be made, the same will not be recognised and the original text of the Schedule of Quantities and Prices will be rigidly adhered to.

The Contractor will be paid on the nett measurement of the work completed and the Contract must allow of all cutting and waste.

Prime Costs, Provisional Sums and Contingency Items, if any, are to be dealt with as provided for in the Conditions of Contract and in the Specification.

A price or rate is to be entered against each item in the Schedule of Quantities and Prices whether quantities are stated or not. Items against which no price is entered by the Tenderer, will be considered as covered by other prices or rates in the Schedule, or, otherwise, in the sole discretion of the Engineer.

The unit rate will be taken as correct where there is any discrepancy between it and the extended total for any item.

The quantities of work and material in the Schedule of Quantities and Prices are not to be considered as limiting or determining the amount of work to be done and material to be supplied by Contractor.

**PD1.5.1 Design and documentation.....Unit: lump sum (Sum)**

The rates tendered shall include for full compensation of all costs incurred in the preparation of the design and calculations, detail working drawings for all items, specifications, schematic diagrams, electrical drawings and wiring diagrams, layout drawings, operation and maintenance instructions, programmes of work (manufacture and on-Site) and any other work as specified for the design of the complete installation. Payment will only be affected after the design and associated documentation has been approved by the Engineer.

Measurement and Payment for the preparation and submission of O&M Manuals shall be covered under Clause 48.11 of Section 48 – Tests on Completion, and paid elsewhere.

**PD1.5.2 Supply and deliver to Site.....Unit: number (No)**

**or: sets (Sets)**  
**or: pairs (Pairs)**  
**or: lumpsum (Sum)**  
**or: length (m)**

The rates tendered shall include full compensation for the supply and delivery of the Plant to Site including supply of raw materials and bought-out items and associated operating Plant items (i.e. gearboxes and actuators; limit switches; cabling and electrical panels); fabrication, manufacture and assembly; quality assurance and quality control; inspection and Factory Acceptance Testing (including attendance on inspections and tests witnessed by the Engineer); type and routine tests; application of finishes (painting and corrosion protection); trial erection and dismantling; preparation and packing for transport; transport from place of manufacture to the Site; insurance, harbour dues etc., during transport; loading and unloading; storage under appropriate conditions from date of delivery until commencement of erection; and any other work as specified. Payment will be made per unit. Payment will only be affected after full compliance of the Plant items with this Section and associated documentation has been approved by the Engineer.

**a) Electric cables.....Unit: length (m)**

Cable lengths stated in the Bills of Quantities are approximate lengths. Interim payment for supply shall be based on cable sizes and quantities delivered to site, based on prior submission of cable schedules to the Engineer. Final payment shall be based on actual installed cable measured on Site. Measured lengths shall be from gland to gland, and supply rates must include for off-cuts and stripped lengths associated with terminations and joints.

Rates shall include for all clamps, strapping, and any other fixing and installation materials. Note that supply of cable warning tape, concrete slabs, and cable route markers shall be measured separately in accordance with the relevant quantities and rates.

**b) Cable terminations and joints.....Unit: number (No)**

The rates for cable terminations and joints shall include for cable glands, termination and jointing kits, heat shrink material, solder, tapes, shrouds, crimped lugs, busbar extensions for connections to terminals and/or bushings, core ferrule numbers and cable numbers inside the compartment, junction boxes, or motor terminal boxes. All materials for providing a complete termination or joint.

**c) Cable ladders, Cable trays and Cable Racks.....Unit: length (m), Unit: number (No)**

The rate shall include for heavy duty cable ladders, racks and/or trays complete with bends, elbows, tee-pieces, unistrut mountings, nuts, bolts, washers, fixings and splices.

**d) Conduit.....Unit: length (m)**

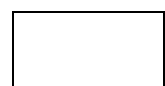
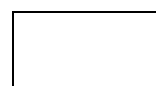
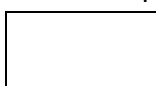
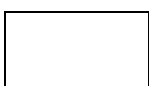
The rate shall include for all draw boxes, elbows, bends, bushes, joints, tees, saddles and fixing materials.

**e) Luminaires, light switches, Switch sockets and Welding plugs.....Unit: number (No)**

The rate shall include for all lamps, ballasts, control gear, suspension materials, and support brackets. For sockets and welding plugs, earth leakage protection as specified shall be included.

**f) LV switchboards and MCC.....Unit: number (No)**

The price shall include all incomers, circuit equipment, busbar joints and connections, relays, gland plates, terminals, and control equipment as shown on Drawings and as specified. All factory testing shall be included.



The supply price shall include the concrete plinth and materials for the trench earthing.

**g) Earthing and lightning protection.....Unit: number (No)**

**Unit: length (m)**

**Unit: lump sum (Sum)**

The rates shall include full compensation for an earthing and lightning protection system complete with all finials, down-conductors, trench earth conductors, sub station earth bars, saddles, earth rods, isolators, bolts, nuts, welding, copper, and usable materials to complete the installation. Earth conductivity and earth mat resistance tests shall be included in the supply price.

**h) Local Stop Start stations.....Unit: number (No)**

The price shall include stop start stations fully assembled with push buttons, selectors, and lock-out facility as required. All mounting facilities such as unistrut posts, fixing materials etc shall be included in the rates

**i) Power factor correction.....Unit: number (No)**

The rates shall include initial harmonic analysis, capacitors, reactors, switchgear, busbars, contactors, power factor controller relay, protection, harmonic filters, as specified and all mounting equipment.

**PD1.5.3 Installation of Plant.....Unit: number (No)**

**or: sets (Sets)**

**or: pairs (Pairs)**

**or: lump sum (Sum)**

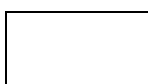
**or: length (m)**

The rates tendered shall include for full compensation for the installation of the Plant on Site including the provision of all labour, transport, materials and Temporary Works necessary to install the complete Works; on-Site quality assurance and quality control, inspection, testing (including attendance at tests witnessed by the Engineer); the installation of all auxiliary Plant items, actuators, limit switches, electrical panels, cabling etc that are necessary for the operation of the installation.

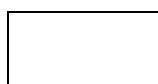
Allow for installing all fixing materials, nuts, bolts, washers, screws, rawl bolts, clips, springs, hangers, clamps, bits of angle iron, unistrut, brackets, consumable materials, and any other minor materials. that are required to make the installation complete.

The rates shall include for all pre-commissioning testing for the individual items of plant. Payment will be made per unit. Payment will only be affected after full compliance of the Plant items with this Section and associated documentation has been approved by the Engineer.

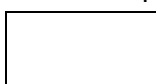
Measurement and Payment for Test on Completion shall be covered under Clause 48.11 of Section 48 – Tests on Completion and paid elsewhere.



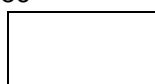
Contractor



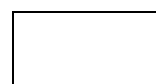
Witness 1



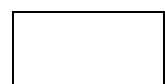
Witness 2



Employer



Witness 1



Witness 2

**a) Electric cables.....Unit: length (m)**

Installation rates shall be for cable installed on racks, in sleeves, or in trenches.  
Payment shall be based on actual installed cable lengths measured on Site. Measured lengths shall be from gland to gland.

Rates shall include for all clamping, strapping, and applying cable numbers.

Note that laying cable warning tape, placing concrete slabs, and cable route markers shall be measured separately in accordance with the relevant quantities and rates.

If required, the rates shall include for drum handling, the provision and positioning of drum stands, cable rollers, corner skid plates, pulling eyes, cable stockings and provision of all equipment for handling and pulling the cables

**b) Cable terminations and joints.....Unit: number (No)**

The rates for cable terminations and joints shall include for installing cable glands, shrouds, heat-shrink material, tapes, crimping of lugs, soldering, wiping, connection to terminals, fitting core ferrule numbers and cable numbers inside the compartment, junction boxes, or motor terminal boxes.\

Rates for joints shall include for preparation of the joint site, excavations (if required), protective coverings for inclement weather, establishment of slack in the adjacent cable lengths, and cleaning up of the site on completion.

**c) Cable ladders, Cable trays and Cable Racks.....Unit: length (m)  
Unit: number (No)**

The rate shall include for installing heavy duty cable ladders, trays and/or racks, complete with bends, elbows, tee-pieces, unistrut mountings, fixings and splices.

**d) Conduit.....Unit: length (m)**

The rate shall include for installation of draw boxes, elbows, bends, bushes, joints tees, saddles and fixing materials.

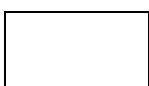
**e) Luminaires, light switches, Switch sockets and Welding plugs.....Unit: number (No)**

The rate shall include for installing luminaires, lamps, ballasts, control gear, suspension materials, fixing material, and/or support brackets, and poles for streetlights and security fence lighting. For the poles the excavation and subsequent back filling and compaction of the holes shall be included.

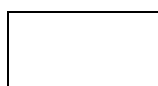
For sockets and welding plugs, earth leakage protection as specified shall be included.

**f) LV switchboards and MCC.....Unit: number (No)**

The price shall include installation of incomers, circuit equipment, relays, gland plates, terminals, and control equipment as specified, combining panels split for shipping, making busbar joints and connections, Leveling of panels, alignment and placing of packers shall be included



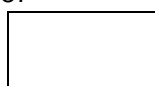
Contractor



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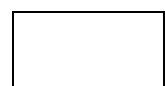
Witness 2



Employer



Witness 1



Witness 2

**g) Earthing and lightning protection.....Unit: number (No)**

**Unit: length (m)**

**Unit: lump sum (Sum)**

The rates shall include for installing the earthing and lightning protection system complete with all finials, down-conductors, trench earth conductors, substation earth bars, saddles, earth rods, isolators, bolts, nuts, welding, copper, trenching and other usable materials to complete the installation. Earth conductivity and earth mat resistance tests after the installation is complete shall have been carried out.

**h) Stop Start stations.....Unit: number (No)**

The rates shall include for installing mounting and fastening materials, unistrut posts, drilling, or welding to make the installation complete.

**i) Power factor correction.....Unit: number (No)**

The rates shall include positioning and leveling of panels, alignment and placing of packers  
Installing capacitors, reactors, switchgear, busbars, contactors, power factor controller relay, protection, harmonic filters.

**PD1.5.4 Co-ordination for connection to Eskom supply.....Unit lump sum (sum)**

The amount shall include all costs incurred in installing Eskom equipment in the incoming circuit breakers for protection of the circuits between the Eskom substation and the pump station switchgear. The rates shall include for combined testing of the protection and inter tripping circuits.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**PE DETAIL TECHNICAL SPECIFICATION FOR 11KV OVERHEAD LINE**

**PE1. GENERAL INFORMATION TO CONTRACTORS**

This specification covers bush clearing where necessary, setting out, the delivery, supply of materials and erection of an 11 kV three phase electrical power distribution line from the Water Treatment Works at Amsterdam in Mpumalanga to the site of the new Gabosch Dam approximately 2,5km away.

**PE2. DETAIL DESCRIPTION OF WORKS**

The work generally comprises of the following components:  
Supply of material and erection of an 11 kV three phase wooden pole transmission line with "Squirrel" ACSR conductor in the Employer's electrical distribution area.

**PE3. SITE (AS REQUIRED)**

The Contractor shall provide the following:

- Sanitation on site for his own use
- All telephone facilities
- Water for the construction purposes
- All the necessary housing facilities for his personnel
- All the necessary storage facilities for equipment including security
- Bidders must allow for all conditions on site in their tenders, since extra claims arising from difficult site conditions in respect of transport, handling, loading, of-loading, Labour, housing, etc., will not be entertained.

**PE4. SITE CONDITIONS**

The Bidder must note the following aspects with regard to site conditions and shall include for these conditions in the relevant items in the bill of quantities.

- a) Line route preparation will be the responsibility of the contractor.
- b) Pegging of line routes and all structures (and decision on types of structures) shall be done by the contractor after consultation with the employer whereby a proposed drawing will be approved.
- c) Access to site is partially by tarred road, dirt road and no road.
- d) No crane is available from the employer for off-loading.
- e) Ground conditions are reasonable on average
- f) Blasting might be required in certain areas, in exceptional cases.

**PE5. TIME OF COMPLETION**

A time of completion for the line shall be established to fit within the Main Contractor's programme. negotiated each individual line.

**PE6. STANDARDS AND SPECIFICATIONS**

All the materials and equipment supplied under this contract must be new and of the best quality available.

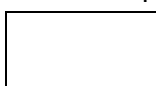
All materials must comply with the requirements of the latest editions of the relevant SANS, BS and IEE specifications.



Contractor



Witness 1



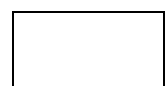
Witness 2



Employer



Witness 1



Witness 2

**PE7. LAWS AND REGULATIONS**

The contractor will be responsible to ensure that the contract works comply in full with the requirements laid down by the latest editions of:

- a) The Occupational Health and Safety Act (85 of 1993)
- b) SANS 10280: Overhead power lines for conditions prevailing in South Africa.
- c) The Code of Practice for wiring of premises (SANS 10142)

**PE8. OPERATING REGULATIONS FOR HIGH VOLTAGE SYSTEMS (ORHVS)**

Successful bidders must be in possession of a current ORHVS certificate or obtain a renewal within three months after tender closing of which failure thereof will result in disqualification of the tender.

**PE9. INFORMATION TO BE SUBMITTED WITH TENDERS**

Bidders shall indicate in the Schedule of Compliance, whether their offers comply in every respect with this specification, or if not, precisely how they deviate from the specifications.

**PE10. INTERCHANGEABILITY**

All items of similar equipment supplied under this Contract must be identical and completely interchangeable.

**PE11. COMMISSIONING**

The contractor will only be responsible for the building of the line. The line will be commissioned by the Employer after inspection.

**PE12. DESIGN AND STANDARDISATION**

The contract works shall be designed to facilitate inspection, cleaning, and repairs, and for operation where continuity of supply is the first consideration.

The lines shall be designed to ensure satisfactory operation under the atmospheric conditions prevailing at the site, and under such sudden variations of load and voltage as may be met under working conditions on the system, including those due to faulty synchronizing and short circuit.

The design shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance of the contract works and of associated works supplied under other contracts.

All nuts and pins shall be locked in position.

All lock nuts or washers shall be of approved type. All bolts, nuts, and washers in contact with non-ferrous parts shall, unless otherwise approved, be of a material which will not cause electro-chemical action or corrode. Each bolt or stud shall project at least one thread through its nut.

The lines shall be designed to obviate the risk of accidental short circuit due to animals, birds, or vermin. Preference shall be given to structures designed to minimize electrocution of birds.

#### **PE13. PROTECTION OF NATURAL VEGETATION**

The contractor shall exercise proper care not to destroy, damage or remove any natural trees and vegetation, except where he is instructed or given permission to do so in cases where it is unavoidable. No trucks or power plants shall be allowed to run over areas not specifically set aside for this purpose.

The contractor shall take care not to have veld fires developing from his site. He shall be responsible for any losses and claims which could arise from veldt fires starting due to his negligence. In the case of any veld fires threatening the site, he shall give all assistance to protect the site against such fires from elsewhere. The contractor shall at his own expense do all the protection as described and shall not be specially paid for any fencing or fire breaks, etc.

Cognisance must be taken of the various species of indigenous trees and bush that are protected by the LAW (Forest Act no. 122 of 1984). Where it is essential to cut indigenous trees and bush, the necessary permits as well as the owner's written consent must be obtained prior to the commencement of work.

#### **PE14. PEGGING OF STRUCTURE POSITIONS**

The contractor will peg out corner, intermediate and anchor structure positions after consultation with the Engineer.

The contractor shall be responsible to ascertain the correctness of structure positions on site according to the drawings and shall, where so required, re-measure and determine positions in conjunction with the Engineer.

The contractor shall be responsible for the ground clearing of two-meter radius around each peg. The rate for this clearing shall be allowed for in the tendered rates for the digging of holes.

#### **PE15. GENERAL DESIGN PARAMETERS FOR OVERHEAD LINES**

The design details are shown on the drawings and described in the detailed specification. The layouts and pole hardware kit compilations are given as guidance only, but shall be used as a basis for the tender. Any deviation shall be quoted as an alternative in the prescribed way and shall constitute definite savings.

The dimensions given are for guidance only and Contractor's design can deviate provided it is pre-approved by the Employer.

#### **PE16. GALVANIZING**

The requirements of SABS 763 for hot-dip galvanizing shall be followed.

The galvanizing shall be applied to all parts by a hot-dip process to give a zinc coating of not less than 600 grams per square metre of surface. The zinc coating shall be smooth, clean, of uniform thickness and free from defects.

All drilling, punching, cutting, or bending of parts shall be completed and all burrs removed before galvanizing.



No drilling, welding, etc., shall be done to any part which is already galvanized.

Contractors shall note that any galvanized part can be rejected on site if found to be below standard.

#### **PE17. BOLTS AND NUTS**

All metal parts shall be secured by bolts and nuts of at least 20mm diameter.

The bolts and nuts shall be of steel with hexagonal heads. The bolts and nuts shall be galvanized. Screwed rods shall also be galvanized. When any end of a bolt or rod is cut on site, it shall be painted with a bitumastic for steel or other approved paint.

Galvanized washers shall be used and all bolts securing insulator strings shall be locked in an approved manner.

All bolts and nuts subject to any vibration of any kind shall be properly locked through the use of "lock tight" or similar approved material or method.

#### **PE18. DEFINITIONS OF EXCAVATIONS**

The definitions of Earth, Soft Rock, Hard Rock and Very Hard Rock shall be as defined in the Standard Specification forming part of this document.

#### **PE19. SUSPENSION AND TENSION INSULATORS AND FITTINGS**

##### **Tension**

The insulators shall be of the composite 22 kV type Elbroc / McWade, 70 KN 16 L CLEVIS / TONGUE drawing number 810502 and 810902 respectively or similar and approved by the Engineer.

##### **Suspension**

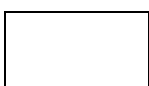
Suspension insulators on intermediate structures shall be porcelain post 22 kV type insulators, similar to the EP 356-01 for 11 kV lines from Cullin Africa, or similar as approved by the Engineer.

#### **PE20. CONNECTIONS**

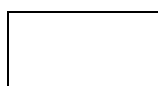
All conductors and fittings shall be designed to withstand maximum horizontal forces due to the wind and short circuit forces for the applicable fault level.

The Contractor shall provide all necessary terminals, clamps, and other fittings for the connections to other apparatus. All fittings and joints shall be of approved design.

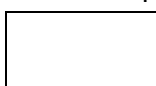
Where dissimilar metals are connected, approved means shall be provided to prevent electro-chemical action and corrosion. Joint surfaces of copper or copper alloy fittings shall be tinned. The connections shall be so arranged and supported that in no circumstances, including short circuit conditions, can the clearances from earthed metal work or from other conductor be less than the distances specified in the detail specification and drawings.



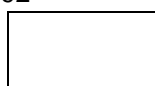
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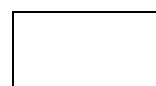
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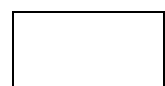
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Witness 2

All connection pieces, clamps, etc., shall be so designed that they do not require any maintenance after erection, but disconnection or taking down shall be uncomplicated. Details of all clamps and mechanical pieces shall be submitted with the tender.

The slack span conductor to be used on all out of line Transformer connections are 0.05 insulated aluminium conductor (Rabbit).

#### **PE21. STAYS**

All stays shall have an angle of 45° to the vertical.

Stay rods shall be planted to a vertical depth of 1.5 metres and the hole shall be of adequate size to allow the rod to enter at the correct angle. The bottom of the hole shall be undercut so that the base plate of the stay may be placed against the undisturbed portion of the ground. Under no circumstances shall the stay rod be bent.

The base plate shall be covered by large stones where after back-filling in easy stages with thorough compaction of each stage. Where necessary, the stay shall be concreted in with 1.3.6 concrete mix. Stay rods visibility above ground shall not be more than 150mm.

Stay wires shall be attached to poles by means of stay brackets or other approved means. The cross-arm shall not be used to prevent the stay from sliding down. When stay brackets are used an extra locknut must be applied. All stays shall be finished off to a standard acceptable to the employer. All stay tails shall be bonded to the stay rod.

#### **PE22. ALUMINIUM STEEL CORED CONDUCTORS**

Aluminium Conductor Steel Reinforced (ACSR) conductors. will comply with SABS 182 or BS 215.

The steel wires shall, during manufacture, be coated with a special neutral grease to give protection against corrosion and bimetallic acting between the galvanized steel and aluminium.

The conductor to be used for this Contract shall be "Squirrel" 6/1/2,11 ACSR.

#### **PE23. STRINGING OF CONDUCTORS**

All conductors shall be spaced in an approved manner.

Under no circumstances shall any conductor be unduly dragged along the ground.

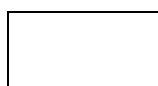
The conductors and earth wires shall be pulled-up and tensioned according to SANS 10280.

Twin conductors, if required, shall be strung simultaneously to ensure matched sags. Conductors shall be strung to the appropriate sag determined from actual span length and the equivalent span of the strain section involved.

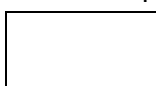
The practice of pre-stressing before final sagging and tensioning shall be adhered to.



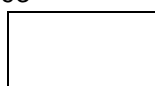
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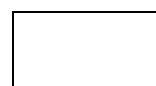
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Witness 2

As far as possible complete drum lengths of conductor wire will be used without cutting to reduce the number of joints.

#### **PE24. JOINTS, CONNECTIONS AND CLAMPS**

All joints of conductors shall be made with compressed fittings only, but joints shall be limited to the absolute minimum. No joints shall be made in long spans, spans crossing roads, railway lines or other overhead services.

No joints will be permitted in any steel conductor unless specifically approved.

Where lines cross each other and connections are made by droppers, these vertical droppers shall be straight and shall be connected to the conductors of the two lines with Aluminium Compression T connectors. At strain structures ferrules will not be on the main line but on the jumps.

Samples of all fittings shall be submitted for approval.

#### **PE25. ARMOUR RODS AND DEAD-END GUY GRIPS**

Armour rods or preformed bindings shall be installed on the conductors at each suspension clamp in accordance with the manufacturer's instructions. All strain and anchor points shall be done with dead end guy grips.

#### **PE26. WOODEN POLE STRUCTURES AND HARDWARE**

The wooden poles shall be planted according to the depths as shown on the drawings and base plates, kicking blocks or baulks shall be provided as required to ensure a rigid structure. Back filling shall be of a proper material and compacted at 300mm intervals.

The different types of structures are shown on the drawings and their proposed material lists are shown below. Bidders shall add any materials required to their own lists and all prices in the Price Schedules shall include these extras. Suitable care shall be taken that cross-arms, where applicable, are level and the poles shall be matched, care being taken with regard to paring poles with similar diameter, length, and appearance.

All augured holes to be creosote treated. Cross arms on H-pole structures must always be installed on the opposite side from the longest span.

##### **PE26.1 Materials list for SINGLE POLE INTERMEDIATE STRUCTURE: 11kV Three-phase (excluding stays and conductor)**

Quantity	Size	Description
1	11m	Wooden pole, top diameter of 160 – 180mm
3		22kV Porcelain Post insulators, EP 356 from Cullin Africa or similar, as approved
3		Spindles for post insulators
3		Twin ties for Squirrel conductor



Contractor



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Witness 2



Employer



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Witness 2

**PE26.2 Materials list for SINGLE POLE STRAIN STRUCTURE: 11 KV THREE PHASE  
(excluding stays and conductor)**

Quantity	Size	Description
1	11m	Wooden pole, top diameter of 160 – 180mm
6		22kV Composite insulators, Elbroc/McWade type or similar as approved
3	20mm	Eyebolts
3		PG Clamps
3		Ring nuts

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Quantity	Size	Description
6		Square washers
6		Tower hooks
6		Dead ends for Squirrel conductor
6		Thimbles for Squirrel conductor
3		22kV Post Insulators
3		Twin ties

**PE26.3 Materials list for SINGLE POLE CORNER STRAIN STRUCTURE MATERIAL LIST: 11 KV THREE PHASE (excluding stays and conductor)**

Quantity	Size	Description
1	11m	Wooden pole, top diameter of 160 – 180mm
6		22kV Composite insulators, Elbroc/McWade type or similar as approved
3	20mm	Eyebolts
3	0,05	PG Clamps
2	2 x 250mm	Studs
3		Ring nuts
6		Square washers
6		Tower hooks
6		Dead ends for Squirrel conductor
6		Thimbles for Squirrel conductor
3		22kV Post Insulators
3		Twin ties

**PE26.4 Materials list for SINGLE POLE TURN STRUCTURE MATERIAL LIST: 11 KV THREE PHASE (excluding stays and conductor)**

Quantity	Size	Description
1	11m	Wooden pole, top diameter of 160 – 180mm
3		22kV Composite insulators, Elbroc type or similar as approved
3		Twin ties
1	2 x 250mm	Stud
3		Square washers
3		Tower hooks
3		Suspension clamps for Squirrel conductor
3		Armour rods for Squirrel conductor



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**PE26.5 Materials list for SINGLE TERMINATION POLE: 11 KV THREE PHASE (excluding stays and conductor)**

Quantity	Size	Description
1	11m	Wooden pole, top diameter of 160 – 180mm
3		22kV Composite insulators, Sediver type or similar as approved
3	20mm	Eyebolts complete with 2 locknuts
6		Square washers galvanized Curved
3		Clevis Thimbles Squirrel
3		Tower hooks
3		Preformed dead-ends Squirrel

**PE26.6 Materials list for 11KV OUT OF LINE THREE PHASE TRANSFORMER INSTALLATION (Excluding Stays, Conductor, Transformer)**

Quantity	Size	Description
2	11m	Wooden pole, top diameter of 160 – 180mm
1	3,9m	Wooden cross-arm
2	2,0m	Wooden cross-arm
6		22kV Composite insulators, Elbroc type or similar as approved
3		22kV fuse base units complete
3	2m	Steel cross-arm
3		22kV Lightning arresters
12	20mm	Square washers, curved, galvanised
8	20mm x 350mm	Galvanised stud with nuts
3		22kV S-bracket
3	20mm x 250mm	Galvanised bolts
6		PG Clamps for Squirrel conductor
12		Merlugs

**PE26.7 Materials list for ONE COMPLETE STAY FOR 11kV**

Quantity	Size	Description
1	20mm	Complete adjustable stay rod, 1,8m total length
1	15m	Stay wire
1		Stay bracket
1	300 x 300 x 5mm	Stay base plate
2		Thimbles
4		Guy grips
1		Stay insulator



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**PE26.8 Materials list for ONE COMPLETE FLYING STAY FOR 11kV**

Quantity	Size	Description
1	11m	Wooden pole, top diameter of 160 – 180mm
1	15m	Stay wire
2		Stay brackets
1		Stay insulator
6		Guy grips
4		Thimbles
2	2 x 250	Eye bolts
1	20mm	Ring nut

**PE27. WOODEN POLES**

**PE27.1 GENERAL**

All wooden poles shall be eucalyptus poles and be top grade quality  
Poles shall comply with the requirements of SABS 754 – 1982 for eucalyptus poles.  
(Standard Specification for wooden power transmission poles and cross arms)  
The retention of preservatives shall comply with the accepted standard.  
All wooden poles shall be impregnated with a creosote mixture conforming to the requirements of SABS 1290 or BS 141.  
The dimensions of wooden poles are specified in the schedule of equipment.

**PE27.2 POLE INSPECTION AND MARKING**

All poles shall be subject to inspection in accordance with SABS 753-1982 or SABS 754-1982 to ensure compliance with the specification. Each pole and cross arm shall bear a marked tag indicating such compliance.  
Of importance is that all the appropriate labelling on the existing poles, such as pole numbers must be transferred to the new installation. Pole numbering rates must be included as part of the pole rates. Pole numbering, where applicable, shall be altered when additional structures are installed, or structures being removed.

**PE27.3 POLE STRENGTH GROUP**

Wooden poles are required to be of strength group to SABS 753-1982 or SABS 754-1982 to ensure compliance with the specification. Each pole and cross arm shall bear a marked tag indicating such compliance.

**PE27.4 BANDING**

The top and butt ends of all poles and cross arms shall be securely bound with steel wire. Banded or gang nailed poles will not be accepted.

**PE27.5 MOISTURE CONTENT AND IMPREGNATION**

Unless otherwise approved, the average moisture content of poles at the time of treatment shall not exceed 250g/kg.  
Impregnation shall be carried out by either of the following methods:

- a) Hot/Cold open tank process
- b) Full cell pressure process and

c) Empty cell pressure process.

**PE28. TENDER DRAWINGS**

Bidders shall submit, with their tenders, typical drawings of the equipment and structures offered, where any difference exist with the drawings issued.

**PE29. INSTALLATION**

The workmanship of the installation shall be of a high standard throughout and to the satisfaction of the Engineer.

The structures shall be installed according to modern practice and shall be properly aligned and plumb.

**PE30. PRIVATE LINES**

No private lines are required under this Contract.

**PE31. ACCESS TO FARMS**

Contractors working in the rural areas must be visible at all times for security reasons and may only enter the property of landowners with his knowledge. Finer detail of clothing and stickers on vehicles can be obtained from the electrical department.

**PE32. POLE NUMBERING**

Pole numbering will be according to the Employer's specifications. All poles will be numbered on new lines and where lines are rebuilt the numbering will be restored.

**PE33. PRICING**

The proposed design details are shown on the drawings and described in this detailed specification. The materials and estimated quantities are given in the Price Schedules and are based on a representative design for the power line. The layouts and pole hardware kit compilations are to be used as a basis of pricing. Any deviation proposed by the bidder shall be quoted as an alternative in the prescribed way and shall constitute definite savings.

The dimensions given are for guidance only and Contractor's design can deviate provided it is pre-approved by the Employer.

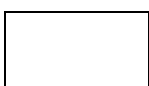
**PE34. AS-BUILT DOCUMENTATION**

Inspection reports, records of work done, quality control and inspection sheets and photos, measurements, test results, drawings, marked-up documents, and any other associated document shall form part of the close-out documentation.

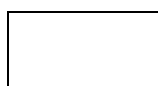
On completion, the Contractor shall hand all "as built" and close-out documents over to the Engineer.

**PE35. MEASUREMENT AND PAYMENT**

All costs for equipment, labour and other expenses for the on-site testing and commissioning of equipment shall be included in the tendered rates for testing and commissioning as set out in the measurement and payment clauses of each item of equipment and in the Schedule of Quantities. Any additional tests specified in the Standard and Detail Specifications shall also be deemed to be included in the tendered rates.



Contractor



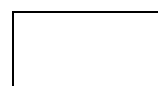
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**PF DETAIL TECHNICAL SPECIFICATION FOR PHOTOVOLTAIC POWER SUPPLY SYSTEM**

**PF1. SITE**

The site is located at the new Gabosch Dam near Amsterdam, Mpumalanga Province. The PV systems are to be installed on the new Administration Building roof space and the Control Room Roof at the dam wall.

**PF2. VISIT TO SITE**

Tenderers shall acquaint themselves with local site conditions such as access to the site, size and type of site, supply of labour, workshop space, transport, loading and unloading facilities, scaffolding, tackle and tools needed for the safe erection of the installation. Additional claims by the Tenderer, which may arise from ignorance of the site conditions, will not be considered and tenderers are required to visit and inspect the site, before submitting a tender.

**PF3. COMPLIANCE WITH REGULATIONS**

The installation shall be erected and carried out in compliance with:

- The Occupational Health and Safety Act 85 of 1993 and incorporated regulations.
- The local Municipal by-laws and regulations as well as the regulations of the local Supply Authority.
- The local Fire Regulations.
- The Standard Regulations of any Government Department or public service company where applicable, such as Telkom, Neotel, etc.
- All regulations and standards as indicated in the scope of works.
- The installation must comply with IEC 60364-7-712

The tenderer shall at his cost issue all drawings and notices in respect of modification of the installation to the local authorities and shall indemnify and exempt the Employer/Client from all losses, costs or expenditure which may arise as a result of the Photovoltaic (PV) Specialist Contractor's negligence to comply with the requirements of the regulations stipulated above. No work shall commence by the Photovoltaic (PV) Specialist Contractor prior to the approvals by the local authority, of the relevant drawings or applications to perform work.

It shall be assumed that the Photovoltaic (PV) Specialist Contractor is conversant with the abovementioned requirements. Should any requirement, by-law or regulation, which contradicts the requirements of this document, apply or become applicable during erection of the installation, such requirement, by-law or regulation shall overrule this document and the Photovoltaic (PV) Specialist Contractor shall immediately inform the Engineer of such a contradiction. Under no circumstances shall the Photovoltaic (PV) Specialist Contractor carry out variations to the installation in terms of such contradictions without obtaining the written permission to do so from the Engineer.

**PF4. STANDARDS AND SPECIFICATIONS**

The following supporting standards and regulations shall apply as well as any additional national and local by-laws, and the systems and their components shall be manufactured and designed to the appropriate standards, including but not limited to:

- SANS 10142 Part 1, Wiring of Premises – Electrical Installations, and all the applicable SANS Specifications for electrical materials referred to therein.
- SANS 10142 Part 3, Wiring of Premises – Embedded Generation.

- SANS 10142 Part 5, Wiring of Premises – Direct Current and Photovoltaic.
- NRS 097-2-1 (Part 2: Small Scale Embedded Generation, Section 1).
- NRS 097-2-2.
- NRS 097-2-3 (Part 2: Small Scale Embedded Generation, Section 3).
- Municipal Guidelines for Embedded Generation.
- NERSA Regulatory Framework on Small Scale Embedded Generation.
- IEC 61215.

## **PF5 PHOTOVOLTAIC SYSTEM SCOPE OF WORKS**

### **PF5.1 System Description**

The Photovoltaic (PV) Specialist Contractor shall be a subcontractor to the Main Contractor and shall undertake the design, supply, delivery, installation, testing and commissioning of a fully functioning fixed PV system installation.

Any direct coupling onto the electrical mains installation or alterations to the existing electrical installation shall be done by the appointed electrical contractor.

This does not exempt the PV specialist contractor from issuing a certificate of compliance for his intended works, according to SANS 1012 Part 1.

The points of interface between this work package and other works are as follows:

The PV Specialist Contractor shall co-ordinate with the Electrical Contractor and other relevant contractors to ensure compatibility:

**Lightning Protection:** The PV Specialist Contractor shall provide the PV frames with suitable lugs for the connection of lightning protection bonds at two locations on each unit. Provision for the connection of 2No M6 or 1No M10 bolted connections to be provided. The Lightning Protection Specialist shall provide the lightning protection bonds on the panels.

**Electrical metering:** The PV Specialist Contractor shall liaise with the electrical contractor for the provision of suitable kWh metering as required by the PV installation.

The PV arrays shall provide an approximate total output of 8kWp and be a Hybrid PV system with associated communication and display elements.

The PV installation shall operate in parallel with the municipal electrical supply from the supply authority, Mkhondo Municipality. Any excess solar electricity produced shall be exported to the supply authority.

It is the responsibility of the PV Specialist Contractor to make the required application to the supply authority on their standard documentation and to ensure that the system installed complies with their standards and specifications.

The PV Specialist Contractor must ensure that the complete system, including the equipment and installation conforms to the Occupational Health and Safety Act and its associated regulations.

The PV arrays shall be mounted on the roof sheeting of the new Administration Building structure at Gabosch Dam.

The overall installation shall include, but not be limited to:

- PV array: Modules of poly-crystalline, positively sorted, minimum 20-year manufacturer warrantee, to fit on available roof space. Each array shall be supplied with a suitably sized disconnect switch.
- PV array support structure: All required supporting framework for the system and attachment to roof is to be provided and installed by supplier. Support system weight, requirements and layout to be coordinated with roof system and structural drawings. Any and all mounting points of the supporting framework to the roofing structure shall be made waterproof and conform to any and all design suggestions made by the structural engineer.
- Modular hybrid inverters: Three -phase hybrid inverters, which comply with any and all local and national by-laws with regard to hybrid PV systems, shall be used. An isolated connection point shall be provided by the Electrical Contractor. The inverters shall be installed in the Store Room or as indicated by the Engineer.
- Maximum power point tracking (MPPT): The inverters must have MPPT incorporated for power optimization of the system and these modules must be compatible with the manufacturer's specifications.
- Batteries: Interconnected Lithium-ion batteries shall be provided to store sufficient energy to drive the inverters supplied on the system.
- Metering monitors: Meter interfaces shall be installed along with the main metering for the building.

Additional requirements include the following:

- DC cabling and containment
- AC cabling and containment

The PV Specialist Contractor shall liaise with the Municipality to ensure that the system is designed, installed and commissioned in accordance with their requirements and ensure that the necessary arrangements are in place for connection to and operation in parallel with the municipal supply.

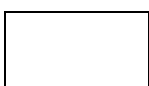
The PV Specialist Contractor shall liaise with the Electrical Contractor in conjunction with the LV switchboard manufacturer to ensure that the correct equipment is installed and coordinated in accordance with their requirements.

## **PF5.2 Equipment Description**

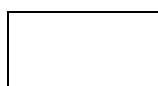
### **PV Modules & frames**

The PV Modules shall comply with the international standards IEC 61215 and carry a CE mark.

The modules shall be installed on purpose made support frames to ensure that the cells are inclined at the optimum tilt to maximise their output over the course of the year.



Contractor



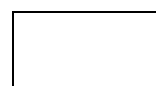
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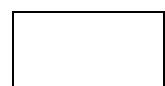
Witness 2



Employer



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Witness 2

The frames shall be constructed and secured to the building to meet the environmental conditions as well as aesthetic conditions when mounted on the roof. The fasteners on the roof must be protected against galvanic-rust/corrosion.

### **DC Cabling**

The PV modules shall be wired in strings to the invertors via DC cabling.

The DC cabling between the solar arrays and the inverters shall consist of purpose designed 80°C photovoltaic cables with purpose-made PV plug and socket connectors.

The cables shall be UV stable, water resistant and multi-stranded to allow for thermal/wind movement of arrays/modules.

The DC component ratings (cables, isolators/ disconnectors, switches, connectors, etc) of the system shall be sized to suit the maximum voltage and current of the PV arrays (and individual modules) taking into account the system voltage/currents of the series/parallel connected modules making up the array. Standard de-rating factors (temperature, solar gain grouping etc) shall be applied in accordance with SANS 10142 part 1.

The DC elements (wiring, connectors etc) of the PV system shall incorporate Class II insulation (double insulation). DC junction boxes with negative and positive parts shall be separated and protected by barriers, or by utilising separate enclosures.

The cable runs should be kept as short as practicably possible. Labels shall be installed along the DC cables with the following wording: "Danger solar PV array cable – high voltage DC - live during daylight".

The PV Specialist Contractor shall design and install all the containment to support and protect the DC cabling. The cables shall be installed in earthed galvanised trunking to provide mechanical protection. The trunking shall be fixed to the frames. Bonding of all steel structures must be in accordance with SANS 10142.

### **DC Switch**

DC isolation switches shall be installed to provide a means of manually isolating each PV string.

The switches shall be located adjacent to, or integrated into the associated inverters.

The switches shall be double-pole and suitable for DC operation (load-break rated) to effectively isolate both PV string positive and negative poles.

The DC switches shall be rated for the maximum system voltage and current.

The DC switches shall be labelled "PV array DC isolator", with the ON and OFF positions clearly marked.

The enclosures shall also be labelled with "Danger - contains live parts during daylight".



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### **Inverters**

Suitable hybrid inverters shall be installed in the Laboratory close to the main distribution, to convert the DC voltage & current into AC voltage & current.

The inverters shall be capable of withstanding the maximum array voltage and current they may encounter.

The inverters shall carry the IEC Type Test certificate (or from a recognized approval body as approved by the Engineer).

The inverters shall be in an IP 65 rated enclosure and mounted so that they are easily accessible for maintenance.

The front of the inverter enclosures shall incorporate the following sign 'Inverter - isolate AC and DC before carrying out work'.

The PV Specialist Contractor shall be responsible for the matching of the voltages of the PV panels offered to the hybrid inverters and shall state in the Returnable Schedules how the panels will be arranged to provide the maximum performance in conjunction with the inverters and batteries offered.

### **AC Cabling**

The inverter shall be connected to the dedicated local 3-phase distribution board which shall connect the PV installation to the low voltage network.

The PV Specialist Contractor shall select and install the AC cables between the inverter and the distribution board in accordance with SANS 10142, Part 1.

The AC cables connecting the inverter to the distribution boards shall be of the XLPE/SWA/LSOH type.

The distribution board shall be located within adjacent risers or on the frame of the PV cells (within an IP 65 enclosure). If the distribution boards are not installed by the clients Electrical Contractor, the PV Specialist Contractor must supply a COC for each distribution board.

The PV Specialist Contractor shall provide and install the MCBs within the distribution boards and be sized to suit the requirements of the PV installations.

Suitably rated IP 65 manual isolators shall be mounted adjacent to each of the inverters to isolate the AC output of the inverters to facilitate the maintenance of the AC cable runs and inverters.

The isolators shall switch the live and neutral conductors.

The isolators shall clearly indicate the ON and OFF positions and be labelled as "PV system – AC isolator" and be securable in the OFF position only. The isolator shall be secured using a standard padlock.

The AC cables shall be installed in or on containment provided and installed by the Electrical Contractor, but the cables themselves shall be part of the PV installation.

### **Metering**

The PV Specialist Contractor shall free issue any approved export meters to the Electrical Contractor for incorporation into the main LV Switchboard, which are supplied from the PV installation.

The meters shall measure and record kWh and instantaneous power output (kW). The meters shall be installed to display/record the energy delivered by the PV system. The metering system must be in accordance with the local supply authority requirements and specifications.

The main distribution is located within the Laboratory area as indicated on the floor plan layout No. 2021/04/E-D02.

### **Testing & Commissioning**

The PV specialist shall undertake the testing and commissioning of the PV installation in accordance with the requirements of the applicable standards and the Engineer.

Tests shall be undertaken to verify the system performance and check for faulty modules. All tests required to satisfy the requirements of the distribution Network Operator shall be undertaken and the necessary documentation provided.

The PV installations shall be earthed in accordance with the applicable regulations to minimise the risk of electric shock to people in the vicinity of the installation under fault conditions.

The frames holding the PV cells shall be bonded to the lightning protection system by the Lightning Protection Sub-Contractor. PV Specialist Contractor shall liaise with the lightning protection specialist to ensure that adequate connection points are available to ensure that the lightning protection system conforms with SANS IEC 62305.

The PV Specialist Contractor shall be responsible for liaising with the Municipality to ensure that the necessary arrangements are in place for connection to and operation in parallel with the Municipal supply.

### **Operation and Maintenance Manuals (O&MMs)**

The O&MMs shall also include the following specific information for the PV installation:

- a) Basic system information.
- b) Single line electrical system schematic.
- c) Manuals, data sheets and other relevant product documentation for the system components.
- d) Copy of the test & commissioning documentation.
- e) Table of inverter protection settings (under/over voltage, under/over frequency, etc).
- f) Procedures for verifying correct system operation.
- g) A checklist of what procedures to undertake in case of a system failure.
- h) Shutdown/isolation and start up procedures.
- i) Maintenance & cleaning recommendations (if any).
- j) Considerations for any future building works adjacent to the PV array to avoid potential damage or shading of the PV array.



Contractor



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Employer



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Witness 2

k) Warranty Information.

### **Tender Information**

Tenders shall submit the priced Bill of Quantities as well as the Returnable Schedules when submitting their tender. As a minimum, the following information must be included:

- a) Nominal peak power output from system.
- b) Proposed PV module type and range.
- c) Electrical efficiency.
- d) Estimate of annual average output.
- e) Physical dimensions of array.
- f) Recommended maintenance space allowances.
- g) Proposed inverter type/details.
- h) Outline design of array and connection to building electrical supply, battery bank, and including proposed number and arrangement of inverters and connection arrangements, as well as voltages and currents.

### **Design Parameters**

AC and DC cables shall be selected in accordance with SANS 10142 Part 1 and must satisfy the following maximum overall voltage drops:

- Connection Maximum Voltage Drop
- DC wiring between the arrays and the inverters < 3%
- AC wiring between inverters and distribution boards < 1 %

### **System Logic**

#### System operation while grid is connected

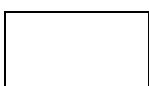
Energy from PV panels must be used in preference to grid energy and be fully utilized by the load (i.e., non-essential daytime loads like air conditioners, with excess energy requirements of these loads provided by grid energy). Solar PV energy must be available on all three phases. Energy may be fed back into the grid. A PLC may be installed to deregulate the inverter by means of the manufacturer's specific equipment or similar approved equipment.

#### System operation when grid fails

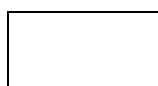
When the grid fails, all hybrid inverters must disconnect from the grid to prevent energy from being fed back into the electrical system, in accordance with local by-laws. When the grid voltage becomes available again, the inverters must reconnect automatically.

#### Logic of potential approaches

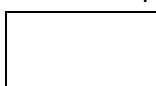
Tenderers are welcome and invited to propose alternative proprietary solutions with comprehensive explanation to meet the system logic as specified above in the event they wish to do so. Technical information, equipment brochures, alternative layouts and special conditions must be included with the main and alternative proposal. The alternative proposal must accompany a priced bill for the described system and its specifications.



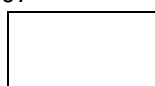
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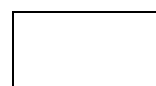
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Testing, commissioning and handover of the hybrid PV system installation shall be completed as described in this document to the complete satisfaction of the Engineer.

**PF6. OTHER CONTRACTORS AND SPECIALISTS**

The PV system sub-contractor shall be employed as a subcontractor to the Main Contractor. It will be required of the PV system sub-contractor to work according to the Main Contractor's programme, in close liaison with the other contractors and specialists appointed by the Employer. Other specialist's contractors shall in no way exonerate the PV system sub-contractor from his obligations in terms of this contract.

**PF7. PROGRAM**

A copy of the Main Contractor's construction programme shall be issued to the successful tenderer. The PV system sub-contractor shall be expected to conform to the overall milestones as contained in this programme.

**PF8. BUILDER'S WORK**

The Main Contractor shall also provide the following:

- The supply and installation of all manholes and sleeves or ducts.
- Isolated electrical connection and data points for connection to the local/internal grid and internal data network.
- The removal and replacement of ceiling tiles, where required, to allow the PV system contractor access to perform work in ceiling spaces.
- The repairs to brick work, plaster and paint where required.
- Cable trays in existing ceiling spaces.

The PV system contractor shall liaise closely with the Electrical Contractor in the above regard and the PV system contractor shall remain responsible for the correct and accurate location of manholes, sleeves, and penetrations.

**PF9. ELECTRICAL SUPPLY**

The electrical supply at all isolated connection points shall be 4-wire, 420V, 50 Hz, 3-phase supply.

**PF10. WORKMANSHIP**

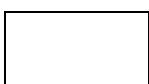
The PV system contractor shall employ (if necessary) only competent artisans to perform construction and installation work on the site.

The contract shall be executed with the best workmanship in a workmanlike manner to the satisfaction of the Employer. Should any workmanship not be to the satisfaction of the Employer, it shall be rectified at the cost of the PV system contractor.

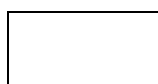
The PV system contractor shall remain responsible for the correct and complete delivery of the installation. Inspection by the Employer shall not release the PV system contractor from his responsibility.

**PF11. QUALITY OF MATERIAL**

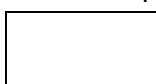
Only material of high quality and suitable for the climatic conditions of the site shall be used and shall be subject to approval of the Employer and Engineer. All material shall conform in



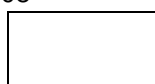
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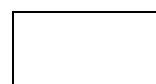
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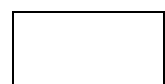
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respect of quality, manufacture, tests and performance, with the requirements of the SANS or where no such standards exist, conform to the appropriate current IEC Specifications. Materials manufactured in South Africa shall as far as possible be used and where applicable shall bear the SABS mark. Imported materials shall comply with the requirements of the appropriate I.E.C. specification. All materials shall be suitable for the conditions under which the materials are installed and used.

Should the materials or components not be suitable for temporary use under site conditions, then the PV system contractor shall at his own cost provide suitable protection until these unfavourable site conditions cease to exist.

**PF12. AMBIENT OPERATING CONDITIONS**

- Ambient Temperature -10°C to 40°C+
- Relative Humidity 0 to 100%
- Altitude 1 300 metres ASL

Over and above the normal exposure to dust and other particles of pollution typically found in an industrial setting, it must be taken that the air is extremely corrosive. All equipment that may be affected by such circumstances shall be shielded, properly sealed and effectively and efficiently treated to withstand the dusty and corrosive environments.

**PF13. GUARANTEE AND MAINTENANCE**

The PV system contractor shall guarantee the complete plant for a period of twelve months after first delivery has taken place.

If during this period the plant is not in working order, or not working satisfactorily owing to faulty material, design or workmanship, the PV system contractor will be notified and immediate steps shall be taken by him to rectify the defects and/or replace the affected parts on site at his own expense.

The PV system contractor shall maintain the plant in good working condition for the full twelve- month period to the final delivery of the installation. The tenderer must also price for an additional 2-year Service Level Agreement (SLA) as part of the tender. However, should the PV system contractor fail to hand over the plant in good working order on the expiry of the specified twelve months and SLA period, the PV system contractor shall be responsible for further monthly maintenance until final delivery is taken.

During this period the PV system contractor will undertake to arrange that the plant be inspected at regular intervals (whatever number of visits the PV system contractor deems necessary to fully maintain the equipment) by a qualified member of his staff who shall:

- Check the mechanical soundness of all parts.
- Check and adjust all the output and control parameters of the system (voltage, frequency, control voltages, etc.).
- Take control measurements on the major system components and record these measurements.
- Replace all defective components.

#### **PF14. INSPECTION AND TESTING**

After completion of the works and before first delivery is taken, a full test will be carried out on the installation for a period of sufficient duration to determine the satisfactory working thereof. During this period the installation will be inspected and the contractor shall make good, to the satisfaction of the Engineer, any defects which may arise.

Note:

- All instrumentation necessary for testing shall be provided by the PV system contractor.
- The results of the above tests must be clearly recorded, signed and handed to the Engineer.
- Once the Engineer has inspected the complete installation and satisfied himself that all testing has been completed and the Contract is complete in all respects, the Engineer may be approached in writing with the above documentation with a view to arranging a hand-over date.
- On completion of the Contract, the PV system contractor shall provide the Engineer with a complete and signed Certificate of Compliance for Electrical Installations as required by the Occupational Health and Safety Act as amended.

#### **PF15. TESTING AND COMMISSIONING DOCUMENTATION**

On completion of the installation and after testing and commissioning, a set of documents shall be compiled and presented to the Engineer. This set shall include the following:

- CAD copy of all drawings marked up "As-built"
- Completed set of workshop drawings.
- Completed set of test and commissioning sheets.
- Set of schematic wiring and function diagrams
- Three sets of Operating and Maintenance Instruction Manuals on all electrical/PV equipment.

#### **PF16. SUBMITTALS**

The following information **MUST** accompany the tender documents at submission:

- A paragraph-by-paragraph schedule of compliance with detailed description of any deviations from this specification.
- A clear description of the operating characteristics and special features of the equipment.
- Descriptive and illustrated brochures and other information pertaining to the solar PV panels, framing system, batteries and inverters.
- The proposed layout, showing equipment interconnection and voltages.
- A sample test report as stated.
- A list of successful installations completed in the Republic of South Africa and abroad (if any).

**PG STANDARD SPECIFICATION FOR SUPPLY, DELIVERY TO SITE, INSTALLATION, TESTING AND COMMISSIONING OF A STANDBY DIESEL GENERATOR**

**PG1. Project background**

The new Gabosch Dam is to be constructed in the Vicinity of Amsterdam in Mpumalanga Province and this part of the specification covers the provision of a standby generator for the premises.

**PG2. Definitions and abbreviations**

<b>ATS</b>	Automatic transfer switch, meaning a self-acting electrical switching device comprising either motorised and mechanically interlocked contactors or electrically and mechanically interlocked circuit breakers combined to form a change-over contactor.
<b>Contractor</b>	Means the successful tenderer with whom the Employer enters into a contract in terms of the tender documents.
<b>dB(A)</b>	Means the A-weighted sound-pressure level as defined in SANS 10103: 2004, Edition 5.1.
<b>Employer</b>	Means the Federal Republic of Ethiopia
<b>MCB</b>	Means miniature circuit breaker
<b>SDGU</b>	Means a stand-by diesel generating unit as described in the tender document

**PG3. Scope of work**

The project comprises the supply, delivery, testing and commissioning of an SDGU installation. The scope of work to be performed by the successful tenderer shall include:

- Design, manufacture and assembly of all components and factory testing of the complete SDGU.
- Design, manufacture and assembly of all components and factory testing of an ATS panel to serve the SDGU
- Provision of detailed design drawings and specifications for concrete foundations and plinths to be constructed by others
- Provision of detailed design drawings, schematics drawings and specifications for the ATS panel supplied under this contract
- Provision of detailed wiring and cable connection drawings and instructions for the SDGU installation to facilitate the electrical power, instrumentation and control cables to be installed by others
- Packaging, marking, insurance for shipping and delivery to site, shipping, paying all taxes and levies, delivery and off-loading to the final location at the designated facility and positioning of the SDGU in an outdoor container on a plinth, together with the relevant ATS panel at the designated position on site.
- Returning to site when all electrical power instrumentation and control cables have been installed and connected by others to perform the necessary commissioning tests

for the SDGU.

- Remedying all defects that may be identified during the period for notifying defects.
- Provision of maintenance services for a period of one year from date of acceptance if the proposed maintenance offer is accepted by the Employer.
- Provision of initial operation and maintenance training to the Employer's personnel.
- Provision of all required equipment drawings, instructions and operating and maintenance manuals.
- Provision of a list of proposed critical spares, with proposed minimum stock levels, which the Tenderer recommends the Employer should hold for routine maintenance of the SDGU.

**PG4. Work to be performed by others**

The following work associated with the installation of the SDGU may be performed by others under the direct supervision of the Employer or his representative:

- The construction of plinths for the SDGU in accordance with the design of the SDGU supplier.
- Any alterations to existing buildings and all building work required to accommodate the SDGU.
- The installation of the ATS panel provided under this contract in the existing location.
- Making the required alterations to existing low voltage panels to accommodate the installation of the SDGU.
- Supply and installation of all power cables and cable ladders to connect the SDGU, the ATS panels and the existing LV panels in the building.
- Supply and installation of all auxiliary power cables to the SDGU, mains voltage cables for mains failure sensing at the SDGU and all telemetry cables to and from the SDGU.

The other contractors responsible for the supply and installation of all power, voltage sensing and telemetry cables to and from SDGU shall terminate these cables on terminals specially provided for this purpose on the SDGU and ATS panels. These terminals shall form the boundary of the responsibility between the contractor and other contractors performing the cable installation work.

The successful tenderer shall inspect and test the cables installed by others to ensure the correctness thereof before starting with the commissioning of the SDGU.

**PG5. Specifications**

This part of the tender document defines the minimum requirements for the SDGU to be procured for installation at Gabosch Dam. The specifications comprise the following parts:

- General specifications
- Standard technical specifications
- Specifications for contractor's design obligations

The tenderer's offer shall comply with all the specifications.

## **PG5.1 General specifications**

### **PG5.1.1 Application**

The SDGU will be installed to provide three-phase power at 50 Hz, 420/240V to the low voltage busbars of the distribution boards in the Admin Building, Drainage Collection Chamber and Outlet Block, serving a number of essential loads. The power will serve as standby power when normal power is interrupted locally for whatever reason.

The SDGU is expected to operate for periods up to 10 hours per day. It is also foreseen that it may at times have to operate continuously for several days.

The types of loads to be supplied include the following:

- Fluorescent, incandescent, halogen and LED lighting.
- Dedicated socket outlets for computer equipment.
- Power supplies for electronic equipment, such as security and fire equipment.

### **PG5.1.2 Drawings**

The following drawings are applicable to this document:

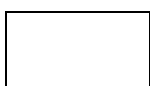
2021/04/E-D01: Electrical Single Line Diagram

### PG5.1.3 Standards

The following Standards, Acts and Codes shall be applicable to the execution of the scope of work.

In the event of conflict between the standards or between any standard and any part of the tender document such conflict shall be referred to the Employer for resolution on precedence.

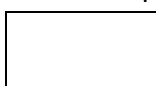
Standard	Title
SANS 8528	Reciprocating internal combustion engine driven alternating current generating sets
SABS IEC 60034-16	Rotating electrical machines – Part 16: Excitation system for synchronous machines
SABS 0103: 1983	The measurement and rating of environmental noise with respect to annoyance and speech communications – Amendment No.2: Nov. 1992
SABS IEC 34-1: 1983	Rotating electrical machines
SABS 1652: 1995	Battery chargers – Industrial type
SABS 1091	National colour standards for paint – Amendment No.2: May 1989
SABS 1186: 1993	Symbolic safety signs – Amendment No.1: May 1993
SABS 0131	The storage and handling of liquid fuel – Amendment No.2: August 1989
SABS IEC 439: 1990	Low voltage switchgear and control gear assemblies
SABS 1507: 1990	Electric cables with extruded solid dielectric insulation for fixed installations (300/500V to 1 900/3 300V)
SABS 10089	The installation, inspection and maintenance of equipment used in explosive atmospheres
SANS 1547	Electrical cables and flexible cords
SABS 342	Automotive diesel fuel
OHS 85: 1993	Occupational Health and Safety Act
NEMA MG-1	Motors and generators
ISO 9001: 2000	Model to quality assurance in design, development, production, installation and services
ISO 3046-1: 1975	Reciprocating internal combustion engines: Performance-Part 1: Standard reference conditions and declarations of power, fuel consumption and lubricating oil consumption - Amendment No.1 1987
ISO 3046-4: 1978	Reciprocating internal combustion engines: Performance-Part 4: Speed governing



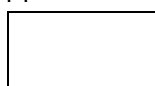
Contractor



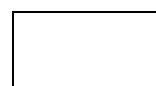
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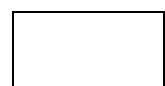
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Witness 1

Witness 2

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Witness 1

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Standard	Title
DEMA 1972	Standard Practices for low and medium speed stationary diesel and gas engines
BS 5514-5: 1979 (1984)	Reciprocating internal combustion engines: Performance-Part 5: Torsional vibrations
IEEE 112	Test procedures for poly-phase induction motors and generators
IEEE 115	Test procedure for synchronous machines
IEEE 126	Recommended specification for speed governing of internal combustion engine/generator unit
IEEE 446	Recommended practice for emergency and standby power
IEC 60529	Degrees of protection provided by enclosures
IEC 947-4-1: 1990	Low-voltage switchgear and control gear Part 4: Contactors and motor starters, Section 1: Electromechanical contactors and motor starters
IEC 947-6 1: 1989	Low-voltage switchgear and control gear Part 6: Multiple function equipment Section 1: Automatic transfer switching equipment
IEC 947-7 1: 1989	Low-voltage switchgear and control gear Part 7: Ancillary equipment Section 1: Terminal blocks for copper conductors
API 650	Welded steel tanks for oil storage
003428-28	Corrosion protection of electrical and instrumentation equipment

#### PG5.1.4 Site conditions

Item	Parameter
Altitude above sea level	1 250m
Maximum ambient temperature	40°C
Average daily maximum temperature	30°C
Minimum ambient temperature	-5°C
Average daily minimum ambient temperature	2°C
Maximum ground temperature	25°C
Minimum ground temperature	10°C
Relative humidity	94%
Lightning conditions	Severe
Degree of pollution	Medium



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

#### PG5.1.5 Electrical system information

Parameter	Value
Nominal system voltage	415V
Maximum rated system voltage	420V
System frequency	50Hz
Phase rotation	Eskom standard
Assumed power factor	0,8 lagging
System earthing	Solidly earthed
Design fault current	20kA

#### PG5.1.6 Earthing

The applicable standard for earthing design shall be IEEE 80-2000.

#### PG5.1.7 Documentation

The contractor shall, two weeks prior to delivery of the SDGU deliver to the Employer three sets of the following documentation in paper and electronic format:

- (a) Complete technical description of the engine the generator all controls and safety devices.
- (b) Detailed parts lists for the engine and all its subsystems generator and all controls and safety devices.
- (c) Detailed operating and maintenance instructions, complete with all specifications, procurement references and part numbers, local and international suppliers and their locations.
- (d) Dimensioned drawings of the SDGU assembly and enclosure.

#### PG5.1.8 Training

The contractor shall provide structured training in the operation and maintenance of the SDGU. A separate training session shall be offered on site once the unit has been successfully tested and commissioned. The training session shall include supervised operation by the Employer's staff.

Training shall be supported with reference literature and the contents and sequence of presentation shall be aimed at ensuring that the Employer's staff is familiarised with the SDGU and can operate the SDGU with confidence.

#### PG5.1.9 Testing

##### (a) Type tests

The SDGU engine and generator shall be certified as having passed the relevant Type Test at an accredited testing station. Full Type Test certificates/reports shall be submitted with the tender.

##### (b) Routine tests

The SDGU shall be tested in the manufacturer's works over the full operating range before delivery to site.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

The Employer reserves the right to witness routine tests conducted at the manufacturer's works for the SDGU. Routine tests shall be conducted in accordance with NEMA MG-1.

After installation at site the SDGU shall be tested over the full operating range. During this testing, the starting capability of the SDGU shall be demonstrated as well as the drive capability and the heat rate. Tests shall be conducted using dummy loads, which are to be provided by the contractor.

Acceptance by the Employer of the SDGU will only follow after receipt of the Routine Test certificates.

**(c) Special tests**

The Employer reserves the right to witness special tests as detailed in this clause for the SDGU offered. The following special tests shall be conducted at the manufacturer's works:

**(i) Load tests**

- Warm-up of the diesel engine as required
- 25% load operation: 10 minutes
- 50% load operation: 10 minutes
- 75% load operation: 10 minutes
- Full load operation: 20 minutes
- 110% load operation: 20 minutes
- Cool-down of the diesel engine

During the test run, temperatures, pressures and fuel consumption shall be measured and recorded.

The diesel engine shall be proven to be capable of operation in steady-state condition on all above-mentioned loads.

(ii) Load acceptance and confirmation of voltage and frequency regulation at zero to full-load tests.

(iii) Load rejection.

(iv) Governor response.

(v) Noise radiation from the enclosure.

(vi) Functionality of all controls, safety devices and instrumentation.

**PG5.1.10 Commissioning**

After delivery and on being advised by the Employer that the installation and connection of all cables to and from the SDGU has been completed and that the installation is ready for commissioning, the contractor shall perform the following tasks:

- (a) Inspect the installation in the presence of the Employer to ensure satisfaction therewith and report to the Employer such aspects of the installation that may prevent commissioning.

- (b) Once the installation work by others has been approved, proceed with the commissioning.
- (c) Do a first filling with fuel, lubricants and chemicals and provide and install all consumables necessary before operation.
- (d) Remove all braces, supports and precautionary devices installed for shipping and delivery.
- (e) Start and run the SDGU without being connected to the electrical system network.
- (f) Prove the functionality of all controls, safety devices, instrumentation and switchgear.
- (g) Prove the ability of the SDGU to deliver 110% of rated output. Provide dummy loads for this purpose.
- (h) With prior arrangements with the Employer, simulate a mains failure and prove load acceptance and load rejection in the mains supply is restored.
- (i) Hand over the fully functional SDGU to the Employer for operation and maintenance.

## **PG5.2 Standard technical specifications**

### **PG5.2.1 SDGUs**

Each SDGU shall consist of the following components:

**(a) Diesel engine including:**

- Fuel system including storage
- Cooling system
- Starting system
- Speed governor
- Engine protection and alarms
- Instrumentation
- Internal wiring
- Exhaust system

**(b) Generator, including:**

- Power terminals
- Protection and alarms
- Instrumentation
- Earthing
- Internal wiring

**(c) SDGU switchgear and controls, including:**

- Generator main breaker
- Control gear
- Terminals for connection of telemetry, sensing voltages

**(d) SDGU assembly and enclosure, including:**

- Skid type base frame
- Engine-to-generator coupling
- Enclosure where specified
- Fire protection system as integral part of the enclosure

## **PG5.2.2 Diesel engine**

### **(a) General requirements**

The diesel generator unit shall comprise a diesel engine of proven reliable standard design, suitable for cold starting, not more than 1500 rpm operating speed, speed governed, water-cooled, turbocharged, multi-cylinder with in-line or V-cylinder configuration, with high-pressure fuel injection system suitable for operation on standard commercially available diesel.

The engine shall be capable of a 10% overload capacity for one running hour within any 12-generation hour period.

The cylinder liners, the main bearings and the connecting rod bearing shall be replaceable without disturbing the crankshaft.

All pumps shall be engine driven and mounted on the engine and/or on the common base frame.

Two independent over-speed protection devices shall be provided. The devices may be either of the mechanical or electronic type and shall shut down the diesel engine at the same set point.

The diesel engine shall be equipped with a crankcase overpressure breather with oil separator. The breather pipe after the oil separator shall be connected either to the exhaust or to the air manifolds (not exposed to the air).

The engine shall be equipped with crankcase overpressure switches to trip the engine when the blow of gases build-up inside the crankcase if the breather is blocked.

The engine shall run free of excess of vibration at normal operating speed under load conditions from no-load to 110% of rated full load.

The engine shall be suitable for running at low loads of as little as 30% of full load for extended periods of time without undue carbon formation in the combustion chamber.

The engine-generator combination shall be analysed to ensure fully functional design.

The engine shall be electrically earthed.

### **(b) Protection from moving parts**

All moving parts of the SDGU shall be covered with safety protection devices to ensure that persons are not exposed to danger. The design of the covers shall be so as not to affect the SDGU operation.

The following parts shall be covered:

- Rotating parts like flywheels, vibration dampers, V-belts and V-belt pulleys
- Fan for cooling system

- Heat-radiating parts and pipes
- Any additional parts which could be damaged or can be dangerous to persons without protection

**(c) Rating**

The engine shall be capable of driving the generator at the specific required output under site conditions, even when the generator is supplying impact loading. The engine shall deliver full load at site conditions within the starting period. The output of the engine shall be the nett output at site.

The engine output shall be rated such that the generator set output, measured at the output terminals, meets or exceeds the specified SDGU prime mover (at 0,8 PF) and permissible average power (PRP) at rated site conditions and after due allowance for internal losses, auxiliaries and considering de-rating factors. Rating and de-rating shall be in compliance with ISO 3046-1 and SANS 8528-1.

The power rating shall be expressed in kilowatts at rated frequency and power factor of 0,8 lagging.

The SDGU shall be capable of operating with a lagging power factor from 0,8 up to unity power factor.

**(d) Diesel engine starting**

The SDGU shall be started by means of a 24 V DC electrical starting motor, driving the diesel engine's flywheel.

NiCad batteries according to the capacity requirements of the starter shall be provided and installed with in an open battery rack. The batteries shall allow a minimum of 10 starts without recharging. If alternative battery systems are offered, full details shall be submitted with the tender.

The battery shall be mounted separately from the engine in a drip tray, close to the starter motor.

The diesel engine shall be provided with a 24 V DC supply battery and battery charger. The charger shall be supplied with 230 V from the generator auxiliary supply and offer both normal charging and boost charging modes. The charger shall be fitted with an ammeter for charger current indication.

**(e) Governor**

The diesel engine shall be fitted with an electrical or mechanical type speed governor having over-speed protection. The speed governor shall have maximum speed regulation of 2-3% through the full operating power range.

To allow possible future parallel operation, the governor shall be able to operate as a proportional governor as per ISO 4046-1 and ISO 8528-2.

**(f) Fuel system**

The fuel system shall be designed for operation on local commercially available diesel as used in motor vehicles and shall consist at least of the following items:

- A built-in lockable fuel day-tank with a capacity to allow the SDGU to operate at maximum power for 10 hours.
- Fuel line filter.
- Fuel lift pump if applicable.
- Injection pump.
- Fuel pipes.
- Fuel injectors.
- Water fill drain and drainpipe.
- Fuel filtration system.

All these items shall be fixed and mounted to the engine, except for the fuel tank, which shall be mounted into the base of the common skid frame. The external connections of the system must be designed by means of flexible pipe elements as to prevent damage resulting from vibrations during the SDGU's operation.

The fuel tank filling valve shall be situated to allow for easy access. Protective venting shall be provided and the tank shall have a removable bolted and gasket-sealed inspection cover. The tank shall be equipped with an easily accessible fuel level indicator and a low fuel level alarm with contact for telemetry connection.

Each tank shall be fitted with a ½" BSP female fitting at the top and the bottom of the tank in positions to be selected in accordance with the requirements for the specified diesel filtration unit.

**(g) External Diesel Filtration Unit**

In order to maintain the quality of the diesel in the day tank, the SDGU shall be equipped with a diesel filtration unit. The unit shall be external to the day tank and shall be equipped with filters, a circulating pump and moisture collection tank. The intake to the filtration unit shall be from the bottom of the day tank and the delivery side shall pump diesel into the top of the day tank.

The unit shall be built into the canopy of the SDGU in such a position where it is readily accessible for maintenance.

The filtration unit and its pipe connections shall be designed to withstand engine vibration.

The circulating diesel filtration unit shall be similar or equivalent to the "Duvalco MFS" type and the capacity of the unit shall be suitable for the capacity of the day tank of the SDGU.

The capacity of the filtration unit and the filters shall be in accordance with the manufacturer's recommendations for the specific application and the relevant day tank capacity.

The unit shall be installed in a position where it is readily accessible for maintenance. The filtration unit piping shall be designed to withstand engine vibration.



**(h) Lubricating oil system**

The lubrication oil circulation shall be provided by a shaft driven oil pump. This oil pump shall be fitted with a suction filter and a discharge filter. Pressure lubrication shall be provided to all parts requiring lubrication. The oil system shall be designed to allow the oil to return to the lubrication oil sump by gravity feed.

The lubrication oil system shall comprise the following:

- Gear driven lubrication oil pump, full flow lubrication oil fine filter, bypass system, full flow lubrication oil cooler, lubrication oil pressure switch (shutdown of engine at low lubrication oil pressure), lubrication oil pressure gauges.
- Drilled lubrication oil lines and pipes routed to all lubricating points of the diesel engine.
- Engine- or SDGU-mounted semi-rotary pump (minimum 30 litres per minute) for lubrication oil change/drainage from the oil pump. The pump shall be provided with a lockable ball valve and oil resistant flexible hose of 3 m length for filling the used oil into barrels, etc.

Lubrication oil samples shall be taken via the semi-rotary pump and the ball valve.

The diesel engine's lubrication oil level shall be topped up by means of fresh lubrication oil pumped out of barrels by means of a portable semi-rotary pump (minimum 30 litres per minute) and a flexible hose to be provided by the contractor.

Used lubrication oil shall be drained from the engine's oil sump by means of the engine mounted semi-rotary pump. Draining facilities shall be easily accessible.

**(i) Cooling water system**

The diesel engine cooling shall be provided by a closed cooling water system with an air-cooled radiator. The radiator and the cooling water piping shall be fitted to the base frame. The fan for the radiator shall be shaft driven by the diesel engine. The air supply shall be from the room or enclosure. The radiator shall be constructed to allow for the connection of a hot air exhaust duct to discharge hot air from the room/enclosure. The duct shall be flange bolted to a receptacle flange fitted to the radiator. The cooling system shall be sized to provide cooling for the diesel engine for continuous operation at the maximum load and the maximum expected ambient temperature.

Extract capacity shall be provided to allow for radiator fouling of 20%.

The cooling water heat exchanger surface shall be designed to allow for fouling of the cooling system over the life of the diesel engine of 50%.

The cooling system shall be designed as a closed system and shall comprise the following:

- Gear-driven centrifugal cooling water pump
- Temperature regulator (thermostats)
- Jacket water pre-heater consisting of an electrical heating element, small circulation pump and control cabinet.

- Cooling water pipes routed to the radiator cooler.
- The cooling water pump shall be driven by the engine and mounted on the engine block.

**(j) Engine aspiration air intake**

The air intake shall be fitted with an intake air filter. The filter element shall be a replaceable dry cartridge type filter.

**(k) Exhaust system**

The exhaust system silencer and piping shall be insulated and protected so that there is no possibility of accidental personnel contact with any hot surface.

The diesel engine exhaust system shall be provided with an in-line silencer to maintain the noise level below the limit specified in this specification.

Flexible connectors shall be provided between the diesel engine and the exhaust system to allow for diesel engine movement during the operation of the diesel engine.

The exhaust system shall be constructed from stainless steel. The exhaust system shall be suitable for either being extended horizontally to exit the SDGU room in the event of indoor location or of being extended vertically in the event of being housed in a soundproof outdoor enclosure.

**(l) Engine heaters**

The diesel engine shall be equipped with a sump and/or cylinder head heater to ensure proper starting at low ambient temperature.

**(m) Instrumentation**

The SDGU use shall be equipped with instrumentation to allow for safe and reliable operation.

**PG5.2.3 Generator**

**(a) General requirements**

The required generator shall be a three-phase 50 Hz 400/231V brushless synchronous generator.

The generator shall deliver a steady-state voltage not exceeding plus or minus 5% and the frequency shall be maintained plus or minus 2, 5% over the full range from no-load to 110% of full load with a power factor from 0,8 lagging to unity.

The generator shall also ensure that under transient conditions, the voltage shall not fall below 80% of rated voltage and shall recover to rated voltage within three seconds. The frequency shall not fall below 95% under these conditions and shall be restored to rated frequency within three seconds also.

It is imperative that the generator be capable of reliable continuous operation when required and be capable of withstanding the system fault level.

The generator rotor shall be supported on a pedestal with a self-lubricating bearing, mounted on the same base frame as the engine.

The generator shall be direct driven by the engine with the coupling capable of accommodating any misalignment between the engine and the generator.

The generator stator winding shall be equipped with temperature sensors to provide an over-temperature alarm.

The ends of the generator phase windings shall terminate in a suitable connection box with sturdy terminals. The winding ends shall be suitably supported to prevent flexing.

The total harmonic distortion (THD) shall not exceed 3%.

**(b) Insulation**

The insulation class for both the stator and rotor shall be "Class H" for both temperature and temperature rises.

**(c) Stator**

The stator winding shall be star-connected and connected to the LV switchgear by cable.

**(d) Exciter**

The exciter shall be of the rotating diode type. The generator excitation shall comply with the requirements of IEC 60034-3. The excitation equipment shall be capable of continuous service under the operating conditions and requirements described in this specification.

**(e) Voltage regulator**

A fast-acting voltage regulator shall be supplied. It shall be suitable for use with the generator under the conditions of operation specified. As a measure of its sensitivity, the regulator shall be capable of maintaining the generator terminal voltage within plus or minus 0, 5% of the controlled value over the load range of the generator between no-load and 110% of full load.

**(f) Protection**

The contractor shall provide the generator complete with all protection required to ensure safe and reliable operation of the unit.

The following minimum protection shall be provided in accordance with SABS IEC 60947-1:

- Overcurrent (inverse time)
- Earth fault
- Reverse power (when connected in parallel)
- Loss of excitation
- Differential protection for generators exceeding 1000 kVA rating only.

The unit shall be complete with adequately rated current transformers in accordance with IEC 60044-1.

Protective devices requiring shut-down of the diesel generator set must be of the lockout type requiring local manual reset.

Winding temperature monitoring shall be provided for each alternate winding. A winding temperature rise alarm in the form of an outdoor red light shall be provided at the SDGU. A

critical winding temperature rise alarm in the form of a second red light and an acoustic alarm shall also be provided at the SDGU which shall be activated when a level of 10°C below the allowable maximum temperature of the respective windings is reached.

#### **PG5.2.4 Electrical switchgear**

Due to the site conditions the electrical switchgear shall be split between the SDGU and the ATS panel. Power cables and the required signalling cable shall be connected between the SDGU and ATS panel.

The SDGU shall be provided with the following:

- A main generator breaker rated for the specified fault current and for switching the full generator output under full-load and no-load current with a power factor between 0,8 lagging and unity, complete with electrical tripping and closing facility.
- All required busbars and flexible connections to connect the generator output terminals to the main generator circuit breaker and to the ATS panel supply cables.
- A robust galvanised steel cable gland plate to support the multiple cable glands.
- The ATS panel shall be provided with the following:
- Electrically and mechanically interlocked mains failure auto transfer switches (ATS) consisting of a set of motorised circuit breakers or contactors rated for the full generator output and fault levels prevailing.
- All required busbars and flexible connections to connect the supply cable from the generator supply, the cable from the mains supply and the supply cable to the LV board to the terminals of the change- over contactor.
- A robust galvanised steel cable gland plate to support the multiple cable glands.
- A Landis & Gyr Type ZMD405CT44.2407 energy meter to log the total energy supplied by the ATS panel to the loads, connected to the loads via class 1.0 CTs with appropriate turns ratio.

A 'generator active' indication and 'load shed signalling' indication shall each be connected to one of the inputs of the meter to log the operation of the generator.

Suitably rated MCBs to provide a mains failure sensing supply from each mains supply to the generator controller, as well as an auxiliary supply to the generator.

(The switchgear shall be mounted in such a manner that the equipment can be operated and maintained with maximum personnel safety.

#### **PG5.2.5 Instrumentation and control**

- (i) An integrated generator controller unit with self-monitoring functionality is required to provide the functionality specified.
- (ii) An operator selector key switch shall be provided with the following minimum operating modes:
  - Auto-start: Automatic start of the SDGU and transfer of load upon mains failure.
  - Manual start and stop: Manual local operation of the SDGU.

- Off: Prevents the SDGU from starting.
- Off lock-out: A key-lock switch shall be provided to block remote controls and automatic starting during maintenance and/or servicing.

A large, brightly marked emergency stop push type mushroom switch shall be provided in the SDGU for use by operating personnel when an emergency arises. When the switch is actuated, the SDGU shall be shut down as quickly as is possible without causing damage.

(iii) Manual operating mode

In manual operating mode, the operator can start and stop the generator via pushbuttons. No transfer of load via the ATS shall be permitted if the mains supply is energised.

(iv) Auto operating mode

In Auto operating mode, the control system shall provide automatic generator start on mains failure and auto transfer of the load to the generator in a secure manner after a settable time period via the ATS.

Note: Care shall be taken with all ATS operations that no interconnection of mains supply and generator supply can occur and that the load is de-energised before the transfer is initiated to inhibit unwanted switching of un-phased networks. It shall be assumed that motor loads exist that require suitable time to stop before re-energisation.

In Auto operating mode, the functionality to start and stop/trip the generator remotely via potential-free contacts shall be provided (for example from a remote control room). No transfer of load via the ATS shall be permitted if the mains supply is energised.

(v) General requirements

Multiple auto transfer switches (ATSs) shall be provided in the ATS panel for each transformer/mains supply if applicable.

If the generator is not capable of taking full load instantaneously, multiple automatic transfer switches shall be provided in the ATS panel and the switchover of these switches shall be staggered to load the generator in incremental steps.

If more than one generator unit is offered for a specific load, the sequential switching of the generators with synchronising facilities between the generators shall be provided. The synchronising of generators and the operation of the ATS shall be coordinated such that no generator overload occurs and the full load is energised within the minimum time.

To detect mains failure, the controller shall monitor the supply and all phases of the mains supply.

The ATS shall only operate if the supply on all three phases of the mains supply has been lost. The operation of the ATS shall be blocked if the MCB on the mains failure sensing supply has tripped.

The control system shall provide all required interlocking to ensure reliable and safe operation of the generator in conjunction with the mains supply at all times

The control system shall be supported by rechargeable batteries and ensure full operational functionality when both mains and standby power is not available. The battery shall have a dedicated charger.

An automatic shut-down shall be provided when potentially harmful conditions to man or machine prevail, including over-speed, very high temperatures, very low lubrication oil pressure, incomplete starting sequence, activation of locally emergency stop push-button.

(vi) Instrumentation

The following indications shall be available in the controller locally:

- All generator status indications (including generator running/stopped, generator breaker open/closed, generator Auto/Manual/Off mode selection)
- Generator engine running hours and number of generator-starts
- All engine and generator alarms (including oil pressure, over-crank, engine over-speed, loss of control power, over/under frequency, over/under voltage, generator start failure, low fuel oil, temperature alarm, unbalance alarm, etc.)
- All power measurements (including amps per phase, mains supply voltage per phase, generator voltage per phase, kW, kVAr, kVA, power factor and maximum demand).

The following indications shall be provided externally to the generator enclosure:

- Red “flashing” lamp indicating that the main supply has failed and that the generator will start, together with an audible beep, until the generator has successfully started and the load is transferred to the generator supply.
- Red “continuously on” lamp indicator, if any alarm condition exists.

The following common alarm shall each be provided by a potential free contact to be relayed to the ATS panel for remote supervision:

- Generator active indication
- Generator start failure
- Low fuel level
- Temperature alarm
- Generator general alarm (i.e. oil pressure, over-crank, engine over-speed, loss of control power, over/under voltage, etc.)
- Battery low/charger fail alarm

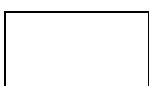
(vii) Load shed command

A load shed signalling contact shall be provided from the controller to be relayed to the ATS panel to isolate non-essential loads in case of overloading the generator. Overload shall be

detected on a) low-frequency set point, b) and overcurrent set point, and c) winding temperature alarm. The indication shall be secure to avoid nuisance tripping during transient loading conditions of the generator, but shall operate before the generator is tripped.

**PG5.2.6 ATS panel**

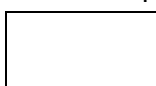
- (a) One ATS panel shall be provided with the SDGU and it shall be integrated into the design to provide the functionality specified. The ATS panel shall be mounted integrally with the generator.
- (b) Others may be responsible for the installation of the required cables and the interconnection of the ATS panel with the SDGU, according to the drawings and design which is to be provided by the SDGU contractor.
- (c) The SDGU contractor shall verify the installation of the ATS panel and cabling and be responsible for the commissioning of the SDGU up to and including the ATS panel.
- (d) The proposed design requirements of the ATS panel are shown on the drawings forming part of this document.
- (e) The ATS panel shall be complete the following minimum equipment:
  - The ATS panel shall have a fault rating equal or better than 120% of the fault rating on the LV side of the transformer served by it.
  - All required busbars and flexible connections to connect the supply cable from the generator, supply cable from the mains supply, and supply cable to the LV board to the terminals of the change-over contactor.
  - A robust galvanised steel cable gland plate to support the multiple cable glands.
  - A Landis & Gyr Type ZMD405CT44.2407 energy meter to record the total energy and demand supplied by the ATS panel to the loads. Each meter shall measure the loads of the primary currents via Class 1.0 current transformers with appropriate selected turn ratios. Both a “generator active” indication and “load shed command” signals shall be connected from the SDGU controller each to one of the binary inputs of the meter to enable it to record the operational status of the generator.
  - Suitably rated MCBs to provide a “mains failure sensing supply” from the mains supply to the generator controller as well as an auxiliary supply to the generator.
  - Terminals to connect the specified instrumentation and control signals that will be extended from the SDGU to the ATS panel.
  - Any other equipment required for the functioning of the controller and ATS function.
- (f) Each ATS panel shall comprise a sheet steel enclosure with appropriate dimensions and designed to accommodate the equipment specified for the application. The physical construction of the ATS panel shall be an indoor wall mounted panel to be mounted inside the generator enclosure. The ATS shall have a current rating determined to suit the capacity of the circuits into which the ATS will be integrated.



Contractor



Witness 1



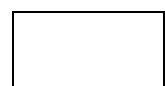
Witness 2



Employer



Witness 1



Witness 2

The rating of the transformer at the Administration Building is 75kVA and is situated on a platform under the transmission line.



### **PG5.2.7 Requirements for load transfer**

- (a) The transfer of load from the mains supply to the generator supply shall be as follows:
- (i) The generator shall start in an off-load condition.
  - (ii) Once the generator is running in a stable state ready to take load, and provided that the mains supply is off, the ATS will be switched to the generator supply.
- (b) Delay timers controlling the delay in closing the ATS shall be selected to allow the generator to reach a stable condition with loads having been connected.
- (c) Once the mains supply is restored, and after monitoring this for a time period which can be pre-set, the change-over from the generator supply to the main supply will be effected as follows:
- (i) The generator breaker shall trip to separate the generator from the load.
  - (ii) After an adjustable time period (to allow de-energisation of motor loads), the ATS will switch to mains supply connecting the LV busbar and hence the loads.
  - (iii) Once all of the load has been switched to the mains supply and provided that the main supply remains available, the generator shall be stopped with due consideration of its cooling down cycle.

### **PG5.2.8 Assembly and enclosure**

#### **(a) Base frame**

The common skid type base frame shall be designed as a strong welded steel construction. The following items shall be mounted on the base frame by means of resilient mountings:

- Diesel engine with all accessories
- Generator with all accessories
- Cooling water radiator (depending on the design)
- Fuel tank
- Switchgear, controls and indication

The common base frame shall be bolted to the concrete foundation.

All external connections such as pipes, cables, hoses, ducts, etc. shall be provided with flexible elements to cope with the vibration during the operation of the unit.

Lifting points shall be provided at the base frame in order to allow lifting up of the complete SDGU. The lifting points shall be positioned in such a way as to prevent damage of the diesel generator unit components during lifting.

Vibration damping in accordance with ISO 8528 shall be provided.

**(b) Drains and leakage**

All drains and leakage (fuel, lubrication oil and water) coming from the diesel generator unit, the fuel oil pump module and the radiator cooler shall be collected by rigid mounted drip trays provided with drain connections (valve). The operators shall be able to manually drain the trays by means of a vessel.

Underneath the fuel oil filters and the lubrication oil filters, drip trays shall be mounted, provided with drain connections, to avoid soiling the diesel generator unit.

The drain connections of the exhaust system shall be routed to the fuel oil tank's concrete base.

**(c) Sound-proof enclosure**

The SDGU shall be completely contained in a sound-proof and weather-proof steel enclosure or container. The enclosure shall meet the following requirements:

- (ii) The enclosure shall be of sturdy construction and shall be designed to mitigate the noise pressure levels to the specified requirements.
- (iii) Steel preparation and finishing shall be suitable for continuous outdoor use exposed to the elements and shall include de-scaling, de-rusting, priming and final coating in enamel paint to a colour to be agreed with the Employer.
- (iv) The inside of the enclosure shall be lined with appropriate sound-proofing material which shall be fixed in a manner that will prevent material from becoming detached due to vibration and ageing.
- (v) The enclosure shall have suitably located strong lockable doors positioned and sized to facilitate ease of normal operation and all required maintenance.
- (vi) The enclosure shall have adequately sized inlet louvres to allow for sufficient cooling air to flow. The inlet louvres shall be equipped with replaceable and washable air filter material.
- (vii) The hot air from the cooling system shall be conducted to a suitably sized and positioned exhaust louver.
- (viii) Inlet and outlet louvres shall be placed to prevent hot area re-circulation.
- (ix) The exhaust shall penetrate the enclosure in a manner to allow for vertical exhausting with a weather proof cover to prevent the ingress of rain.
- (x) The enclosure shall be equipped with all statutory safety, cautionary and unit identification notices in durable material such as stencilled epoxy painted aluminium sheeting.
- (xi) A local distribution board with a lighting circuit and industrial quality wiring, light switches and bulkhead light fittings for night-time operation, in each of the enclosure areas for the diesel engine, generator, electrical switchgear and controls.
- (xii) A low power-consumption emergency light shall be provided at the control area in the enclosure. The light shall be powered from the starter batteries.
- (xiii) An earth-leakage protected industrial quality single phase utility switched socket outlet in the area with the diesel engine is accessed from outside.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

#### **PG5.2.9 Noise pressure level**

The maximum noise pressure level emitted by the SDGU when operating at full rated capacity shall be as follows:

- 65 dB(A) at 10 m distance in all directions from the SDGU enclosure, and
- 105 dB(A) inside the SDGU enclosure

#### **PG5.2.10 Fire protection**

The fuel line to the diesel engine shall be provided with a cut-off valve which, in the case of fire within the enclosure, shall be activated by a weight suspended from a fusible link above the diesel engine.

In addition, tenderers shall provide a price for optionally fitting roll-down curtains to cover the intake and outlet louvres of the enclosure in the case of fire, operated by the same fusible link.

#### **PG5.2.11 Spares**

The contractor shall submit a schedule of recommended spares which he considers should be kept on site by the Employer.

#### **PG5.2.12 Provision for scheduled maintenance**

- (a) In accordance with the relevant part of the Bill of Quantities, the tenderer shall include the complete price of the maintenance of the SDGU, inclusive of all maintenance consumables, for a period of 12 months after the commissioning of the SDGU.
- (b) The above-mentioned provision for maintenance shall include the following:
  - (i) Monthly inspection

The monthly inspection shall include the following:

- Check the condition and volumes of lubricants, cooling water, and other supplements as may be required.
- Check when the SDGU has last been used and if it has not been used more recently than two weeks before the date of inspection, start and run the SDGU in an off-line mode for the minimum period recommended by the engine manufacturer.
- Visually check the SDGU components.

Issue a monthly inspection report to the Employer stating:

- The date of the inspection
- The name of the inspector
- The running hours of the engine
- Whether a test run was done and, if so, for how long
- List of parts replaced, cooling water added, lubricants added, if any
- Actions required
- Observations
- The names of Employer's staff present during the inspection, if any

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(ii) Six monthly inspections

Six monthly check all safety devices, controls and instrumentation and the general condition of the SDGU and ATS and issue a certificate to the Employer stating all tests performed and the findings thereof.

- (c) Prior arrangements with respect to access shall be made with the Employer for all activities related to this maintenance requirement.
- (d) For the purpose of this maintenance requirement, the Contractor shall be capable of providing breakdown maintenance with an 8 (eight) hour response time measured from call-out until on-site identification of the cause of failure by a qualified technician.

**PG5.3 Specification for Contractor's Design Obligations**

The Contractor shall be responsible for the following design work:

Within two weeks from the date of receipt by the Contractor of the Acceptance from the Employer, the Contractor shall submit construction drawings for the concrete foundation plinth to be constructed on site. The drawings shall include reinforcing details, the concrete composition design and strength and the details of all openings and cast-in fixtures that may be required.

Within two weeks from the date of receipt by the Contractor of the Acceptance from the Employer, the Contractor shall submit schematic cable drawings wiring diagrams and fabrication drawings showing the overall dimensions and the position and dimensions of all doors and removable panels for the ATS panel.

Within two weeks from the date of receipt by the Contractor of the Acceptance from the Employer, the Contractor shall submit drawings showing the overall dimensions, the location of doors, louvres and exhaust system for the SDGU.

## **PH ELECTRICAL PROJECT SPECIFICATION**

### **PH1. SCOPE**

#### **PH1.1 Introduction**

The Specification covers the electrical plant and equipment that is to be installed as part of the construction of the new Gabosch Dam.

#### **PH1.2 General**

Details of the electrical equipment to be supplied are given below in this specification. All low voltage (LV) switchgear, LV cabling, LV motor control, distribution boards, lighting, small power, earthing, the erection of a new 11kV overhead power line, as well as photovoltaic power (PV) supply systems, form part of this contract.

No other electrical Contractor shall carry out any other work whatsoever, unless specifically stated in this project specification. Tenderers shall ensure that prices in the schedules include for all installation materials, consumable items, and labour to provide a total and complete installation that complies with all the contract specifications.

The supply, installation, connecting and commissioning of control equipment, instrumentation, terminal equipment, pressure switches, PV equipment and components, metering equipment, surge and lightning protection equipment, as well as interfacing with such equipment, form part of this contract.

#### **PH1.3 Overview of Work and Equipment Required at Gabosch Dam**

The work and equipment described below in this specification includes the following:

- The final design development and erection of an 11kV three-phase overhead power line with wooden poles and Squirrel ACSR conductors.
- Provision and installation of an 11kV/420V three-phase Dyn11 75kVA transformer with metering box.
- Supply, delivery and installation of an emergency 75kVA diesel generator housed in an outdoor type canopy complete with automatic change-over panel and LV distribution cubicle.
- Provision and installation of new main supply cables from the distribution cubicle at the generator to the new Administration Building, the Dam Wall Control Room and the Drainage Collection Chamber of the dam wall.
- Provision, installation and interconnection of a complete PV system at the new Administration Building consisting of roof-mounted PV panels, junction boxes, inverters, batteries and ancillary equipment.
- Provision and installation of a complete PV system at the new Dam Wall Control Room for indoor lighting.
- Provision and installation of area lighting consisting of 6m poles with LED luminaires with an integrated PV panel.
- Provision and installation of 420/240 volt distribution boards.
- Supply and install new LED luminaires in the Administration Building and against the walls of areas within the dam wall (passages, galleries and rooms) and the Drainage Collection Chamber.
- All LV cabling, control cabling, and control wiring between switchgear, motors, valves,



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pumps, MCC, sensors and instruments.

- Earthing installation for all building structures, electrical equipment, PV equipment, and lightning protection devices for the electronic equipment.
- Cable trenches, cable ducts, ladders, trays and wireways.
- Testing, commissioning, handing over, demonstration (and training of personnel where necessary) of the entire installation.
- Furnishing all documentation and record drawings associated with all equipment forming part of the installation as specified.
- Issue Certificate of Compliance.

#### **PH1.4 Electrical Supply**

No existing power supply to the site is available at present. A new 11kV overhead line is to be erected to feed the new transformer at the new Administration Building at the dam site. New LV feeder cables are to be installed from the transformer position to the Administration Building, the dam wall Control Room and the Drainage Collection chamber of the dam wall.

#### **PH1.5 Site Conditions**

The site conditions shall be as described elsewhere in this document.

#### **PH1.6 Project Drawings**

The following drawings form part of this Contract:

2021/04/E-L00: General Layout Plan of Bulk Power Supply

2021/04/E-L01: Layout Plan of Internal Electrical Supply and Components

2021/04/E-D01: Electrical Single Line Diagram

2021/04/E-D02: Administration Building Lighting, Power and PV Installation Layout

2021/04/E-D03: Outlet Block Lighting and Power Layout Sheet 1 of 2

2021/04/E-D04: Outlet Block Lighting and Power Layout Sheet 2 of 2

2021/04/E-D05: Drainage Collection Chamber Lighting and Power Layout

2021/04/E-D06: Overhead Power Line Structures

#### **PH2. 11kV OVERHEAD POWER LINE**

A new 11kV three-phase overhead power line is to be constructed from the existing Water Treatment Works to the new dam. The estimated line length is 2 600m. The line shall be constructed as described in the Standard Specification for Overhead Power Lines and the Detail Specification for the erection of the power line forming part of this document.

#### **PH3. STAND-BY DIESEL GENERATOR**

A new 75kVA standby generator set shall be installed in a free-standing outdoor canopy enclosure in accordance with the Specification for Standby Generator forming part of this document.

#### **PH4. PHOTOVOLTAIC (PV) POWER SUPPLY SYSTEM**

A new PV power supply system shall be provided and installed at the new Administration Building in accordance with the Detail Specification for Photovoltaic Power Supply System forming part of this document.



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## **PH5. LOW VOLTAGE INSTALLATION**

The new overhead power line will feed the new 75kVA transformer in the vicinity of the new Administration Building, where the Municipal metering box is to be installed. The new stand-by diesel generator shall be equipped with an automatic change-over panel and LV distribution cubicle. The change-over panel shall be equipped with lightning arresters for each phase in accordance with SANS 61643 -12, shall bear the SABS mark, and shall be solidly earthed directly onto the cubicle earth bar by means of a copper strap and be as short and straight as possible.

From this LV distribution cubicle new main supply cables shall be laid in ground to the new distribution boards in the Administration Building, the Dam Wall Control Room and the Drainage Collection Chamber of the dam wall, as shown on the drawings forming part of this document.

A new distribution board shall be installed in the Administration Building to feed the circuits as shown on the drawings. This distribution shall also be connected to the inverter of the PV system and the distribution board shall function from the PV system and the mains system via the hybrid inverter, PV panels, and DC system as an autonomous no-break supply of a nominal rating of 10kWp.

A new distribution board shall be installed in the Control Room of the dam wall to feed the equipment in the dam wall. The lighting in the dam wall buildings and structure as well as instrumentation shall be connected to a back-up PV system inverter.

A new distribution board shall be installed in the Drainage Collection Chamber to feed the pumps and fans as shown on the drawings.

All LV installations shall comply with the Standard Specification for Electrical Plant and Installation forming part of this document.

## **PH6. LIGHTING AND SMALL POWER**

The layouts of small power and lighting in the different buildings and structures are shown on the drawings forming part of this document.

## **PH7. CABLING**

The supply and installation of power and control cables shall comply with the requirements of the Standard Electrical Specification.

The contractor shall supply and install the following new cables:

- From the generator change-over panel to the Administration Building DB: 16 mm<sup>2</sup> / 4 core cable with ECC copper earth wire.
- From the generator change-over panel to the Control Room DB at the dam wall: 25 mm<sup>2</sup> / 4 core cable with ECC copper earth wire.
- From the generator change-over panel to the Drainage Collection DB at the dam wall: 10 mm<sup>2</sup> / 4 core cable with ECC copper earth wire.
- From the transformer to the generator change-over panel: 25 mm<sup>2</sup> / 4 core cable with Kwen 16 mm<sup>2</sup> copper equivalent earth wire.



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All LV cables shall be 600/1000 V grade, flame retardant, low halogen, PVC insulated, PVC bedded, steel wire armoured and PVC sheathed cables with copper conductors. The sizes of the cables shall be rated according to the circuit full load and the operating conditions. Cable ducts may be provided inside the buildings and cables shall be installed on cable ladders/trays mounted against the side-walls of the trenches as specified and shown on the layout drawings. Otherwise, the cables shall be installed on cable ladders/trays mounted against the building structure walls and floors. No cable ties shall be used to fasten main cables onto cable ladders.

The Contractor shall forward drawings showing the proposed layouts of Distribution Boards and cable runs before any installation of cable ladders/trays commences. The onus is on the Contractor to ensure that the cable ladder/trays are sized correctly. All outdoor cables shall be laid at 600mm with suitable bedding and backfilling and with cable warning tape at a depth of 200mm.

#### **Measurement and Payment**

The rates for the termination of cables shall include for the making-off, glands, shrouds, lugs, wire numbers and all necessary materials to make a complete installation.

The rates for the installation of cables on cable ladders/trays shall include for the fixing clamps. A full set of cable schedules for power, control and instrumentation cables shall be prepared by the Contractor, to suit the detailed system design. These schedules shall be submitted to the Engineer before installation of cables is commenced.

#### **PH8. LIGHTING AND SMALL POWER**

The new interior and exterior lighting shall be connected to the new LV distribution boards as indicated on the drawings forming part of this document. All new luminaires shall be LED luminaires as indicated in the price schedules.

#### **PH9. EARTHING**

All the earth bars and the PV installation components shall be inter-connected and bonded with bare copper earth wire and connected to the main earth electrode/earth mat of buildings as indicated on the drawings.

#### **PH10. LIGHTNING PROTECTION**

All electronic equipment, the PV installations and signal cables shall be provided with lightning protection devices.

#### **PH11. CONTROL AND INSTRUMENTATION**

##### **PH11.1 Scope**

This Section covers the design, supply, delivery, installation, testing, commissioning and guarantee of the control and instrumentation (C&I) system of the Gabosch Dam.

The C&I system consists of:

- Level sensors
- Flow meters
- Flow valves

This Contract includes:



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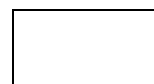
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- Instrumentation cabling;
- Interfacing to the pump and valve control panels;
- Any other installation work and materials stated or implied to provide for a complete, working installation in accordance with the Specifications, Drawings and technical schedules, and the provision of a complete data pack including record drawings, O&M manuals, etc.

#### **PH11.2 Surge Protection**

In order to protect all system input/output and power supply input (dc, mains) circuits of the control and instrumentation systems, the Contractor shall install all the necessary surge protection equipment, earth mats and earth connections.

The following equipment shall be included as an absolute minimum requirement:

- On all analogue/digital input and output circuits - DEHN BLITZDUCTORS TYPE LZ or equivalent with appropriate voltage ratings;
- On all mains power supply circuits - DEHN type VA-280 surge arrestors or equivalent;
- On all communications lines - protection network containing gas arrestors, inductors, transorb type arrestors and 600 ohm/600 ohm isolating transformers. Loop and ringing current circuits shall be optically isolated.

The Engineer may allow the use of alternative types of surge arrestors, provided that equivalent or superior protection levels are achieved. SABS and/or CSIR test reports to substantiate protection level claims shall be provided for the alternative offers.

It is possible that the stated equipment will not, when used on its own, necessarily provide the required level of protection and the Contractor shall implement additional measures deemed necessary to achieve the required protection levels as specified in SANS 62305.

#### **PH11.3 I/O and Instrumentation Work**

The work shall include the supply, delivery, installation, connection, and testing and commissioning of the entire installation, including all cabling, terminations, connectors, I/O modules, power supplies, and measuring instruments.

All flow meters and control valves shall have a separate power supply board fed from the LV panel, as well as a local level display and transmitter, with cabling to the DB as required, as well as a display on the DB or display module.

#### **PH11.4 Cabling for Control and Instrumentation**

Cable sizes, types and approximate lengths for tender purposes shall be as shown in the Bill of Quantities.

The Bill of Quantities has been prepared using estimated quantities of cables. However, the final design shall be done by the Contractor based on the actual equipment offered, and the final cable schedules, showing cable types, sizes, source, destination, route, termination details and estimated quantities shall be drawn up by the Contractor once the final design has been submitted to and approved by the Engineer.



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## **PH12. AS-BUILT DRAWINGS**

On the completion of the Works, the Contractor shall deliver to the Engineer's office one complete set-in triplicate of high-quality paper copies together with an electronically saved version (on compact disc) of the Contractor's Drawings, updated to reflect the as-built information. These drawings shall be clearly marked as "As-Built".

These drawings shall contain general arrangements, assemblies, parts lists (including part numbers) and complete component details as well as wiring and hydraulic diagrams. These items are required in draft form before the tests on completion are commenced and in final form before taking-over in terms of the General Conditions of Contract.

Layout Drawings shall be marked up by the Contractor showing all dimensions to buildings, including the relative positions of underground cables.

### **PH12.1 Drawing Format**

Drawings provided by the Contractor shall be to scale size A3 produced in hard copy and electronically in PDF format. Each Drawing shall show the following particulars in the lower right-hand corner:

- Name of Employer;
  - Name of Engineer;
  - Name of Contractor;
  - Project title;
  - Contract number;
  - Title of Drawing (location, item and detail);
  - Scale;
  - Date of Drawing;
  - Details of electrical supply (where applicable);
  - Drawing number; and
  - Revision identification.
- Dimensions on all Drawings shall be metric.

A blank space 45 mm by 30 mm shall be provided as an extension of the title block for the Engineer's approval stamp. Provision shall be made for details of revisions to be recorded above the title block. Prints of Drawings shall be in the form of black lines on a white background.

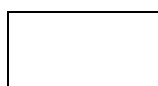
## **PH13. MEASUREMENT AND PAYMENT**

### **PH13.1 General – Supply and Delivery to Site**

The rates tendered shall include full compensation for the supply and delivery, including supply of raw materials and bought-out items, fabrication/manufacture/assembly, system design, quality inspection/tests including those witnessed by the Engineer, type and routine tests, the application of finishes (paint or corrosion protection), trial erection and dismantling, preparation and packing for transport, transport from place of manufacture to the Site, insurance, harbour dues, etc. during transport, loading and unloading, storage under appropriate conditions from the date of delivery until the commencement of installation and any other work specified.



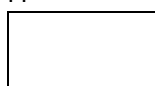
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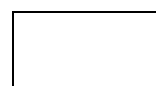
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### **PH13.2 General - Installation**

Measurement of installation shall be certified once each sub-system has been inspected and the pre-commissioning thereof has been witnessed and accepted by the Engineer.

The tendered rates shall include full compensation for the installation, including the provision of all labour, equipment, transport, materials and temporary works necessary to recover from storage and install the complete works, on-site quality assurance and quality control, inspection and testing (including attendance at tests witnessed by the Engineer), the installation and supply of all consumables (electricity, fuel, oil, lubricants, etc.) necessary for the operation of the installation, i.e. the pre-commissioning, until taken over by the Employer, the putting into service of the complete installation and any other work specified.

## **PH14. TESTING ON SITE AND COMMISSIONING**

### **PH14.1 Preliminary Testing**

The contractor shall make use of suitably qualified personnel, equipped with all necessary test equipment, to carry out all preliminary testing to ensure that all equipment is functioning correctly and free of inherent defects or faults. The Engineer shall be kept informed of the details regarding preliminary testing and shall be available to witness and comment on any relevant matters. Testing shall include but not be limited to:

- Complete physical check on all wiring, wire numbering and termination block numbering and preparation of as-built drawings accordingly.
- Physical check on all electrical clearances.
- Pressure testing of all busbars, switchgear panels and secondary wiring.
- Complete primary injection testing to confirm the correctness and accuracy of the complete protection design.
- Physical checking of all operating mechanisms and adjustments on all switching equipment.
- Calibration and setting up of all equipment to ensure proper operation.
- Such further checks as the Engineer may require subsequent to the energising of the pump station, to ensure that all equipment is operating correctly in conjunction with other parts of the installation to form a complete system.

### **PH14.2 Combined Testing**

Before combined running and operational testing commences in co-operation with other possible sub-contractors, a programme shall be drawn up and handed to the Engineer, setting out the procedures and requirements that are necessary to ensure that testing progresses smoothly.

The programme shall also indicate the involvement of specialist personnel from suppliers (e.g., PV installation and 11kV line and transformer, as well as diesel generator equipment) that shall be involved in these aspects of the project.

Tests may include the following:

- Operation of equipment on Manual control.
- Assisting other Contractors (e.g., PV suppliers, instrumentation and control contractors) to get their equipment working satisfactorily.
- Testing and/or simulating all possible running conditions and fault situations.



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- Full functional testing and checking of all telemetry signals and communications.
- Ensuring that the proposed functional operating processes work in practice.

## **PH15. TRAINING OF OPERATING STAFF**

### **PH15.1 Formal Training**

The Contractor shall state a price in the Schedules of Quantities and Prices relevant equipment for providing formal training on the PV equipment, in a training centre, for the Client's operating personnel. This shall be programmed to take place before testing on site commences.

Such training shall be done by experienced and qualified experts and shall include both theoretical and practical content relating directly to the equipment being provided.

On completion the personnel shall be fully conversant with the PV equipment, and they shall be provided with copies of all necessary documentation, manuals and/or related software.

### **PH15.2 Site Training**

The Contractor shall train the operating staff during the erection and commissioning periods to such a level where they can fully operate and maintain the system.

Training shall include the following fields:

Control operator staff to level where they are fully conversant with the functions, equipment and operation of the system.

The operator staff shall be trained in the handling of emergency operations and simulated fault conditions.

Technicians responsible for PLC's, and telemetry, if applicable, shall be trained to a level where they can run the software programmes, locate and rectify basic errors.

On completion of the above training programme and after commissioning of control systems, the Contractor shall keep suitable staff available to aid with the operation and maintenance of the system by the operating staff.

All training programmes shall be submitted to the Engineer for approval at least one month prior to the commencement of site installation work. The Engineer and/or the Employer shall supervise all training.

The Contractor shall submit a weekly report to the Engineer on the progress made by the trainees.

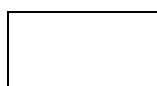
### **PH15.3 Payment**

All Employees will be remunerated by the Employer during training periods. Salaries and all the other expenses for the Contractor's staff shall be included in the tender prices.

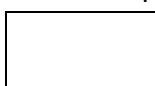
The Contractor shall at no additional cost to the Employer provide all necessary documentation and training manuals required for the training of personnel. This shall include



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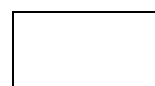
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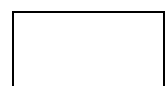
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all equipment descriptions, wiring diagrams, programme listings, etc., required to fully describe the system.

The training costs shall be indicated in the Schedules.

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## **PI MONITORING INSTRUMENTATION AND EQUIPMENT**

### **PI1. SCOPE**

#### **PI1.1 Introduction**

The Specification covers the monitoring instrumentation and equipment that is to be installed as part of the construction of the new Gabosch Dam and Flow Gauging weir.

#### **PI1.2 General**

Details of the monitoring instrumentation and equipment to be supplied are given below in this specification. The design, supply, installation, connecting and commissioning, and surveillance of monitoring equipment and instrumentation, as well as interfacing with such equipment, form part of this contract.

No other instrumentation Contractor shall carry out any other work whatsoever, unless specifically stated in this project specification. Tenderers shall ensure that prices in the schedules include for all installation materials, consumable items, and labour to provide a total and complete installation that complies with all the contract specifications.

#### **Operational Monitoring**

There must be reservoir level monitoring and recording as well as measurement and recording of all releases.

#### **Required Measurement Systems**

The following measurements are required:

- a) Uplift pressure at the base of the dam at a sufficient number of transverse sections
- b) Seepage into the dam structure and appearing downstream;
- c) Temperature of the interior of the dam concrete during construction; and
- d) Displacement measurements by geodetic survey of external targets and crack displacement devices.
- e) Measurement of stage (i.e. discharge), precipitation and evaporation at the flow gauging weir

#### **PI1.3 Overview of Monitoring Instrumentation and Equipment Required at Gabosch Dam**

The work and equipment described below in this specification includes the following:

- The final design development of the monitoring instrumentation and equipment.
- Uplift pressure in blocks 2,3,4,5 and 6.
- Dam concrete internal temperatures in blocks 3,4,5 and 6.
- Seepage flow measurement.
- Dam/Reservoir water level measurement.
- Gauging weir - Stage measurement (i.e. discharge) and real time recording, rain gauge and evaporation station.
- Displacement measurement with Crack Displacement Gauges.
- Geodetic Measurement Survey Beacons and Targets.
- Cables, cable trenches, cable ducts and trays.
- Testing, commissioning, handing over, demonstration (and training of personnel where necessary) of the entire installation.

- Surveillance at 3-month intervals during the Defect Liability Period.
- Furnishing all documentation and record drawings associated with all equipment forming part of the installation as specified.
- Issue Certificate of Compliance.

#### **PI1.4 Electrical Supply**

No existing power supply to the site is available at present. A new 11kV overhead line is to be erected to feed the new transformer at the new Administration Building at the dam site. New LV feeder cables are to be installed from the transformer position to the Administration Building, the dam wall Control Room and the Drainage Collection chamber of the dam wall.

#### **PI1.5 Site Conditions**

The site conditions shall be as described elsewhere in this document.

#### **PI1.6 Project Drawings**

The following drawings form part of this Contract:

2021/04/DW-L10: General Layout of Dam Monitoring Network

2021/04/DW-D08: Intake Tower Detail Sections – Sheet 1 of 2

2021/04/DW-D17: Drainage Collection Chamber Details

#### **PI2. UPLIFT PRESSURE MEASUREMENT**

Uplift pressures will be monitored on Blocks 2, 3, 4, 5 and 7 (Outlet Block). Instrumentation will be vibrating wire piezometers or offered alternatives, depending on the best selection at the time of construction. The installation shall be complete with PVC cabling, Readout Unit, Terminal box and readout unit calibration system.

Positions of foundation / uplift pressure piezometers will be:

- between the grout curtain and drainage curtain, and
- 3m upstream of the downstream toe of the dam

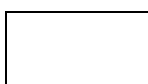
With two piezometers per block, spaced on each longitudinal line. There should be 4 piezometers per block. Readout shall be in the Outlet Block office.

Two piezometers shall be placed in the downstream rockfill at approximate chainages 50, and 73m. Cables from these piezometers can be laid with the seepage monitoring drains and readout shall be in the Seepage Well building. (Max cable length approximately 115m).

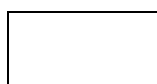
#### **PI3. INTERNAL TEMPERATURE MEASUREMENT**

These will be monitored in the early blocks specifically, in particular 2, 4, 3 and 5 (in the sequence in which they will be constructed).

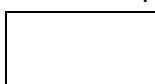
Temperatures shall be monitored at three positions at the approximate cross-section centroid, and at 1m from the upstream face and 2m from the downstream face, with sensors placed in recesses near the surface of lifts 1, 3 and 5 of each monitored block. Accuracy of temperature sensing should be to 1° C and any encased battery should have a life of at least 2-years. Wireless temperature readout systems shall have battery lives of at least two (2) years. Cables for direct readouts should eventually be located in the Outlet block.



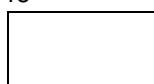
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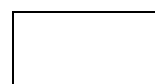
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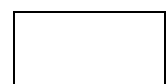
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## **PI4. PHYSICAL MEASUREMENT SYSTEMS**

### **PI4.1 Reservoir Level**

#### **PI4.1.1 Automatic Level Sensing and Recording**

This will be measured by duplicate pressure transducers with 4-20mA output with relevant roll chart graphic recorder and digital record every 12 hours. The transducer will be located in a vertical tube well in the screened inlet section to the 800mm dia. outlet, which will have a duplicate tube as a flushing system to remove any debris occluding the intake. The read out / recording unit shall be in the office of the outlet block and report via SCADA to the control room at the water treatment works.

#### **PI4.1.2 Gauge Plates**

Gauge plates to standard DWS design must be mounted on the northeast face of the outlet block so that they are visible from the roadway.

### **PI4.2 Release Flow Measurement**

The 200mm dia. outlets and 800mm dia. outlet will be metered by in-line "Magflo" flow meters or similar.

The outputs from the meters will be 4-20mA with display of instantaneous flows and total discharged volumes. These meters will report to readout and totalisers on the operating level and report via SCADA to the control room at the water treatment works. This installation shall be done in consultation with the electrical installation as per PH11.1.

### **PI4.3 Seepage Flow**

Seepage from the concrete section inspection gallery and the rockfill core and foundation area shall be measured in the Seepage Well at the toe of the rockfill adjacent to the spillway outfall. This will be in five (5) V-notch bays requiring continuous flow depth measurement and recording at daily intervals. The depth range anticipated in the V-notches is 350mm.

Gauge plates shall be installed in each bay with zero on the V-notch level.

The read out / recording unit shall be in the office of the outlet block and report via SCADA to the control room at the water treatment works.

### **PI4.4 Release flow measurement at Gauging weir**

Stage measurement by means of pressure transducer shall be installed up and downstream of the gauging weir. These shall be connected to a real-time recorder. Gauge plates shall be installed to for physical measurement purposes of the stage (i.e. water level) upstream of the weir.

An automatic rain gauge and evaporation station shall be installed for the purposes of calculating a dam balance and subsequent inflow into the new dam. A suitable position needs to be determined on site during construction. Proposed locations are either the dam, the gauging weir or water treatment works.

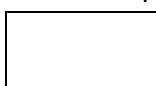
The read out / recording unit shall be in the instrumentation hut and report via SCADA to the control room at the water treatment works.



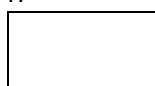
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Witness 2



Employer



Witness 1



Witness 2



All equipment shall be in accordance to the relevant Department of Water and Sanitation and regional hydrological services standards.

**PI5. DISPLACEMENT MEASUREMENT**

Displacement measurements shall be done using installed 3-D crack / tilt gauges with handheld digital micrometers. These are to be placed across each block-to-block joint in the drainage gallery, on the upstream face, including the joint with the retaining wall, (8No.) and on surface the upstream edge of the crest of the gravity sections on the left flank (4No). A total of three (3) digital micrometers shall be supplied with a dummy gauge for calibration.

The proposed locations of the 3-D crack / tilt gauges and piezometer are shown on drawing 2021/04/DW-LS01 and D13.

**PI6. TESTING ON SITE AND COMMISSIONING**

**PI6.1 Preliminary Testing**

The contractor shall make use of suitably qualified personnel, equipped with all necessary test equipment, to carry out all preliminary testing to ensure that all equipment is functioning correctly and free of inherent defects or faults. The Engineer shall be kept informed of the details regarding preliminary testing and shall be available to witness and comment on any relevant matters. Testing shall include but not be limited to:

- Complete physical check on all equipment, wiring and preparation of as-built drawings accordingly.
- Physical checking of all operating mechanisms and adjustments on all equipment.
- Calibration and setting up of all equipment to ensure proper operation.

**PI6.2 Combined Testing**

Before combined running and operational testing commences in co-operation with other Contractors, a programme shall be drawn up and handed to the Engineer, setting out the procedures and requirements that are necessary to ensure that testing progresses smoothly. The programme shall also indicate the involvement of specialist personnel from suppliers (e.g., Piezometers, Pressure Transducers etc.) that shall be involved in these aspects of the project.

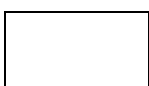
Tests may include the following:

- Operation of equipment on Manual control.
- Assisting other Contractors (e.g., Piezometers, Pressure Transducers suppliers, SCADA and Telemetry suppliers) to get their equipment working satisfactorily.
- Testing and/or simulating all possible running conditions and fault situations.
- Full functional testing and checking of all telemetry signals and communications.
- Ensuring that the proposed functional operating processes work in practice.
- Fully automatic operation as an integrated system of all monitoring instrumentation and equipment to the satisfaction of the Engineer and the Employer.

**PI7. TRAINING OF OPERATING STAFF**

**PI7.1 Formal Training**

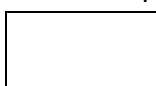
The Contractor shall state a price in the Schedules of Quantities and Prices relevant equipment for providing formal training on the instrumentation and equipment, in a training



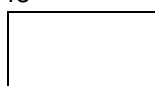
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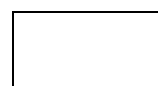
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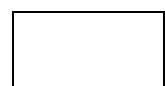
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Witness 2

centre, for the Client's operating personnel. This shall be programmed to take place before testing on site commences.

Such training shall be done by experienced and qualified experts and shall include both theoretical and practical content relating directly to the equipment being provided.

On completion the personnel shall be fully conversant with the instrumentation and equipment, and they shall be provided with copies of all necessary documentation, manuals and/or related software.

#### **PI7.2 Site Training**

The Contractor shall train the operating staff during the erection and commissioning periods to such a level where they can fully operate and maintain the system.

Training shall include the following fields:

- Control operator staff to level where they are fully conversant with the functions, equipment, and operation of the system.
- The operator staff shall be trained in the handling of emergency operations and simulated fault conditions.

On completion of the above training programme and after commissioning of monitoring instrumentation and equipment systems, the Contractor shall keep suitable staff available to aid with the operation and maintenance of the system by the operating staff.

All training programmes shall be submitted to the Engineer for approval at least one month prior to the commencement of site installation work. The Engineer and/or the Employer shall supervise all training.

The Contractor shall submit a weekly report to the Engineer on the progress made by the trainees.

#### **PI7.3 Payment**

All Employees will be remunerated by the Employer during training periods. Salaries and all the other expenses for the Contractor's staff shall be included in the tender prices.

The Contractor shall at no additional cost to the Employer provide all necessary documentation and training manuals required for the training of personnel. This shall include all equipment descriptions, wiring diagrams, programme listings, etc., required to fully describe the system.

The training costs shall be indicated in the Schedules.

#### **PI8. SCHEDULED ITEMS**

The tendered rates shall include full compensation for the installation, including the provision of all labour, equipment, transport, materials and temporary works necessary to recover from storage and install the complete works, on-site quality assurance and quality control, inspection and testing (including attendance at tests witnessed by the Engineer), the

installation and supply of all consumables necessary for the operation of the installation, i.e. the pre-commissioning, until taken over by the Employer, the putting into service of the complete installation and any other work specified.

**PI8.1 Design Development of Monitoring Instrumentation and Equipment.....Sum**

Selection and Design Development of Monitoring Instrumentation and Equipment System will include a design report and detailed drawings, to be approved by the Employer's Agent.

**PI8.2 Piezometers**

- a) **Piezometer installation at foundation sites complete.....No.**
- b) **Cables and cable ducts including bends and draw boxes.....m**
- c) **Temporary Terminal Box.....Sum**
- d) **Permanent Terminal .....Sum**
- e) **Readout Unit and Calibration.....Sum**

Measurement of installation shall be certified once each sub-system has been inspected and the pre-commissioning thereof has been witnessed and accepted by the Engineer.

**PI8.3 Dam Internal Temperature Measurement**

**a) Cables Temperature Sensors**

- i) **Unit.....No.**
- ii) **Cables and cable ducts including bends and draw boxes.....m**
- iii) **Temporary Terminal Box.....Sum**
- iv) **Permanent Terminal .....Sum**
- v) **Readout Unit and Calibration.....Sum**

**b) Wireless Temperature Sensors**

- i) **Unit.....No.**
- ii) **Readout Unit and Calibration.....Sum**

Measurement of installation shall be certified once each sub-system has been inspected and the pre-commissioning thereof has been witnessed and accepted by the Engineer.

**PI8.4 Displacement Measurement**

- a) **3D Crack Displacement / Tilt Surface Displacement Gauges.....No.**
- b) **Digital micrometer reading units.....No.**

Measurement of installation shall be certified once each sub-system has been inspected and the pre-commissioning thereof has been witnessed and accepted by the Engineer.

#### PI8.5 Physical Measurement Systems

- a) Reservoir Level
  - i) Automatic Sensing / Recoding Unit with SCADA connection (0-25m)...Sum
  - ii) Reservoir Level Guage Plates.....Sum
- b) Release Flow Meters and Output Display / Recording and SCADA connection
  - i) 200mm dia.....No.
  - ii) 800mm dia.....No.
- c) Seepage Flow Measurement
  - i) Electronic Level Sensor (0-500mm).....No.
  - ii) Sensor Mounting and Cabling.....No.
  - iii) Readout Display and Recording & SCADA connection.....No.
  - iv) Gauge Plates.....No.
- d) Allowance for Gauging Weir instrumentation
  - i) Stage Measurement, Real-Time Recorder, Rain Gauge and Evaporation Station etc.....PSum

Measurement of installation shall be certified once each sub-system has been inspected and the pre-commissioning thereof has been witnessed and accepted by the Engineer.

#### PI8.6 Training

- a) Formal Training.....PC Sum
- b) Site Training.....PC Sum

Prime Cost Sums has been allowed for training of operating staff as per Clause PI9. Measurement of training shall be certified once all staff has been formally and stie trained with the submission of the necessary documentation (e.g. Certificates) as proof.

#### PI8.7 Handling Fee for Contractor's Cost and Expenses.....%

The main contractor will be allowed to charge a percentage (%) fee as a Contractors' Charge on the above-mentioned Sums.

## **PJ FOUNDATION DRILLING AND GROUTING**

### **PJ1. SCOPE**

#### **PJ1.1 Introduction**

The Specification covers the drilling and curtain grouting that has to be done as part of the construction of the new Gabosch Dam.

#### **PJ1.2 General**

The detail of the work to be carried out under this section of the contract includes, but is not limited to:

- The Sub-Contractors site establishment, including establishment of grouting installations, water installations, compressed air installations, drilling equipment, and any equipment related to doing the work.
- Performing a test section first in order to establish the grouting method statements, suitable drilling equipment as well as grout mixes to be used.
- The curtain grouting, in stages, for the full length of the dam wall. Because of the inclination and orientation of the holes, grouting will preferably be done from the first or second layer of concrete. The rates for drilling and grouting should make provision for this.
- Drilling pressure relief holes vertically down into the dam foundation from within the gallery or from the downstream face of the left flank dam wall.
- Documenting the drilling, water tests and grouting activities.
- Completion report covering the actual methods employed, including the pressure and grouting record for each component and the as-built drawings.
- Due to the nature of the construction activities, it may be required to have intermediate de-establishment and establishment.

All work shall be done in accordance with the specifications listed in the Particular Specification and Drawings

#### **PJ1.3 Extent of the Contract**

The final extent of the contract will depend on the results of the grouting tests and the effectiveness of the proposed grouting procedures. The quantities are considered to be a reasonable estimate of the expected work to be done under this contract.

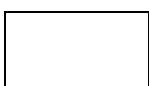
In practice however there may be areas where less grouting is required and other areas where more extensive grouting will be required. This implies that not all work described in this specification will be undertaken.

#### **PJ1.4 Site and General Geological Conditions**

The site conditions (Location, Weather etc.) shall be as described elsewhere in this document. For the general geological conditions, refer to the Geotechnical Report attached to this as Annexure E

#### **PJ1.5 Project Drawings**

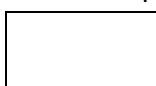
The following drawings form part of this Contract:  
2021/04/DW-L01: General Layout of Dam



Contractor



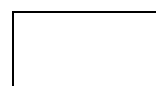
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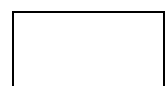
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Employer



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## **PJ2. GROUTING OF THE FOUNDATION**

The final specifics of the grouting will be determined after performing a test section first in order to establish the grouting method statements, suitable drilling equipment and well as grout mixes to be used.

Curtain grouting (angle to be specified) will be done as indicated on the drawings. The maximum depth is approximately 23.5m.

Grout holes are envisaged to be inclined at 70 degrees to both planes, which gives a net inclination of 63 degrees on a line at 45 degrees to the dam centreline along the spillway and embankment sections. For the left flank section, the grout hole orientation is rotated through 90 degrees. Primary hole spacing is envisaged to be 7,5m along the main dam sections and 5m along the left flank. Because of the inclination and orientation of the holes, grouting will preferably be done from the first or second layer of concrete. For the asphalt core, this is obligatory.

Spacing of primary holes along the spillway would be at 7,5m centres, which is a hole spacing of just under 5m. Spacing on the left flank should be 5m. The area around the Outlet Works is a bit complex, with changes in directions of holes and the necessity to reduce uplift as much as possible.

Tertiary holes between the secondary holes may be required, depending on the decision of the Approved Professional Person (APP) after all the pressure testing results of the primary and/or secondary grout holes has been presented to the APP by the Contractor.

This pattern is continued into the rockfill area, where the asphalt plinth lengths will be 7,5m as well, to suit the grout hole spacing. No particular attention has been paid to the paleochannel area or the right abutment. Where there are particular problems here with wedges of rock allowing percolation through the cut-off, specific remediation / foundation treatment must be specified after cleaning and primary (or more) grouting.

## **PJ3. GROUTING OF BLOCK JOINTS**

Block joints shall have incorporated tube-a-manchette grout pipes set in at the time of concreting. These will either emerge on the non-overspill crest or be connected through to the inspection gallery. In the case of connection to the inspection gallery, an air release pipe shall be incorporated to enable de-airing as the grouting commences.

Grout water cement ratio will be a nominal 1:1 with grout pressures being to 0,5 bar above the non-overspill crest. Grouting shall be taken to refusal or evidence of leakage onto the upstream face or gallery.

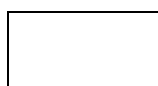
Grouting will be carried out on each joint 30 days after the latest block completion.

## **PJ4. DRILLING OF DRAINAGE HOLES**

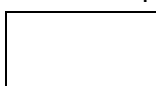
After all grouting has been completed, tested and accepted, pressure relief holes with a diameter of 102mm NB will be drilled (at an angle specified) downwards, downstream of the grout curtain, at 2,5m centres from within the gallery, and other outside the gallery such as



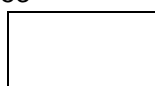
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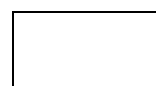
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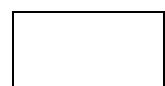
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Employer



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Witness 2

on the asphalt core concrete plinth, into the foundation to 70% of grout curtain depth (Approximately 45% of Hydrostatic Head), ranging from 10m to 2m deep. The positions are indicated on the drawings.

#### **PJ5. REMEDIAL WORK IN THE PALEO CHANNEL**

The suspected paleo channel or waterfall plunge pit may be remediated by colgrouting techniques, which is flushing out the fines in the whole volume and grouting the residual pebble / boulder mass. This may be done in downward stages, involving drilling, casing, flushing, grouting, redrilling, flushing etc.

#### **PJ6. CONSTRUCTION MATTERS**

##### **PJ6.1 General Responsibilities**

The Site and all services are under the control of the Contractor and therefore the Employer expects the Sub-Contractor to liaise regularly with the Contractor in order to ensure smooth execution and integration of activities with the Contractor's activities.

Due to the specialised nature of the Works the Contractor shall ensure that qualified technical staff is available on site to carry out the necessary calculations for setting out of the grout hole positions as well as undertake the setting out. The contractor must liaise in time with the Main Dam Contractor on his requirements.

##### **PJ6.2 Methods and Materials**

It is a requirement of this contract that final work procedures must be approved before commencement of work. Method statements with full details concerning the methods, equipment and materials will be required for the following but not limited to:

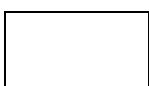
- Grouting procedure including drilling water testing and grouting.
- Disposal of waste and clean-up of excess grout and spillages.

##### **PJ6.3 Quality Management**

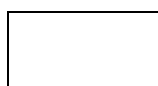
The Contractor shall be responsible under the Contract for the quality and testing of materials, workmanship and production processes in fulfilment of the Contract. The Contractor shall have a Quality Management system in place which details the following in order to satisfy the Specification relevant to each operation to the works in accordance with the Contract

- Quality control procedures;
- Personnel responsibilities;
- Testing procedures, both on and off-site;
- Equipment and calibration;
- Frequency of testing, calibration, etc.;
- Hold points in production for inspection;
- Rejection and rectification procedures;
- Documentation and communication;
- Drawing issue procedures; and
- Drawing register.

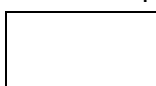
As much of the testing as is practicable shall be carried out on Site, including trial, acceptance and routine testing which is the responsibility of the Contractor, and any other tests as instructed by the Engineer for any additional investigations required from time to time during the course of the Contract.



Contractor



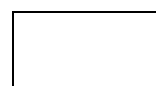
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Witness 2



Employer



Witness 1



Witness 2

#### **PJ6.4 Provision of Materials and Goods**

The Contractor shall supply his/her own cement conforming to SANS 50197

#### **PJ6.5 Grout Mixes**

Grouting trial on initial drill holes will indicate the range of grout mixes to be used. Exploratory drilling has indicated a general mix with 2:1 water cement ratio, which may be thinned to 2.5:1 for zones of tight jointing. The Contractor will be required to carry out tests in conjunction with the Engineer's staff to determine the grout mixes and management of higher take areas.

If the contractor intends to use any additives, he must submit full technical information and the applicable standard for approval before commencement of work.

#### **PJ6.5 Competence of Workmen**

The-Contractor shall ensure that only competent personnel are employed in operations involving particular skills affecting the quality of the works. Should the competence of any member of the Contractor's workforce be in doubt, the Engineer may order that the member be sent for additional training at the Contractor's account and/or that member be replaced with a competent person to perform that work.

#### **PJ6.6 Grout Sludge Clean-ups and Disposal**

The Contractor shall make arrangements for the clean-up of soft and hardened grout sludge as well as soil materials contaminated by grout. Provision must be made for the removal of grout stains on exposed rock faces as well as all concrete on site.

Grout and sludge in all waste forms shall be contained in such a manner (e.g., temporary earth bunds etc.) and shall be disposed of at designated sites within the dam basin. No grout spill shall be allowed to enter the river downstream of the dam, upon which the works shall be suspended. All machines must have drip trays for oil spillages, of which any hydrocarbons to be disposed at an approved facility.

#### **PJ7. SCHEDULED ITEMS**

The tendered rates shall include full compensation for the provision of all labour, equipment and temporary works necessary to complete set up, to drill, removal on completion of drilling and grouting at the specific location, grout clean-ups and disposal, including on-site quality assurance and quality control, inspection and testing (including attendance at tests witnessed by the Engineer), and the installation and supply of all consumables necessary for the operation of the installation.



### PJ7.1 Setting up

- a) On Natural Surfaces.....No.
- b) On Concrete Base – 1m to 2m thick.....No.
- c) On Gravity Section downstream face.....No.
- d) In Gallery.....No.
- e) Extra-Over Re-Setup.....No.
- f) For Drilling Drainage Holes.....No.
- g) For Paleo Channel Remedial Work.....No.

The tendered rates shall include full compensation for setting up of drilling and grouting equipment (Per set up) in locations and on surfaces as itemised.

### PJ7.2 Drilling

#### PJ7.2.1 Drilling holes for grouting or drainage holes

- a) Subvertical down.....m
- b) Inclined down 60 - 30 degrees.....m
- c) Sub horizontal.....m
- d) Inclined up 60 - 30 degrees.....m
- e) Subvertical up.....m

#### PJ7.2.2 Redrilling through grout

- a) Subvertical down.....m
- b) Inclined down 60 - 30 degrees.....m
- c) Sub horizontal.....m
- d) Inclined up 60 - 30 degrees.....m
- e) Subvertical up.....m

#### PJ7.2.2 Drilling into Paleo boulder deposit

- a) Subvertical down.....m

The tendered rates shall include full compensation for the drilling (per linear meter) at the orientation as specified.

### PJ7.3 Casing / Standpipes.....m

The tendered rates shall include full compensation for the installation of the casing and/or standpipes (per linear meter).

### PJ7.4 Pressure Tests.....No.

The tendered rates shall include full compensation for the comprehensive water pressure testing of grout holes (Number of) as specified, including the connections for performing the test using a single packer. It shall further include the presentation of the results to the Employer's Agent and APP.

**PJ7.5 Grout Materials**

- a) Cement.....No. of 50kg bags  
b) Bentonite.....No. of 40kg bags  
c) Sand.....m<sup>3</sup>

The tendered rates shall include full compensation for the supply of grouting materials as specified.

**PJ7.6 Flushing of Grout.....No.**

The tendered rates shall include full compensation for the flushing of grout (Per hole). The tender rate shall include the provision for mixing the grouting materials (including water as required) to the desired mix. Material for grouting measured and paid under Item PJ 5.5.

**PJ7.7 Remedial Works to Paleo Channel (Colcrete Grouting).....m<sup>3</sup>**

The tendered rates shall include full compensation for remedial work to the paleo channel. Method of remediation and/or foundation treatment to be finalised upon inspection of cleaned foundation excavation. Treatment is envisaged to be colgrouting of voids.

**PJ7.8 Progress and Grout Takes Reporting and Completion Report.....Sum**

Drilling and Grouting shall be reported on every week, giving details of hole position, direction and inclination, drilling advances, pressure testing and grouting. Within 30 days after the end of the drilling and grouting of foundations and paleo channel, the Contractor must submit a completion report covering the actual methods employed and the consolidated data from weekly reports. All the information shall be compiled into as-built documentation.

**PK ROCKFILL EMBANKMENT**

**PK1. SCOPE**

The work consists of the construction of rockfill zones of embankments and other rockfills required by the drawings and specifications.

**PK2. MATERIALS**

Material for rockfill and bedding shall be obtained from the specified rock quarry and from selected dam foundation excavation, as instructed by the Engineer. The material shall be excavated, selected, processed, and handled as necessary to conform to the specified grading requirements as specified in Section C4.2.

**PK3. ROCK QUARRY DEVELOPMENT**

Rock Quarry development shall be to the lines and levels shown on the drawings and shall be described in full detail in Method Statements to be approved by the Engineer.

Rock quarry development generally will require initial ripping or blasting after clearing and grubbing and prior to stripping.

Where rockfill borrow becomes too coarse for placement and compaction by available or specified equipment, borrow operations shall be adjusted or new areas located for producing acceptable rockfill sizes. Blast hole patterns, type and amount of explosives, and delayed blast timing plan shall be adjusted to produce the desired rock gradation sizes. Oversized rocks shall be selectively removed during borrow excavation and "grizzly" screening. The removal of oversize rock during fill placement by dozing fragments to the downstream embankment slope will not be permitted.

**PK4. EMBANKMENT FOUNDATION PREPARATION**

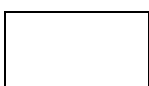
Foundations for rockfill shall be stripped to remove vegetation and other unsuitable material or shall be excavated as specified and shall be described in full detail in Method Statements to be approved by the Engineer.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities, and test pits or other cavities shall be filled with compacted earthfill of approximately the same kind and density as the adjacent foundation material.

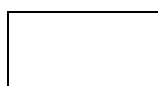
Rock foundation surfaces shall be cleared of all loose material not conforming to the specifications for the rockfill.

Abutments for rockfill zones of embankments shall be prepared as specified above for foundations.

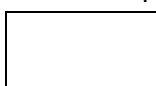
Rockfill and/or bedding shall not be placed until the foundation preparation is completed and the foundation and excavations have been inspected and approved.



Contractor



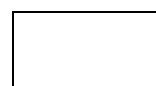
Witness 1



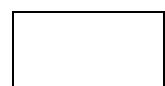
Witness 2



Employer



Witness 1



Witness 2

## **PK5. BEDDING**

When a bedding layer beneath rockfill is specified, the bedding material shall be spread uniformly on the prepared subgrade surfaces to the depth indicated. Compaction of the bedding material shall be as specified in this specification.

## **PK6. TEST EMBANKMENT PLACEMENT AND COMPACTION TESTING**

Test Embankment Placement and compaction testing shall be advised by the following guidelines and shall be described in full detail in Method Statements to be approved by the Engineer.

### **PK6.1 General**

Following rock borrow selection and development and moisture conditioning procedures have been determined, the Contractor shall carry out test embankment procedures for acceptable rockfill lift thickness and compactive effort with the specified or available onsite construction roller equipment. The established rockfill placement and compaction procedures from test fill performance shall be subsequently verified by in-place density and gradation test results in the rockfill structure.

### **PK6.2 Test Embankment Layout**

The test embankment shall be within the area upstream of the core structure designated as a spoil area of selected material from foundation excavations. The foundation area shall be compacted by ten passes of the vibratory steel drum compactor or heavy rubber-tired roller planned for use in the test fill to minimize the effect of subsequent roller pass settlements in the test fill subgrade.

The test embankment limits shall be determined by the size of the construction equipment and the number of lifts to be used for testing rockfill placement and compaction. The minimum width of the test fill subgrade area shall be three times the width of the compaction roller and three times the height of the final test fill surface above the base level, as shown in Equation 1.

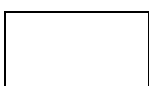
Test Embankment Minimum Base Width =  $(W \times 3) + (N \times T \times 3)$  (Eq. 1)

Where: W = Roller drum width,  
N = Number of lifts to be placed, and  
T = Planned loose lift thickness.

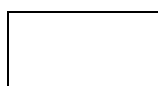
A typical 10-ton vibratory roller with a drum width of 2.0 m and say two test fill lifts of 0.45m each should have a 9m minimum test fill subgrade base width, allows the steel drum roller compactor to stay about 0.3 m away from the edges of the final lift fill level for support purposes.

Test Embankment Minimum Base Width =  $(2m \times 3) + (2 \text{ lifts} \times 0.5 \times 3) = 9m$  (Eq. 2)

The compactor length dictates how much level fill surface length is required between the ramp and test area for level compaction across the test section. The test fill length is generally at least two times the width to allow the vibratory compaction operator to set and adjust his speed and vibration controls before crossing the planned control area on a level test fill



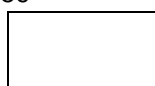
Contractor



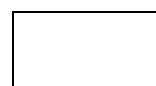
Witness 1



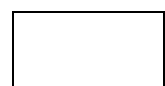
Witness 2



Employer



Witness 1



Witness 2

surface. Ramps shall be used at both ends of the test embankment as needed to place, spread, and compact each lift horizontally; similar to planned operations.

The minimum length at the base of the test embankment pad would be about 18 m, depending on the time required to set compaction controls. Shorter test fill lengths are possible when the operator does the machine adjustments outside of the test fill limits before reaching the ramp to the level test fill surface.

### **PK6.3 Lift Thickness**

An 8 to 15 ton (static drum weight) smooth steel drum vibratory compaction rollers generally have an effective rockfill compaction lift thickness of between 0.5 to 1 m in about 4 roller passes on moistened rockfill. The 20 ton (static drum weight) smooth steel drum vibratory compaction rollers generally have a deeper effective rockfill compaction lift thickness of between 1 to 1.5 m in about 4 passes on moistened rockfill. The definition of moistened rockfill for this discussion is minus 19 mm earthfill materials within a range of 2 percent dry to 2 percent wet of optimum moisture content.

The maximum lift height will be specified by the Engineer depending on available plant and the results of the test embankment compaction. The maximum rock size shall be no more than 2/3 of the layer depth.

### **PK6.4 Lift Placement**

The Contractor's Method Statement shall detail how lift placement will be carried out with particular reference to controlling the level and thickness of the uncompacted layer as well as minimising segregation.

### **PK6.5 Roller Type**

Experience indicates the most efficient rockfill compactors are 8-to-20-ton vibratory steel drum rollers. Test fill information and visual observations of rockfill test pits indicate the steel drum vibration range is most efficient at 1,200 to 1,500 vibrations per minute (vpm) at a roller speed of about 3 km/h. This roller speed is equivalent to a casual walk by a person across level ground. The rockfill surface is generally not uniform in rock fragment distribution so that the natural resonance of the rockfill can be somewhat variable, when measured with a vibration meter. The Contractor will discuss the use of a particular roller in his Method Statement.

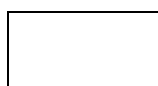
### **PK6.6 Roller Passes**

After the loose lift is placed, an initial survey of the lift surface shall be conducted by spray painting a cross pattern with a test point number at each control point to be surveyed. Occasional rock protrusions in the selected control point areas shall be removed and filled in with smaller rock or the fill surface is proof-rolled by a single pass of the smooth drum roller without vibration to seat the rock for initial survey readings.

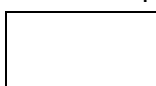
The control points shall be surveyed for elevation (settlement) readings versus roller passes using a conventional survey level, rod, and minimum 0.3 m square plate having a cross pattern and centre mark. The cross pattern on the plate shall be lined up to match the control point cross pattern on the fill surface for consistent survey readings at the exact same location on the rocky surface.



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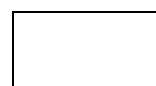
Witness 1



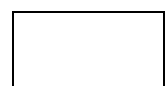
Witness 2



Employer



Witness 1



Witness 2

A minimum of five control points for each lift shall be analysed for acceptable test fill control. The control points shall be laid out in a pattern for the central portion of the roller drum to pass over the control points with about 0.3 m of side overlap for each pass.

A total of eight passes in two-pass increments shall be made for each test embankment lift to evaluate settlement versus roller passes and determine the required number of passes acceptable for rockfill placement for the particular rock on site. In general, the required number of passes is set at 80 percent of the total settlement in eight passes or a maximum of six passes.

Excessive passes on rockfills with large or heavy roller equipment tend to pulverize and crush the surficial 0.15 to 0.3 m of rockfill without significantly improving the density of the lower portion of the lift. The engineered test fill survey control work to determine acceptable roller passes on active rockfill placement areas can be conducted over a period of less than one hour for each lift (marked survey readings on the active lift after each two-pass increment).

Once the optimum roller compactive effort has been determined the Engineer may reduce the survey requirements, but is not obliged to do so.

**PK7. PLACEMENT**

The rock shall be dumped and spread into position in approximately horizontal layers not to exceed 1m in thickness. It shall be placed to the lines and levels and tolerances shown on the drawings to produce a reasonably homogeneous stable fill that contains no segregated pockets of large or small fragments or large unfilled spaces caused by bridging of the larger rock fragments. The maximum rock size shall be 450mm as specified in Section C4.2 of these Specifications.

**PK8. CONTROL OF MOISTURE**

The moisture content of rockfill material shall be controlled as specified in section 10 of this specification. When the addition of water is required, it shall be applied in a manner to avoid excessive wetting of adjacent earthfill. Except as specified in section 10 of this specification, control of the moisture content is not required.

The moisture content of the bedding material shall be controlled to ensure that bulking of the sand materials does not occur during compaction operations.

**PK9. COMPACTION OF ROCKFILL**

Rockfill shall be compacted as described below or by an approved equivalent method.

Each layer of fill shall be compacted by at least four passes over the entire surface with a steel-drum vibrating roller that weighs at least 5 tons and exerting a vertical vibrating force of not less than 20,000 pounds at a frequency not less than 1,200 times per minute.

Heavy equipment shall not be operated within 1m of any structure. Vibrating rollers shall not be operated within 1.5m feet of any structure. Compaction by means of drop weights operating from a crane, hoist, or similar equipment is not permitted.

When rockfill is placed in trenches or other locations inaccessible to heavy equipment it shall be compacted by manually controlled pneumatic or vibrating tampers or by equivalent methods approved by the engineer.

**PK10. MEASUREMENT AND PAYMENT**

For items of work for which specific unit prices are established in the contract, the volume of each type of rockfill, including bedding, with the zone boundaries and limits specified on the drawings or established by the engineer is measured and computed to the nearest cubic meter by the method of average cross-sectional end areas.

Payment for each type of rockfill is made at the contract unit price for that type of fill. Except as otherwise specified in section 10 of this specification, such payment will constitute full compensation for all labour, equipment, material, and all other items necessary and incidental to the performance of the work including furnishing, placing, and compacting the bedding material.

Compensation for any type of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in **PSDE 8.3** of this specification.



Contractor



Witness 1



Witness 2



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Witness 2

**PL ASPHALT CORE**

**PL1. SCOPE**

The work consists of the construction of asphalt core and adjacent filter and transition rockfill zones of embankments as required by the drawings and specifications.

**PL2. MATERIALS**

**PL2.1 Graded Crushed Rock**

Material for rockfill transition and filter zones shall be obtained from the specified rock quarry, as instructed by the Engineer. The grading curves for specific zones are given in Section C4.2.

**PL2.2 Bitumen**

B60 type bitumen shall be used for the asphalt mix, unless otherwise authorised by the Engineer

**PL2.3 Asphalt Mix.**

AC test samples containing various bitumen content shall be prepared, ranging from 5.5-7.0 percent, on which Marshall tests shall be performed. Table 4 presents the final bitumen content and various other parameters of the AC laboratory samples.

Parameter	Unit	Target Value Range
Bitumen content	%	6.0 – 6.8
Specific Gravity	No	2.4 -2.45
Air voids content	%	1.8 – 2.0
Stability	N	3650 - 3800
Flow	mm	7.2 -7.5

**PL3. TEST ASPHALT CORE PLACEMENT AND COMPACTION**

Test Core Placement and compaction testing shall be advised by the following guidelines and shall be described in full detail in the Contractor's Method Statements to be approved by the Engineer.

**PL3.1 General**

It is expected that the Contractor has had no experience in constructing an asphalt cored rockfill and that there will be reliance on information available in literature. The following is information taken from the paper titled "Asphalt concrete core of the Meijaran dam in brief": Soltani A.S. and Litkouhi S; Dam Engineering Vol XX Issue 3., which is available from the Engineer.

**PL3.2 Test Core Layout**

The test core shall be carried out on foundation plinths laid between Chainages 60m, and 90m so as to be incorporated in the dam structure and out of the way of critical path activities. The sections of the trial outside the central nominal 16m will be required to be removed after the trial unless otherwise agreed to by the Engineer.

**PL3.3 Sequence of Testing**

Testing will include the following sequence:



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Witness 1



Witness 2



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Witness 1



Witness 2



- Foundation preparation;
- Anchor placing, including drilling and grouting with non-shrink grout;
- Concrete plinth construction requiring at least three lateral joints, so as to include three joints with Sikaflex sealing and cold bitumen junction pots;
- After curing 7 days, applying a bitumen tac coat over the whole length of the test strip allowing this to cure and test adhesion;
- Placing filter material with shutters along the core sides;
- Survey levels and prepare for compaction measurement;
- Heat tac coat and place 0.2m layer of asphalt parallel to foundation concrete;
- Survey;
- Compact with 3 passes of vibratory plate compactor and survey;
- Survey and compact with further 3 passes;
- Repeat to total of 9 passes;
- Add 0.3m of asphalt, compact and survey – repeat the above three compaction and survey sequences.

This should give data on thickness of layer and effect of compaction effort. This may be transferrable to a larger compaction machine.

Test core should be drilled after 5 days, to check the percentage air entrained and the adhesion tac coat to asphalt and between asphalt layers.

#### **PL3.4 Lift Thickness**

Layer thickness will probably be between 0.2m and 0.3m

#### **PL3.5 Lift Placement**

The Contractor's Method Statement shall detail how each lift placement will be carried out with particular reference to controlling the adhesion to the previous layer, the level and thickness of the uncompacted layer as well as the compacted layer and the density /degree of compaction.

The adhesion will be dependent on correct re-heating and temperature control of the previous layer.

#### **PL3.6 Roller Type**

It is anticipated that a special adaptation of a paver may be used, which should give a compactive effort between a plate compactor and a vibratory roller

#### **PL3.7 Roller Passes**

Once the optimum roller compactive effort has been determined the Engineer may reduce the survey requirements, but is not obliged to do so.

Guidelines: Achieved Results on Meijaran Dam

Zone	Lift Thickness (m)	Maximum Particle Size (mm)	Roller Static Weight (tons)	No. Dynamic Passes	Roller Model
ACC	0.25	19	1.8	8 – 16 <sup>2</sup>	HEPCO HC13 <sup>1</sup> 0.9m wide @ 1.8 ton
Filter	0.25	60	1.8	5	
Transition <sup>3</sup>	0.3	150	10	4 - 8	HEPCO CA25 2.1m wide @ 9 ton
Rockfill <sup>3</sup>	0.6	300	10	8	

1 – Rear drum only vibrating

2 – When using paver with vibratory plate, 8 passes were supplied.

3 – Wet conditions were provided by water sluicing.

**PL4. PLACEMENT**

a) Asphalt

The selected method of placement will be determined from the trial tests, but the Contractor shall revise his Method Statements according to his perceived optimum procedures.

b) Filter and transition zones

Filter and transition zone shall be constructed so as to lag the core construction by about 1m, where the core is retained by formwork. The alternative is for the filter zones to be laid ahead of the core, providing support. The final filter zone and full transition zone compaction can be addressed.

**PL5. MIX CONTROL**

It is anticipated that the asphalt mix will be supplied by others, from Piet Retief. The Contractor shall provide test equipment of verification of the mix and heating arrangements, if not on the transport vehicle, to maintain correct asphalt temperatures.

**PL6. COMPACTION OF TRANSITION AND FILTER ZONES**

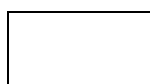
Rockfill shall be compacted as described below or by an approved equivalent method. Each layer of fill shall be compacted by at least four passes over the entire surface with a 10-ton vibratory roller.

**PL7. MEASUREMENT AND PAYMENT**

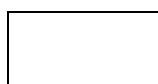
For items of work for which specific unit prices are established in the contract, the volume of each type of fill, including asphalt, measured to the neat zone boundaries and limits specified on the drawings or established by the engineer is measured and computed.

Except as otherwise specified in this specification, such payment will constitute full compensation for all labour, equipment, material, and all other items necessary and incidental to the performance of the work including furnishing, placing, and compacting the bedding material.

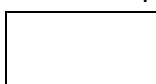
Compensation for any type of work described in the contract, but not listed in the bid schedule is included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section **PSDE 8.3** of this specification.



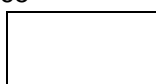
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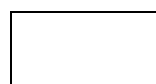
Witness 1



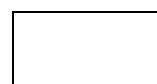
Witness 2



Employer



Witness 1



Witness 2

**PM SUPPLEMENTARY MECHANICAL SPECIFICATIONS**

**PM1. SCOPE**

The mechanical work consists of (but not limited) to:

- Pipework;
- Valves;
- Closure Gates, Screens, Guides and Grapple Beams;
- Cranes and Hoists;
- Crawl Beams;
- Roof Hooks;
- Dewatering Pumps; and
- Extraction Fans.

**PM2. APPLICABLE STANDARDS**

The following standards are applicable (but not limited to):

- DWS 1130 – DESIGN MANUFACTURE AND SUPPLY OF STEEL PIPE
- DWS 2510.01 – SUPPLY OF VALVES
- DWS 2510.03 – BUTTERFLY VALVES
- DWS 2510.03 – SLEEVE VALVES
- DWS 9900 C1 - CORROSION PROTECTION OF STEEL PIPES AND SPECIALS FOR PIPE LINES
- AWS D1.1 – SPECIFICATION ON ELECTRIC ARC WELDING

**PM3. PIPE AND VALVES SPECIFICATION**

<b>Pressure Limit (kPa):</b>	1000	Pipe Class	304L-1000/150
<b>Temperature Limit (°C):</b>	150	Pressure Class	1000 kPa
<b>Description</b>			
Gabosch dam pipe steel specification. Design Pressure 220 kPa / Design Temperature 25 dC			
<b>Pipe</b>			
<b>Size</b>	<b>Rating</b>	<b>Description</b>	<b>Material</b>
15NB - 50NB	Sch10s	Pipe/SML/Plain ends/ASME B36.19M	ASTM A312 Gr TP304L
65NB - 80NB	Sch10s	Pipe/WLD/Plain ends/ASME B36.19M	ASTM A312 Gr TP304L
100NB -600NB	Sch10s	Pipe/WLD/Beveled ends/ASME B36.19M	ASTM A312 Gr TP304L
<b>Fittings</b>			
Butt welded fittings preferred on all sizes			
<b>Size</b>	<b>Rating</b>	<b>Description</b>	<b>Material</b>
15NB - 50NB	Sch10s	Buttwelded Fittings/WLD/Beveled ends/ASME B16.9	ASTM A403 Gr WP304L-WX
	300LB	Forged Fittings/FGD/Socket Welded/ASME B16.11	ASTM A182 Gr F304L



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Witness 1



Witness 2



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Witness 1



Witness 2

	300LB	Forged Fittings/FGD/Threaded BSP/ASME B16.11	ASTM A182 Gr F304L
	Sch40s	Nipple/WLD/Threaded BSP/	ASTM A312 Gr TP304L
65NB-800NB	Sch10s	Buttwelded Fittings/WLD/Beveled ends/ASME B16.9	ASTM A403 Gr WP304L-WX
<b>Flanges</b>			
<b>Size</b>	<b>Rating</b>	<b>Description</b>	<b>Material</b>
15NB - 200NB	EN1092(BS4504) PN6	Type 02 Loose (Loose Plate with Weld Ring Neck)	ASTM A182 Gr F304L
	EN1092(BS4504) PN6	Blind, Raised Face	ASTM A182 Gr F304L
250NB - 800NB	EN1092(BS4504) PN6	Type 02 Loose (Loose Plate with Weld Ring Neck)	SANS 1431 GR 300W (Galvanised)
	EN1092(BS4504) PN6	Blind, Raised Face	SANS 1431 GR 300W (Galvanised)
<b>Welding Ring Neck</b>			
<b>Size</b>	<b>Rating</b>	<b>Description</b>	<b>Material</b>
50NB - 600NB	EN1092 PN6	EN1092-1 Type 35 (Weldring Neck)	304L SS
<b>Gaskets</b>			
Non-Metal, Flat ring, EN 1514-1, RF, Garlock 3500 or Equivalent with Gasket/Filler : PTFE with Silica Filler/ Ring: / 3.2mm / CHEMFLON PINK			
<b>Valves</b>			
Refer to DWS2510.01 Supply of valves, DWS2510.03 Sleeve valves and DWS2510.03 Butterfly valves.			
<b>Branch Table</b>			

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Witness 1

Witness 2

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Witness 1

Witness 2

Header Nominal Diameter																					Branch Nominal Diameter
15	20	25	32	40	50	65	80	100	150	200	250	300	350	400	500	550	600	650	750	900	
BT	BR	BR	BR	BR	BR	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	15	
	BT	BR	BR	BR	BR	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	20	
		BT	BR	BR	BR	BR	BR	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	25	
			BT	BR	BR	BR	BR	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	32	
				BT	BR	BR	BR	BR	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	40	
					BT	BR	BR	BR	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	SC	50	
						BT	BR	BR	BR	RB	RB	RB	RB	RB	RB	RB	RB	RB	RB	65	
							BT	BR	BR	BR	RB	RB	RB	RB	RB	RB	RB	RB	RB	80	
								BT	BR	BR	BR	RB	RB	RB	RB	RB	RB	RB	RB	100	
									BT	BR	BR	BR	RB	RB	RB	RB	RB	RB	RB	150	
										BT	BR	BR	BR	RB	RB	RB	RB	RB	RB	200	
											BT	BR	BR	BR	BR	BR	BR	BR	BR	250	
												BT	BR	BR	BR	BR	BR	BR	BR	300	
													BT	BR	BR	BR	BR	BR	BR	350	
														BT	BR	BR	BR	BR	BR	400	
															BT	BR	BR	BR	BR	500	
																BT	BR	BR	BR	550	
																	BT	BR	BR	600	
																		BT	BR	650	
																			BT	750	
																				900	

ST= Socket Weld Tee - Straight  
SR= Socket Weld Tee - Reducing  
SC= Socket Weld Half Coupling  
SF= Socket Weld Full Coupling  
BT=Butt Weld Tee - Straight  
BR=Butt Weld Tee - Reducing  
RB=Reinforced Branch

Testing: NDT: Radiography - 5% and Liquid Penetrant Inspection - 100% of all remaining welds

#### PM4. CLOSURE GATES, SCREENS, GUIDES AND GRAPPLE BEAMS

##### Grapple Beams

The general arrangement is shown on drawings DCE-2565-S-01

Specification:

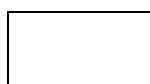
- Material to be hot rolled sections: EN10025 S355JR
- Hot rolled plate: EN10025 S25JR
- All welds to be 6mm continuous fillet or bead welds where applicable U.O.N.
- All welding to conform to AWS d1.1. Specification for electric arc welding
- All holed to be drilled
- All bolts to be GR. 8.8 Hot Dipped Galvanized
- All nuts to be GR. 8.8 Hot Dipped Galvanized
- Painting and Corrosion Protection: - Hot Dipped Galvanized

##### Intake Screens

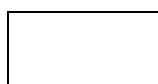
The general arrangement is shown on drawings DCE-2565-S-02

Specification:

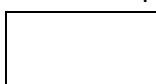
- Material to be hot rolled sections: EN10025 S355JR
- Hot rolled plate: EN10025 S25JR
- All welds to be 6mm continuous fillet or bead welds where applicable U.O.N.
- All welding to conform to AWS d1.1. Specification for electric arc welding
- All holed to be drilled
- All bolts to be GR. 8.8 Hot Dipped Galvanized
- All nuts to be GR. 8.8 Hot Dipped Galvanized



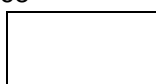
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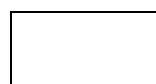
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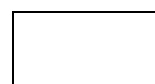
Witness 2



Employer



Witness 1



Witness 2

- Painting and Corrosion Protection: - Hot Dipped Galvanized

### **Intake Gates**

The general arrangement is shown on drawings DCE-2565-S-03

Specification:

- Material to be hot rolled sections: EN10025 S355JR
- Hot rolled plate: EN10025 S25JR
- All welds to be 6mm continuous fillet or bead welds where applicable U.O.N.
- All welding to conform to AWS d1.1. Specification for electric arc welding
- All holed to be drilled
- All bolts to be GR. 8.8 Hot Dipped Galvanized
- All nuts to be GR. 8.8 Hot Dipped Galvanized
- Painting and Corrosion Protection: - Hot Dipped Galvanized



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

### **Intake Gates and Screens Guide Frame**

The general arrangement is shown on drawings DCE-2565-S-04

Specification:

- Material to be 304L Stainless Steel U.O.N.
- All welds to be 6mm continuous fillet
- All welding to conform to AWS d1.1. Specification for electric arc welding
- All holed to be drilled

### **River Diversion Closure Gate**

The general arrangement is shown on drawings DCE-2565-S-04

Specification:

- Material to be hot rolled sections: EN10025 S355JR
- Hot rolled plate: EN10025 S25JR
- All welds to be 6mm continuous fillet or bead welds where applicable U.O.N.
- All welding to conform to AWS d1.1. Specification for electric arc welding
- All holed to be drilled
- All bolts to be GR. 8.8 Hot Dipped Galvanized
- All nuts to be GR. 8.8 Hot Dipped Galvanized
- Painting and Corrosion Protection: - Hot Dipped Galvanized

## **PM5. CRANES AND HOISTS**

The general arrangement is shown on drawings DCE-2565-Z-01

Specification:

- Steel gantry crane (2.5 Ton) Morris type overhead crane with electrical multi-directional crawler beam
- Min. 20 starts per hour

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>L1=</td><td>230 mm</td></tr> <tr><td>L2=</td><td>8 397 mm</td></tr> <tr><td>L3=</td><td>315 mm</td></tr> <tr><td>L4=</td><td>303 mm</td></tr> <tr><td>L5=</td><td>975 mm</td></tr> <tr><td>L6=</td><td>1500 mm</td></tr> <tr><td>L7=</td><td>180 mm</td></tr> <tr><td>TRAVEL</td><td>5 100 mm</td></tr> </table>	L1=	230 mm	L2=	8 397 mm	L3=	315 mm	L4=	303 mm	L5=	975 mm	L6=	1500 mm	L7=	180 mm	TRAVEL	5 100 mm	
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TRAVEL	5 100 mm																
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">Hoist + Trolley</td> <td>GM 8 2000.8-1/EF 22 ABUS COMPACT CHAIN HOIST - S.W.L 2 TON / Or Equivalent</td> </tr> <tr> <td>Crane</td> <td>DLVM 2 Ton x 8397 mm From MORRIS UNDERSLUNG CRANES / Or Equivalent</td> </tr> </table>		Hoist + Trolley	GM 8 2000.8-1/EF 22 ABUS COMPACT CHAIN HOIST - S.W.L 2 TON / Or Equivalent	Crane	DLVM 2 Ton x 8397 mm From MORRIS UNDERSLUNG CRANES / Or Equivalent												
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Crane	DLVM 2 Ton x 8397 mm From MORRIS UNDERSLUNG CRANES / Or Equivalent																

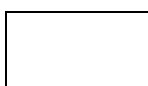
  

<b><u>Load Conditions</u></b>					
<b>SWL:</b>	2 000 kg	<b>Cycle per Years:</b>	5	<b>Duty Type</b>	Light
<b>Runway beam:</b>	UB 356X171X57	<b>Lifting Height</b>	30 000mm	<b>End Truck Bumpers</b>	Yes
<b><u>Operating Conditions</u></b>					
<b>Relative Humidity:</b>	54% - 82%	<b>Min Temp:</b>	-5 °C	<b>Max Temp:</b>	40 °C
<b>Dusty:</b>	No				
<b><u>Power Requirements</u></b>					
<b>Supply Voltage:</b>	380V AC	<b>Hoist Type</b>	Electric	<b>Hoist Speed</b>	8m/min
<b>Frequency:</b>	50 Hz	<b>Cross Travel Type</b>	Electric	<b>Cross Travel Speed</b>	20m/min
<b>Control Type:</b>	Pendant	<b>Cross Travel Length</b>	8627mm		
<b>Pendant Cable Length:</b>	By Supplier ±4000mm				

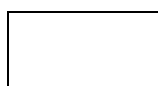
## PM6. CRAWL BEAMS AND ROOF HOOKS

### Crawl/Runway Beams

- Crawl beams to be 203x133x30 I section and IPE160 as specified on drawings
- Roof bolts - M20 Gr8.8 x 2 per anchor point to be used
- Maximum spacing between supports 3m
- 4 wheel trolleys to be used
- SWL to be indicated on crawl beam



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2



- Load test to be done at 1.1 x SWL by certified LMI
- Crawl Beams to be hot dip galvanized

#### **Roof Lifting Hooks**

- M16 U-Bolt welded to anchor plate
- Anchor Plate – 220x100x10mm
- Painting and Corrosion Protection: - Hot Dipped Galvanized

### **PM7. DEWATERING PUMPS**

#### **PM7.1 Outlet Block - Dewatering Pumps**

- 2 off Submersible De-Watering Pumps
- One duty and one standby
- Automated level-controlled switching device
- The pumps will be installed in a 400mm deep by 700mm wide sump and should be sized to fit this sump.
- The equipment will be installed in a corrosive environment and should be designed and specified accordingly.
- The equipment's shall be suitable for continuous service 24 hours per day, 365 days per year. High reliability and low maintenance intervention is required.
- The equipment shall be designed and manufactured in accordance with the VENDOR's standards with a proven track record in similar installations with an expected life span of 25 years.
- Pumps shall be provided with suitable means such as eyebolts or lugs to facilitate lifting and disassembly. VENDOR shall provide details on any special lifting requirements or considerations for safe handling.
- Where possible, the VENDOR is requested to provide selections such that pumps and spare parts are interchangeable, and a minimal inventory of spare parts is necessary. The VENDOR is asked to outline which pumps and spare parts will be interchangeable.
- Pumps shall be provided with a stainless-steel name plate securely attached to the pump with pertinent design information, equipment name and equipment number which will be provided by the client.

Medium:	Clean Water
Design Temperature:	5 - 40 dC
Static Head:	3m
Dynamic Head:	10m
Design Duty Head:	13m
Design Head:	13m
Duty Flow rate:	5000 (to be confirmed) l/hr
Pump Material of construction:	316 SS complete
Motor Voltage:	380V (to be confirmed)
Motor Size:	Full runout power for impeller selected + 15%
Motor Speed:	1500 rpm or less



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

**The following documents to be included in the submission as a minimum:**

- Pump technical information, installation & maintenance manuals
- Pump Curve
- Guarantees
- Spare parts list
- General Arrangement Drawings
- Factory acceptance test documentation

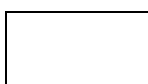
**PM7.2 Drainage Collection - Dewatering Pumps**

- 2 off Submersible De-Watering Pumps
- One duty and one standby
- Automated level-controlled switching device
- The pumps will be installed in a 500mm deep by 900mm wide sump and should be sized to fit this sump.
- The equipment will be installed in a corrosive environment and should be designed and specified accordingly.
- The equipment's shall be suitable for continuous service 24 hours per day, 365 days per year. High reliability and low maintenance intervention is required.
- The equipment shall be designed and manufactured in accordance with the VENDOR's standards with a proven track record in similar installations with an expected life span of 25 years.
- Pumps shall be provided with suitable means such as eyebolts or lugs to facilitate lifting and disassembly. VENDOR shall provide details on any special lifting requirements or considerations for safe handling.
- Where possible, the VENDOR is requested to provide selections such that pumps and spare parts are interchangeable, and a minimal inventory of spare parts is necessary. The VENDOR is asked to outline which pumps and spare parts will be interchangeable.
- Pumps shall be provided with a stainless-steel name plate securely attached to the pump with pertinent design information, equipment name and equipment number which will be provided by the client.

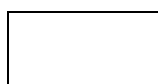
Medium:	Clean Water
Design Temperature:	5 - 40 dC
Static Head:	6.7m
Dynamic Head:	10m
Design Duty Head:	16.7m
Design Head:	17m
Duty Flow rate:	5000 (to be confirmed) l/hr
Pump Material of construction:	316 SS complete
Motor Voltage:	380V (to be confirmed)
Motor Size:	Full runout power for impeller selected + 15%
Motor Speed:	1500 rpm or less

**The following documents to be included in the submission as a minimum:**

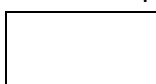
- Pump technical information, installation & maintenance manuals



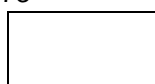
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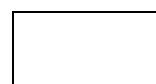
Witness 1



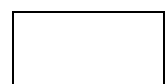
Witness 2



Employer



Witness 1



Witness 2

- Pump Curve
- Guarantees
- Spare parts list
- General Arrangement Drawings
- Factory acceptance test documentation

## **PM8. EXTRACTION FANS**

### **PM8.1 Drainage Collection Chamber**

#### **Fan**

Required Air Changes/hour:	x6
Volume:	200m <sup>3</sup>
Required Flow Rate:	1200m <sup>3</sup> /h
Safety Factor:	25%
Design Flow Rate:	1500m <sup>3</sup> /h, 25 m <sup>3</sup> /min, 0.4 m <sup>3</sup> /s
Fan Duty Differential Pressure:	21.5Pa
Fan Selection:	Donkin Majax-2 Axial Fan / 315 / 1440 rpm / 4 blade 28 deg. pitch or similar approved.

#### **Louvered Air Vent**

Height:	0.5m
Width:	0.5m
Surface Area:	0.25m <sup>2</sup>
Velocity through Louvre:	1.67m/s

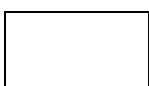
#### **Air Duct**

Diameter:	0.35m
Area:	0.10m <sup>2</sup>
Velocity:	4.3m/s
Duty Flow rate:	5000 (to be confirmed) l/hr
Specification:	Material of Construction – SS304 supported at 3m intervals with HDG supports. Inlet grill to have 12mm max. openings.

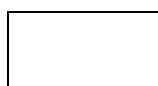
## **PM9. MEASUREMENT AND PAYMENT**

The tendered rates shall include full compensation for the provision of all labour, equipment and temporary works necessary to complete set up, to drill, removal on completion of drilling and grouting at the specific location, grout clean-ups and disposal, including on-site quality assurance and quality control, inspection and testing (including attendance at tests witnessed by the Engineer), and the installation and supply of all consumables necessary for the operation of the installation.

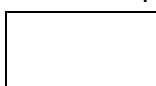
Refer to PSHA and Bill of Quantities.



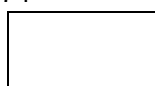
Contractor



Witness 1



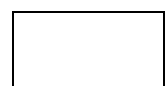
Witness 2



Employer



Witness 1



Witness 2

**PN HYDRAULIC PACK**

**PN1. SCOPE**

Hydraulic controlled butterfly valves will be used for selecting the level at which water is to be drawn off, and sleeve valves at the downstream end for controlling the releases. A hydraulic controlled butterfly valve will be used to isolate the flood release outlet. The outlet works valves will be hydraulically controlled from the operating level.

The scope of work can be summarised as the design, supply, installation and commissioning of the hydraulic power pack, control system, hydraulically operated intake valves and hydraulically operated Sleeve / Fixed Cone Valves.

**PN2. APPLICABLE STANDARDS, SPECIFICATIONS AND DRAWINGS**

When reference is made to a code, specification or standard, the reference shall be taken to mean the latest edition of the code, specification or standard, including addenda, supplements, and revisions thereto.

The following standards apply:

- DWS 2510 SUPPLY OF VALVES – GENERAL TECHNICAL SPECIFICATION
- DWS 2510 SUPPLY OF VALVES – BUTTERFLY VALVES
- DWS 2510.02 SUPPLY OF VALVES – AUXILIARY DRIVES.
- DWS 1601 GENERAL MECHANICAL SPECIFICATION
- DWS 9900 CORROSION PROTECTION PART C3 AND C8
- DWS 2020 QUALITY CONTROL
- SANS STANDARDS
- BS STANDARDS
- DIN STANDARDS
- API STANDARDS
- ANSI STANDARDS
- OCCUPATIONAL HEALTH AND SAFETY REGULATIONS (ACT NUMBER 85 OF 1993)

The following drawings apply:

- TBC

The contractor shall submit the following completed documents as part of the tender submission:

- DWS 2510 SUPPLY OF VALVES – ANNEXURE VS2 – PROJECT SPECIFIC FORMS

**PN3. FUNCTIONAL DESCRIPTION**

Valves:

Valves shall be suitable for the specified service and fit for purpose.

The valves shall be tight shut off valves that has no leakage past the sealing faces in its closed position under test conditions.

Hydraulic System:

The hydraulic unit will be installed on the operating deck and the system will be manually controlled from the operating deck.

The intake valves shall not be allowed to stay in a partially opened position. Other than during the opening- and closing process the valves shall be fully open or fully closed.

The intake valves shall be fitted with limit switches to indicate the valve position. The valve positions shall be indicated on the control panel.

The system shall be designed in such a manner that no creep can occur once the valve is set in an operating position.

Opening - / Closing velocities shall be sufficiently slow to ensure no water hammer occurs.

It will not be required to operate more than one intake valve simultaneously.

The outlet sleeve valves shall be operable over the full range of the valve. Position feedback of each sleeve valve shall be indicated on the control panel.

It will not be required to operate more than one sleeve valve simultaneously.

Audible and visual alarms shall be triggered if faults occur.

Valves shall be fully operable under full load conditions.

Provision shall be made for manual operation by a single operator in the case of a power failure.

**PN4. CONSTRUCTION AND INSTALLATION CONDITIONS**

The construction will take place in a rural area with limited infrastructure. The contractor shall provide all equipment, tools, resources, utilities and spares required to execute the full scope of work.

**PN5. DETAILED SPECIFICATION**

**PN5.1 Engineering and Services**

The Supplier shall provide all design & draughting required to complete the scope of work.

All drawings provided by the Contractor shall be approved by the Engineer prior to fabrication and installation.

The following shall as a minimum be included in the Contractors submission:

- Graphical diagrams, showing each piece of hydraulic equipment, including all interconnecting lines, by means of graphical symbols as specified in ISO 1219.
- Hydraulic piping layouts.
- Circuit diagrams.



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

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Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

- Operating and maintenance instructions & - manuals which shall include the following as a minimum:
  - Normal operating conditions of the work equipment.
  - Foreseeable abnormal conditions.
  - Conclusions to be drawn from any experience acquired during operation of the work equipment.
  - Cautions for use where applicable.
  - Performance indicators and limits of use of work equipment.
  - Trouble shooting chart.
  - Test procedures.

All valves, accessories and devices shall be clearly identified with the same identification as shown on the diagram. Such identification shall be shown on a metal tag mounted adjacent to the component.

#### **PN5.1.1 General System Design**

The hydraulic power pack shall be constructed of 304L stainless steel.

Supply voltage – 380V

Hydraulic equipment and piping shall be located and protected as to prevent damage from external forces and adverse atmospheric and industrial conditions applicable to the installation. Drain lines shall be independent of other return lines and similarly, pilot return lines shall be independent of power return lines, unless otherwise specified. Piping shall be so mounted to prevent them from being submerged in any corrosive liquids.

Circuits shall be designed to ensure that all units operate in a correct relationship regardless of load variations.

Hydraulic circuits shall be designed so that load variations and changes of fluid temperature will not cause variations in the cycle time inconsistent with the service intended. Circuits should be constructed such that one functional control adjustment does not adversely affect other functions.

Where pressure testing points are necessary, they shall be provided in accessible positions. Pressure testing points are to be provided at both ends of all actuators.

Bleed points shall be provided to release air which would otherwise cause malfunction of the system.

The pump outlet shall be provided with a relief valve to limit the system pressure. The setting of this valve shall be not greater than 30 bar above normal working pressure unless due reason can be shown.

In addition to the above relief valve, an additional system shall be provided whereby the pressure can be relieved on any specific section of the system with a bypass back into the return line

Acoustic noise levels shall not exceed 85 dB(A) measured at 1m from the source of the noise unless special permission is obtained from the Engineer before commencement of final installation. Flexible hose shall not be used to reduce the transmission of noise and vibration.

The hydraulic system shall be designed as simple as possible and shall contain the least number of components consistent with this specification.

Flow in pipelines and associated components shall not exceed the following velocities:

- Pressure lines: 4,5 m/s
- Return lines: 1,5 m/s
- Suction lines: 1,0 m/s

The following shall apply to hydraulic system which have two or more parallel branches:

- Hydraulic systems with parallel branches shall have isolating valves fitted to the inlet and outlet of each parallel branch.
- These valves shall enable a faulty branch, hence the fault to be isolated completely.
- The above isolating valves shall be connected to warning circuits on a central monitoring board, which will clearly indicate when such valves are in ABNORMAL mode.

Electrically controlled hydraulic devices shall be applied in such a manner that in the event of electrical circuit failure they will fail safe, i.e., there will be no damage to the equipment or danger of injury to personnel.

Hydraulic equipment shall be so designed that there is no external fluid leakage from it or ingress of air to it.

Each individual component in a hydraulic circuit shall be capable of functioning satisfactorily after being subjected to a static pressure of 50% more than the maximum system pressure to which it would be subjected when installed in the circuit. The specific performance and testing of individual components shall be the subject of agreements between the contractor and the Engineer.

Components and hardware supplied shall be of the best quality possible and selected for maximum life of the main components under normal usage.

Drip trays shall be provided at the following points:

- Power pack
- Control panel
- Test points
- Pumps
- Any other location where necessary

Hydraulic components attached to the industrial equipment shall be located so that they can be serviced with safety and are easily accessible for test and maintenance purposes.

Steel piping shall be secured by means of approved clamps every 1,2m.



Means shall be provided to prevent unintentional movement of hydraulic actuators where danger or damage might ensue. Where there would be danger to personnel from unguarded hydraulic rams, these rams and attachments shall be effectively guarded when the ram is in motion to prevent access to trapping zone between the ram or attachments and a fixed part of the equipment. Where a sliding or hinged hydraulically interlocked guard is provided, the interlock valve shall be operated positively to the safe position, i.e., the stem of the valve shall be held depressed while the guard is in any position other than fully closed. Where, as a secondary precaution, the guard is also electrically interlocked with a valve solenoid circuit or with the power supply to the pump motor, the interlock shall comprise two limit switches, one with contacts normally open, the other with contacts normally closed. The stem of the switch with normally closed contacts shall be held depressed while the guard is in any position other than fully closed.

Electrically controlled hydraulic devices shall be applied in such a manner that in the event of electrical power failure there will be no danger to personnel or damage to equipment.

Where there is more than one pump on the equipment and stoppage of a pump could result in damage, then interlocks shall be installed to safeguard the equipment. Where the operation of one pump in improper sequence can result in damage, interlocks shall be provided to ensure the operation of all pumps in proper sequence.

Where danger to personnel or damage to equipment may result from the functional failure of any automatic control, the circuit shall be arranged with protective interlocks. Where the incorrect manual operation of one or more valves could cause damage, the circuit shall be arranged with protective interlocks, or alternatively notices drawing attention to the dangers of possible damage shall be attached to the valves.

Safety guards complying with OSH Act requirements and shall be fitted over all rotating couplings and shafts.

The contractor shall always consider safety to personnel as of prime importance.

The contractor shall bring to the attention of the Engineer any aspects of the design or equipment, which may constitute a safety hazard.

Where a contractor is of the opinion that an additional design feature may provide safer or improved reliability at a reasonable cost, he shall supply details of these features to the Engineer.

Flexible lines shall be restrained or confined if their failure might constitute a hazard to personnel.

Where great danger of fire or human injury exists, particular attention shall be paid to the routing and protection of hydraulic pipes and hoses to ensure that in the event of a burst, hydraulic fluid shall not reach hazardous areas nor endanger personnel.

The system shall be so designed that components can be removed or dismantled without undue loss of fluid from the equipment.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Where there are pumps in parallel, valves which will permit removal of one pump while the others are still in operation, shall be provided.

All hydraulic equipment shall incorporate an emergency control or controls, these being readily accessible from the operators' normal working position or positions

A pressure relief valve capable of relieving the maximum flow at the outlet of the pump shall be provided on the delivery side of each pump and there shall be no other valve between the pump and the relief valve

In multistage pumps, or pumps connected in series, pressure overload protection shall be provided for each stage.

Where control valves in a closed position or any other circumstance would result in an excessive hydraulic pressure in any component or circuit, pressure overload protection shall be provided, and shall be of a form which will relieve the full flow of fluid without exceeding the maximum working pressure.

All such relief valves shall be accessible for purposes of testing and adjustment.

All pressure and flow controls shall be constructed so that they are not adjustable outside the safe working range of the system of which they form a part. All pressure controls shall be marked to indicate the minimum and maximum pressures to which they can be adjusted.

Where loss of pressure, reduced flow or excessive temperature of the fluid may result in danger to personnel, means shall be provided to prevent operation under these conditions. Such means should also be provided where these conditions may result in damage, or alternatively, an adequate warning system shall be provided.

Manual isolating controls (lockable) shall be provided in areas where inadvertent operation of the equipment could entrap or endanger operating personnel.

Hydraulic circuits shall be designed constructed and the components adjusted to minimize surge pressures. The components shall be of a strength, which will withstand such surge pressures.

Enough test points shall be provided for complete hydraulic system performance evaluation.

#### **PN5.1.2 Drawings**

Drawings giving detailed information of the hydraulic system and valves, to make a proper assessment of the equipment offered, shall be submitted with the tender. The drawings shall include overall dimensions of the valves, actuator details, materials of construction, etc.

All drawings shall be approved by the engineer prior to construction.

A complete set of "as built" drawings shall be provided.

### **PN5.1.3 Electrical**

All general electrical installation shall be carried out in compliance with the requirements of SANS 10142-1: Part 1: Low Voltage Installations.

An electrical certificate of compliance shall be supplied on completion of the electrical installation.

### **PN5.1.4 Tubing**

All tubing and brackets shall be grade 304 stainless steel.

The ends of all tubes and bends shall be smooth and at right angles to the centerline.

All tubes supplied shall be phosphate internally, oiled and plugged.

No threads shall be permitted on hydraulic tubing.

Tube bends shall have a minimum bend radius of seven (7) times the OD of the tube, measured on the centerline of the tube.

Bends shall be cold formed by suitable tube bending equipment.

Piping between actuating devices shall be as short as practicable. Sudden changes of pipe section should in general be avoided.

The use of pipe couplings shall be kept to a minimum consistent with pipe lengths and ease of assembly. Pipe runs should be removable without dismantling equipment components or adjacent piping.

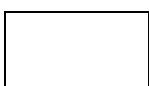
All rigid piping shall be securely supported to minimize vibration or movement. In general, it is advisable that the distance between pipe supports should not exceed 1,2m. Points of contact or support shall be designed to avoid damage to the piping. Piping shall not be welded to supports.

The length and method of supporting flexible piping shall be such as to avoid sharp flexing and straining, particularly at end fittings. Care shall be taken to ensure that flexible piping is not subjected to undue torsional strain during assembly and in operation. Such piping shall be restrained if its failure might constitute a hazard to personnel.

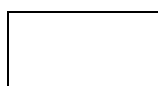
Piping shall not be located where it would interfere with the adjustment, repair or replacement of controls or units. Piping connections shall be readily accessible for maintenance.

Mounting shall be so arranged as to permit movement of pipes due to temperature changes without inducing stresses in the pipes.

Where compression fittings complying with the requirements of BS 4368-1: 1998, Type A, are used, these shall be pre-assembled, and the compression ring checked for correct bedding on the pipe prior to final assembly.



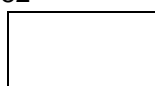
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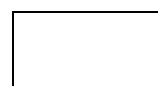
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Witness 2

Where quick release self-sealing couplings are used, they shall be of the pin type and not the ball type. With these types of couplings precaution shall be taken to minimize side loading.

Tubing between actuating devices and feed control devices, and such valves as pressure controls with remote operation, shall be short and rigidly mounted to eliminate vibration and chattering and to maintain a constant rate of flow of fluid through the tube runs.

Tube runs shall be as direct as possible with the minimum number of bends. They shall, however, be neat and functional both from a design aspect and maintenance requirements.

The number of tube connections shall be kept to the minimum.

Tube runs shall not affect the accessibility of equipment components.

Lines shall be positioned to localise air traps in desired positions, which will minimize removal and/or control problems.

Tube supports and clamps shall be DIN 3015 heavy duty type, and so arranged that it will be possible to remove any single tube without disturbing others.

Tube clamps shall be fitted in selected positions to prevent excessive tube vibration.

Clamps shall have the following properties.

- Be heat resisting up to 120°C.
- Be oil resisting
- Be rigid
- Have vibration and sound absorption

In general, tube clamps shall be so arranged that the mass of tubes, valves and other items is directly supported, and a minimum strain is imposed on each associated connector.

#### **PN5.1.5 Flexible Hoses**

Flexible hoses shall be in accordance with the requirements of BS EN 853: 1997. Any deviations from the requirements of this standard shall be the subject of agreement between the contractor and the Engineer.

Flexible hoses shall be double wire braid in accordance with BS EN 853: 1997: Type B2 or alternatively, in accordance with SAE J 517, hose 100 R2, Type A.

For pressures higher than that for which the flexible hose in specified is capable, 4 or 6 wire spiral hoses shall be used.

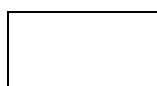
Test certificates showing tested pressure shall be included in the QA data books.

All flexible hoses shall have a permanent marking identifying the following Manufacturers codes:

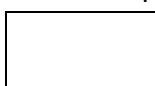
- Month and year of manufacture



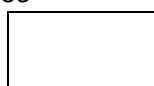
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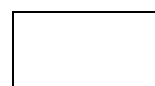
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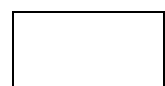
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- Maximum operating pressure
- A specific code or number, which will identify what length, fittings and fitting angles.

The flexible hoses supplied as part of any package (or spares) shall not have a manufactured age of more than one year at the date of receipt on site.

Flexible hoses shall not be used on suction lines.

Design pressure shall not exceed the maximum recommended working pressure according to the tables of the manufacturer concerned.

Hose material shall be compatible with system fluid.

Hoses shall have separate armor protection where exposed to damage.

All flexible hoses provided shall be suitable for a temperature range of -20°C to 120°C.

Pressure and temperature test certificates shall be made available to the Engineer on request.

Flexible couplings shall be in accordance with the requirements of BS EN 853: 1997. Any deviations from the requirements of this standard shall be the subject of agreement between the contractor and the Engineer.

The use of pipe couplings shall be kept to a minimum consistent with pipe lengths and ease of assembly.

All couplings shall be steel and shall have a factor of safety of 4.

#### **PN5.1.6 Hydraulic Fluid**

All hydraulic system components shall be compatible with the hydraulic fluid used and shall be installed and used in accordance with the recommendations of the component manufacturers.

All necessary precautions to eliminate trouble due to incompatibility between the hydraulic fluid and other fluids, materials and protective finishes shall be taken, in accordance with the recommendations of the hydraulic fluid supplier.

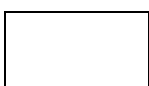
The hydraulic fluids required shall be subject to discussions between the contractor and the Engineer.

The temperature of the oil in the reservoir shall not exceed 60°C when using mineral oil or phosphate ester based hydraulic fluids and 55°C in the case of water based hydraulic fluids

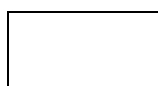
#### **PN5.1.7 Hydraulic Pumps**

The selection of hydraulic motors, pumps and power packs shall be subject to the approval of the Engineer.

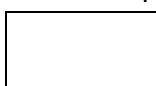
Full details of the equipment offered shall be submitted with the tender



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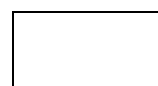
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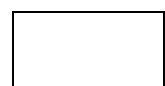
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Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

Motors shall be mounted on anti-vibration mountings.

Means are to be provided for filling and draining pump and motor casings in accordance with the manufacturers' specifications.

Pumps shall be of robust construction and in operation shall have a low noise level.

The minimum rated pressure output and volumetric output shall be 25% greater than the specified requirements of the system.

Pumps shall be capable of continuous operation at system normal working pressure at 60°C.

If not flange mounted, the pumps shall be foot mounted on a base plate integral with the electric motor. The mounting surface shall be rigid to prevent coupling misalignment due to workload and temperature variation. The surface shall be machined to take the pump and motor and the mounting holes shall be drilled.

Pumps shall be mounted adjacent to and below the fluid level in the reservoir to ensure a flooded suction.

Pump suction lines shall be as direct as possible with all fittings of the free flow type.

A pressure gauge tapping point shall be provided immediately before and after the pumps. Hydraulic equipment shall be so assembled that there is to be no external leakage from, or ingress of air to hydraulic components and piping. Pumps and motors shall be mounted externally to the reservoir, except where design considerations make this impracticable.

The maximum permissible misalignment of the pump and motor shall be less than 0,01mm.

When two pumps are arranged in a system, with one pump as a standby, they shall be connected in such a way that they can be operated from a remote location, without manually opening or closing valves.

The following information shall be permanently indicated on each hydraulic pump:

- manufacturers' name and address
- maximum rated deliver in 1/s or cc/rev
- maximum rated pressure in MPa
- maximum pump speed r/min
- manufacturers' identification number
- agents' name and address where applicable.
- direction of rotation
- ports shall be clearly marked to indicate inlet and outlet

The original nameplate shall not be removed from the pump or motor.

### PN5.1.8 Reservoirs

The reservoir shall be designed to the general Standards for Industrial Equipment but shall incorporate all features described below:

- The capacity of a fluid reservoir shall be sufficient to contain all the fluid that can flow from the system into the reservoir and maintain the fluid level at a safe working height during the operating cycle.
- Reservoirs shall be equipped with flush mounted or protected fluid level indicators, which must be visible during filling. They shall be provided with markings indicating high and low levels with pump running, and where necessary high level with pump stopped.
- Reservoirs shall be designed and constructed to prevent entry of foreign matter, including fluid contamination.
- They shall be designed to eliminate build-up while filling. Both the fluid intake and return points shall terminate sufficiently below the minimum working fluid level as not to cause aeration.
- Baffles or other suitable means shall be provided between the outlet and return to facilitate the separation of air and foreign matter from the hydraulic fluid without unduly restricting flow.
- Ample and accessible provision shall be made for complete cleaning, filling and replenishment of reservoirs. Well protected and accessible means shall be provided to empty them without spillage. Reservoir bottoms shall be shaped to facilitate emptying and cleaning.
- The reservoir shall be of welded stainless steel plate construction, suitably stiffened.
- The base of the reservoir shall preferably be at least 250mm from the floor level to allow free circulation of air.
- The base shall be sufficiently dished or sloped so that residues will move to the drain connection. The drain connection shall be so placed that complete drainage takes place. A drain valve shall be in an accessible position.
- The reservoir shall be separate and removable from the equipment base, where applicable.
- The reservoir shall be fitted with suitable baffles to separate physically the high velocity incoming oil returning from the system and oil at the pump inlet, to prevent vertexing and subsequent cavitation.
- The baffles shall also slow down the oil, thereby increasing cooling time and promoting the separation of air and foreign matter entrained in the oil.
- The baffle plates shall extend upwards to a height of three-quarters of the normal working fluid level.
- Return fluid shall have peripheral flow along the reservoir sides.
- Each baffle shall have small cut-outs at the height of the fluid outlet to provide adequate flow even when the fluid level is low.
- Pump suction lines shall be taken from a point at least 75mm above the base of the reservoir.
- The return lines shall be at the furthestmost point from the pump suction.
- Fluid velocity in the return lines shall be kept to a minimum, i.e., 1,5 m/s to prevent excessive aeration and agitation in the tank. These connections shall be internal and finish well below the minimum operating fluid level.



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- The return lines shall enter at or near the top of the tank and drop vertically to a point near the bottom of the tank.
- Atmospheric drain lines from equipment shall enter the reservoir above the maximum operating level of the fluid.
- Filler holes shall have strainers which do not unduly restrict the filling process, fixed such that hand tools are required for removal, and shall also be provided with well-fitting caps with suitable captive devices.
- On vented reservoirs the breather holes shall be protected by air cleaners. Such air cleaners shall be of sufficient capacity to meet the maximum demands of the hydraulic system and shall prevent entry of splashed liquids. The degree of air filtration shall be consistent with the requirements of the equipment and operating environment.
- The filling point shall incorporate a permanent filter and shall also be provided with a fully sealed cover to prevent any breathing at this point.
- A suitable silica gel breather shall be fitted to the air cleaner when temperature variations and operating conditions render this desirable.
- Ample provision shall be made, and access provided for complete cleaning of the reservoir.
- Airtight hinged manholes with latch bolts shall give access to both suction and return sides of the baffle plates. Alternatively, the tank top shall be removable. In this case, the top shall be fitted with lifting lugs and a gasket joint.
- The reservoir shall be fitted with a small cock to enable oil samples to be taken 50mm from the bottom.
- Drip trays shall be fitted whenever maintenance, cleaning, refilling and inspection operations normally occurs.
- Three liquid level switches unless otherwise specified, shall be installed in the reservoir. The lowest level switch shall initiate a pump cut-off relay in the event of excessive loss of fluid. The middle level switch shall be installed to indicate low fluid level. The purpose of this switch shall be to operate a "low level" indicator warning light on the control panel and at the same time, to sound an alarm. Additional loss of fluid will cause the fluid level to recede thus operating the pump cut-out switch which stops all pump motors.
- Glass tube-type fluid level indicator shall be fitted.
- High oil temperature switch shall be fitted.
- Tank heaters shall be provided if required.
- The reservoir shall be designed to have a sufficiently large surface area to allow natural cooling to be used where space and ambient conditions permit.
- The volumetric capacity of the reservoir shall be at least 20% greater than that required to contain all the fluid that will drain from the system back into the reservoir.
- Drip trays and drain systems shall be provided at all points where fluid leakage may occur due to normal operation, inspection and maintenance.

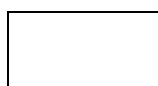
#### **PN5.1.9 Filters & Strainers**

Filters shall be provided for the continuous removal from the hydraulic fluid of materials which are detrimental to the operation of the equipment.

Filter "Clogged" indication to be provided.



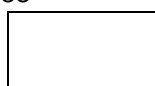
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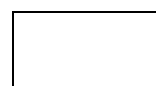
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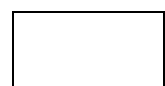
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Filters shall be so constructed and installed that their elements can be changed without disturbing the piping or incurring undue loss of fluid.

When means are not provided to indicate when a filter should be serviced, the contractor shall provide recommendations for servicing periods. Provision should be made for sampling of fluid to assess the degree of contamination.

The filter element reference number shall be durably marked on or adjacent to the filter case, such that it is readily visible in services.

Suction filters shall be provided only on closed loop circuits.

The pressure drop through the suction filter if fitted in clean condition shall not exceed 10 kPa.

The filter rating shall be according to the manufacturer specification.

All systems, other than closed loop systems, shall be fitted with pressure filters.

They shall however, in any event, not exceed 12 microns absolute for mineral oil or phosphate ester, or be less than 25 microns for water-based fluid systems.

Return line filters shall be provided.

The return line filters shall be installed before the reservoir.  
The filter shall be of the full flow type.

The filter element shall be in accordance with manufacturer recommendations but shall in any event not be more than 25 microns, absolute.

#### **PN5.1.10 Hydraulic Valves**

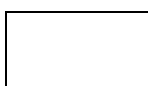
Wherever possible, valves should be mounted so that their removal and replacement can be made without disconnecting pipe fittings. Such valves shall be designed to ensure correct orientation of valve to base. Other valves should, wherever possible, be designed to ensure correct orientation of the valves in the circuit.

Where valves are designed to be used in one direction only, the direction of flow shall be clearly and permanently marked.

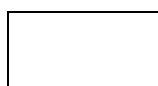
Adjustable valves shall be such that their settings, when made, will be maintained, e.g., against vibration.

Valves in any part of a hydraulic system shall be suitable for heavy duty service and shall be rated for the system pressure applicable plus 25%.

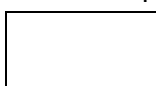
All hydraulic valves, accessories and devices shall be plainly identified with the same identification as shown on the circuit schematic, and as approved by the Engineer. Such identification shall be shown on a tag, preferably metal, mounted on or next to the valve.



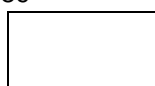
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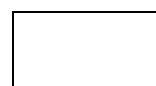
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All hydraulic controls and valves shall have a manufacturers' code and/or serial number securely attached to the component together with the manufacturers' name.

#### **PN5.1.11 Accumulators and Surge Absorbers**

Accumulators shall be so constructed that it is not possible to dismantle them before relieving accumulator gas and liquid pressure. Gas accumulators operating on oil hydraulic circuits at pressures above 1,4 MPa and where it is possible for the oil to be in contact with the charging gas, shall be charged with nitrogen. This possibility shall include the breakdown of sealing or separating member.

Where there is direct contact between oil and gas, some of the gas will be absorbed into the oil at high pressure and released when the pressure of the oil is lowered. This should not be permitted to cause malfunction of the equipment.

The design shall provide adequate precautions to prevent leakage of gas into the hydraulic system. It shall be possible to replenish the accumulator with gas.

Piston-type accumulators shall have a degree and type of finish of the bores and fitted pistons consistent with the type of service intended and shall be free of porosity or other defects.

Accumulators shall comply with the Machinery and Occupational Safety Act requirements.

The Tender shall state what energy absorbing or surge damping equipment has been provided and its location in the hydraulic system.

Testing equipment shall be installed as required by the Machinery and Occupational Safety Act.

The accumulator shall be constructed to withstand at least four (4) times the maximum working pressure of the hydraulic system it serves.

Hydraulic circuits, incorporating accumulators, shall be arranged so that the system can be bled at the high point of the circuit.

A manual drain shall be incorporated, to enable the accumulator to be drained to the tank.

On circuit applications, where accumulator pressure is isolated, full information's shall be given on or near the accumulator for proper servicing, to prevent injury to personnel.

Materials used in the accumulators shall be compatible with the fluid specified.

Bladder type accumulators are preferred, but other accumulators may be provided if agreement is reached with the Engineer before the tenders are submitted.

All accumulators shall be of proven design and obtained from established local manufacturers.

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Bladder and gas piston accumulators shall be charged with nitrogen even if fire-resistant fluids are use.

Hydraulic circuits incorporating accumulators shall be constructed such that when the equipment is isolated from its power supply, there is no pressure appreciably above the atmospheric in the system external to the accumulator.

An isolation valve shall be fitted between the accumulator and the main oil line. This valve shall provide the accumulator oil a path to the tank.

When locating the accumulator, consideration shall be given to the provision of additional accumulators. The accumulator manifold shall be suitable for extension.

Arrangements shall be made to support accumulators in such a manner that no strain is imposed on associated lines and equipment.

Operating, maintenance and recharging instructions shall be provided on an indelible chart mounted near the accumulator and easily visible to maintenance staff.

The manufacturer of each cylinder shall durably mark the following on each accumulator:

- Maximum operating pressure.
- Test pressure.
- Manufacturers' name and address.
- Manufacturers' model number.
- Manufacturers' serial number, if any.
- Maximum hydraulic working capacity.
- Charging medium.
- Charging pressure.

The Engineer shall be supplied with the following documents:

A certificate of manufacture stating:

- the name of the manufacturer
- the address of the manufacturer
- the factory model and serial number
- the date of manufacture
- the specification to which the accumulator is manufactured
- maximum allowable working pressure and temperature
- capacity of accumulator
- the material of manufacture
- the tensile strength, yield point, elongation and impact value of the material.

A pressure test certificate which states:

- name of manufacturer/authority conducting the test
- the test pressure
- the regulations in accordance with which the accumulator was tested
- the test results



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- the approval of an authorized person

#### **PN5.1.12 Cylinders**

The cylinder specification shall be adequate to enable the suitability of the cylinder for its application to be determined. When considering the suitability of a cylinder, its strength as a strut to withstand imposed axial loads, including cushioning, shall be considered.

The cylinder assembly should be designed to keep frictional losses to a practical minimum.

Cylinder bores shall have a degree and type of finish consistent with the type of service intended and shall be free of porosity or other defects. The material, hardness and surface finish of piston rods shall be such as to minimize scoring.

All cylinder external-sealing devices shall be readily accessible for servicing. Piston rods shall be adequately protected by cleaning and sealing devices.

When metallic rings are used as sealing devices on pistons, they should be of the step-cut type.

Dual piston rod seals with inter seal drains shall be provided when specified by the Engineer.

Where necessary, cushioning shall be incorporated in cylinders.

When pistons are assembled to rods, they shall be positively locked.

Cylinders should be designed and installed, with the ports at the extreme tops of bores to allow air to be quickly and automatically removed during working. If this is not possible, other venting provisions should be made.

All cylinder bores shall be honed to give a 4-to-8-micron surface finish, 15° to 45° cross hatch pattern regardless of the piston seal arrangement.

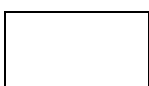
Where there is a possibility of corrosion due to the type of hydraulic fluid employed, the cylinders shall be hard chrome plated to a depth of 0,01mm to 0,06mm.

The Tender who wishes to offer alternatives to chrome plating shall submit full details for approval.

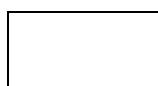
Approval or acceptance of any deviations shall be specifically accepted by the Engineer in writing.

A detailed drawing shall be supplied by the contractor showing a longitudinal cross section of the mounting and body dimensions and shall include a parts list. Where specifically designed cylinders are supplied, full dimensional drawings shall be supplied, with material specification, (BS equivalent for all material).

Designs shall provide a minimum number of parts with ease of dismantling for maintenance.



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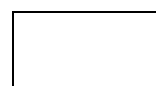
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The following items shall be considered for satisfactory design:

- Maximum load in each direction of stroke
- Off-center loads if unavoidable
- Over-running or over-center loads
- Piston velocity in each direction of stroke
- Cushioning requirements

Cylinder maximum deviation from straightness, 1mm / M

Chamfers on bores shall be sufficient to allow easy replacement of seals, pistons etc., (a minimum chamfer of 3mm x 15° to 30° shall be provide.)

Cylinder tube flanges shall be machined, forged or rolled carbon steel, which may be an integral part of the cylinder or mounted on the cylinder by means of keeper rings or welding.

Keeper or locking rings shall be fitted in a groove machined in the cylinder periphery.

The keeper or locking rings shall be of high tensile steel suitably heat treated.

Barrels shall be honed after flanges have been welded.

Cylinder heads and caps shall each be of one-piece steel construction, machined from suitable rolled carbon steel plate, bar stock, forging or cast steel.

Where rolled plate, forging or castings are used for cylinder heads and caps, they shall be free from porosity and other defects.

Cylinder heads and caps shall have spigot locations to the cylinder bores.

Piston design shall be such that an adequate bearing surface is provided, consistent with the overall cylinder design and application.

Piston rods shall be steel and shall be generally designed with a minimum safety factor of four (4) calculated on the tensile strength and rated maximum pressure, at the least cross-sectional area.

The cylinder mounting with its effect on side loads shall be considered when establishing piston rod diameter and lengths.

Cylinders shall be accessible for servicing and shall be replaceable except where they form an integral part of the equipment structure.

Cylinders shall be installed so that under all working conditions the side loads imposed on the piston rods or rams shall not exceed those for which the cylinder was designed.

Lubrication points shall be provided where necessary and the lubrication points shall be on the pin end.

Cylinders and actuators shall generally be connected to associated pipe work by flexible hoses.

Cylinders and actuators shall be accessible for servicing, cushion adjustment, bleeding and fitting connections.

#### **PN5.1.13 System Controls**

Controls shall be located and protected to prevent accidental operation.

All automatically controlled devices shall be grouped together except where special conditions make this inadvisable. All manual controls shall be mounted within reach of the operator when in his normal operating positions. Operators shall not be required to reach past moving elements to operate manual controls.

Instruction plates shall be provided for all manual controls and shall be located so that they can be easily read by the equipment operator.

All hydraulic controls shall be mounted such that they are readily accessible for adjustment and maintenance. The controls shall be mounted a minimum of 0,6m or maximum of 1,8m above the maintenance working floor level of the equipment, unless the size of the equipment of function requires other mountings.

All equipment and piping shall be accessible and shall be mounted in a position that will permit safe and adequate maintenance and adjustment.

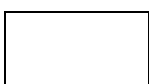
#### **PN5.1.14 Quality Control**

Refer to DWS 2020.

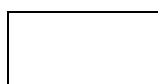
#### **PN5.2 PROCUREMENT AND SUPPLY**

The following items shall be supplied as part of this package:

- Outlet Works Valves (Hydraulically Operated)  
200NB x 4 off  
800NB x 1 off
- Sleeve / Fixed Cone Valves (Hydraulically Operated)  
200NB x 2 off  
600NB x 1 off
- Hand Isolation Valves  
100NB x 4 off  
50NB x 2 off  
25NB x 6 off



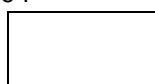
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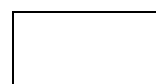
Witness 1



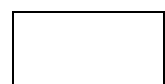
Witness 2



Employer



Witness 1



Witness 2

- Hydraulic Power Pack  
Complete system with hydraulic – and electrical control panels
- Bolts, Nuts & Washers.
- Flange insulation kits according to DWS 9900 Section 3.

Valves shall be supplied complete with bolt units, consisting of a standard-length bolt, nut and two washers. The stud unit, where applicable, shall be supplied with a standard-length stud, nut and washer. A washer shall be fitted under all bolt/screw heads and nuts

The shortest standard bolt or stud that protrudes beyond the nut by a minimum of two threads when the assemblies are fully tightened shall be used. The same applies to stud units.

Stainless steel bolted units to DIN 931 shall be used.

The manufacturer shall specify a fastening sequence for bolts (if applicable) and the torque settings (in Nm) for all bolts. These torque settings and fastening sequences shall be included in the Operation and Maintenance Manual.

Corrosion Protection:

Corrosion protection of equipment supplied under this technical specification shall conform to:

DWS 1601	-	General Mechanical Specification
DWS 9900	-	Corrosion Protection Part C3 and C8
DWS 2020	-	Quality Control

Color coding according to international accepted standard.

Valve Specifications:

Outlet Valves (Hydraulic Operated – 800NB x 1, 200NB x 2):

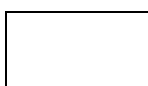
Double Eccentric Butterfly Valve with face-to-face according to ISO 5752 Series 13 / BS 5155 Short with stainless steel seats.

Valve should be rated and with flange drilling to EN1092 PN6 and should comply with the DWS 2510 Standard Specification for the Supply of Valves and DWS 2510.03 Butterfly Valves.

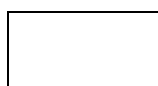
The valves shall be tight shut off valves with resilient seals that has no leakage past the sealing faces in its closed position under test conditions.

Valves must be full (pipe) bore butterfly valves with hydraulic actuators. Power fail close.

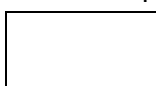
Valves must be fitted with limit switches to give indication at the control deck of full open or fully closed status, with a warning if an intermediate state is reached and is a “permanent” state.



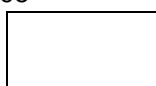
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Witness 1



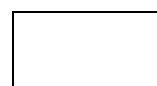
Witness 2



Employer



Witness 1



Witness 2



Sleeve / Fixed Cone Valves (Hydraulically Operated – 600NB x1, 200NB x2):

Downstream control valves must be sleeve (also known as fixed cone) valves with stainless steel hoods. The valves must be hydraulically operated, with the hydraulic power pack located on the operating floor.

Valve should be rated and with flange drilling to EN1092 PN6 and should comply with the DWS 2510 Standard Specification for the Supply of Valves and DWS 2510.03 Butterfly Valves.

Valves must be fitted with mechanical indicators of state of opening as well as linear inductive sensors for indication of state of opening at the operating deck or house.

Bypass Valves (Gearbox Operated – 100NB x4):

Short pattern flanged fully rubber lined (EPDM) butterfly valve with 316SS blade.

Valve should be rated and with flange drilling to EN1092 PN10 and should comply with the DWS 2510.01 Standard Specification for the Supply of Valves and DWS 2510.03 Butterfly Valves.

The valves shall be tight shut off valves with resilient seals that has no leakage past the sealing faces in its closed position under test conditions.

Pressure Transmitter Valves (Hand Operated – 25NB x6, 50NB x2):

Full bore ball valves, 316SS Complete, PTFE Seats, Pressure rating and flange drilling according to EN1092PN10 and comply with the DWS 2510 Standard Specification for the Supply of Valves.

### **PN5.3 VERIFICATION AND TESTING DURING FABRICATION**

All hydraulic systems shall be given tests to determine conformity with equipment specifications at completion of assembly and/or installation, as agreed between the contractor and the Engineer.

During these tests, pressures sufficient to operate the relief valves shall be developed, and the satisfactory function of the relief valves, at their pressure and flow settings for the application, shall be checked.

In cases where the maximum working pressure cannot normally be exceeded (e.g., in some accumulator operated systems) this shall constitute the assembled test pressure, and satisfactory function of the relief valve at its setting for the application shall be ensured by means of a separate test.

All equipment at the completion of assembly and before shipments, shall be given complete performance tests to determine conformity with equipment specification.

Copies of the manufacturers' material and independent test certificates shall be forwarded to the Engineer for approval



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

Cylinders shall be proof tested at 1,5 times the stated maximum operating pressure. No external leakage shall be permitted.

Cylinder shall be cycled by internal hydraulic pressure to test for correct functioning. Internal leaks can fall within design limits but are preferable to be internally leak free.

After completion of testing, cylinders shall be drained and cleaned. The ports shall be plugged after a rust preventive fluid has been introduced for protection during shipment. The rust preventative fluid must be compatible with the hydraulic oil used in the installation. Test information to be included in the QA data books.

#### **PN5.4 PACKAGING AND PREPARATION FOR SHIPMENT**

All openings in hydraulic equipment shall be sealed, and all hydraulic reservoirs shall be thoroughly cleaned prior to dispatch.

Adequate precautions shall be taken to prevent corrosion during transit.

For protection, all male threads shall be sleeved, and all openings shall be equipped with suitable closures up to the time of installation. When equipment is constructed such that it is necessary to move it in sections, identification of piping runs shall be provided, corresponding to the diagram.

The bores of all piping and fittings shall be cleaned to ensure that all scale, swarf and foreign matter is removed, and steps shall be taken to minimize contamination after cleaning prior to final assembly.

All pipe fittings, oil passages, cored or drilled holes shall be free of burrs and foreign matter, which might cause damage to any hydraulic unit or contaminate the hydraulic fluid.

#### **PN5.5 INSTALLATION**

Hydraulic equipment shall be so assembled that there is no external fluid leakage from, or ingress of air to hydraulic components and piping.

All paint work provided is not to be adversely affected by the hydraulic fluid and operating conditions.

No thread sealing tape will be permitted.

Arrangements shall be made to clean the system after final assembly to an acceptable ISO standard, to be agreed between the contractor and the Engineer.

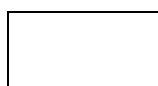
All pipe work will be installed with the minimum use of welded joints.

Pipe work will be bent and formed from standard pipe lengths using hydraulic pipe bending machines.

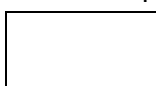
All pipes will be cut square at the ends, deburred and cleaned.



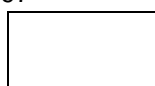
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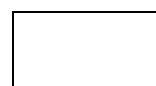
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Witness 2



Employer



Witness 1



Witness 2

Socket weld type fittings will be utilised to join pipe lengths and end fittings.

All pipe work welding will conform to BS 2633:1987 specifications.

Welds will be examined on a random basis and tested by means of the dye penetrate method to check for cracks and pinholes.

All pipe work will be color coded in accordance with Industry standard specifications.

#### **PN5.6 COMMISSIONING**

The Contractor shall provide a commissioning plan and will be responsible for the commissioning of the complete system.

New and existing pipe work will be flushed clean to an agreed procedure by the Engineer. The flushing oil will be the system working fluid.

The flushing oil is to be provided by the contractor.

The first fill of specified fluid is to be supplied free issue to the contractor, who will specify the type and quantity of the operating oil.

The reservoir shall be filled with the specified fluid, which shall be continually filtered utilising the power pack filling pump (if available) or alternatively a mobile filler/filter unit.

Isolating valves shall be opened and closed as appropriate to permit the filling of as much of the system as possible using the natural head of all the system.

Pressure safety valves shall be adjusted to a minimum prior to starting main line pumps, which will execute the final filling of the system.

Adequate fluid level in the oil reservoir shall be maintained during the filling operation of the system to ensure the pumps are not starved.

Care must be taken never to overfill the system particularly when all actuators are in the extended condition.

#### **PN5.7 TRAINING**

The Contractor shall provide training manuals and provide training for operations – and maintenance personnel.

#### **PN5.8 MAINTENANCE & SPARES**

Service manuals for all hydraulic equipment shall be provided. This shall contain replacement part data and other maintenance information.

A two-year optional maintenance service plan shall be offered.

A two-year spare parts list with pricing shall be offered.

#### **PN6. BATTERY LIMITS**

The valves will be mechanically fitted in the pipeline by the piping contractor.

Any auxiliary / hydraulic fittings required to be attached the valves forms part of this scope.  
All plinths and grouting required forms part of this scope.

Electrical supply up to the junction box in the hydraulic room will be supplied by the electrical contractor. All other electrical work forms part of this scope.

All cabling, - racking and supports required form part of the scope.

All rigging of equipment related to this enquiry, except the valves forms part of this scope.

#### **PN7. DESIGN PARAMETERS**

Medium:

Fresh Water

Medium Design Parameters:

Operating Static Pressure: 175 kPa(g)

Design Pressure: 600 kPa(g)

Design Temperature (Min): 5 °C

Design Temperature (Max): 25 °C

Design Life:

All valves and fittings shall be designed for a useful life of forty-five (45) years under normal operating conditions.

#### **PN8. INSPECTION, TESTING AND ACCEPTANCE**

Pumps shall be run in to approved manufacturers' recommendations or in accordance with BS 4617: 1983: Class A, B or C (whichever is applicable).

All valves shall be tested as per DWS2510.01 and a test certificate containing a statement by the manufacturer confirming that the valves have been tested in accordance with this standard and stating the actual pressures and medium used in the test shall be issued.

#### **PN9. GUARANTEES**

The supplier shall guarantee that the equipment meets the specified operating parameters the performance testing, and more particularly:

- Noise levels

All valves shall be guaranteed against faulty design, materials, and workmanship for a period of five (5) years from the date of delivery. During this period the Contractor shall attend to and rectify at his own cost any defects that can be attributed to faulty design, materials and workmanship. Normal wear and tear shall be excluded.

#### **PN10. SAFETY**

The Supplier shall ensure that all design and equipment supplied meets the requirements specified in the Occupational Health and Safety Regulations (Act number 85 of 1993).



Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

This shall include:

- Equipment Safeguarding
- Noise levels

The Supplier shall ensure all Occupational Health and Safety Regulations (Act number 85 of 1993) requirements are adhered to during construction & commissioning.

The Supplier shall perform a risk analysis to define all those applying to the work equipment created.

#### **PN11. MEASUREMENT AND PAYMENT**

The tendered rates shall include full compensation for the provision of all labour, equipment and temporary works necessary to complete set up, to drill, removal on completion of drilling and grouting at the specific location, grout clean-ups and disposal, including on-site quality assurance and quality control, inspection and testing (including attendance at tests witnessed by the Engineer), and the installation and supply of all consumables necessary for the operation of the installation.

Refer to SANS 1200 L and Bill of Quantities.

**Part C4:     Site Information**

- C4.1 Locality Plan
- C4.2 Construction Materials Required
- C4.3 Geotechnical
- C4.4 Mineral Permit and Application License
- C4.5 Drainage and Pollution Control

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Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

C4.1    Locality Plan

## C4.2 Construction Materials Required

The following construction materials are required to be mined on site and processed under this part of the contract:

Type / Usage	Source	Min. and Max. Particle Size (mm)	Volume Required (m³)
Rockfill Material	Quarry	6 – 450 (quarry floor run) 6 – 250 (foundation spoil)	59 300
Asphalt Protection Zone	Quarry	5 - 150	5 900
Filter Zone	Quarry	8 - 60	14 950
Concrete Aggregate	Quarry	13-75	24 000
Asphalt Concrete Aggregate	Quarry	13 - 19	1 750
Riprap	Quarry	25 - 600	4 600
Concrete Fines (Sand)	Commercial (Westoe Dam Quarry)	0.5 - 6	12000

### C4.2.1 Materials Grading Curves

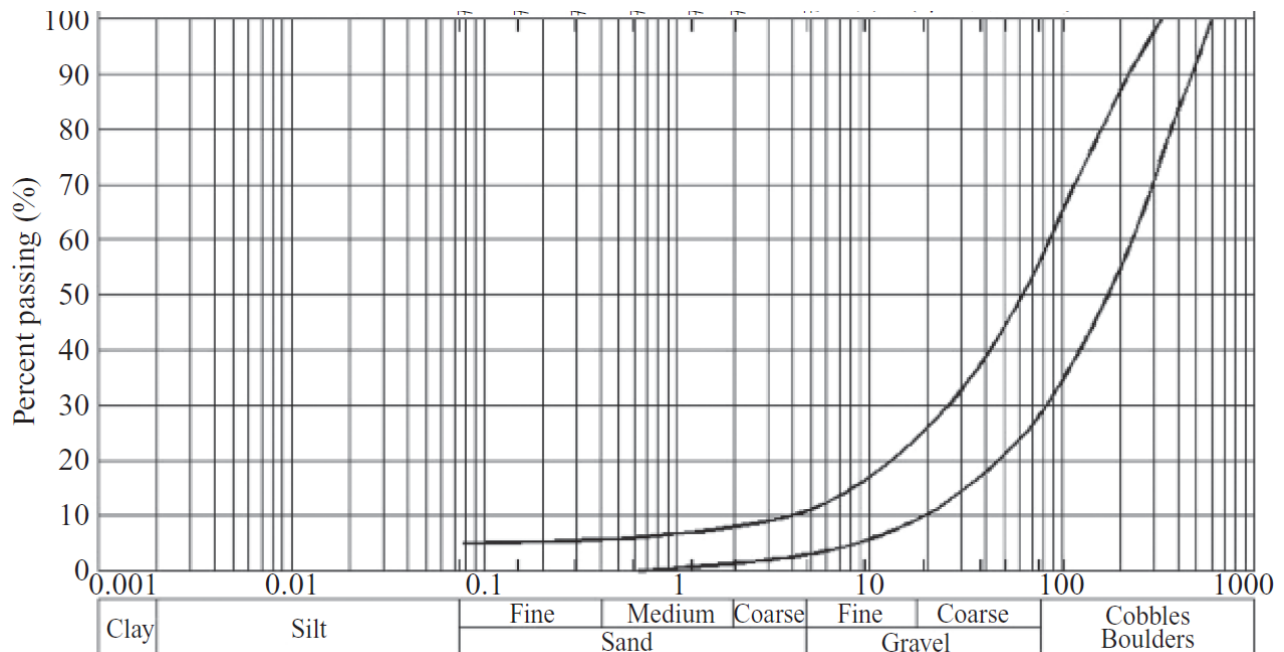


Figure C4.2.1 Grading tolerances of the Rockfill Shell Zone



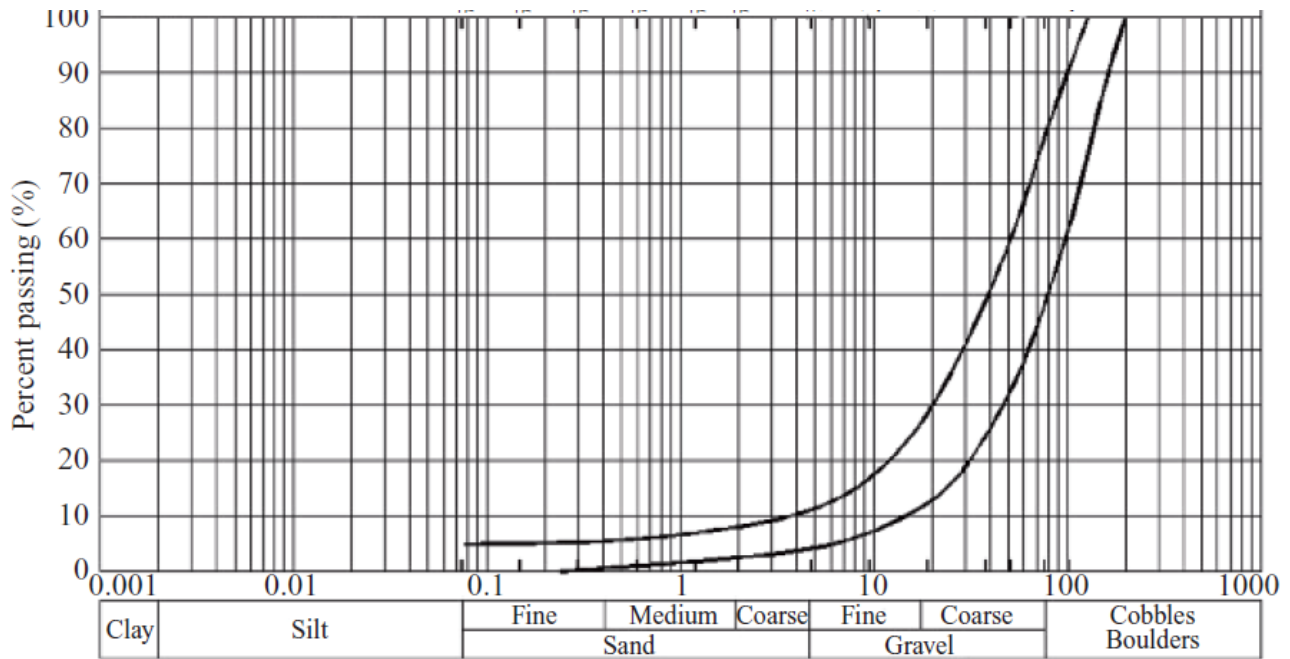


Figure C4.2.2 Grading tolerances of the Transition Zone/ Asphalt Protection

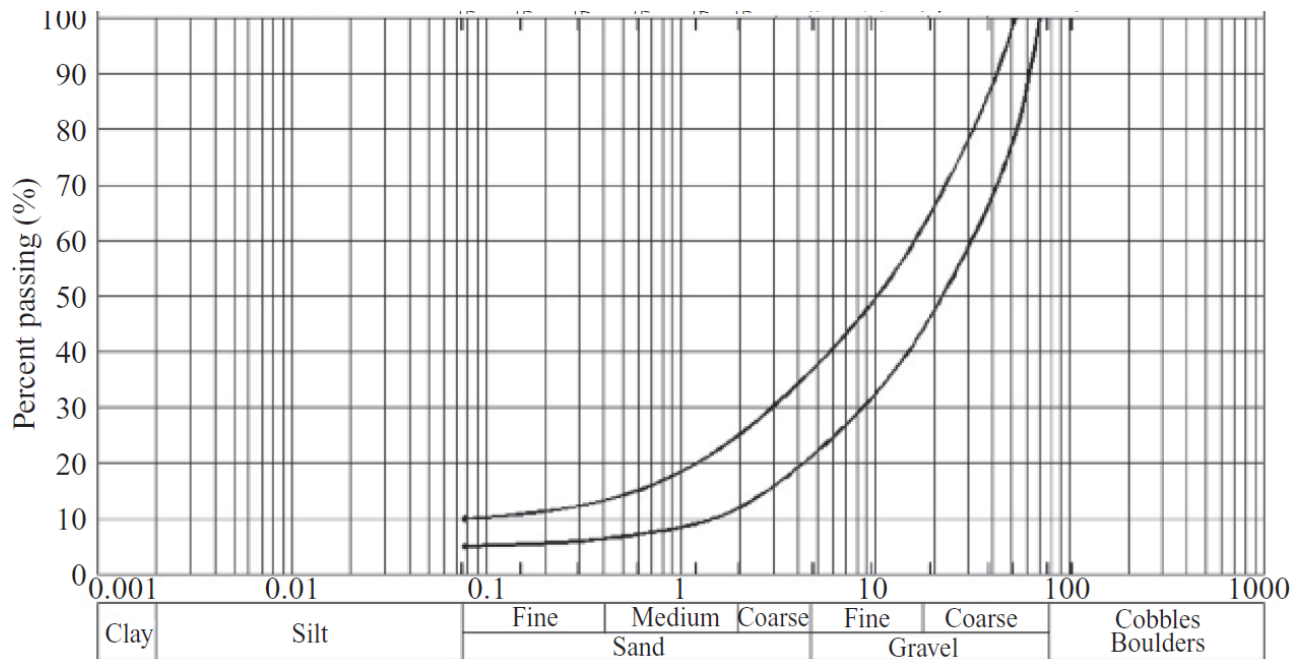


Figure C4.2.3 Grading tolerances of the Filter Zone (Upstream)

Finer than downstream filter and drillable – with transition zone – for grouted repairs if necessary.

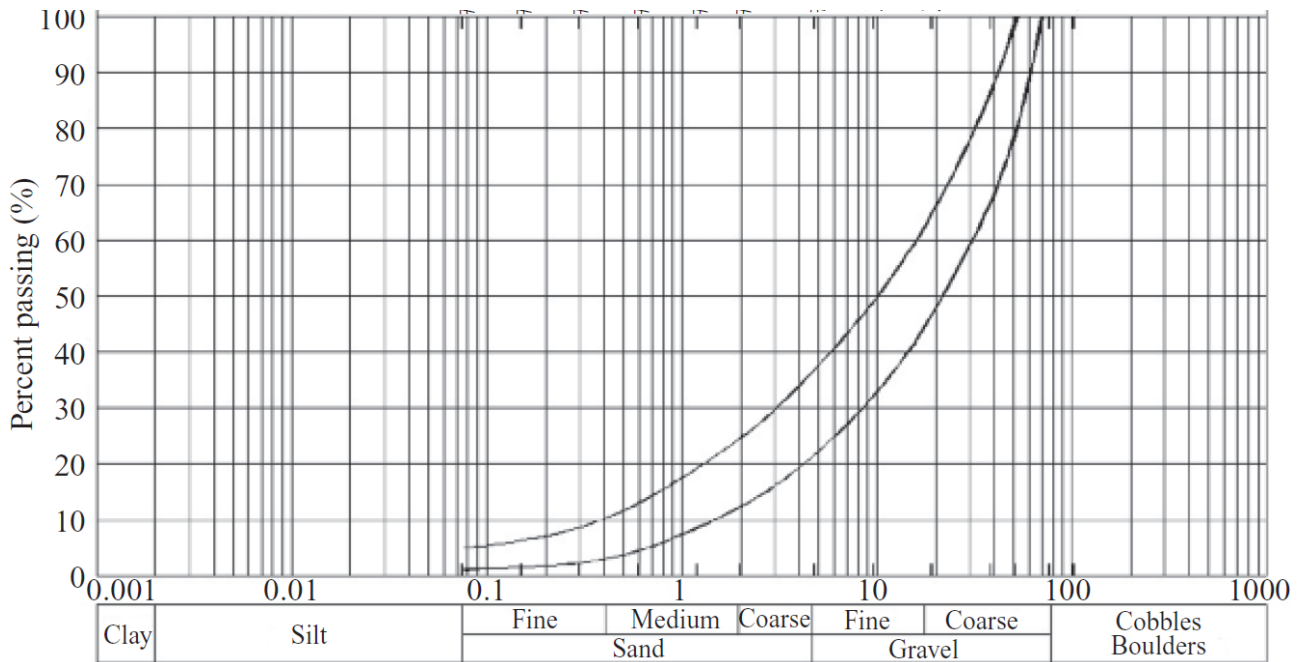


Figure C4.2.4 Grading tolerances of the Filter Zone (Downstream)

Coarser than upstream transition zone for drainage.

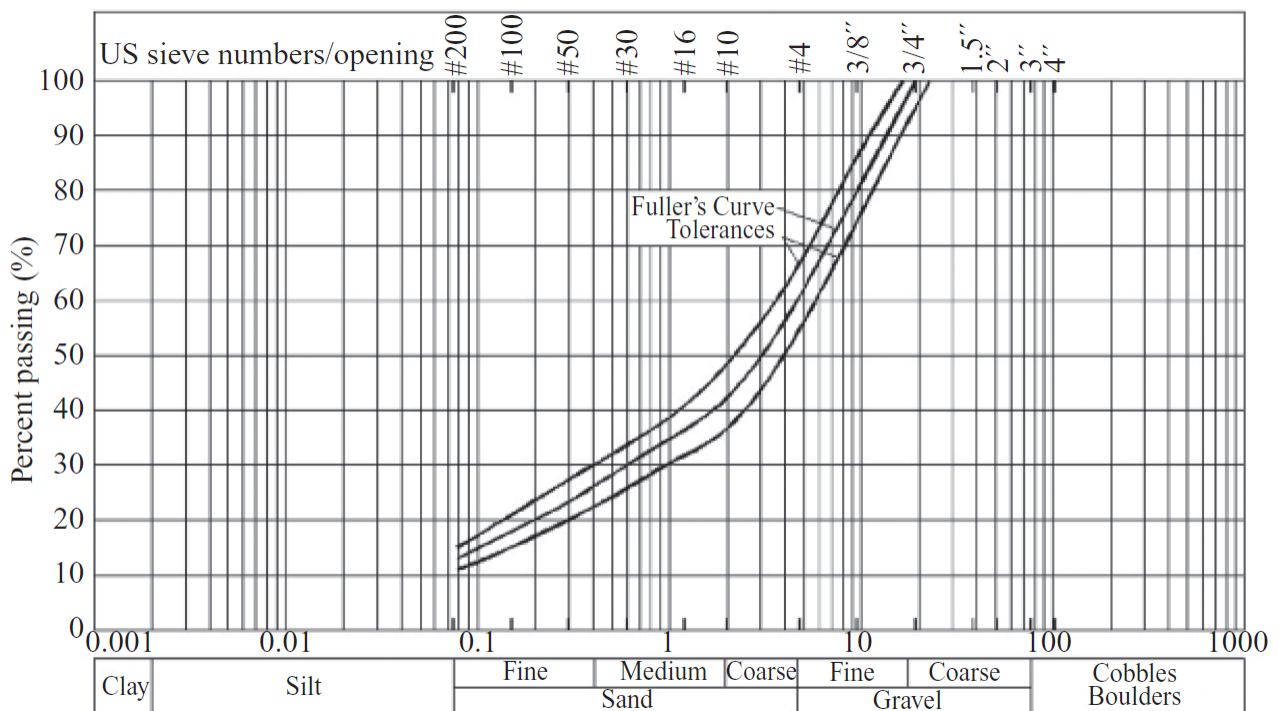


Figure C4.3.5 Grading tolerances of the ACC (Fuller's Curve)

### C4.3 Geotechnical

A comprehensive geotechnical investigation was conducted in and around the proposed location of the quarry. The geotechnical report is attached hereto as **Annexure E**.

Some import abstracts from the report are listed below:

#### Section 4.6 Search for Fine Aggregate Required for Concrete Mixes

*“Local deposits along the banks of the Gabosche River comprise mixes of sand, clay, pebbles, gravels, cobbles and boulders in various concentrations and thicknesses and tend to be erratically distributed both up- and downstream from the dam site.*

*A source of better-quality material had to be and seemingly good quality fine aggregate material for concrete mixes was located on the right flank of the Westoe Dam, some 20km NNE of Amsterdam.*

#### Section 7.1 Concrete Aggregate

*“Concrete aggregate and rockfill material will have to be supplied from the quarry in the dam basin. This would form part of the main construction contract. A summary of the boreholes drilled in the quarry area and their intersection depths with rippable and solid rock (requiring blasting) is provided in Table 7.1.1 below.*

**TABLE 7.1.1: QUARRY BOREHOLE SUMMARY**

<b>BH No</b>	<b>BH Elevation</b>	<b>Hole Depth</b>	<b>Rippable Depth (m)</b>	<b>Rippable Elevation</b>	<b>Depth to solid rock</b>	<b>Solid Rock Elevations</b>
GBH07	1282.00	8.20	1.70	1280.30	6.60	1275.40
GBH08	1280.70	8.20	2.45	1278.25	2.45	1278.25
GBH09	1275.00	9.00	2.13	1272.87	3.00	1272.00
GBH10	1275.50	9.00	2.00	1273.50	2.00	1273.50
GBH26	1275.89	15.00	2.30	1283.59	4.35	1281.54
GBH27	1279.87	10.00	2.45	1277.42	3.50	1276.37
GBH28	1279.57	11.19	6.00	1273.57	7.30	1272.27

*The overburden thickness increases towards the stream valley/gulley in the west of the quarry basin area – refer Figure 7.1.1 below.*



Contractor



Witness 1



Witness 2



Employer

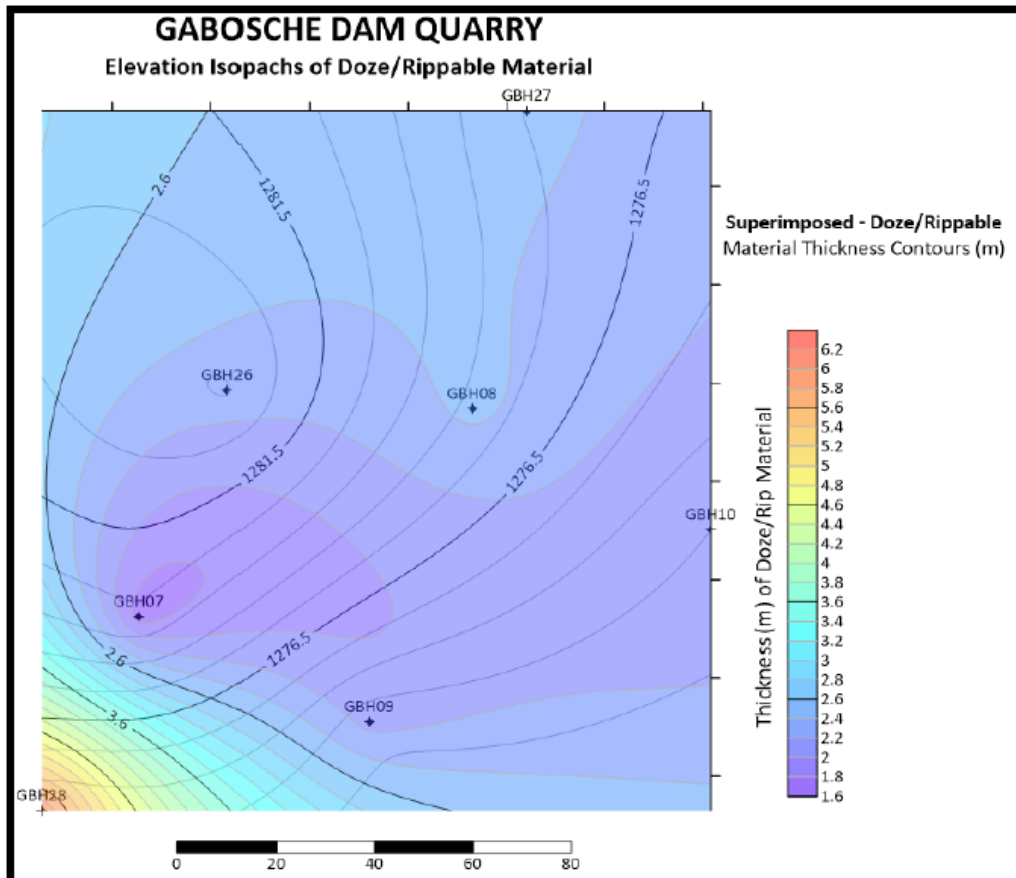


Witness 1



Witness 2

**FIG. 7.1.1 ISOPACH PLAN OF QUARRY SHOWING ELEVATION TO BASE OF DOZABLE/RIPPABLE MATERIAL**



*(Note: The underlying colour contours indicate depth to base of rippable material)*

Rock excavated from the quarry is expected to comprise predominantly andesite with minor mixes of dacitic andesite and isolated dolerite predominantly to the west of the quarry site. Andesite does not usually initiate aggregate-cement reactions and the fines or crusher dust are considered beneficial to strength gain in concrete. The effect on water demand in mixes and related harshness may depend on the actual site-specific qualities of the rock.

*Both dacite and andesite will provide excellent rockfill, road fill, gabions, and riprap."*

#### **Section 9.1.9 Quarry Site & Construction Materials**

*"The quarry site is located upstream of the dam and within the full supply level to minimize the environmental impact. The quarry is expected to provide adequate sources of Andesite lava material for both rockfill and concrete, however the basin does not have good sources of fine aggregate and other than crusher run material, other fines may require importing."*

#### **C4.4 Mining Permit Application and License**

A mining permit as per the Mineral and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002) and regulations will be available at the start of construction to enable the extracting of the required construction materials. If a Mining Permit is not available, a Mining Permit exemption issued by the DMRE will be issued to the Contractor. This exemption must be neatly filed in a secure place on site and be available for the duration of construction activities.

#### **C4.5 Drainage and Pollution Control**

Drainage and pollution control form an integral part of the operation of the quarry and processing plants. Storm water control measures and a settlement pond has been allowed for. The contractor is advised to familiarise himself with the proposed Quarry Management Plan, waste pollution and effluent management facilities and stormwater control measures as envisaged in the Mineral and Mining Report.

Drainage and Pollution Control shall furthermore adhere to the requirement of the Environmental Management Plan and Specifications.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

ANNEXURES

**ANNEXURE A: STANDARD CONDITIONS OF TENDER**

**ANNEXURE B: OCCUPATIONAL HEALTH AND SAFETY SPECIFICATIONS**



**ANNEXURE C: ENVIRONMENTAL MANAGEMENT PLAN / SPECIFICATIONS**

**ANNEXURE D: EPWP ALIGNMENT / PROVISION OF STRUCTURED TRAINING**

## **EPWP ALIGNMENT (PROVISION OF STRUCTURED TRAINING)**

### **CONTENTS**

- PEA 1 SCOPE
- PEA 2 GENERIC TRAINING
- PEA 3 ENTREPRENEURIAL SKILLS TRAINING
- PEA 4 INSERVICE TRAINING
- PEA 5 MEASUREMENT AND PAYMENT

#### **PEA 1 SCOPE**

This specification covers the requirements for the provision of structured training to be arranged by the contractor over the period of this contract.

#### **PEA 2 GENERIC TRAINING**

PEA 2.1 The contractor shall, from the commencement of the contract, implement a structured progressive training programme.

PEA 2.2 The generic training will inter alia comprise, but not be limited to the following subjects:

<b>Course Description</b>	<b>Estimated No. of Trainees</b>	<b>Estimated Duration (Days)</b>
1. Road safety for construction workers		
2. Flagmen		.....
3. Concrete handling, placing and finishing		.....
4. Guardrails		.....
5. Bituminous road surfacing		.....

PEA 2.3 Training shall be at or by an approved accredited organisation and shall be delivered by suitably qualified and experienced trainers.

PEA 2.4 The tenderer shall provide with his tender full details of the structured training programme he intends to implement, which details shall include the following:

- a) The name of the training institution and programme
- b) The manner in which the training is to be delivered.
- c) The numbers and details of the trainers

Such details shall be entered on or attached returnable documents of this tender.

Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

PEA 2.5 The contractor shall be responsible for the provision of everything necessary for the delivery of the generic training programme, including the following:

- a) A suitable venue with sufficient furniture, lighting and power;
- b) All necessary stationery consumables and study material;
- c) Transport of the students; (as necessary)
- d) Payment of wage to all trainees during the classroom training at a rate equal to the minimum wage as set in the Ministerial Determination for the Expanded Public Works Programme on an annual basis;
- e) Relevant PPE required for the project works; and
- f) Additional supervision of learners during the practical learning stages of the works.
- g) Wage for the learners during this stage of the training will be paid through the outputs.

PEA 2.6 Generic training courses shall commence within one month of possession of site and be completed before the end of the contract period.

PEA 2.7 The contractor's training programme shall be subject to the approval of the engineer, and the contractor shall if so instructed by the engineer alter or amend the programme and course content if a need is identified once the contract commences.

PEA 2.8 The contractor shall keep comprehensive records of the training given to each student and whenever required shall provide copies of such records to the engineer. At the successful completion of each course each student shall be issued with a certificate indicating the course contents as proof of attendance and completion.

In addition to the above, a monthly return shall be submitted by the contractor.

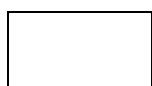
### **PEA 3 ENTREPRENEURIAL SKILLS TRAINING**

PEA 3.1 Small contractors and subcontractors will be entitled to receive a structured training programme, which will comprise both management skills as well as business development skills.

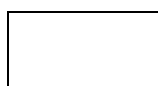
PEA 3.2 The contractor shall closely monitor the performance of all small subcontractors in the execution of their contracts and shall identify all such subcontractors who, in his opinion, display the potential to benefit from structured training as may be provided for in the contract and where required by the engineer, shall make recommendations in this regard. The final list of candidates will be decided between the contractor and the engineer.

PEA 3.3 The training will be delivered by trainers who are accredited by the Civil Engineering Training Scheme (CEITS) or other institutions recognised by the Department of Labour. Accredited training refers to both the trainers as well as to the training material.

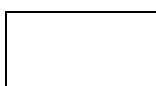
PEA 3.4 The contractor shall facilitate in the delivery thereof, by instructing and motivating the subcontractor regarding attendance and participation therein.



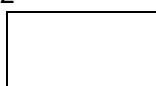
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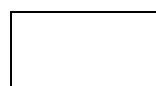
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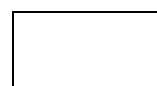
Witness 2



Employer



Witness 1



Witness 2

PEA 3.5 The contractor shall further make all reasonable efforts to co-ordinate the programming of the subcontractor.

PEA 3.6 The structured training will comprise out of the following as decided by the Employer:

Course Description	Estimated Duration (Days)
1. Basic Business Principles	.....
2. Basic Supervision	.....
3. Running A Business	.....
4. Legal Principles	.....
5. Achieving Standards	.....

PEA 3.7 The contractor shall provide with his tender, full details of the structured training programme, which he intends to implement, which details shall include the following:

- a) The name of the training institution and programme;
- b) The various aspects of each type of training comprised in the programme;
- c) The manner in which the training is to be delivered; and
- d) The numbers and details of the trainers to be utilised.

Such details of the proposed entrepreneurial training programme shall be entered on or attached returnable documentation of the forms to be completed by the tenderer.

PEA 3.8 The contractor shall be responsible for the provision of everything necessary for the delivery of the entrepreneurial training programme, including the following:

- a) A suitably furnished venue (if required) with lighting and power;
- b) All necessary consumables, stationery and study material; and
- c) Transport of the subcontractors. (as necessary)

PEA 3.9 All entrepreneurial training shall take place within normal working hours.

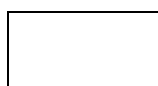
PEA 3.10 The contractor's training programme shall be subject to the approval of the engineer, and the contractor shall if so, instructed by the engineer alter or amend the programme and course content if a need is identified once the contract commences.

PEA 3.11 The contractor shall keep comprehensive records of the training given to each subcontractor and whenever required shall provide copies of such records to the engineer. At the successful completion of each course each subcontractor shall be issued with a certificate indicating the course contents as proof of attendance and completion.

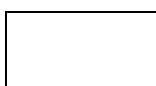
In addition to the above, a monthly return shall be submitted by the contractor.



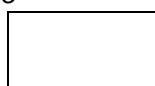
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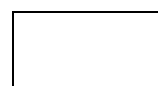
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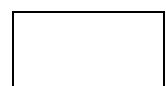
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#### **PEA 4. IN SERVICE TRAINING**

PEA 4.1 The contractor shall in addition to the structured (accredited) training as provided for in this document implement an in-service training programme, from the commencement of the contract, in which the various skills required for the execution and completion of the works are imparted to the labourers engaged thereon, in a programmed and progressive manner. Labourers shall be trained progressively throughout the duration of the contract, in the various stages of a particular type of work.

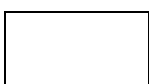
##### **PEA 4.1.1 Details of In-Service Training**

- a) The contractor shall attach to applicable returnable form the basic details of his proposed in- service training programme, which details shall inter alia include the following:
  - i. the details of training to be provided
  - ii. the manner in which the training is to be delivered
  - iii. the number and details of trainers to be utilised.
- b) The in-service training programme shall be submitted with the initial works programme. The progress in relation to this programme will be recorded monthly and attached to the site meeting minutes and payment certificate.
- c) The contractor shall provide onsite, sufficient skilled and competent trainers to train all labourers engaged on the contract, in the various skills required for the execution and completion of the works.
- d) All labourers shall be remunerated in respect of all time spent undergoing training.
- e) Every worker engaged on the contract shall on the termination of his participation on the contract, be entitled to receive from the contractor, a certificate of service in which the following information shall be recorded:
  - i. the name of the contractor;
  - ii. the name of the employee;
  - iii. the name of the project/contract;
  - iv. the nature of the work satisfactorily executed by the worker and the time spent thereon;
  - v. the nature and extent of training provided to the worker; and
  - vi. the dates of service.
- f) The cost of the above obligations shall be deemed to be covered by the sums and rates tendered for in relevant items within the bill of quantities. The performance of the contractor in providing in-service training, shall be taken into consideration should the contractor fail to reach his CPG at the completion of the project.

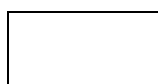
##### **PEA 4.1.2 Lead Time for Training**

The training of labour as specified shall, as far as possible, take place before commencement of each activity and the contractor shall take into account in his programme the lead-time he requires for such training. All training herein specified shall be deemed to be a construction activity and a non-negotiable condition of the contract”.

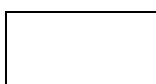
All formal training is to be documented in terms of the National/Provincial submission forms, and accompanied by an attendance register for the applicable days.



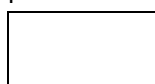
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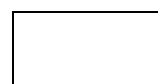
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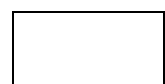
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**PEA 5 MEASUREMENT AND PAYMENT**

**PEA 5.1 Provision for training**

- a) Generic skills Provisional (list training courses): .....Sum
- b) Entrepreneurial skills Provisional .....Sum
- c) Handling cost and profit in respect of sub item ..... Percentage (%)
- d) Training Venue (only if required) .....Lump Sum

**Transportation and accommodation** of workers for training where it is not possible to undertake the training in close proximity to the site (Provisional Sum) Sum

The prime cost sums are provided to cover the actual costs (including wages, tools and PPE) for attendance of accredited training courses as agreed with the engineer and shall be expended in accordance with the provisions of sub-clause 48(2) of the general conditions of contract. The tendered percentage in sub-item 4.1(c) is a percentage of the amount actually spent under sub-items 5.1(a) and (b) which shall include full compensation for the contractor's handling cost, profit, mentoring, record keeping, reporting and all other costs in connection therewith.

The lump sum tendered for 5.1(d) shall include full compensation for the provision of the training venue, for all necessary lighting, power, furniture, stationery, consumables and study material and for transportation of the students to and from the training venue. Payment of the lump sum will be made in two instalments as follows:

- a) The first instalment, 75% of the lump sum, will be paid after the contractor has met all his obligations regarding the provision of the training venue as specified.
- b) The second and final instalment, 25% of the lump sum, will be paid after the provision of all the accredited training as specified in the document.

The lump sum tendered for 5.1 (e) shall include full compensation for the provision of additional supervisory staff to manage the output generated from the learners during practical training.



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**ANNEXURE E: GEOTECHNICAL REPORT**



**ANNEXURE F: MINERAL AND MINING REPORT**

**ANNEXURE G: BOOK OF DRAWINGS**

## **ANNEXURE H: FLOATING SAFETY BOOM STANDARDS, SPECIFICATIONS AND COMPLIANCE**

### **ROTO-MOULDED POLYETHYLENE FLOATING AIDS TO NAVIGATION (AtoN), DEMARCATION MARKERS & FIXING ACCESSORIES**

#### **1. BACKGROUND**

The Department of Water & Sanitation (DWS), its delegated public sector partners and delegated water management institutions have the responsibility to implement the required Aids to Navigation (AtoN), both fixed and floating; and demarcation markers, on all Government Waterworks (Dams) for general navigation.

In terms of international conventions and national legislation, DWS has to ensure compliance to the South African Maritime Safety Authority (SAMSA) AtoN Standards and Directive of all maritime AtoN and Demarcation Markers, both fixed and floating; on all Government Waterworks in the Republic of South Africa (RSA).

In addition to the DWS, Local Accountable AtoN Parties (LAAP) providing access to Waterworks, watercourses, privately owned dams and other navigable watercourses, or requiring a specific demarcated area for specific recreational usage, have an obligation to ensure that the required AtoN is in accordance with the recommendation of DWS and approval of SAMSA.

#### **2. STANDARDS, SPECIFICATIONS, AND MANDATORY COMPLIANCE**

The offered equipment with regard to its operational performance is to be in strict accordance with these Detail Specifications and information supplied in the Technical Schedules. Any deviation/s or modifications to the Specifications can be listed in the space provided at the end.

DETAILS OF OFFER			COMPLY / DO NOT COMPLY
1	<b>GUARANTEES AND GENERAL CONDITIONS (ONLY APPLICABLE TO FLOATING ATON &amp; DEMARCATION MARKERS):</b>		
	1.1	The supplier shall be required to guarantee the equipment; <b>excluding</b> any fastening kits; for a period of not less than twelve (12) months from the date of collection.	
	1.2	The colour stability will however be guaranteed for a period of not less than twenty four (24) months from the date of deployment.	
	1.3	If during the first twelve (12) months that the equipment is in service, any inherent faults develop not due to fair wear and tear, of which the purchaser is not aware at the time of acceptance of the offer; the purchaser reserves the right to return it to the supplier; all or part of the complete equipment.	
	1.4	The supplier/s shall assume full liability for the cost of the equipment and such transport charges between the factory and the site as the purchaser may have incurred. Under these circumstances, the purchaser shall not be	

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DETAILS OF OFFER			COMPLY / DO NOT COMPLY
		liable for any depreciation or wear and tear of the apparatus whilst it was in service.	
	1.5	Bids that do not include the guarantees as specified in <i>Paragraphs 5.1. &amp; 5.2.</i> above will not be considered.	
	1.6	The <b>manufacturer</b> shall have an ISO 9001 accredited Quality Management System. <b>Proof WILL be submitted.</b>	
	1.7	The <b>manufacturer</b> shall be a Member of the <i>Association of Rotational Moulders of Southern Africa (ARMSA)</i> ; or similar Association. <b>Proof WILL be submitted.</b>	
	1.8	If the <b>bidder</b> is not the manufacturer; the bidder <b>shall submit proof</b> that he / she is / are the authorized dealer / distributor in the RSA / Africa for the equipment.	
	1.9	Descriptive Literature and Specification Sheet/s (in English), of the items offered, shall be supplied.	
	1.10	The Employer's Agent may request the bidder <b>to demonstrate</b> the suitability of the different types / shapes of buoys and demarcation markers; including top marks and signage on these. The date and venue will be corresponded within 14 days after the bid closing date. <b>Typical tests that could be undertaken:</b>	
		1.10.1. Pillar Buoy Ballast Test; buoy to return to its vertical position after manually pushed into the horizontal and released;	
		1.10.2. Testing of any mooring eye by putting additional strain on it to ensure that it doesn't break-out of the buoy;	
		1.10.3. Puncture any types / shapes of buoys (foam filled) to ensure that no buoy will have any ingress of water to cause the buoy to sink;	
		1.10.4. Test the Pillar Buoy Top Marks that they cannot be vandalised / broken off easily; etc.	
		1.10.5. May request the bidder to prove that the equipment on offer complies to the specifications, e.g.: <ul style="list-style-type: none"> <li>• Destructive Test; and</li> <li>• Cut open any buoy or demarcation marker to demonstrate the thickness of the polyethylene.</li> </ul>	
		1.10.6. All of the above-mentioned test, if done, will be at the cost of the bidder.	
	1.11.	The Employer's Agent reserves the right to visit the manufacturing facility / factory.	
	1.12.	Regular in-house inspections shall be undertaken by the manufacturer to ensure adherence to the requirements of this specification and DWS may decide to be present at these inspections. The <b>manufacturer WILL</b> inform the Employer's Agent when the manufacturing process will start.	

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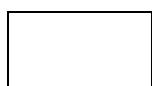
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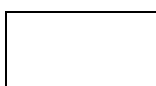
DETAILS OF OFFER				COMPLY / DO NOT COMPLY
	1.13.	The successful bidder will have to deliver the items and the handling shall be their sole responsibility until delivered and installed on site.		
2.	GENERAL SPECIFICATIONS FOR FLOATING ATON & DEMARCATION MARKERS:			
	2.1.	All parts, excluding the metal parts, shall be rotationally moulded from UV stabilised premium grade <b>virgin</b> polyethylene to form a seamless; watertight buoy body with a <b>nominal</b> wall thickness of <b>at least 5 mm</b> .		
	2.2.	The polyethylene used; shall have the following minimum requirements:		
		2.2.1.	Linear Low Density Polyethylene resin (LLDPE);	
		2.2.2.	High Rigidity, Good Impact Strength; Heat and UV Resistant;	
		2.2.3.	The colour pigments shall be permeated all the way through the polyethylene and not be added as a coating; and	
		2.2.4.	The LLDPE and colouring pigment will be stabilized to a <b>minimum UV-8 level</b> index.	
	2.3.	A copy of the product data sheet for the LLDPE <b>will be supplied with the offer</b> .		
	2.4.	The mould design and manufacturing process shall increase the thickness of the polyethylene at the major stress points; especially at the mooring eyes.		
3.	DETAIL SPECIFICATIONS: AIDS TO NAVIGATION (ATON) PILLAR BUOY:			
	NOTE: <i>Drawings shown are not to scale and are only used for illustration purposes.</i>			
	3.1.	GENERAL:		
		3.1.1.	All pillar buoys will be designed with the necessary ballast to be able to stand upright on its own and to ensure that the buoy is able to track well (do not lean over excessively); with the standard top marks; <b>at wind speeds of up to 15 m/s (54 km/h)</b> .	
		3.1.2.	The top part of the pillar buoy may have any of the following shapes: <u><b>Top View</b></u>	
		(a)	 Cylinder	
		(b)	 Cone	
		(c)	 Triangle	
		3.1.3.	The pillar buoy shall be Yellow within the range as per the IALA chromaticity diagram ( <b>Paragraph 2.7.2.</b> ); and	



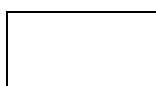
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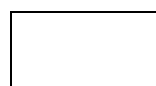
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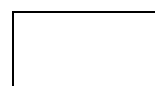
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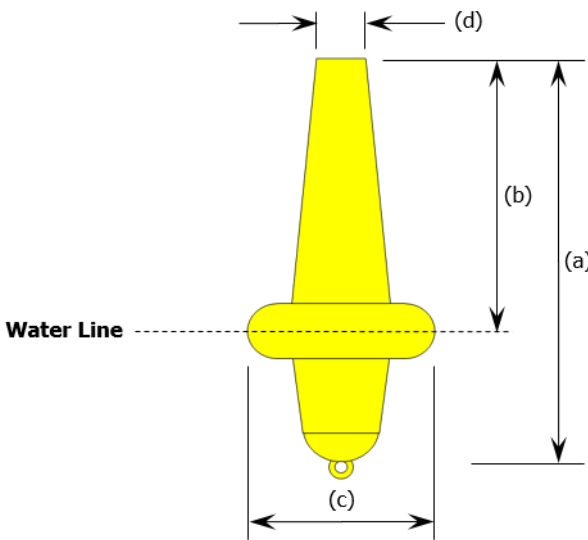
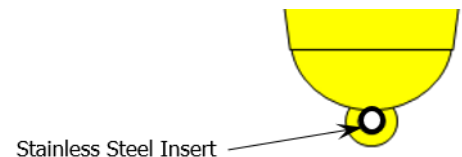
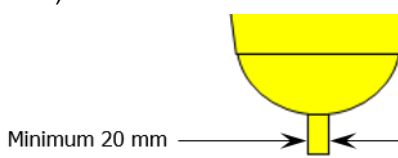
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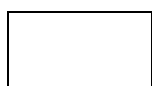
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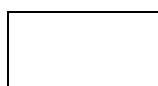
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DETAILS OF OFFER				COMPLY / DO NOT COMPLY
			Have the following minimum dimensions <i>(Also refer to the illustration below)</i> :	
		(a)	Total Length (Height): Between 1.100 m & 1.300 m	
		(b)	Length (Height) above Water Line: Between 0.900 m & 1.100 m	
		(c)	Diameter at Water Line: Between 0.500 m & 0.650 m	
		(d)	Diameter at Top of Buoy: Between 0.150 m & 0.200 m	
				
		3.1.4.	<p>All pillar buoys will have a rigid mooring eye / fixing point at the bottom with a stainless steel insert with an inside diameter of not less than 15 mm.</p> 	
		3.1.5.	<p>The width of the plastic at the mooring eye / fixing point shall have a minimum thickness of 20 mm. (Length of stainless steel insert as mentioned above)</p> 	
		3.1.6.	Each buoy shall have self-contained customised ballast and will be filled with Rigid Closed Cell High Density Polyurethane Foam.	

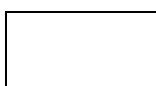
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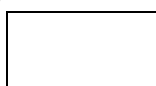
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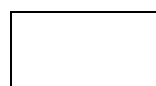
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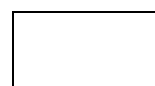
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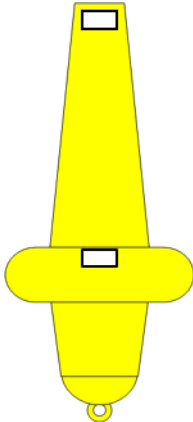
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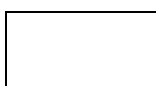


Witness 2

DETAILS OF OFFER					COMPLY / DO NOT COMPLY
		3.1.7.	Each AtoN Pillar Buoy shall be marked with a unique number so that the DWS can keep record of each buoy; for each dam as well as the originally deployed position.		
		3.1.8.	The marking / number <b>WILL</b> be engraved / printed on the side, close to the top, of each buoy or on the flat surface of the Buoy (As indicated). No marking / number shall be on the top mark or top mark base. (This will ensure that the buoy will still be identified, should the top mark be vandalized / broken off.)		
		3.1.9.	The marking / number will be legible with the letters and numerals <b>≥ 15 ≤ 25 mm high</b> , to ensure easy identification. The marking / number should also not be able to be scratched off or removed from the buoy.		
		3.1.10.	The pre-fix for the markings / numbers will be utilized as follows: • GWW 0001-9999 (Government Waterworks - DWS).		
		3.1.11.	Application procedures for the deployment of buoys are in place and <b>NO</b> AtoN Buoy will be manufactured and supplied without the prior recommendation from DWS and approval from SAMSA. A database will be held with DWS and SAMSA. AtoN buoy numbers <b>can only</b> be obtained from / supplied by: <b>Michael Kriel</b> Email: <a href="mailto:krielm@dws.gov.za">krielm@dws.gov.za</a> DWS: WRI: Operations & Maintenance: Technical Support Pretoria.		
		3.1.12.	The buoy body shall be watertight. The top of the buoy will be sealed watertight after the foam has been filled.		
		3.1.13.	Each buoy shall be supplied with a suitable top-mark mounting facility / plate. This mounting will be manufactured from stainless steel and be fixed onto the top of the buoy. The mounting facility / plate will not be less than 2 mm thick and not less than 100 x 100 mm		
		3.1.14.	Threaded brass or stainless steel inserts / nuts; minimum M6; will be moulded into the top of the Pillar Buoy to facilitate the mounting / plate.		



Contractor



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Witness 2




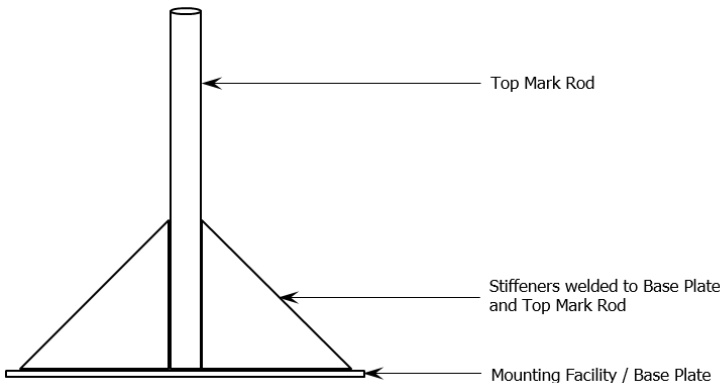
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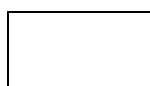
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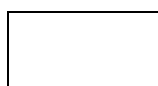
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DETAILS OF OFFER				COMPLY / DO NOT COMPLY
		3.1.15.	<p>The mounting facility / plate will be fixed with “anti-theft” bolts/screws; e.g. 6-lobe button security screws; onto the buoy as to ensure that the mounting facility / plate with the top mark cannot be removed by any unwanted person/s.</p> <p><b>The bolts / screws will be supplied with each mounting facility/plate.</b></p> 	
		3.1.16.	Spare bolts / screws will be offered as an accessory.	
		3.1.17.	An adequate screw-driver and/or L-Shape key to tighten / loosen the “anti-theft” bolts / screws as offered in <i>Paragraph 7.1.15.</i> will be supplied as an accessory.	
		3.1.18.	All Top Marks will be fixed onto a Stainless Steel Rod or Stainless Steel Threaded Rod with a minimum diameter of 10 mm.	
		3.1.19.	Marks will be fixed in such a way that it cannot be unscrewed / removed from the Pillar Buoy mounting facility and / or Stainless Steel Rod / Threaded Rod.	
		3.1.20.	<p>The Stainless Steel Rod or Stainless Steel Threaded Rod will be fixed to the mounting facility / base plate by welding it onto the mounting facility / base plate and supported with 3 or 4 stiffeners spaced proportionally, minimum 2 mm thick and 40 mm high; to avoid that anybody can easily break-off the top mark rod from the base plate.</p> 	
		3.1.21.	<p>All Top Marks will be packed / transported separately to avoid any damage to the Top Marks. The Top Marks will be fitted on site and the Bidder will supply an adequate Sealant / O-Ring to ensure that no water can enter the Buoy Body from the top.</p>	

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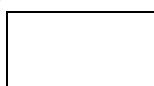
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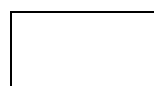
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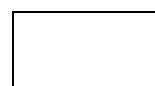
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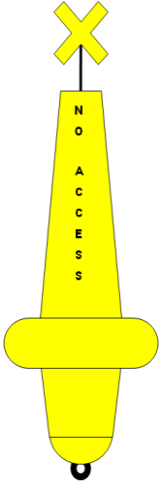
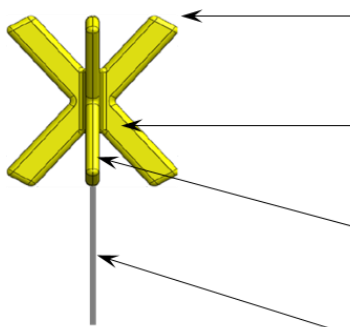


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DETAILS OF OFFER				COMPLY / DO NOT COMPLY
	3.2.	<b>IALA SPECIAL WATER MARKS WITH “NO ACCESS” GRAPHICS:</b>		
		3.2.1.	<p>Yellow Pillar Buoys will be utilized as Special Water Markers (“No Access”); which will include mould-in / mould-on graphics and will be displayed as follows:</p> 	
		3.2.2.	Each buoy <b>will contain four (4) sets</b> of “No Access” graphics spaced proportionally around the buoy.	
		3.2.3.	Black lettering should be typically Aerial Bold and each letter should not be smaller than 40 mm high and 30 mm wide.	
		3.2.4.	The lettering should be spaced so that the last letter is at least 200 mm above the waterline.	
		3.2.5.	The graphics should resist attack from chemicals, solvents and exposure to extreme weather conditions.	
		3.2.6.	Graphics should be embedded in a layer of plastic resin to protect it from fading, cracking, chipping or peeling.	
	3.3.	<b>TOP MARK FOR SPECIAL WATER MARKER:</b>		
		3.3.1.	Top Mark is a <b>3-D Yellow Diagonal Cross “X”</b> .	
		3.3.2.	<p><b>Minimum Dimensions:</b></p>  <p><b>Size of Diagonal Cross:</b> The Arms of the “X” should be diagonally contained within a square with length and height of the sides of about 33 % of the Buoy Ø at Waterline.</p> <p><b>Width of Cross Arms:</b> The Width of the “X” should be about 15 % of the length of the side of the square.</p> <p><b>Thickness of Cross Arms:</b> Not less than 10 mm if plastic sheeting is used and not more than 16 mm if roto-moulded.</p> <p><b>Distance between Top of Buoy to Bottom of Top Mark:</b> At least 35 % of the height of the square mentioned above.</p>	

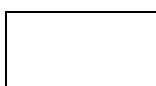
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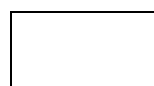
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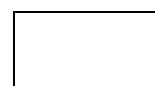
Witness 2



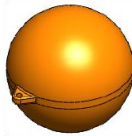


Employer



Witness 1

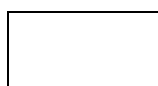


Witness 2

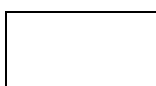
DETAILS OF OFFER				COMPLY / DO NOT COMPLY
4.	DETAIL SPECIFICATIONS: DEMARCATION MARKERS:			
	4.1.	ROUND DEMARCATION MARKERS:		
		4.1.1.	The Round demarcation markers will be offered in <b>Orange</b> (No Access Zone) within the range as per the IALA chromaticity diagram ( <b>Paragraph 2.7.2.</b> ). 	
		4.1.2.	The round demarcation markers will be offered in the following dimensions: (a) $\pm 400 \text{ mm } \varnothing$ ( $\geq 400 \text{ mm} < 420 \text{ mm}$ ); and (b) $\pm 600 \text{ mm } \varnothing$ ( $\geq 600 \text{ mm} < 630 \text{ mm}$ ).	
		4.1.3.	All round demarcation markers shall have a rigid mooring eye / fixing point on the buoy with a stainless steel insert with an inside diameter of not less than 15 mm. (As illustrated in <b>Paragraph 7.1.4.</b> )	
		4.1.4.	All round demarcation markers shall be filled with Rigid Closed Cell High Density Polyurethane Foam.	
		4.1.5.	The buoy body shall be completely watertight but should not deform after deployment because of altitude / air pressure.	
		4.1.6.	Therefore, each round demarcation marker shall include a mechanism to compensate for altitude / air pressure, e.g. a watertight screw able plug / cap supplied separately to be fixed on site when the buoys are deployed.	
		4.1.7.	Should such plug / cap be utilised, it should be watertight and tamper proof, e.g. hexagon head or sunk in hexagon head. 	
		4.1.8.	An adequate tool to tighten / loosen the plug will be supplied as an accessory.	
		4.1.9.	PTFE (Teflon) Tape, commonly known as "Plumbing Thread Tape" to seal the above mentioned plug will be supplied as an accessory: 10 or 12 mm wide x 10 m long roll 	



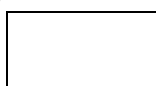
Contractor



Witness 1



Witness 2



Employer



Witness 1



Witness 2

## DETAIL SPECIFICATIONS: FIXING ACCESSORIES

### GENERAL

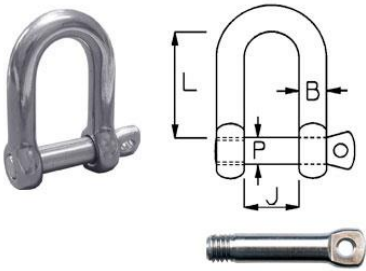
All AtoN (Pillar Buoys) and demarcation markers (Round Demarcation Markers) will be deployed / assembled / fixed by using various methods and accessories, i.e. D-shackles; Chain; Cable Clamps; etc.

### FIXING BUOYS AND DEMARCATION MARKERS TO EXISTING OR NEW MAIN CABLE/S

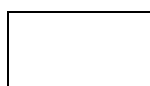
At most Government Waterworks; existing wire ropes (cables) or synthetic ropes are fixed a certain distance upstream of the Outlet Tower / Spillway / Dam Wall to indicate a “No Access” zone. Other areas might also have existing wire ropes (cables) or synthetic ropes in front of State Land or Nature Conservation Areas that might be closed off as “No Access” zones or indicating a “Restricted Access” zone.

The main wire rope diameters can vary from 6 mm Ø to 16 mm Ø and synthetic ropes up to 30 mm Ø.

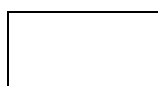
Demarcation Markers (Round or Cylindrical) will be fixed to the mentioned main cable/s. AtoN (Special Water Markers) can however be fixed to the existing main cable or fixed / moored individually up-stream of the main buoy line.

DETAILS OF OFFER				COMPLY / DO NOT COMPLY
	9.3.	<b>ACCESSORIES:</b>		
		9.3.1.	<p>“Marine Grade 316 Stainless Steel” D-Shackles will be supplied to be fixed to the AtoN buoy’s and Demarcation Markers’ fixing point. (These D-Shackles will be ordered separately and as required.)</p> <ul style="list-style-type: none"> <li>The D-Shackle width (“J” indicated below) shall fit over the <math>\pm 20</math> mm wide buoy fixing point with the pin fitting through the stainless steel insert.</li> <li>The pin diameter (“P” indicated below) shall have a minimum diameter of 10 mm.</li> </ul> 	

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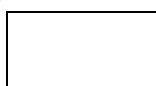
Contractor



Witness 1



Witness 2



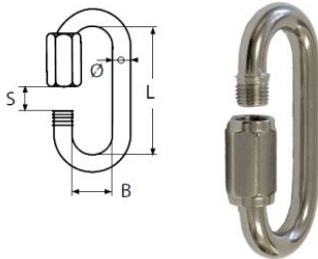
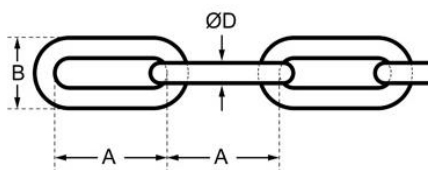
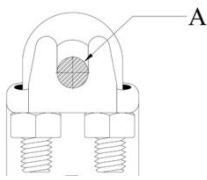


Employer



Witness 1



Witness 2

DETAILS OF OFFER				COMPLY / DO NOT COMPLY
		9.3.2.	<p>“Marine Grade 316 Stainless Steel” “Maillon Rapide” quick links will be supplied to fit into the D-Shackle and Cable Clamp. The quick link shall have the following dimensions:</p> <ul style="list-style-type: none"> <li>• Minimum of 8 mm Ø;</li> <li>• “B” as indicated below, a minimum of 16 mm so that the quick link can fit over the D-Shackle as shown in Paragraph 8.3.1.; as well as the Cable Clamp can fit into the quick link;</li> </ul> 	
		9.3.3.	<p>Pre-Cut “Marine Grade 316 Stainless Steel” Chain to fit into the “Maillon Rapide” quick link with the following dimensions will be supplied:</p> <ul style="list-style-type: none"> <li>• “Long Link” chain will be offered;</li> <li>• 8 mm Ø,</li> <li>• Pre-Cut lengths shall be 100 mm, 200 mm &amp; 300 mm long.</li> </ul> 	
		9.3.4.	<p>Suitable “Marine Grade 316 Stainless Steel” Cable Clamp to fit the new offered 12 or 13 mm Ø [A] “Main Cable”.</p> 	
		9.3.5.	<p>12 or 13 mm Ø wire rope “Marine Grade 316 Stainless Steel” 7 x 19 will be offered. (NO PVC coated wire ropes will be offered.)</p> 	
		9.3.6.	<p>“Marine Grade 316 Stainless Steel” thimbles will be offered. The Thimble groove must be able to accommodate the offered wire rope.</p> 	

## DEVIATIONS AND/OR MODIFICATIONS

Any deviation/s or modifications to the Specifications can be listed in the table below:

(Should there be no deviation/s or modifications, the Bidder **MUST** indicate so, e.g. "NIL")

PARAGRAPH NUMBER	PAGE NO.	DEVIATION OR MODIFICATION

**ANNEXURE I: SERVICE LEVEL AGREEMENT**

This part of the tender document shall be completed on acceptance of the most responsive contractor.

***GERT SIBANDE DISTRICT MUNICIPALITY***



**SERVICES LEVEL AGREEMENT**

**Between**

**“GERT SIBANDE DISTRICT MUNICIPALITY”**

**And**

.....

**TABLE OF CONTENTS**

- 1. PRECEDENCE**
- 2. DURATION**
- 3. SERVICES**
- 4. PAYMENT TERMS**
- 5. OBLIGATIONS OF SERVICE PROVIDER**
- 6. ADMINISTRATION OF THE SERVICE**
- 7. CHANGE IN CIRCUMSTANCES**
- 8. BREACH OF AGREEMENT**
- 9. JURISDICTION**
- 10. ADDRESS FOR RECEIPT OF NOTICES AND DOCUMENTS**
- 11. VARIATION**
- 12. WAIVER**
- 13. GENERAL**
- 14. CONFIDENTIALITY AND PROTECTION OF PROPRIETARY INFORMATION**
- 15. WARRANTY OF AUTHORITY**
- 16. SEVERABILITY**
- 17. SERVICE REQUESTS**
- 18. FORMALITIES**
- 19. ENVIRONMENT**
- 20. WHOLE AGREEMENT**



**THEREFORE THE PARTIES CONCLUDE THEIR AGREEMENT ON THE FOLLOWING TERMS AND CONDITIONS: -**

**1. PRECEDENCE**

The terms and conditions of this agreement shall take precedence over any other terms and conditions that may have been discussed by the parties.

**2. DURATION**

- 2.1 Notwithstanding the date of signature, this agreement shall commence on on this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_ and shall continue for a term of 36 months unless terminated by either party giving **30 days' notice in writing** to the other party.

**3. SERVICES**

- 3.1 ..... shall execute works as depicted in Clause C3.1.3 Extent of the Works.

**4. PAYMENT TERMS**

- 4.1 ..... shall submit a valid invoice to GSDM for the provision of services on monthly basis.
- 4.2 GSDM shall pay the amount charged within *30 days* of the date of a valid invoice into the bank account nominated by .....

**5. OBLIGATIONS OF .....**

..... as a service provider shall render the following services:

Extend of works depicted in Clause C3.1.3 and quantified in the Bill of Quantities.

**6. ADMINISTRATION OF THE SERVICE**

The Service Provider must ensure that they have the resources available (both staff and systems) to ensure that the material requested are available on order.

**7. CHANGE IN CIRCUMSTANCES**

If the circumstances surrounding the fulfilment of this agreement should alter materially from those prevailing at the time of signature of this agreement, then the parties undertake to renegotiate such of the terms and provisions of this agreement as may be necessary to ensure that this agreement remains fair and equitable to each of the parties.

**8. BREACH OF AGREEMENT**

- 8.1 If a dispute arises between the parties concerning any matter relating to this agreement, then both parties shall enter into negotiations, in good faith, in order to resolve the matter.
- 8.2 If the parties are unable to resolve the matter between them, they may but are not obligated to refer the matter to arbitration. The arbitrator may in turn appoint an independent expert in the field in which the dispute has arisen, provided that both parties accept and agree on the arbitrator and his choice of independent expert and the terms and conditions of his appointment. The arbitrator shall decide the matter, and both parties shall agree to be bound by his decision.

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Witness 1



Witness 2



Employer



Witness 1



Witness 2

- 8.3 In the event that the parties are unable to resolve the matter, or fail to agree on either an arbitrator or an expert, or the terms and conditions of his appointment, or if either party is in repeated breach of this agreement, then the party who has been aggrieved shall give written notice to the other party calling on it to remedy any breach of the agreement. If the other party fails to remedy the breach within 7 (seven) days of receipt of the notice, then the aggrieved party may elect to cancel the agreement, or to demand specific performance, without prejudice to its rights to claim damages and without prejudice to any other rights it may have in law.

## 9. JURISDICTION

Both Parties consent to the jurisdiction of the Magistrate's Court in respect of any action or proceedings which may be brought against either of them by the other; provided that either party shall be entitled to bring any proceedings in the High Court where such proceedings would, but for this consent, fall outside the jurisdiction of the Magistrate's Court.

## 10. ADDRESS FOR RECEIPT OF NOTICES AND DOCUMENTS

- 10.1 The parties choose the following as their addresses for the receipt of any notices or documents in terms of this agreement, including any documents that may be issued by a court of law:

10.1.1 Physical Address:  
: Gert Sibande District Municipality  
: Cnr. Joubert and Oosthuise Street.  
: Ermelo

10.1.2 Postal Address:  
: P/Bag X1748  
: **ERMELO**  
: 2350

Fax : 017 811 1207  
Tel : 017 811 7000 / 7144

10.1.3 Postal Address: (Details of the Potential Service Provider)  
: .....  
: .....  
: .....  
: .....  
Cell No:.....

- 10.2.1 Either party may change the address given above on written notice to the other, provided that the address is a physical place of business or residence, and not merely a postal address.

- 10.2.1 Every notice shall be deemed, unless the contrary is proved, to have been received: If delivered by hand, on the date of delivery;

- 10.2.2 If sent by prepaid registered post, 7 (seven) days after the date on which the notice is posted;

- 10.2.3 If sent by fax, on the first business day after the date of successful transmission of the fax.

## 11. VARIATION

No variation, alteration or consensual cancellation of this agreement shall be of any force or effect, unless in writing and signed by all of the parties.

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**12. WAIVER**

No indulgence which either party may grant to the other shall constitute a waiver of any of the rights of that party, who shall not thereby be precluded from exercising any of its rights against the other party which may have arisen in the past or which might arise in the future.

**13. GENERAL**

- 13.1 Unless the context indicates otherwise the rights and obligations of any party arising from this agreement shall devolve upon and bind its successors-in-title.
- 13.2 Prior drafts of this agreement shall not be admissible in any proceedings as evidence of any matter relating to any negotiations preceding the signature of this agreement.
- 13.3 Neither party may cede or assign any of their rights or obligations in terms of this agreement to any person, without the prior written consent of the other party, which consent shall not be unreasonably withheld.

**14. CONFIDENTIALITY AND PROTECTION OF PROPRIETARY INFORMATION**

- 14.1 All of the details of this Agreement shall be considered as confidential, and shall not be given in any form whatsoever to a third party, without prior written consent of the other party. This excludes any necessary information required by a third party in order to give effect to the provisions of this agreement.

**15. WARRANTY OF AUTHORITY**

- 15.1 Both parties, and the persons signing on behalf of the parties, warrant their authority to conclude this agreement.
- 15.2 Both parties further warrant that there is nothing that influence, or prevent any of the provisions of this agreement from being enforced.

**16. SEVERABILITY**

If any provision of this agreement is invalid or unenforceable for any reason, it will not thereby invalidate the whole agreement, unless the provision in question goes to the heart of the agreement. In such event, the party who is adversely affected by the invalid provision may elect to cancel the agreement; or to continue with it, or continue with it subject to agreement on any appropriate provision to replace the invalid or unenforceable one.

**17. SERVICE REQUESTS**

In support of services outlined in this Agreement, the Service Provider will respond to service requests submitted by the Customer within the following time frames:

- Within 3 (Three) Working days (during business hours).

**18. FORMALITIES**

The parties agree that they will do all things and sign all documents necessary to give effect to the terms of this agreement.

**19. ENVIRONMENT**

The service provider shall ensure that all material, services and works supplied in terms of the contract conform to all applicable environmental legislation.

**20. WHOLE AGREEMENT**

This written agreement constitutes the entire agreement between the parties, and no representation by any of the parties or their agents, whether made prior or subsequent to the signing of this agreement shall be binding on any of the parties unless in writing and signed by the parties.

Thus done and signed at \_\_\_\_\_ on this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_

\_\_\_\_\_  
**Ms ME RADEBE**  
**ACTING Municipal Manager**

AS WITNESSES For: **Gert Sibande District Municipality**

1 \_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_  
Who by his/her signature as Director warrants that he/she is duly authorised

AS WITNESSES For: **Service Provider**

1 \_\_\_\_\_

2 \_\_\_\_\_

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Contractor	Witness 1	Witness 2	Employer	Witness 1	Witness 2

## ANNEXURE MBD 6.2

### Form T: Declaration Certificate for Local Production and Content for Designated Sectors

This Municipal Bidding Document (MBD 6.2) must form part of all bids invited. It contains general information and serves as a declaration form for local content (local production and local content are used interchangeably).

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

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

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

Where:

x is the imported content in Rand

y is the bid price in Rand excluding value added tax (VAT)

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

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

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

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

Description of services, works or goods	Stipulated minimum threshold
_____	_____ %
_____	_____ %
_____	_____ %

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

(Tick applicable box) YES ☐ NO ☐

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

The relevant rates of exchange information are accessible on [www.reservebank.co.za](http://www.reservebank.co.za)

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

Currency Rates of exchange  
US Dollar  
Pound Sterling  
Euro  
Yen  
Other

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

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

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## LOCAL CONTENT DECLARATION

(REFER TO ANNEX B OF SATS 1286:2011)

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

IN RESPECT OF BID NO. GSDM17/2022

ISSUED BY: GERT SIBANDE DISTRICT MUNICIPALITY

NB

- 1 The obligation to complete, duly sign and submit this declaration cannot be transferred to an external authorized representative, auditor or any other third party acting on behalf of the bidder.
- 2 Guidance on the Calculation of Local Content together with Local Content Declaration Templates (Annex C, D and E) is accessible on [http://www.thdti.gov.za/industrial development/ip.jsp](http://www.thdti.gov.za/industrial%20development/ip.jsp). Bidders should first complete Declaration D. After completing Declaration D, bidders should complete Declaration E and then consolidate the information on Declaration C. Declaration C should be submitted with the bid documentation at the closing date and time of the bid in order to substantiate the declaration made in paragraph (c) below. Declarations D and E should be kept by the bidders for verification purposes for a period of at least 5 years. The successful bidder is required to continuously update Declarations C, D and E with the actual values for the duration of the contract.

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

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

Bid price, excluding VAT (y)                      R

Imported content (x), as calculated in terms of SATS 1286:2011      R.....

Stipulated minimum threshold for local content (paragraph 3 above)

Local content %, as calculated in terms of SATS 1286:2011

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

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

- (d) I accept that the Procurement Authority / Institution has the right to request that the local content be verified in terms of the requirements of SATS 1286:2011.

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

SIGNATURE:

DATE: \_\_\_\_\_

WITNESS No. 1

DATE: \_\_\_\_\_

WITNESS No. 2

DATE: \_\_\_\_\_

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Local Content Declaration - Summary Schedule

Tender No.  
Tender description:  
Designated product(s)  
Tender Authority:  
Tendering Entity name:  
Tender Exchange Rate:  
Specified local content %

**Annex C**

Pula  EU  GBP

Note: VAT to be excluded from all calculations

Calculation of local content								Tender summary			
Tender item no's	List of items	Tender price each (excl VAT)	Exempted imported value	Tender value net of exempted imported content	Imported value	Local value	Local content % (per item)	Tender Qty	Total tender value	Total exempted imported content	Total Imported content
(C8)	(C9)	(C10)	(C11)	(C12)	(C13)	(C14)	(C15)	(C16)	(C17)	(C18)	(C19)
(C20) Total tender value											
(C21) Total Exempt imported content											
(C22) Total Tender value net of exempt imported content											
(C23) Total Imported content											
(C24) Total local content											
(C25) Average local content % of tender											

Signature of tenderer from Annex B

Date: \_\_\_\_\_

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### Annex D

#### Imported Content Declaration – Supporting Schedule to Annex C

(D1)Tender No.		Note: VAT to be excluded from all calculations					
(D2)Tender Description							
(D3)Designated Products							
			Pula		EU		GBP

A. Exempted imported content				Calculation of imported content						Summary	
Tender item no's	Description of imported content	Local supplier	Overseas Supplier	Foreign currency value as per Commercial Invoice	Tender Exchange Rate	Local value of imports	Freight costs to port of entry	All locally incurred landing costs & duties	Total landed cost excl VAT	Tender Qty	Exempted imported value
(D7)	(D8)	(D9)	(D10)	(D11)	(D12)	(D13)	(D14)	(D15)	(D16)	(D17)	(D18)
This total must correspond with Annex C - C 21									(D19) Total exempt imported value		

B. Imported directly by the Tenderer				Calculation of imported content						Summary	
Tender item no's	Description of imported content	Unit measure of	Overseas Supplier	Foreign currency value as per Commercial Invoice	Tender Exchange Rate	Local value of imports	Freight costs to port of entry	All locally incurred landing costs & duties	Total landed cost excl VAT	Tender Qty	Total imported value
(D20)	(D21)	(D22)	(D23)	(D24)	(D25)	(D26)	(D27)	(D28)	(D29)	(D30)	(D31)

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Witness 1

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								(D32) Total imported value by tenderer			
C. Imported by a 3rd party and supplied to the Tenderer				Calculation of imported content						Summary	
Description of imported content	Unit of measure	Local supplier	Overseas Supplier	Foreign currency value as per Commercial Invoice	Tender Exchange Rate	Local value of imports	Freight costs to of port entry	All locally incurred landing costs & duties	Total landed cost excl VAT	Tender Qty	Total imported value
(D33)	(D34)	(D35)	(D36)	(D37)	(D38)	(D39)	(D40)	(D41)	(D42)	(D43)	(D44)
								(D45) Total imported value by 3rd party			

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Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

B. Imported directly by the Tenderer			Calculation of foreign currency payments	
Type of payment	Local supplier making the payment	Overseas beneficiary	Foreign currency value paid	Tender Rate of Exchange
(D46)	(D47)	(D48)	(D49)	(D50)

Summary of payments
Local value of payments
(D51)

(D52) Total of foreign currency payments declared by tenderer and/or 3rd party

(D53) Total of imported content & foreign currency payments - (D32), (D45) & (D52) above

This total must correspond with Annex C - C 23

Signature of tenderer from Annex B

\_\_\_\_\_

Date:

\_\_\_\_\_

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Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

**Annex E**

SATS 1286.2011

**Local Content Declaration - Supporting Schedule to Annex C**

Note: VAT to be excluded from all calculations

Tender description:  
Designated products:  
Tender Authority:  
Tendering Entity name:

**Local Products (Goods, Services and Works)**

Description of items purchased

Local suppliers

Value

% of  
LC

(E6)

(E7)

(E8)

(E9) Total local products (Goods, Services and Works)

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Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2

Manpower costs (E10)( Tenderer's manpower cost)

Factory overheads (E11)(Rental, depreciation & amortisation, utility costs, consumables etc.)

Administration overheads and mark-up (E12)(Marketing, insurance, financing, interest etc.)

(E13) Total local content

Signature of tenderer from Annex B

This total must correspond with  
Annex C - C24

Date:

The guidance document can be found at: [www.dti.gov.za/industrial\\_development/docs/ip/guideline.pdf](http://www.dti.gov.za/industrial_development/docs/ip/guideline.pdf)

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Contractor

Witness 1

Witness 2

Employer

Witness 1

Witness 2