



Nkomazi
Local Municipality

9 Park Street - Malalane

Private Bag X101

Malalane,

1320

Tel: (013) 790 0245

Fax: (013) 790 088

Customer Care No. (013) 790 0990

www.nkomazi.gov.za

RE-ADVERT FOR APPOINTMENT OF A PANEL OF MAXIMUM 10 (TEN) CONTRACTORS FOR THE REFURBISHMENT AND REPLACEMENT OF CIVIL WORKS, MECHANICAL AND ELECTRICAL EQUIPMENTS AT WATER, WASTE WATER TREATMENT WORKS AS AND WHEN REQUIRED FOR 36 MONTHS

BID NO: NKO:09/2025

**NKOMAZI
PRIVATE BAG x 101
MALELANE
1320**

**The Municipal Manager
Mr. NO Nkosi**

**TEL.: 013 – 790 0245
FAX: 013 – 790 0886**

VAT Registration No: 4300102938

PLEASE NOTE THAT THIS DOCUMENT MUST ACCOMPANY YOUR PROPOSAL AND RELEVANT DOCUMENTATION

Name of Bidder	
Address	
Contact Numbers	
Telephone No. or Cell phone No.	
Fax No.	
E-mail Address	
Tendered Amount (VAT INC)	

CLOSING DATE: 17/04/2026



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1320
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BID NO: NKO:09/2025: RE-ADVERT FOR THE APPOINTMENT OF A PANEL OF MAXIMUM OF 10(TEN) CONTRACTORS FOR THE REFURBISHMENT AND REPLACEMENT OF CIVIL WORKS,MECHANICAL AND ELECTRICAL EQUIPMENT AT WATER,WASTE WATER TREATMENT WORKS AS AND WHEN REQUIRED FOR NKOMAZI LOCAL MUNICIPALITY FOR A PERIOD OF THIRTY-SIX (36) MONTHS.TENDERES SHOULD HAVE A CIDB CONTRACTOR GRADING OF 5CE,5EP AND 5ME(A COMBINATION OF ANY 2 CONTRACT GRADING OR HIGHER)

The Nkomazi Local Municipality invites interested parties for re-advert for the appoint of a panel of maximum of 10(ten) contractors for the refurbishment and replacement of civil works, mechanical and electrical equipment at water ,waste water treatment works as and when required for a period of thirty-six (36) months. Tender documentation with complete details is available upon the payment of a non-refundable amount of **R1 740.02** on each tender document or can be downloaded for free on the e-Tender portal. Tender document(s) will be available as from **11/03/2026** and to be obtained at Nkomazi Local Municipality: Budget and Treasury office (Old Malalane Taxi Rank), 22 Impala Street from the Cashiers Desk from **07h45 to 15H30** (Monday-Friday).

A compulsory tenderer briefing session will be held on **20/03/2026 at 10h00** at the Municipal Town Hall (Kobwa Hall) at Fish Eagle. Failure to attend the briefing session will lead to disqualification. Bidders are advised not to commit fraudulent activities or forgery to document. All abusers of the SCM system, including or faking of returnable documents, may be reported to SAPS and restricted from doing business with any public institution for a period not exceeding 10 years is in line with section 28 and 29 of the prevention and combating of corrupt activities Act 12 of 2004.

A preferential system shall apply whereby this contract will be allocated to a bidder in accordance with the Preferential Procurement Policy Framework Act, no 5 of 2000 and as defined in the bid document, read in conjunction with the Preferential Procurement Regulation, 2022 where 80 points will be allocated in respect of price and 20 points in respect of targeted goals.

Completed bid documentation must be deposited on/before **12h00 on 17/04/2026** in the Tender Box situated at the main entrance of the municipality (Civic Centre), 9 Park Street, Malalane.

Tenders/Bids must be submitted in a sealed envelope or container on which the tender/bid number and addressee is clearly marked. No bids transmitted by fax or e-mail will be accepted. It must be noted that the municipality is not bound to accept the lowest on any other tender. Tender/bid documentation which is incomplete or filled incorrectly, not filled in the official bid documentation or which is received after the closing of the bids, will be ignored. It must also be noted the tender submitted in a wrong tender box will not be considered.

For Supply Chain enquiries contact Mr. R. Mabuza at 013 790 0386, and for technical enquiries contact Mr. P Nyakane at 013 790 0145, between 07H15 – 16H00 on working weekdays.

.....
MR. O. N. NKOSI
MUNICIPAL MANAGER

06/03/2026
Date

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❖ **The tender will be evaluated based on the criteria outlined below in conjunction with the information in the table, which focuses on administrative compliance. Bidders who fail to meet or adhere to the conditions and requirements specified in the tender document will be automatically disqualified from the evaluation process.**

- (a) Price amendment without initials and signature of authorised personnel in the bills of quantity
- (b) Original certified copy of company registration certificate (CK)
- (c) Original certified copies of all Directors/members.
- (d) Attach Copy of SARS Tax Pin or tax clearance certificate
- (e) Valid COIDA
- (f) Active CIDB grades (combination of the two (2); minimum 5CE, 5EP and 5ME or higher)
- (g) Original certified copy of current municipal account (not older than 3 months and not in arrears for more than three months) or copy of valid Lease Agreement– business accompanied by its certified/orginal proof of payments of rates.
- (h) Original certified copies of current municipal account (not older than 3 months and not in arrears for more than three months) all directors/members of the company in case of leasing should submit a copy of valid Lease Agreement– accompanied by its certified/orginal proof of payments of rates
- (i) Letter of Authority to complete and sign the tender document (Must be in the company letter head)
- (j) CSD detailed report (printed after the tender advert and on or before tender closing)
- (k) Joint Venture Agreement (In case of a Joint Venture)
- (l) Joint Ventures must be registered on CSD as Joint Venture.
- (m) All forms must be filled in full
- (n) Failure to sign applicable pages.
- (o) Completion of the bill of quantity
- (p) Alterations to the bid document or submission of a copy of the original bid document
- (q) Completion of the bid document using pencil or erasable pen.
- (r) Usage of Tippex is not allowed
- (s) Non completion of form of offer in words and figures
- (t) Scratching out / painting over rates / use of correcting fluid is not allowed.
- (u) Failure to submit documents required in this document
- (v) Enterprise particulars not provided.
- (w) The bid has been submitted after the closing date and time.

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❖ The below are not disqualifying requirement:

NO	DOCUMENT NAME	RETURNABLE / INCLUDED IN THE BID DOCUMENT (Mark)		
		Included in Bid Doc	Returnable	Required Documents from Supplier
	An Original/certified Tax Clearance or SARS Pin?	No		Yes
	CSD Registration Report (printed after the tender advert and on or before tender closing).	No		Yes
	Certified copy of Company Registration (CK) (If the copy has more than one page, all pages must be certified)	No		Yes
	Copy of B-BBEE Certificate (SANAS accredited) or sworn affidavit	No		Yes
	Authority of Signatory; Original if a copy must be certified (must be in the company letterhead)	No		Yes
	Full CSD report not older than 3 months	No		Yes
	Certified copy of proof of payment for Municipal rates and taxes or letter from the municipality indicating that your business is situated in an area where there are no rates billing for all directors, Board members and business. If the rates and taxes account is not in the names of the company, the attached municipal rates and taxes statement must be submitted together with an original affidavit from the property owner whose name/s are reflecting on the municipal rates and taxes statement to confirm that the company operates from their property	No		Yes
	Schedule of Rates (T10) (should be completed in full)	Yes	Yes	
	Appointment letters and or purchase orders, Refer to the Technical Evaluation Criteria	No	Yes	
	Reference letters, Refer to the Technical Evaluation Criteria	No		
	Bank Rating letter on a Bank's letter head and should not be older than 3 months	No		Yes
	Comprehensive Methodology on how the tenderer is planning to invest back to the community of Nkomazi Local Municipality, refer to specific goals on MBD 6.1	No		Yes
	Latest Annual Financial Statements; refer to MBD 5	No		Yes
	Audited Annual Financial Statements (to bidders who are legal required by law); refer to MBD 5	No		Yes

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NB: All declarations and authorizations forms must be duly signed.

NB: Certified copies of documentation must not be older than three months to be regarded as valid. Copies of “certified copies” will not be acceptable as true copies of original documents. Failure to adhere will lead to immediate disqualification.

- “Acceptable bid” means any bid which, in all respects, complies with the conditions of bid and specifications as set out in the bid documents, including conditions as specified in the Preferential Procurement Policy Framework Act (Act 5 of 2000) and related legislation as defined in this bid document, read in conjunction with the Preferential Procurement Regulation, 2022 where 80 points will be allocated in respect of price and 20 points in respect of targeted goals.

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PART A INVITATION TO BID

YOU ARE HEREBY INVITED TO BID FOR REQUIREMENTS OF THE (NKOMAZI LOCAL MUNICIPALITY)				
BID NUMBER:	NKO: 09/2025	CLOSING DATE:	17/04/2025	CLOSING TIME: 12:00
DESCRIPTION	RE-ADVERT FOR APPOINTMENT OF A PANEL OF MAXIMUM 10 (TEN) CONTRACTORS FOR THE REFURBISHMENT AND REPLACEMENT OF CIVIL WORKS, MECHANICAL AND ELECTRICAL EQUIPMENTS AT WATER, WASTE WATER TREATMENT WORKS AS AND WHEN REQUIRED FOR 36 MONTHS			
THE SUCCESSFUL BIDDER WILL BE REQUIRED TO FILL IN AND SIGN A WRITTEN CONTRACT FORM (MBD7).				

BID RESPONSE DOCUMENTS MAY BE DEPOSITED IN THE BID BOX SITUATED AT (STREET ADDRESS)

SUPPLIER INFORMATION

NAME OF BIDDER			
POSTAL ADDRESS			
STREET ADDRESS			
TELEPHONE NUMBER	CODE	NUMBER	
CELLPHONE NUMBER			
FACSIMILE NUMBER	CODE	NUMBER	
E-MAIL ADDRESS			
VAT REGISTRATION NUMBER			
TAX COMPLIANCE STATUS	TCS PIN:	OR	CSD No:
1. ARE YOU THE ACCREDITED REPRESENTATIVE IN SOUTH AFRICA FOR THE GOODS /SERVICES OFFERED?	<input type="checkbox"/> Yes <input type="checkbox"/> No [IF YES ENCLOSE PROOF]	2. ARE YOU A FOREIGN BASED SUPPLIER FOR THE GOODS /SERVICES OFFERED?	<input type="checkbox"/> Yes <input type="checkbox"/> No [IF YES, ANSWER PART B:3]
3. TOTAL NUMBER OF ITEMS OFFERED		4. TOTAL BID PRICE	R
5. SIGNATURE OF BIDDER	.....	6. DATE	
1. CAPACITY UNDER WHICH THIS BID IS SIGNED			

BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO:		TECHNICAL INFORMATION MAY BE DIRECTED TO:	
DEPARTMENT	SCM	CONTACT PERSON	Prince Nyakane
CONTACT PERSON	Richard Mabuza	TELEPHONE NUMBER	
TELEPHONE NUMBER	(013) 790 0386	FACSIMILE NUMBER	(013) 790 0386
FACSIMILE NUMBER		E-MAIL ADDRESS	
E-MAIL ADDRESS	richard.mabuza@nkomazi.gov.za	E-MAIL ADDRESS	Prince.nyakane@nkomazi.gov.za

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PART B

TERMS AND CONDITIONS FOR BIDDING

1. BID SUBMISSION:

- 1.1. BIDS MUST BE DELIVERED BY THE STIPULATED TIME TO THE CORRECT ADDRESS. LATE BIDS WILL NOT BE ACCEPTED FOR CONSIDERATION.
- 1.2. **ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS PROVIDED (NOT TO BE RE-TYPED) OR ONLINE**
- 1.3. THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT AND THE PREFERENTIAL PROCUREMENT REGULATIONS THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER SPECIAL CONDITIONS OF CONTRACT.

2. TAX COMPLIANCE REQUIREMENTS

- 2.1 BIDDERS MUST ENSURE COMPLIANCE WITH THEIR TAX OBLIGATIONS.
- 2.2 BIDDERS ARE REQUIRED TO SUBMIT THEIR UNIQUE PERSONAL IDENTIFICATION NUMBER (PIN) ISSUED BY SARS TO ENABLE THE ORGAN OF STATE TO VIEW THE TAXPAYER'S PROFILE AND TAX STATUS.
- 2.3 APPLICATION FOR THE TAX COMPLIANCE STATUS (TCS) CERTIFICATE OR PIN MAY ALSO BE MADE VIA E-FILING. IN ORDER TO USE THIS PROVISION, TAXPAYERS WILL NEED TO REGISTER WITH SARS AS E-FILERS THROUGH THE WEBSITE WWW.SARS.GOV.ZA.
- 2.4 FOREIGN SUPPLIERS MUST COMPLETE THE PRE-AWARD QUESTIONNAIRE IN PART B:3.
- 2.5 BIDDERS MAY ALSO SUBMIT A PRINTED TCS CERTIFICATE TOGETHER WITH THE BID.
- 2.6 IN BIDS WHERE CONSORTIA / JOINT VENTURES / SUB-CONTRACTORS ARE INVOLVED, EACH PARTY MUST SUBMIT A SEPARATE TCS CERTIFICATE / PIN / CSD NUMBER.
- 2.7 WHERE NO TCS IS AVAILABLE BUT THE BIDDER IS REGISTERED ON THE CENTRAL SUPPLIER DATABASE (CSD), A CSD NUMBER MUST BE PROVIDED.

3. QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS

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

IF THE ANSWER IS "NO" TO ALL OF THE ABOVE, THEN IT IS NOT A REQUIREMENT TO REGISTER FOR A TAX COMPLIANCE STATUS SYSTEM PIN CODE FROM THE SOUTH AFRICAN REVENUE SERVICE (SARS) AND IF NOT REGISTER AS PER 2.3 ABOVE.

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

SIGNATURE OF BIDDER:

CAPACITY UNDER WHICH THIS BID IS SIGNED:

DATE:

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1. BID INSTRUCTIONS

- 1.1 The tender document(s) have been drafted to ensure that essential information is furnished upon the correct completion of the document(s). Where there is insufficient space, or additional particulars are required to be furnished, such must be provided on a separate annexure, clearly indicated.
- 1.2 Tender document(s) may not be retyped or redrafted. Also no photocopies of the original document(s) may be used.
- 1.3 Tender document(s) may be completed by mechanical devices such as typewriters; alternatively black ink must be used to fill in the document(s).
- 1.4 Tenderer must ensure that no pages are missing from the bid document(s), and that the pages of the bid are numbered consecutively. Nkomazi Local Municipality shall not be held liable with regard to claims arising from the fact that pages are missing or duplicated.
- 1.5 Firm tender prices (rates) and delivery periods are preferred, and tenders must clearly state whether prices and delivery periods will remain firm for the duration of the contract or not.
- 1.6 Tenderer must be strictly to specification. In cases where items are not to specification, deviations must be clearly indicated. It must also be noted that supplier/tenderer may quote for other items other than the one indicated on the schedule of quantity on a separate sheet, but it would not form part of items to be evaluated for.
- 1.7 Tender prices must be quoted in South African currency and in the specified units, unless the contrary is clearly indicated.
- 1.8 All the documents herewith form part of the bid and failure to comply with any part thereof may invalidate a bid.
- 1.9 Nkomazi Local Municipality may issue Briefing Notes during the briefing session which may contain amendments or information that may assist bidders in articulating their bids.
- 1.10 Nkomazi Local Municipality require as a condition of the bid that the non-compulsory/optional explanatory meeting be attended by prospective bidders. This requirement will be clearly stated in the tender advertisement as well as in the documentation.
- 1.11 Nkomazi Local Municipality requires the furnishing of a non-refundable bid deposit together with the drawing of bid documentation (if applicable). Where such a non-refundable bid deposit is requested in the bid documentation, for those who purchased the tender document. No tender document will be accepted unless such a deposit (or cash) is submitted in the form of a bank cheque payable to Nkomazi Local Municipality before submission of the bid. Alternatively, the bid documentation can be downloaded for free on e-Tender or Nkomazi Website.
- 1.12 Tenders must be submitted to the addressee before the closing time. Bids submitted after the closing time shall be considered late, and will not be admitted for consideration.
- 1.13 The contractor/Service provider shall not abandon, transfer, assign or sublet a contract or part thereof without prior written consent of the council.
- 1.14 It is an irrefutable condition of this contract that the successful tenderer will have to negotiate and conclude a service level agreement with the council

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2. SCOPPE OF WORK

The scope of work is detailed in C3:

- C3.1 Standard specifications
- C3.2 Project specifications
- C3.3 Particular specifications
- C3.4 Day work schedule

2.1 The pricing instructions describe the criteria and assumptions which will be assumed in the contract that the Tenderer has taken into account when developing his prices. The bills of quantities record the contractor's rates for providing supplies, services, engineering and construction works in accordance with the scope of work.

C2: Pricing Data

C2.1 Pricing Instructions

C2.2 MBD 3.1: Bid Pricecompetition among the appointed service providers or contractors and all terms and conditions of the procurement are set out in the in this tender document with no possibility for an additional service provider.

Contract Period

This is a thirty-six (36) months contract in which the appointed tender for the appointment of a panel of maximum 10 (ten) contractors for the refurbishment and replacement of civil works, mechanical and electrical equipments at water, waste water treatment works as and when required for 36 months as in when required by the municipality and in specified quantities using the items descriptions and prices as per the schedule of rate per each calendar year as contained in T10.

Bid Specification

Refer to the attached schedule of rates or bill of quantities as in T10

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3.1. SUPPLIERS / CONTRACTORS

3.1.1. "Certificate of authority to sign all documents in connection with this tender and any contract or agreement which may arise there from", duly signed and dated, shall be provided by the Board of Directors of the firm and shall be attached to this page. An example is given below.

3.2. JOINT VENTURE

3.2.1. The document of formation of the Joint Venture shall be attached to this page.

3.2.2. A "certificate of authority to sign all documents in connection with this tender and any contract or agreement which may arise there from", duly signed and dated, shall be provided by the Boards of Directors of each member of the Joint Venture and shall be attached to this page.

EXAMPLE OF A CERTIFICATE OF AUTHORITY FOR SIGNATORY

"By resolution of the board of directors passed at a meeting held on

Mr. /Ms..... whose signature appears below, has been duly authorized

to sign all documents in connection with the tender for Contract no.....

and any contract which may arise there from on behalf of (block capitals).....

SIGNED ON BEHALF OF THE COMPANY.....

IN HIS/HER CAPACITY AS:

DATE:

SIGNATURE OF SIGNATORY:

WITNESS: 1:

2:

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1. No bid will be accepted from persons in the service of the state:
2. Any person or having kinship with a person in the service of state, or persons who act on behalf of Nkomazi Local Municipality, including a blood relationship, may make an offer or offers in terms of this bid invitation. In view of possible allegations of favouritism or bias, should the resulting bid, or part thereof, be awarded to persons employed by State, or to persons who act on behalf of Nkomazi Local Municipality, or to persons connected with or related to them, it is required that the bidder or his authorised representative shall declare any interest of whatever nature and/or relationship (including blood relationship) to any employees, or persons who act on behalf of, or persons connected with or related to Nkomazi Local Municipality.
3. In order to give effect to the above, the following questionnaire must be completed and submitted with the bid:

- 3.1. Full Name of the bidder or his representative:
- 3.2. Identify Number:
- 3.3. Position occupied in the Company (director, trustee shareholder):
.....
- 3.4. Company Reference Number:
- 3.5. Tax Reference Number:
- 3.6. VAT Registration Number:
- 3.7. The names of all directors/trustees/ shareholders members, their individual identity numbers and state employee numbers must be indicated in paragraph 4 below.
- 3.8. Are you presently in the service of the state? YES/NO
- 3.8.1 If yes, furnish particulars:
-

❖ MSCM Regulations: “in the service of the state” means to be-

- (a) A member of-
 - (i) Any municipal council
 - (ii) Any provincial legislature, or
 - (iii) The national Assembly or the national council of provinces
- (b) A member of the board of directors of any municipal entity;
- (c) An official of any municipality or municipal entity;

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- (d) An employee of any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No. 1 of 1999);
- (e) A member of the accounting authority of any national or provincial public entity; or
- (f) An employee of parliament or a provincial legislature

❖ Shareholder means a person who owns shares in the company and is actively involved in the management of the company or business and exercises control over the company.

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

If yes, furnish particulars:

.....

3.10. Do you, have any relationship (family, friend, other) with a person employed by state/Nkomazi Local municipality, who may be involved in the evaluation and adjudication of this bid? *YES / NO

3.10.1 If yes, furnish particulars:

.....

.....

3.11. Are you, aware of any relationship (family, friend, other) between the bidder and any person employed by state/Nkomazi Local Municipality, who may be involved in the evaluation and adjudication of this bid? *YES / NO

3.11.1 If yes, furnish particulars:

.....

.....

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

3.12.1 If yes, furnish particulars.

.....

.....

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

13.13.1 If yes, furnish particulars.

.....

.....

13.14 Do you or any of the directors, trustees, managers, principle shareholders, or stakeholders

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of this company have any interest in any other related companies or business whether or not they are bidding for this contract.

13.14.1 If yes, furnish particulars.

YES/NO

.....
.....

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

Full Name	Position filled in the " State"	ID number	State employee number

.....
Signature Bid Number Date
.....
Capacity Name of the Company

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

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

1. Are you by law required to prepare annual financial statements for auditing?

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

.....
.....

2. Do you have any outstanding undisputed commitments for municipal services towards any municipality for more than three months or any other service provider in respect of which payment is overdue for more than 30 days?

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

2.2 If yes, provide particulars.

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

* Delete if not applicable

• YES / NO

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

3.1 If yes, furnish particulars

.....
.....

***YES / NO**

4. Will any portion of goods or services be sourced from outside 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

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MBD 6.1**PREFERENCE POINTS CLAIM FORM IN TERMS OF THE PREFERENTIAL PROCUREMENT REGULATIONS 2022**

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

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

1. GENERAL CONDITIONS

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

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

1.2 To be completed by the organ of state

(delete whichever is not applicable for this tender).

- a) The applicable preference point system for this tender is the 90/10 preference point system.
- b) The applicable preference point system for this tender is the 80/20 preference point system.
- c) Either the 90/10 or 80/20 preference point system will be applicable in this tender. The lowest/ highest acceptable tender will be used to determine the accurate system once tenders are received.

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

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

1.4 To be completed by the organ of state:

The maximum points for this tender are allocated as follows:

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

1.5 Failure on the part of a tenderer to submit proof or documentation required in terms of this tender to claim points for specific goals with the tender, will be interpreted to mean that preference points for specific goals are not claimed.

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

2. DEFINITIONS

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

3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

3.1. POINTS AWARDED FOR PRICE

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

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

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

Where

Ps = Points scored for price of tender under consideration

Pt = Price of tender under consideration

Pmin = Price of lowest acceptable tender

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

3.2.1. POINTS AWARDED FOR PRICE

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

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

Where

Ps = Points scored for price of tender under consideration

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Pt = Price of tender under consideration
 Pmax = Price of highest acceptable tender

4. POINTS AWARDED FOR SPECIFIC GOALS

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

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

(Note to organs of state: Where either the 90/10 or 80/20 preference point system is applicable, corresponding points must also be indicated as such.

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

POINTS FOR CONTRACTING AN ENTERPRISE OWNED BY HISTORICALLY DISADVANTAGED PERSONS OR INDIVIDUALS		
A total of 8 preference points shall be allocated on a proportional or pro rata basis for contracting an enterprise owned by historically disadvantaged persons or individuals who meet the following requirements -		
HISTORICALLY DISADVANTAGED PERSONS OR INDIVIDUALS	POINTS ALLOCATION	SOURCE DOCUMENTS REQUIRED TO CLAIM POINTS
100% black person or people owned enterprise	2	A copy of a Full CSD report not older than 3 months
More than 30% woman or women shareholding or owned enterprise	2	
more than 30% youth shareholding or owned enterprise	2	
More than 30% people living with disability shareholding or owned enterprise	2	A copy of a Medical Certificate to confirm disability
POINTS FOR IMPLEMENTING OF RDP PROGRAMMES		

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A total of 12 preference points shall be allocated on a proportional or pro rata basis for implementing of programmes for RDP -

Enterprises regarded as *EMEs located within the Ehlanzeni District Municipality area of jurisdiction	2	<ul style="list-style-type: none"> ➤ A copy of a Full CSD report not older than 3 months <li style="padding-left: 20px;">NB: Points will only be awarded if the CSD physical address is the same as the address for the proof of residence required in 1.9 above.
Enterprise who will sub-contract minimum of 30% of the contract value to EMEs in the ward or local communities where the services of work to be rendered will be undertaken;	2	<ul style="list-style-type: none"> ➤ Joint venture requirements as per the tender document and all relevant legislations pertaining to joint ventures
Points for Corporate Social Investment (CSI) or Social Labour Plan proposition	5	<p>Comprehensive Methodology on how the tenderer is planning to invest back to the community of Nkomazi Local Municipality:</p> <ul style="list-style-type: none"> • Community development grounded on the principles of empowerment, social justice, collective action to mention but a few. • These undertakings shall form part of the service level agreements SLA and be managed as such.
Points for valid B-BBEE level 1 contribution (SANAS accredited B-BBEE certificate for generic enterprise, and for EME and SME a sworn affidavit or CIPC issued certificate confirming annual turnover and level of Black Ownership).	3	<ul style="list-style-type: none"> ➤ Certified Valid BBBEE certificate ➤ or Certified Valid EME and SME a sworn affidavit ➤ or Certified Valid CIPC issued certificate confirming annual turnover and level of Black Ownership
TOTAL PREFERENCE POINTS TO BE CLAIMED	20	

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DECLARATION WITH REGARD TO COMPANY/FIRM

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

4.4. Company registration number:

4.5. TYPE OF COMPANY/ FIRM

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

[TICK APPLICABLE BOX]

4.6. I, the undersigned, who is duly authorised to do so on behalf of the company/firm, certify that the points claimed, based on the specific goals as advised in the tender, qualifies the company/ firm for the preference(s) shown and I acknowledge that:

- i) The information furnished is true and correct;
- ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;
- iii) In the event of a contract being awarded as a result of points claimed as shown in paragraphs 1.4 and 4.2, the contractor may be required to furnish documentary proof to the satisfaction of the organ of state that the claims are correct;
- iv) If the specific goals have been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the organ of state may, in addition to any other remedy it may have –
 - (a) disqualify the person from the tendering process;
 - (b) recover costs, losses or damages it has incurred or suffered as a result of that person’s conduct;
 - (c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;
 - (d) recommend that the tenderer or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted from obtaining business from any organ of state for a period not exceeding 10 years, after the *audi alteram partem* (hear the other side) rule has been applied; and
 - (e) forward the matter for criminal prosecution, if deemed necessary.

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

SURNAME AND NAME:

DATE:

ADDRESS:

.....

.....

.....

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❖ **TECHNICAL EVALUATION CRITERIA**

- All bidders are required to respond to the evaluation criteria measurements. Only Bidders that have met the Pre-Qualification Criteria will be evaluated for pricing.
- Bidders will be evaluated out of 100 points and are required to achieve minimum threshold of 70 points in order to proceed to price evaluations. A bidder who scores less than 70 points on technical evaluation will be disqualified.

Description of the Evaluation Criteria	Maximum number of tender evaluation points
Tenderer's experience	50
Construction resources	10
Experience of key staff and capacity	40
Maximum total evaluation points for functionality	100

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The following standard terms and conditions of bid have been accepted and laid down by the Council of Nkomazi Local Municipality and are applicable to all bids, contracts and orders, unless otherwise directed by the Council prior to the invitation of bids.

1. GENERAL DIRECTIVES

1.1. Formal contracts

Formal contracts shall only be concluded with bidders where this requirement is stated in the bid documents. In the absence of a formal contract, the duly completed and signed bid accepted by a letter of acceptance by Nkomazi Local Municipality and signed by both parties, shall be the contract between the parties, and this shall include the tender document.

1.2. Expenses

Unless otherwise indicated in the bid documents, Nkomazi Local Municipality shall not be liable for any expenses incurred in the preparation or submission of any bid.

1.3. Briefing Notes

Nkomazi Local Municipality may issue Briefing Notes from time to time during the bid submission phase so that prospective bidders will timeously be made aware of any and all information that might assist them in articulating their bids.

Briefing Notes will be sequentially numbered to facilitate easy reference.

1.4. Governing laws

Laws of the Republic of South Africa shall govern contracts arising from the acceptance of bids.

1.5. Site inspections and explanatory meetings

1.5.1 Nkomazi Local Municipality may require the attendance of a Compulsory site inspection or explanatory meeting. Where this is a condition of bid, bidders must attend the site inspection or explanatory meeting in order to submit a valid bid. Failure to attend or coming late for the said meeting will result in the bid being non-compliant.

1.5.2 Particulars of the place and time of the site inspection or explanatory meeting will be indicated in the advertisement and the bid documentation.

1.5.3 Minutes will be taken of all information disclosed during the site inspection or explanatory meeting, and copies of these minutes will be made available on request to all interested parties that attended the relevant inspection or meeting.

1.5.4 Where the attendance of the site inspection or explanatory meeting is an absolute requirement to the bid, bidders must be required to certify that they attended the site meeting or explanatory meeting and that they are fully aware of the scope of the bid.

2. INVITATIONS TO TENDER/BID

2.1. Service Provider Database

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Nkomazi Local Municipality may issue invitations to bid for specific supplies or services to service providers listed on the Nkomazi Local Municipality service provider database.

Without derogating from the above, Nkomazi Local Municipality reserves the right to go to open bid for the obtainment of supplies or services.

Requests for listing on the service provider database of Nkomazi Local Municipality will be issued from time to time in the local media.

2.2. Documents to be used

2.2.1 Bids must make use of the prescribed bid documents, and supply all necessary and required information called for therein.

2.2.2 Failure of a bidder to submit a bid duly signed in black ink, or to provide all required documentation or to complete bid documentation and certificates in all respects, may invalidate the bid.

2.2.3 Bidders should not qualify their bids by their own conditions, and such bidders run the risk of having their bid declared invalid.

2.2.4 Nkomazi Local Municipality may request the furnishing of a non-refundable bid deposit together with the submission of bids. This is to defray in part the cost of non-responsive bids, and to prevent nuisance bids being submitted.

3. Samples

3.1.1. Prospective bidders may be charged for samples provided to them by Nkomazi Local Municipality. Failure to do so may render the bid invalid. Nkomazi Local Municipality shall not be liable for any cost involved in the supply of samples by a tenderer/ bidder;

3.1.2. Where samples are called for in the bid documents, samples must be clearly marked with the bid numbers, item number and name of the bidder. Samples must reach the designated address for the submission of bids no later than the closing time;

3.1.3. Nkomazi Local Municipality may accept goods offered on loan for trial purposes, but is under no obligation to purchase the loaned goods, or any similar goods, and Nkomazi Local Municipality accepts no responsibility in the event of breakage of damage, or for the depreciation of depreciable goods.

4. Closing of tenders/bids

4.1. Bids close at 12:00 AM on the closing date as indicated in the bid documents.

4.2. Extension of the closing date may be granted in certain circumstances where such extension is justified. Any extension will however be published before the original closing date or can be communicated during briefing session.

4.3. Tenders/bids shall be considered late if they are received at the address indicated in the bid documents after the closing time on the closing date. A late bid shall not be admitted for consideration, and where practicable, shall be returned unopened to the bidder.

5. Submission of tenders/bids

5.1. Tender/bid documents must be deposited in the bid box at the address indicated in the bid documentation, failing which at a clearly indicated alternative site (where applicable).

5.2. Tenders/bids must be deposited in a sealed envelope or container, which envelope or container must clearly indicate the bid number and description of bid (where applicable).

5.3. Tenders/bids must be submitted in English.

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- 5.4. Tenders/bids received by facsimile, telegram, telex, e-mail or other similar media will not be accepted as validly submitted bids (where applicable).
- 5.5. Only original tenders/bids or photocopies of the original documentation which is submitted in the prescribed manner may be accepted as valid bids.
- 5.6. All tenders/bids received prior to the closing date shall be kept in safe custody until the closing time of bids.

6. Opening of tenders/bids

- 6.1. Tenders/bids will be opened in public (where applicable) as soon as practicable after the closing time.
- 6.2. Tenders/bids will be given a registration mark and a list of bids received will be placed on record.

7. Validity periods

The period for which bids are to remain valid and binding shall be indicated in the bid documents. The validity period is calculated from the closing time and will continue until the close of business on the last day of the period, and where this day falls on a Saturday, Sunday or public holiday, the bid will remain valid and binding until the close of business on the following business day.

8. Tender/bid prices and delivery periods

- 8.1. Firm tender/bid prices and delivery periods are preferred.
- 8.2. "Firm" prices are deemed to be prices which, are only subject to adjustments in accordance with the actual increase or decrease resulting from the change, imposition, or abolition of any tax, levy or duty, which in terms of a law or regulation is binding on the bidder and will demonstrably have an influence on the prices of supplies or on the cost of rendering services.
- 8.3. "Non-firm" prices are deemed to be all prices which are not "firm."
- 8.4. Where non-firm prices are offered, Nkomazi Local Municipality may require the submission of proof regarding labour and material costs, or other factors which are specified by the bidder, and should these costs be seen to be unrealistic, it may negatively affect the consideration of the bid.
- 8.5. Where applicable, the value of certificates (payment) issued in terms of the contract, shall be increased or decreased by applying a "contract price adjustment factor" calculated according to the formula and the conditions set out in the Contract Price Adjustment Schedule referring to the General Conditions of Contract for works of engineering construction.
- 8.6. Expressions relating to the delivery of supplies or services which are unspecified such as "soonest" or "earliest" etc. are not acceptable. Where it has not been indicated whether prices or delivery periods are firm or not, bided prices and delivery periods shall be deemed to be firm and the contractor shall be bound thereby.

3. CONSIDERATION OF TENDER/BIDS

- 3.1. All bids validly submitted will be taken into consideration. Each tender/bid will be reviewed and evaluated for its ability to deliver the specific requirements of the bid in line with set criteria of paragraph 3.3.
- 3.2. Nkomazi Local Municipality is under no obligation to accept any tender/bid, or to accept the lowest tender/bid.
- 3.3. All tenders/bids will be reviewed and evaluated in accordance with the following criteria:
 - General Information supplied by the bidder
 - Compliance with bid requirements
 - Pricing

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- Technical Evaluation
- Preferential Procurement points

- 3.4. Nkomazi Local Municipality may elect to invite verbal presentations from bidders for clarification of the content of their bids.
- 3.5. Nkomazi Local Municipality may, where a bid relates to more than one item, accept such tender/bid in respect of any specific item or items, and may also accept part of the specified quantity of any specific item or items.
- 3.6. Any decision by Nkomazi Local Municipality shall be final and Nkomazi Local Municipality shall only on request provide reasons for the acceptance or passing over of a bid.
- 3.7. Where a bid has been granted on the strength of information furnished by the bidder, which later proves to be incorrect, Nkomazi Local Municipality may, in addition to any other remedy it may have, recover all costs and damages suffered or sustained by Nkomazi Local Municipality as a result of the award of the bid from the bidder, and/or cancel the agreement and claim damages from the bidder.
- 3.8. Nkomazi Local Municipality will award a preference to bids in accordance with the Preference Certificate in the form of BBBEE status level certificate [T 5].
- 3.9. In the event of equal bids, the following order of priority will normally be applied in the consideration of equal bids:

Evaluation of bids that scored equal points

- 3.9.1. In the event that two or more bids have scored equal total points, the successful bid must be the one that scored the highest points for BBBEE,
- 3.9.2. IF two or more bids have equal points, including equal preference points for BBBEE, the successful bid must be the one scoring the highest score for technical evaluation if technical evaluation is part of the evaluation process,
- 3.9.3. In the event that two or more bids are equal in all respects, the award must be decided by the drawing of lots
- 2.4 Successful bidders will be notified in writing of the acceptance of their bids.

4. TERMS AND CONDITIONS

4.1 Information provided

Nkomazi Local Municipality provides the bid documentation or any other information, in good faith. Any party or parties considering entering into a contract with Nkomazi Local Municipality on the basis of such information should conduct their own investigations and obtain the necessary professional advice and council, at their cost, necessary to formulate their own opinion regarding all matters related to the bid. Nkomazi Local Municipality cannot be held liable for any costs or damages flowing from a failure to do so by any bidder.

4.2 Legal and regulatory framework

- 4.2.1. All bids must function and be implemented within the general legal and regulatory framework relating to the supply or service, and requires compliance with all law by any bidder.
- 4.3.2. The onus is on the bidder to ensure compliance of its bid as well as during the implementation of the bid with the applicable legal and regulatory requirements, and Nkomazi Local Municipality reserves the right to reject any bid on the basis of non-compliance by the bidder with the applicable legal and regulatory framework.

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4.4.3. Where relevant Nkomazi Local Municipality may request the Respondent to submit proof of compliance with any aspect of the legal and regulatory framework.

4.3 No representations or warranties

All information contained in or provided as part of the bid documentation is offered in good faith and for the guidance of bidders. Nkomazi Local Municipality does not make any representation (express or implied), or provide any warranty as to the accuracy, completeness or correctness of bid documentation. Nkomazi Local Municipality shall not be liable for any claim for loss or damage to any bidder arising from any error, misstatement or omission contained in the bid documentation or any reliance thereon.

4.4 Declaration of interest

In order to prevent allegations of favouritism or nepotism in the procurement process, bidders must complete the Declaration of Interest & Interest in the State. (T4)

4.5 Reservation of rights

4.5.1. Nkomazi Local Municipality reserves the right to consider all possible options during the evaluation of bids. This includes the right not to proceed with the bid, suspend or temporarily defer the bid, or not to award the bid to any bidder. No liability shall attach to Nkomazi Local Municipality in the exercising of any of these rights.

4.5.2. If Nkomazi Local Municipality elects not to award the bid to any bidder, it may at its sole discretion, solicit bids in such manner as it may deem necessary in its absolute and sole discretion.

4.5.3. Copyright of all documents, data, designs, electronic aids, programmes etc. forming part of the bid documentation or developed by Nkomazi Local Municipality, shall remain to vest in Nkomazi Local Municipality.

4.6. Queries relating to the bid

4.6.1. Any queries relating to a bid or any process should be addressed in writing (registered mail, facsimile or e-mail), marked for the attention to:

The person and address stated in the bid documentation

4.6.2. Queries will be responded to in writing, and the written query and response may be distributed to all prospective bidders who have collected the bid documentation. The names of bidders raising queries will not be made known.

4.7. Information to be provided by bidders

The onus is on the bidder to ensure that all requirements contained in the bid documentation are complied with and all information requested from the bidder is supplied.

4.8. Independent submission

By submitting a bid, each bidder certifies that –

4.81. Its bid has been submitted independently, without consultation, communication or agreement for restricting competition, with any other bidder or to any other competitor; and

4.8.2. No attempt has been made or will be made by the bidder to induce any other person or firm to submit a bid for the purpose of restricting competition.

4.9. Sole property of Nkomazi Local Municipality

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4.9.1. All materials, information and data submitted by bidders shall become the sole property of Nkomazi Local Municipality, with the exception of –

4.9.1.1. Confidential financial statements of the bidder; and

4.9.1.2. Copyright material, trade secrets or other proprietary information clearly identified as such by the bidder.

4.10. Confidentiality

4.10.1. Nkomazi Local Municipality undertakes to keep confidential all information received from any bidder which is clearly identified as confidential in the bid and which is not already public knowledge or available in the public domain or in the hands of Nkomazi Local Municipality or required to be disclosed by legal or regulatory requirements, and the bidder accordingly indemnifies Nkomazi Local Municipality against any claim or liability for its refusal to disclose the relevant information/data to any person seeking access thereto. Failure to honour such indemnity shall be deemed to be a waiver by the bidder of its right to exemption from disclosure and shall Nkomazi Local Municipality be authorised to provide a copy of the relevant information/data or any part thereof to the requester.

4.10.2. Information disclosed by Nkomazi Local Municipality is deemed as confidential and it is expected that bidders treat it as such. This includes all information which is not public knowledge or available in the public domain or required to be disclosed by legal or regulatory requirements. Bidders will be held liable for non-compliance in this regard.

4.10.3. No information of bidder shall be made available to another bidder or any person unless requested by the court of law. Bidder can be allowed to request to see his/her bid document or to seek clarity of his/her failure, but not to have access to other bidder's information.

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(a) CONTRACT FORM - PURCHASE OF GOODS/SERVICES

THIS FORM MUST BE FILLED IN DUPLICATE BY BOTH THE SUCCESSFUL BIDDER (PART 1) AND THE PURCHASER (PART 2). BOTH FORMS MUST BE SIGNED IN THE ORIGINAL SO THAT THE SUCCESSFUL BIDDER AND THE PURCHASER WOULD BE IN POSSESSION OF ORIGINALLY SIGNED CONTRACTS FOR THEIR RESPECTIVE RECORDS.

(b) PART 1 (TO BE FILLED IN BY THE BIDDER)

- 3. I hereby undertake to supply all or any of the goods and/or services described in the attached bidding documents to (name of institution)..... in accordance with the requirements and specifications stipulated in bid number..... at the price/s quoted. My offer/s remain binding upon me and open for acceptance by the purchaser during the validity period indicated and calculated from the closing time of bid.
- 4. The following documents shall be deemed to form and be read and construed as part of this agreement:
 - (i) Bidding documents, viz
 - Invitation to bid;
 - Proof of Tax Compliance Status;
 - Pricing schedule(s);
 - Technical Specification(s);
 - Preference claim form for Preferential Procurement in terms of the Preferential Procurement Regulations;
 - Declaration of interest;
 - Declaration of bidder's past SCM practices;
 - Certificate of Independent Bid Determination;
 - Special Conditions of Contract;
 - (ii) General Conditions of Contract; and
 - (iii) Other (specify)
- 5. I confirm that I have satisfied myself as to the correctness and validity of my bid; that the price(s) and rate(s) quoted cover all the goods and/or works specified in the bidding documents; that the price(s) and rate(s) cover all my obligations and I accept that any mistakes regarding price(s) and rate(s) and calculations will be at my own risk.
- 6. I accept full responsibility for the proper execution and fulfilment of all obligations and conditions devolving on me under this agreement as the principal liable for the due fulfillment of this contract.
- 7. I declare that I have no participation in any collusive practices with any bidder or any other person regarding this or any other bid.
- 8. I confirm that I am duly authorised to sign this contract.

NAME (PRINT)

CAPACITY

SIGNATURE

NAME OF FIRM

DATE

WITNESSES	
1
2.
DATE:

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CONTRACT FORM - PURCHASE OF GOODS/SERVICES

(c) PART 2 (TO BE FILLED IN BY THE PURCHASER)

1. I..... in my capacity as..... accept your bid under reference numberdated.....for the supply of goods/services indicated hereunder and/or further specified in the annexure(s).
2. An official order indicating delivery instructions is forthcoming.
3. I undertake to make payment for the goods/services delivered in accordance with the terms and conditions of the contract, within 30 (thirty) days after receipt of an invoice accompanied by the delivery note.

NO.	PRICE (ALL APPLICABLE TAXES INCLUDED)		DELIVERY PERIOD	TOTAL PREFERENCE POINTS CLAIMED	POINTS CLAIMED FOR EACH SPECIFIC GOAL

4. I confirm that I am duly authorized to sign this contract.

SIGNED ATON.....

NAME (PRINT)

SIGNATURE

OFFICIAL STAMP

WITNESSES

1.

2.

DATE

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CONTRACT FORM - RENDERING OF SERVICES

(f) PART 2 (TO BE FILLED IN BY THE PURCHASER)

- 4. I..... in my capacity as..... accept your bid under reference numberdated.....for the rendering of services indicated hereunder and/or further specified in the annexure(s).
- 5. An official order indicating service delivery instructions is forthcoming.
- 6. I undertake to make payment for the services rendered in accordance with the terms and conditions of the contract, within 30 (thirty) days after receipt of an invoice.

(g) DESCRIPTION OF SERVICE	PRICE (ALL APPLICABLE TAXES INCLUDED)	COMPLETION DATE	TOTAL PREFERENCE POINTS CLAIMED	POINTS CLAIMED FOR EACH SPECIFIC GOAL

4. I confirm that I am duly authorised to sign this contract.

SIGNED AT ON

NAME (PRINT)

SIGNATURE

OFFICIAL STAMP

WITNESSES

1

2

DATE:

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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 10 (TEN) years;
 - c) willfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past 10 (TEN) years; or
 - d) been listed in the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004).
4. **In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.**

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

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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 10 (TEN) years?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
4.3.1	If so, furnish particulars:		
Item	Question	Yes	No
4.4	Does the bidder or any of its directors owe any municipal rates and taxes or municipal charges to the municipality / municipal entity, or to any other municipality / municipal entity, that is in arrears for more than three months?	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 10 (TEN) 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 (FULL NAME)

CERTIFY THAT THE INFORMATION FURNISHED ON THIS
DECLARATION FORM TRUE AND CORRECT.

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

.....
Signature

.....
Date

.....
Position

.....
Name of Bidder

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CERTIFICATE OF INDEPENDENT BID DETERMINATION

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

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

(Bid Number and Description)

in response to the invitation for the bid made by:

(Name of Municipality / Municipal Entity)

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

I certify, on behalf of: _____ that:

(Name of Bidder)

- 1. I have read and I understand the contents of this Certificate;
- 2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect;
- 3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder;
- 4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign, the bid, on behalf of the bidder;

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5. For the purposes of this Certificate and the accompanying bid, I understand that the word "competitor" shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:
- (a) has been requested to submit a bid in response to this bid invitation;
 - (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
 - (c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder
6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However communication between partners in a joint venture or consortium³ will not be construed as collusive bidding.
7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:
- (a) prices;
 - (b) geographical area where product or service will be rendered (market allocation)
 - (c) methods, factors or formulas used to calculate prices;
 - (d) the intention or decision to submit or not to submit, a bid;
 - (e) the submission of a bid which does not meet the specifications and conditions of the bid; or
 - (f) bidding with the intention not to win the bid.
8. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.
9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.
10. I am aware that, in addition and without prejudice to any other remedy provided to combat any restrictive practices related to bids and contracts, bids that are suspicious will be reported to the Competition Commission for investigation and possible imposition of administrative penalties in terms of section 59 of the Competition Act No 89 of 1998 and or may be reported to the National Prosecuting Authority (NPA) for criminal investigation and or may be restricted from conducting business with the public sector for a period not exceeding ten (10) years in terms of the Prevention and Combating of Corrupt Activities Act No 12 of 2004 or any other applicable legislation.

.....
Signature

.....
Date

.....
Position

.....
Name of Bidder

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1. I/We hereby bid to supply all or any of the supplies and/or to bid all or any of the services as described and required in the bid documentation to Nkomazi Local Municipality, on the terms and conditions and in accordance with the specifications as stipulated in the bid documentation (which bid documentation shall be taken as part of, and incorporated into, this bid) at the prices and delivery periods as required therein.
2. I/We agree that –
the offer herein contained shall remain binding on me/us and open for acceptance by Nkomazi Local Municipality during the validity period indicated in the bid documentation, which period shall be calculated from the closing time of the bid;
3. this bid and its acceptance shall be subject to the Standard Terms and Conditions of Bid [T 5] which are contained in this bid documentation and with which contents I am/we are fully acquainted with;
4. if I/we withdraw my/our bid within the validity period of the bid for which I/we have agreed that the bid shall remain open for acceptance, or fail to fulfil the contract when called upon to do so, Nkomazi Local Municipality may, without prejudice to any other remedies at its disposal, agree to the withdrawal or cancellation of the bid or contract that may have been entered into and I/we will then pay to Nkomazi Local Municipality any additional expense incurred by Nkomazi Local Municipality having to either accept any less favourable bid, or if fresh bids have to be invited, the additional expenditure incurred by the invitation of fresh bids and by the subsequent acceptance of any less favourable bid;
5. if my/our bid is accepted the acceptance may be communicated to me/us by letter by ordinary post or registered post and that the Post Office shall be regarded as my/our agent, and delivery of such acceptance to the Post Office shall be treated as a delivery to me/us;
6. The law of the Republic of South Africa shall govern the contract created by the acceptance of my/our bid and that I/we choose our *domicilium citandi et executandi* in the Republic at :

.....
7. I/We furthermore confirm that I/we have satisfied myself/ourselves as to the correctness and validity of my/our bid and that the prices and scope of work bided cover all my/our obligations in terms of the bid documentation and that I/we accept that any mistakes regarding prices or calculations will be at my/our risk.
8. I/We hereby accept full responsibility for the proper execution and due fulfilment of all obligations and conditions devolving on me/us under this contract as the principal bidder liable for the contract.
9. I/We agree that any action arising from this contract may in all respects be instituted against me/us and I/we hereby undertake to satisfy fully any judgment obtained against me/us as a result of such action.

Signature Tender/Bid no.....

Capacity

Duly authorised to sign on behalf of
.....

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The Municipal Manager
 Nkomazi Municipality
 Private Bag X 101
 Malalane
 1320

Sir/Madam

CONTRACT NO: NKO:09/2025 RE-ADVERT FOR APPOINTMENT OF A PANEL OF MAXIMUM 10 (TEN) CONTRACTORS FOR THE REFURBISHMENT AND REPLACEMENT OF CIVIL WORKS, MECHANICAL AND ELECTRICAL EQUIPMENTS AT WATER, WASTE WATER TREATMENT WORKS AS AND WHEN REQUIRED FOR 36 MONTHS

DATE OF PUBLICATION OF TENDERS	CLOSING DATE AND TIME FOR SUBMISSION OF TENDERS	THIS TENDER HOLDS GOOD FOR ACCEPTANCE UNTIL
06/03/2026	17//04/2026	90 days

1. Having examined the documents for the execution of the above-mentioned Project as well as any addenda subsequently issued, I/we the undersigned offer to **RE-ADVERT FOR APPOINTMENT OF A PANEL OF MAXIMUM 10 (TEN) CONTRACTORS FOR THE REFURBISHMENT AND REPLACEMENT OF CIVIL WORKS, MECHANICAL AND ELECTRICAL EQUIPMENTS AT WATER, WASTE WATER TREATMENT WORKS AS AND WHEN REQUIRED FOR 36 MONTHS** conformity with the above-said documents and addenda, for the sum of -

.....

(R.....) * Excluding VAT

or such other sum as may be determined in accordance with the general conditions of contract and the tender rules applicable to this contract, as well as the conditions included in this form of tender.

2. I/We acknowledge that all the certificates, schedules and forms included in this document for completion by the Tenderer have been fully completed by me/us and form part of my/our tender.
3. I/We undertake to complete and deliver the whole of the Project comprised in this contract within 24 months including the holidays during December and January and any other specified non-working days, calculated from the commencement day of supervision.
4. In the event of my/our not completing the whole of the works within the period tendered by me/us in paragraph 3 hereof, I/we agree to pay the Employer, as a penalty for such default, the sum stated in the Appendix to Tender for each calendar day or part thereof in excess of my/our tendered time for completion and the Employer may, without prejudice to any other method of recovery, deduct such sum monthly from any monies due or to become due to me/us.
5. If my/our tender is accepted, I/we undertake -

To sign the form of agreement included in this document within a period of twenty-one (21) days of receipt of written acceptance of my/our tender subject to the prior provision of the approved contract guarantee by me/us.

6. I/We agree to abide by this tender for a period of ninety (90) days from the closing date fixed for the submission of tenders, and it shall remain binding upon me/us and may be accepted at any time before expiry of that period.

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7. Unless and until a formal agreement is prepared and executed, this tender, together with the written acceptance thereof, shall constitute a binding contract between us and shall be deemed for all purposes to be the contract agreement.
8. In the event of there being any arithmetical errors in the priced bill of quantities, I/we agree to their being corrected, the rates being taken as correct.
9. I/We understand that you are not bound to accept the lowest or any particular tender you may receive, and that you shall not defray any expenses incurred by me/us in tendering.
10. I/We agree and undertake to commence the abovementioned Project within seven (7) days from the date on which the Project has been handed over to me/us by a written instruction from the Employer.
11. I/We declare that, notwithstanding anything contained in a covering letter to this tender, this tender is submitted entirely without qualifications.
12. I/We choose *domicilium citandi et executandi* at -

.....

in the Republic of South Africa.

Yours faithfully

SIGNED ON BEHALF OF TENDERER

NAME OF SIGNATORY (IN CAPITALS):

SIGNED ON THIS THEDAY OFIN THE YEAR OF.....

ON BEHALF OF:

ADDRESS.....

TELEPHONE NUMBER

FAX NUMBER:

WITNESS 1:

NAME IN CAPITALS:

WITNESS 2:

NAME IN CAPITALS:

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SCHEDULE OF DOCUMENTS

The tender documents for this contract comprises of the following:

THE TENDER

T1: Tendering Procedures

- T1.1 Tender Notice and Invitation to Tender
- T1.2 Tender Data
- T1.3 Standard Conditions of Tender

T2: Returnable Documents

T2.1 List of Returnable Documents

T2.1.1 Returnable Schedules Required for Tender Evaluation Purposes

- Schedule 1 : Resolution of Board of Directors
- Schedule 2 : Resolution of Board of Directors to enter into consortia or JV's
- Schedule 3 : Schedule of proposed sub-contractors
- Schedule 4 : Commitments of tenderer
- Schedule 5 : Record of addenda to tender documents
- Schedule 6 : Local & non-local labour
- Schedule 7 : Management and supervisory staff
- Schedule 8 : Compulsory enterprise questionnaire
- Schedule 9 : Certificate for water & lights
- Schedule 10 : Evaluation Schedule : Tenderer's experience
- Schedule 11 : Evaluation Schedule : Experience of key staff
- Schedule 12 : Capacity to execute & implement the tender evaluation
- Schedule 14 : Alterations by tenderer

T2.2.2 Compulsory Municipal Bid Documentation

- MBD 4 : Declaration of Interest
- MBD 5 : Declaration for procurement above R10-million
- MBD 6.1 : Preference Points Claim Form
- MBD 7.1 : Contract form for rendering of construction work (Part 1)
- MBD 7.1 : Contract form for rendering of construction work (Part 2)
- MBD 8 : Declaration of bidder's past supply chain management practices
- MBD 9 : Certificate of Independent Bid Determination

T2.2.3 Other schedules and documents that will be incorporated into the contract

- OSD1 : Form of intent to provide a performance guarantee

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- OSD2 : Execution programme
- OSD3 : Occupational health & safety declaration form
- OSD4 : Contractor's safety plan
- OSD5 : Pro forma notification form in terms of the Occupational Health & Safety Act 1993, Construction Regulations, 2014
- OSD6 : Transfer of rights
- OSD7 : Pro forma contract of employment EPWP
- OSD8 : Pro forma monthly labour report

THE CONTRACT

C1: Agreement and Contract Data

C1.1 Form of Offer and Acceptance

C1.1.1 Form of Offer

C1.1.2 Form of Acceptance

C1.1.3 Schedule of Deviations

C1.2 Contract Data

C1.2.1 Conditions of Contract

C1.2.2 Part 1: Data provided by the Employer

C1.2.3 Part 2: Data provided by the Service Provider

C1.2.4 Contract price adjustment schedule

C2: Pricing Data

C2.1 Pricing Instructions

C2.2 MBD 3.1: Bid Price

C3: Scope of Work

C3.1 Standard specifications

C3.2 Project specifications

C3.3 Particular specifications

C3.4 Day work schedule

ANNEXURES

1. Construction OHS environment audit system
2. Guidelines for the development of a health & safety plan
- 3.** Guide to risk assessment

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T1.2 TENDER DATA

CLAUSE NO.	
	<p>The conditions of tender are the Standard Conditions of Tender as contained in Annexure F of CIDB standard uniformity in construction procurement. (See www.cidb.org.za) which are reproduced without amendment or alteration for the convenience of tenderers in this tender in the section T1.3 of the tender data.</p> <p>The Standard Conditions of Tender for procurement makes several references to the tender data for details that apply specifically to this tender. The tender data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the standard conditions of tender for procurement other than disposals.</p> <p>Each item of data given below is cross-referenced to the relevant clause in the above mentioned Standard Conditions of Tender.</p>
1.1	The employer is the NKOMAZI LOCAL MUNICIPALITY
1.2	<p>The single volume approach is adopted for this contract.</p> <p>The list of returnable documents identifies which of the documents a tenderer must complete when submitting a tender offer. The tenderer must submit his tender offer by completing the returnable documents including the fully priced Pricing Schedule, signing the "Offer" section in the "Form of Offer and Acceptance" and delivering the single volume procurement document back to the Nkomazi Local Municipality bound up as it was when it was received.</p> <p>The tender documents issued by the employer comprise of the following:</p> <p>TENDER</p> <p>Part T1: Tendering procedures T1.1 - Tender notice and invitation to tender T1.2 - Tender data T1.3 – Standard Conditions of Tender</p> <p>Part T2: Returnable documents T2.1 List of returnable documents T2.2 Returnable schedules</p> <p>CONTRACT</p> <p>Part C1: Agreements and contract data C1.1 Form of offer and acceptance C1.2 Contract data</p> <p>Part C2: Pricing Schedule C2.1 Pricing Instructions and Schedule C2.2 Priced fees and disbursements</p> <p>Part C3: Terms of reference C3 Terms of reference</p> <p>Part C4: Site information</p>

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CLAUSE NO.	
1.4	
1.5	The employer's right to accept or reject any tender offer: The employer is not obliged to accept the lowest or any tender offer
1.6.2.1	A competitive negotiation procedure will not be followed
2.1.1	<p>Eligibility</p> <p>A tenderer will not be eligible to submit a tender if:</p> <ul style="list-style-type: none"> (a) The contractor submitting the tender is under restrictions or has principals who are under restriction to participate in the employer's procurement due to corrupt or fraudulent practices; (b) The tenderer does not have the legal capacity to enter into the contract; (c) The contractor submitting the tender is insolvent, in receivership, bankrupt or being wound up, has his affairs administered by a court or a judicial officer, has suspended his business activities, or is subject to legal proceedings in respect of the foregoing; (d) The tenderer does not comply with the legal requirements stated in the employer's procurement policy; (e) The tenderer cannot demonstrate that he possesses the necessary professional and technical qualifications and competent, financial resources, equipment and other physical facilities, managerial capability, personnel, experience and reputation to perform the contract; (f) The tenderer cannot provide proof that he is in good standing with respect to duties, taxes, levies and contributions required in terms of legislation applicable to the work in the contract; (g) Only those tenderers who have in their employ management and supervisory staff satisfying the requirements of the scope of work for labour intensive competencies for supervisory and management staff are eligible to submit tenders; (h) Only those tenderers who are registered with the CIDB as defined in the Regulations 9 June 2004 and 22 July 2005), in terms of the CIDB Act No. 38 of 2000, or are capable of being so prior to the evaluation of submissions, in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum tendered for a 5CE, 5EP, AND 5ME (ALL 3) or higher class of construction work, are eligible to submit tenders. <p>Joint ventures are eligible to submit tenders provided that:</p> <ul style="list-style-type: none"> (a) every member of the joint venture is registered with the CIDB; (b) the lead partner has a contractor grading designation in the 5CE, 5EP, AND 5ME (ALL 3) or higher class of construction work; and

CLAUSE NO.	
2.1.1	(c) the combined contractor grading designation calculated in accordance with the Construction Industry Development Regulations is equal to or higher than a

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CLAUSE NO.											
	<p>contractor grading designation determined in accordance with the sum tendered for a/an 5CE, 5EP, AND 5ME (ALL 3) or higher class of construction work.</p> <p>Only those tenderers who score a minimum score of 70 points in respect of the following technical evaluation criteria will proceed to the price and preference goals.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="background-color: #f4a460;">Description of evaluation Criteria</th> <th style="background-color: #f4a460;">Maximum number of tender evaluation points</th> </tr> </thead> <tbody> <tr> <td>Tenderer's experience</td> <td>50</td> </tr> <tr> <td>Construction resources</td> <td>10</td> </tr> <tr> <td>Experience of key staff and capacity</td> <td>40</td> </tr> <tr> <td>Maximum total evaluation points for functionality</td> <td>100</td> </tr> </tbody> </table>	Description of evaluation Criteria	Maximum number of tender evaluation points	Tenderer's experience	50	Construction resources	10	Experience of key staff and capacity	40	Maximum total evaluation points for functionality	100
Description of evaluation Criteria	Maximum number of tender evaluation points										
Tenderer's experience	50										
Construction resources	10										
Experience of key staff and capacity	40										
Maximum total evaluation points for functionality	100										
2.7											
2.8	The closing time for submission of tender offers is as indicated in the tender notice and invite										
2.11	<p>Alterations to document</p> <p>A tender offer shall not be considered if alterations have been made to the forms of tender data or contract data (unless such alterations have been duly authenticated by the tenderer) or if any particulars required therein have not been completed in all respects. Authenticated alterations must be attached to schedule 6 – record of addenda to tender documents.</p>										

CLAUSE NO.	
2.12.1	Alternative tender offers will not be considered
2.13.3	Additional copies of the tender offer, document will not be required
2.13.5 2.13.7	<p>The employer's address for delivery of tender offers and identification details to be shown on such tender offer package are:</p> <p>As indicated in the tender notice</p> <p><u>Tender No. NKO 09/2025: APPOINTMENT OF A PANEL OF MAXIMUM TEN (10) CONTRACTORS FOR THE REFURBISHMENT AND REPLACEMENT OF CIVIL WORKS, MECHANICAL AND ELECTRICAL EQUIPMENTS AT WATER, WASTE WATER TREATMENT WORKS AS AND WHEN REQUIRED FOR 36 MONTHS.</u></p>
2.13.6 3.5	A two-envelope procedure will not be followed
2.19	The site of works is located at various sites throughout NKOMAZI LOCAL MUNICIPALITY. Site specific information will be issued upon project identification

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CLAUSE NO.	
2.22	<p>Return of other documents</p> <p>All retained tender documents must be returned within 28 days after the expiry of the validity period</p>
2.23	<p>Certificates</p> <p>The tenderer is required to submit with his tender:</p> <p>1. A certificate of contractor registration issued by the Construction Industry Development Board and</p>
3.4	<p>The location for opening of the tender offers, immediately after the closing time thereof shall be at:</p>
3.11	<p>The procedure for the evaluation of responsive tenders is method 1 accounting to the 80/20 Preferential Procurement point system.</p> <p>The total number of tender evaluation points for preferences to may be claimed is indicated in MBD 6.1</p>
	<p>(a) the tenderer has <u>not</u> abused the employer's supply chain management system or has failed to perform on any previous contract and has been given a written notice to this effect;</p> <p>(b) the tenderer or any of its principals, directors or managers is <u>not</u> employed in the service of the State or any municipality. In the event that such principals are involved, official approval from the executing authority regarding carrying out remunerative work outside of the public service must be included in the tender submission;</p> <p>(c) the employer is satisfied that the tenderer or any of his principals have <u>not influenced</u> the tender offer and acceptance by the following criteria:</p> <p>i) having offered, promised or given a bribe or other gift or remuneration to any person in connection with the obtaining or execution of this contract;</p> <p>ii) having acted in a fraudulent or corrupt manner in obtaining or executing this contract;</p> <p>iii) having approached an officer or employee of the employer or the employer's agent with the objective of influencing the award of a contract in the tenderer's favour;</p> <p>iv) having entered into any agreement or arrangement, whether legally binding or not, with any other person, firm or company to refrain from tendering for this contract or as to the amount of the tender to be submitted by either party;</p> <p>v) having disclosed to any other person, firm or company other than the</p>

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CLAUSE NO.	
	<p>employer, the exact or approximate amount of his proposed tender;</p> <p>vi) the employer may, in addition to using any other legal remedies, repudiate the tender offer and acceptance and declare the contract invalid should it have been concluded already.</p>
3.17	The number of paper copies of the signed contract to be provided by the employer is one

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T1.3: STANDARD CONDITIONS OF TENDER

CIDB STANDARD CONDITIONS OF TENDER (August 2019 edition) as published in Annex C of the CIDB Standard for Uniformity in Engineering and Construction Works Contracts in Board Notice 423 of 2019 in Government Gazette No 42622 of 08 August 2019.

C.1 General

C.1.1 Actions

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

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

Note: 1) A conflict of interest may arise due to a conflict of roles which might provide an incentive for improper acts in some circumstances. A conflict of interest can create an appearance of impropriety that can undermine confidence in the ability of that person to act properly in his or her position even if no improper acts result.

2) Conflicts of interest in respect of those engaged in the procurement process include direct, indirect or family interests in the tender or outcome of the procurement process and any personal bias, inclination, obligation, allegiance or loyalty which would in any way affect any decisions taken.

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

C.1.2 Tender Documents

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

C.1.3 Interpretation

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

C.1.3.2 These conditions of tender, the tender data and tender schedules which are required for tender evaluation purposes, shall form part of any contract arising from the invitation to tender.

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

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

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- b) comparative offer means the price after the factors of a non-firm price and all unconditional discounts it can be utilised to have been taken into consideration;
- c) corrupt practice means the offering, giving, receiving or soliciting of anything of value to influence the action of the employer or his staff or agents in the tender process;
- d) fraudulent practice means the misrepresentation of the facts in order to influence the tender process or the award of a contract arising from a tender offer to the detriment of the employer, including collusive practices intended to establish prices at artificial levels;

C.1.4 Communication and employer's agent

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

C.1.5 Cancellation and Re-Invitation of Tenders

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

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

C.1.5.2 The decision to cancel a tender invitation must be published in the same manner in which the original tender invitation was advertised

C.1.5.3 An employer may only with the prior approval of the relevant treasury cancel a tender invitation for the second time.

C.1.6 Procurement procedures

C.1.6.1 General

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

C.1.6.2 Competitive negotiation procedure

C.1.6.2.1 Where the tender data require that the competitive negotiation procedure is to be followed, tenderers shall submit tender offers in response to the proposed contract in the first round of submissions. Notwithstanding the requirements of C.3.4, the employer shall announce only the names of the tenderers who make a submission. The requirements of C.8 relating to the material deviations or qualifications which affect the competitive position of tenderers shall not apply.

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

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

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

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

C.1.6.3 Proposal procedure using the two stage-system

C.1.6.3.1 Option 1

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

C.1.6.3.2 Option 2

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

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

C.2 Tenderer's obligations

C.2.1 Eligibility

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

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

C.2.2 Cost of tendering

C.2.2.1 Accept that, unless otherwise stated in the tender data, the employer will not compensate the tenderer for any costs incurred in the preparation and submission of a tender offer, including the costs of any testing necessary to demonstrate that aspects of the offer complies with requirements.

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

C.2.3 Check documents

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

C.2.4 Confidentiality and copyright of documents

Treat as confidential all matters arising in connection with the tender. Use and copy the documents issued by the employer only for the purpose of preparing and submitting a tender offer in response to the invitation.

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C.2.5 Reference documents

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

C.2.6 Acknowledge addenda

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

C.2.7 Clarification meeting

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

C.2.8 Seek clarification

Request clarification of the tender documents, if necessary, by notifying the employer at least 10 (TEN) (5) working days before the closing time stated in the tender data.

C.2.9 Insurance

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

C.2.10 Pricing the tender offer

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

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

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

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

C.2.11 Alterations to documents

Do not make any alterations or additions to the tender documents, except to comply with instructions issued by the employer, or necessary to correct errors made by the tenderer. All signatories to the tender offer shall initial all such alterations.

C.2.12 Alternative tender offers

C.2.12.1 Unless otherwise stated in the tender data, submit alternative tender offers only if a main tender offer, strictly in accordance with all the requirements of the tender documents, is also submitted as well as a schedule that compares the requirements of the tender documents with the alternative requirements that are proposed.

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

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

C.2.13 Submitting a tender offer

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

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C.2.13.2 Return all returnable documents to the employer after completing them in their entirety, by writing legibly (by hand) in non-erasable ink, unless stated otherwise on the tender advert.

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

C.2.13.4 Sign the original and all copies of the tender offer where required in terms of the tender data. The employer will hold all 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.

C.2.13.5 Seal the original and each copy of the tender offer as separate packages marking the packages as "ORIGINAL" and "COPY". Each package shall state on the outside the employer's address and identification details stated in the tender data, as well as the tenderer's name and contact address.

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

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

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

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

C.2.14 Information and data to be completed in all respects;;

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

C2.15 Closing time

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

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

C.2.16 Tender offer validity

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

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

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

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

C.2.17 Clarification of tender offer after submission

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

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

C.2.18 Provide other material

C.2.18.1 Provide, on request by the employer, any other material that has a bearing on the tender offer, the tenderer's commercial position (including notarized joint venture agreements), preferencing arrangements, or samples of materials, considered necessary by the employer for the purpose of a full and fair risk assessment.

Should the tenderer not provide the material, or a satisfactory reason as to why it cannot be provided, by the time for submission stated in the employer's request, the employer may regard the tender offer as non-responsive.

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

C.2.19 Inspections, tests and analysis

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

C.2.20 Submit securities, bonds and policies

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

C.2.21 Check final draft

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

C.2.22 Return of other tender documents

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

C.2.23 Certificates

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

C.3 The employer's undertakings

C.3.1 Respond to requests from the tenderer

C.3.1.1 Unless otherwise stated in the tender Data, respond to a request for clarification received up to 10 (TEN) (5) working days before the tender closing time stated in the Tender Data and notify all tenderers who collected tender documents.

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

- a) an individual firm, or a joint venture as a whole, or any individual member of the joint venture fails to meet any of the collective or individual qualifying requirements;
- b) the new partners to a joint venture were not prequalified in the first instance, either as individual firms or as another joint venture; or

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- c) in the opinion of the Employer, acceptance of the material change would compromise the outcome of the prequalification process.

C.3.2 Issue Addenda

If necessary, issue addenda that may amend or amplify the tender documents to each tenderer during the period from the date that tender documents are available until three (3) working days before the tender closing time stated in the Tender Data. If, as a result a tenderer applies for an extension to the closing time stated in the Tender Data, the Employer may grant such extension and, shall then notify all tenderers who collected tender documents.

C.3.3 Return late tender offers

Return tender offers received after the closing time stated in the Tender Data, unopened, (unless it is necessary to open a tender submission to obtain a forwarding address), to the tenderer concerned.

C.3.4 Opening of tender submissions

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

C.3.4.2 Announce at the meeting held immediately after the opening of tender submissions, at a venue indicated in the tender data, the name of each tenderer whose tender offer is opened and, where applicable, the total of their prices.

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

C.3.5 Two-envelope system

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

C.3.5.2 Evaluate technical evaluation of the technical proposals offered by tenderers, then advise tenderers who remain in contention for the award of the contract of the time and place when the financial proposals will be opened. Open only the financial proposals of tenderers, who score in the technical evaluation more than the minimum number of points for technical evaluation stated in the tender data, and announce the score obtained for the technical proposals and the total price and any points claimed on Specific Goals. Return unopened financial proposals to tenderers whose technical proposals failed to achieve the minimum number of points for functionality.

C.3.6 Non-disclosure

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

C.3.7 Grounds for rejection and disqualification

Determine whether there has been any effort by a tenderer to influence the processing of tender offers and instantly disqualify a tenderer (and his tender offer) if it is established that he engaged in corrupt or fraudulent practices.

C.3.8 Test for responsiveness

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

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

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

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

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

C.3.9 **Arithmetical errors, omissions and discrepancies**

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

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

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

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

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

- a) If bills of quantities or pricing schedules apply and there is an error in the line item total resulting from the product of the unit rate and the quantity, the line item total shall govern and the rate shall be corrected. Where there is an obviously gross misplacement of the decimal point in the unit rate, the line item total as quoted shall govern, and the unit rate shall be corrected.
- b) Where there is an error in the total of the prices either as a result of other corrections required by this checking process or in the tenderer's addition of prices, the total of the prices shall govern and the tenderer will be asked to revise selected item prices (and their rates if bills of quantities apply) to achieve the tendered total of the prices.

C.3.10 **Clarification of a tender offer**

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

C.3.11 **Evaluation of tender offers**

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

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

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procedures.

The CIDB Standard Conditions of Tender are based on a procurement system that satisfies the following system requirements:	
Requirement	Qualitative interpretation of goal
Fair	The process of offer and acceptance is conducted impartially without bias, providing simultaneous and timely access to oarticioatina oarties to the same information.
Eauitable	Terms and conditions for performing the work do not unfairly prejudice the interests of the parties.
Transparent	The only grounds for not awarding a contract to a tenderer who satisfies all requirements are restrictions from doing business with the employer, lack of capability or capacity, legal impediments and conflicts of interest.
Competitive	The system provides for aooropriate levels of comoetition to ensure cost effective and best value outcomes.
Cost effective	The processes, procedures and methods are standardized with sufficient flexibility to attain best value outcomes in respect of quality, timing and price, and least resources to effectively manage and control procurement processes.

The activities associated with evaluating tender offers are as follows:

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

C.3.11.1 General

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

C.3.12 Insurance provided by the employer

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

C.3.13 Acceptance of tender offer

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

- a) is not under restrictions, or has principals who are under restrictions, preventing participating in the employer's procurement;
- b) can, as necessary and in relation to the proposed contract, demonstrate that he or she possesses the professional and technical qualifications, professional and technical competence, financial resources, equipment and other physical facilities, managerial capability, reliability, experience and reputation, expertise and the personnel, to perform the contract;
- c) has the legal capacity to enter into the contract;

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- d) is not; insolvent, in receivership, under Business Rescue as provided for in chapter 6 of the Companies Act No. 2008, bankrupt or being wound up, has his/her affairs administered by a court or a judicial officer, has suspended his/her business activities or is subject to legal proceedings in respect of any of the foregoing;
- e) complies with the legal requirements, if any, stated in the tender data; and
- f) is able, in the opinion of the employer, to perform the contract free of conflicts of interest.

C.3.14 Prepare contract documents

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

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

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

.3.15 Complete adjudicator's contract

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

C.3.16 Registration of the award

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

C.3.17 Provide copies of the contracts

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

C.3.18 Provide written reasons for actions taken

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

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T2 RETURNABLE DOCUMENTS

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T2.1 LIST OF RETURNABLE DOCUMENTS

1 RETURNABLE SCHEDULES REQUIRED FOR TENDER EVALUATION PURPOSES

- 1.1 Schedule 1 : Resolution of Board of Directors
- 1.2 Schedule 2 : Resolution of Board of Directors to enter into consortia or JV's
- 1.3 Schedule 3 : Schedule of proposed sub-contractors
- 1.4 Schedule 4 : Commitments of Tenderer
- 1.5 Schedule 5 : Record of Addenda to tender document
- 1.6 Schedule 6 : Local & non-local labour
- 1.7 Schedule 7 : Management and supervisory staff
- 1.8 Schedule 8 : Compulsory enterprise questionnaire
- 1.9 Schedule 9 : Certificate for water and lights
- 1.10 Schedule 10 : Evaluation Schedule : Tenderer's experience
- 1.11 Schedule 11 : Evaluation Schedule : Experience of key staff
- 1.12 Schedule 12 : Evaluation Schedule : Resources
- 1.13 Schedule 14 : Alterations by tenderer

2 COMPULSORY MUNICIPAL BID DOCUMENTATION

- 2.1 MBD 4 : Declaration of interest
- 2.2 MBD 5 : Declaration for procurement above R10-million
- 2.3 MBD 6.1 : Preference Points Claim Form
- 2.4 MBD 7.1 : Contract form for rendering of construction work (Part 1 and 2)
- 2.5 MBD 8 : Declaration of bidder's past supply chain management practices
- 2.6 MBD 9 : Certificate of Independent Bid Determine

3 OTHER SCHEDULES AND DOCUMENTS THAT WILL BE INCORPORATED INTO THE CONTRACT

- 3.1 OSD1 : Form of intent to provide a performance guarantee
- 3.2 OSD2 : Execution programme
- 3.3 OSD3 : Occupational health and safety declaration form
- 3.4 OSD4 : Contractor's safety plan
- 3.5 OSD5 : Pro forma notification form in terms of the Occupational Health and Safety Act 1993, Construction Regulations, 2003
- 3.6 OSD6 : Transfer of rights
- 3.7 OSD7 : Pro forma contract of employment EPWP
- 3.8 OSD8 : Pro forma monthly labour report

THE CONTRACT

C1: Agreement and Contract Data

C1.1 Form of Offer and Acceptance

C1.1.1 Form of Offer

C1.1.2 Form of Acceptance

C1.1.3 Schedule of Deviations

C1.2 Contract Data

C1.2.1 Conditions of Contract

C1.2.2 Part 1: Data provided by the Employer

C1.2.3 Part 2: Data provided by the Service Provider

C1.2.4 Contract price adjustment schedule

C2: Pricing Data

C2.1 Pricing Instructions

C2.2 MBD 3.1: Bid Price

C3: Scope of Work

C3.1 Standard specifications

C3.2 Project specifications

C3.3 Particular specifications

C3.4 Day work schedule

ANNEXURES

1. Construction OHS environment audit system
2. Guidelines for the development of a health and safety plan
3. Guide to risk assessment

General Conditions of Contract

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**T2.1.1 RETURNABLE SCHEDULES FOR TENDER EVALUATION
PURPOSES**

SCHEDULE 1

RESOLUTION OF BOARD OF DIRECTORS

Resolution of a meeting of the Board of *Directors / Members / Partners of:

		(Enterprise Name)
Held at		(place)
on		(date)

RESOLVED that:

1.	The enterprise submits a bid / tender to the NKOMAZI LOCAL MUNICIPALITY in respect of the following project: TENDER NKO 09/2025: APPOINTMENT OF A PANEL OF MAXIMUM TEN (10) CONTRACTORS FOR THE REFURBISHMENT AND REPLACEMENT OF CIVIL WORKS, MECHANICAL AND ELECTRICAL EQUIPMENTS AT WATER, WASTE WATER TREATMENT WORKS AS AND WHEN REQUIRED FOR 36 MONTHS.	
2.	Mr / Mrs / Ms	
	in his/her capacity a:	(Position in the Enterprise)
	and who will sign as follows:	(Authorized Signature)
be, and is hereby, authorized to sign the bid / tender, and any and all other documents and/or correspondence in connection with and relating to the bid /tender, as well as to sign any contract, and any and all documentation, resulting from the award of the bid / tender to the enterprise mentioned above.		

Directors / Members / Partners of:

	NAME	CAPACITY	SIGNATURE
1			
2			
3			

Note:

1. *Delete which is not applicable
2. **NB.** This resolution must be signed by all the directors / members / partners of the bidding enterprise
3. Should the number of directors / members / partners exceed the space available above, additional names and signatures must be supplied on a separate page

ENTERPRISE STAMP

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SCHEDULE 2

RESOLUTION OF BOARD OF DIRECTORS TO ENTER INTO CONSORTIA / J/V

RESOLUTION of a meeting of the Board of *Directors / Members / Partners of:

		(Enterprise Name)
Held at		
	(place)	
On		
	(date)	

RESOLVED that:

1.	The enterprise submits a bid / tender, in consortium / joint venture with the following enterprises:	
	(List all the legally correct full names and registration numbers, if applicable, of the enterprises forming the consortium / joint venture)	
	To the to the NKOMAZI LOCAL MUNICIPALITY in respect of the following project	
	TENDER NKO 09/2025: APPOINTMENT OF A PANEL OF MAXIMUM TEN (10) CONTRACTORS FOR THE REFURBISHMENT AND REPLACEMENT OF CIVIL WORKS, MECHANICAL AND ELECTRICAL EQUIPMENTS AT WATER, WASTE WATER TREATMENT WORKS AS AND WHEN REQUIRED FOR 36 MONTHS.	
2.	Mr / Mrs / Ms	
	in his/her capacity as	(Position in the Enterprise)
	and who will sign as follows	(Authorized Signature)
2.1	be, and is hereby, authorized to sign a consortium / joint venture agreement with the parties listed under item 1 above, and any and all other documents and/or correspondence in connection with and relating to the consortium / joint venture, in respect of the project described under item 1 above.	
2.2	The enterprise accepts joint and several liability with the parties listed under item 2 above for the due fulfillment of the obligations of the joint venture deriving from, and in any way connected with, the contract to be entered into with the department in respect of the project described under item 1 above.	
2.3	The enterprise chooses as its <i>domicilium citandi et executandi</i> for all purposes arising from this joint venture agreement and the contract with the department in respect of the project under item 1 above	
	i) Physical address	
	ii) Postal address	
		(Code)

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	iii) Telephone number	
	iv) Fax Number	

All documents applicable to this Schedule must be attached as Annexure A

RESOLUTION OF BOARD OF DIRECTORS TO ENTER INTO CONSORTIA OR JOINT VENTURES

Directors / Members / Partners of:

	NAME	CAPACITY	SIGNATURE
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Note:

1. *Delete which is not applicable*
2. **NB.** *This resolution must be signed by all the directors / members / partners of*

Enterprise Stamp

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the bidding enterprise

3. *Should the number of directors / members / partners exceed the space available above, additional names and signatures must be supplied on a separate page*

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SCHEDULE 3

SCHEDULE OF PROPOSED SUB-CONTRACTORS

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

	NAME AND ADDRESS OF PROPOSED SUB-CONTRACTOR	NATURE AND EXTENT OF WORK	PREVIOUS EXPERIENCE WITH SUB-CONTRACTOR
1			
2			
3			
4			
5			

NAME OF REPRESENTATIVE	SIGNATURE	CAPACITY	DATE

NAME OF ORGANIZATION	
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SCHEDULE 4

COMMITMENTS OF TENDERER

Kindly provide particulars of commitments which the tenderer is presently engaged and/or involved with:

CURRENT PROJECTS / CONTRACT	ORGANIZATION	CONTACT PERSON NAME	CONTACT TEL. NO.	CONTRACT AMOUNT	CONTRACT PERIOD	DATE OF COMMENCEMENT	SCHEDULED DATE OF COMPLETION
1.							
2.							
3.							
4.							
5.							

NAME OF REPRESENTATIVE	SIGNATURE	DATE

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SCHEDULE 5

RECORD OF ADDENDA TO TENDER DOCUMENTS

I / we confirm that the following communications received from the Nkomazi Local Municipality before the submission of this tender offer, amending the tender documents, have been taken into account in this tender offer: *(Attach additional pages if more space is required)*

Attach communication requirement by municipality amending the tender documents.

	DATE	TITLE OR DETAILS
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

I / we confirm that no communications were received from the Nkomazi Local Municipality before the submission of this tender offer, amending the tender documents.

NAME OF REPRESENTATIVE	SIGNATURE	DATE

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SCHEDULE 6

LOCAL & NON-LOCAL LABOUR

In order to complete the works under this contract, I / we propose that the following labour be employed:

Number of local labour	
Number of non-local labour	
TOTAL labour employed	

NAME OF REPRESENTATIVE	SIGNATURE	DATE

In order to complete the works under this contract (30%) of the contract must be local labour. Indicate in the schedule the proposed labour to be employed.

Note:

Also note other schedule documents (OSD) 7 and 8 which must be completed on a monthly basis under the EPWP requirements for local and non-labour.

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SCHEDULE 7

MANAGEMENT & SUPERVISORY STAFF

In order to manage and supervise this project the following are the key staff we propose to be on site:

NAME	ROLE i.e. MANAGERIAL OR SUPERVISORY	EXPERIENCE (YEARS)	NQF LEVEL COMPLETED (SEE SD8-1)

NAME OF REPRESENTATIVE	SIGNATURE	DATE

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SCHEDULE 8

COMPULSORY ENTERPRISE QUESTIONNAIRE

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

Section 1: Name of enterprise			
Section 2: VAT registration number, if any			
Section 3: Particulars of sole proprietors and partners in partnerships			
No	Name*	Identity Number*	Personal Income Tax Number*
3.1			
3.2			
3.3			
* Complete only if sole proprietor or partnership and attach separate page if more than 3 partners			
Section 4: Particulars of companies and close corporations			
4.1	Company Registration number		
4.2	Close corporation number		
4.3	Tax reference number		
Section 5: Record in the service of the state			
Indicate by marking the relevant boxes with a cross, if any sole proprietor, partner in a partnership or director, manager, principal shareholder or stakeholder in a company or close corporation is currently or has been within the last 12 months in the service of any of the following:			
		An employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act 1 of 1999)	
A member of any municipal council		A member of an accounting authority of any national or provincial public entity	
A member of any provincial legislation		An employee of Parliament or a provincial legislature	
A member of the National Assembly or the National Council of Provinces		An official of any municipality or municipal entity	
A member of the board of directors of any municipal entity			

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

Section 6: Records of spouses, children and parents in the service of the state

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

A member of any municipal council		An employee of any provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management act, 1999 (act 1 of 1999)	
A member of any provincial legislature		A member of an accounting authority of any national or provincial public entity	
A member of the National Assembly or the National Council of Province.		An employee of Parliament or a provincial legislature	
A member of the board of directors of any municipal entity		An official of any municipality or municipal entity	

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

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

- i) authorizes the Employer to obtain a tax clearance certificate from the South African Revenue Services that my / our tax matters are in order;
- ii) confirms that the neither the name of the enterprise or the name of any partner, manager, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears on the Register of Tender Defaulters established in terms of the Prevention and Combating of Corrupt Activities Act of 2004.
- iii) confirms that no partner, member, director or other person, who wholly or partly exercises, or may exercise, control over the enterprise appears, has within the last 10 (TEN) years been convicted of frauds or corruption;
- iv) confirms that I / we are not associated, linked or involved with any other tendering entities submitting tender offers and have no other relationship with any of the tenderers or those responsible for compiling the scope of work that could cause or be interpreted as a conflict of interest; and
- v) confirms that the contents of this questionnaire are within my personal knowledge and are to the best of my belief both true and correct.

Note: insert separate page if necessary

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NAME OF REPRESENTATIVE	AUTHORIZED SIGNATURE (UNDERSIGNED)
CAPACITY	DATE

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SCHEDULE 9

CLEARANCE CERTIFICATE FOR WATER & LIGHTS

Section 45(1)(d) of Municipal Supply Chain Regulations requires that the municipality must reject a bidder whose municipal rates and taxes are in arrears for more than three months.

The purpose of this schedule is to obtain proof that municipal services, rates and taxes of the service provider are not in arrears for more than three months, with the relevant municipality in the municipal area where the service provider conduct his / her business.

Each bidder must complete the below checklist. Important: if you fail to complete this form, the bid will be non-responsive. (Please tick with **X** where appropriate):

QUESTIONS		YES	NO
1.	Do you own a property?		
2.	Do you receive a municipal rates account?		
3.	Is your municipal rates and taxes account up to date / current (not in arrears for more than three months)?		
4.	Provide the following details:		
4.1	▪ Municipality name		
4.2	▪ Municipal account number		
5.	Please attach proof in the form of the copy of the bidder's municipal rates and taxes account not older than 3 months		
6.	Does the bidder lease / rent the property where the business is situated?		
7.	If yes, provide the following details:		
7.1	▪ Landlord name		
7.2	▪ Address property is situated		
7.3	▪ Contact number of landlord		
8.	Please attach the copy of the lease agreement signed by the landlord / lessor and the tenant / lessee as proof (Annexure A)		
I, (Insert full name)			
of (insert physical address)			
being a Director, Principal Shareholder, owner of company (Insert company name)			
Hereby confirms that, the information submitted in this form is accurate, to the best of my knowledge			
SIGNATURE			

*** IMPORTANT: IF YOU FAIL TO COMPLETE THIS FORM, PLEASE REGARD YOUR QUOTE AS NON RESPONSIVE**

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SCHEDULE 10

EVALUATION SCHEDULE: TENDERER'S EXPERIENCE

The following is a statement of major works of a similar nature successfully executed by myself/ourselves (see clause 2.1(3) of the tender data.

The experience of the tenderer in similar projects or nature or similar areas and conditions in relation to the scope of work for **RE-ADVERT FOR APPOINTMENT OF A PANEL OF MAXIMUM 10 (TEN) CONTRACTORS FOR THE REFURBISHMENT AND REPLACEMENT OF CIVIL WORKS, MECHANICAL AND ELECTRICAL EQUIPMENTS AT WATER, WASTE WATER TREATMENT WORKS AS AND WHEN REQUIRED FOR 36 MONTHS.** will be evaluated. Briefly describe company or individual experience in regard to the above scope of work and attach this to this schedule.

NB: Proof of previous work history must be attached in form of Official Purchase Order or Appointment Letter and Completion Certificate or reference letter.

A summary of the relevant work experience in line with the scope of work should be indicated in the table below: All documents applicable to this Schedule must be attached as Annexure B

Employer, contact person and telephone number, where available	Description of work (service)	Value of work (i.e. the service provided) inclusive of VAT (Rand)	Date completed

The scoring of the tenderer's experience will be as follows:

0 point	<ul style="list-style-type: none"> ▪ No Appointment letter for construction/refurbishment / maintenance of Water and/or Waste Water Treatment Works
10 points	<ul style="list-style-type: none"> ▪ Appointment letter(s) for Construction/refurbishment/maintenance of at least two (2) Water and/or Waste Water Treatment Works with minimum project value of R5 000 000.00 with contactable references purchase order and completion certificates, etc. ▪ 5 points per appointment letter together with the completion certificates (max 10)
20 points	<ul style="list-style-type: none"> ▪ Appointment letter (s) for Construction/refurbishment/ maintenance of at least two (2) Water and/or Waste Water Treatment Works with minimum project values of R10 000 000.00 each, with contactable references/purchase order and completion certificates, etc. ▪ 10 points per appointment letter together with the completion certificates (max 20)
30 points	<ul style="list-style-type: none"> ▪ Appointment letter(s) for Construction/refurbishment of two (2) Water and/or Waste Water Treatment Works with minimum project values of R15 000 000.00 each, with contactable references, purchase order, completion certificates, etc. ▪ 15 points per appointment letter together with the completion certificates (max 30)
40 points	<ul style="list-style-type: none"> ▪ Appointment letter (s) for Construction/refurbishment of two (2) Water and/or Waste Water Treatment Works with minimum project values of R20 000 000.00 each, completed with contactable references, purchase order, completion certificates, etc. ▪ 20 points per appointment letter together with the completion certificates (max 40)
50 points	<ul style="list-style-type: none"> ▪ Appointment letter (s) for Construction/refurbishment of two (2) Water and/or Waste Water Treatment Works with minimum project values of R35 000 000.00 each, with contactable references, purchase order, completion certificates, etc. ▪ 25 points per appointment letter together with the completion certificates (max 50)

NB: Only bidders who score a minimum of 70 points will be further evaluated on price and Specific Goals.

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I the undersigned, who warrants that he / she is duly authorized to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

SIGNED AT	AUTHORIZED SIGNATURE (UNDERSIGNED)
DATE	NAME AND CAPACITY

SCHEDULE 11

EVALUATION SCHEDULE: EXPERIENCE OF KEY STAFF

A CV of each key staff member of not more than 2 pages should be attached to this schedule. The CV should be structured under the following headings:

1. Personal particulars
 - name
 - date and place of birth
 - place (s) of tertiary education and dates associated therewith
 - professional awards
2. Qualifications (degrees, diplomas, grades of membership of professional societies and professional registrations). Attach certificates
3. Name of current employer and position in enterprise
4. Overview of post graduate / diploma experience (year, organization and position)
5. Outline of recent assignments / experience that has a bearing on the scope of work

All documents applicable to this Schedule must be attached as Annexure C

The scoring of the experience of key staff will be as follows:

Key Staffs	Qualifications:	Years of experience:
Project Manager (max 9 points)	Minimum of relevant degree in Built Environment: 4 points Professional registration (PMP, CMP or similar): 2 points	At least 5 years of water and/or wastewater project experience: 3 points
Mechanical Engineer (max 9 points)	BEng /BTech Mechanical Engineering: 4 points Professional registration (ECSA): 2 points	At least 5 years' water and/or wastewater project related experience: 3 points
Civil/Structural Engineer (max 9 points)	BEng /BTech Civil Engineering: 4 point Professional registration (ECSA): 2 points	At least 5 years' water and/or wastewater project related experience: 3 points
Electrical, Control	BEng /BTech Electrical Engineering: 4 point	At least 5 years' water and/or

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and Instrumentation Engineer (max 9 points)	Professional registration (ECSA): 2 points	wastewater project related experience: 3 points
Health and Safety Officer (max 4 points)	Health and Safety Certificate: 2 points	At least 5 years' experience in health and safety: 2 points

NB: Only bidders who score a minimum of 70 points will be further evaluated on price and Specific Goals.

The undersigned, who warrants that he / she is duly authorized to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

SIGNED AT	AUTHORIZED SIGNATURE (UNDERSIGNED)
DATE	NAME AND CAPACITY

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SCHEDULE 12
EVALUATION SCHEDULE: CONSTRUCTION RESOURCES

The maximum number of tender evaluation points for this category will be distributed as follows:

1. Construction equipment:

The tenderer must list the following categories of construction equipment:

- (a) Construction equipment that is owned the tenderer (including leased equipment) and will be available immediately for this Contract,
- (b) Construction equipment that will hired for this Contract

The information required for each category should be put in tabular form with the indicated headings.

*Major construction equipment owned by the tenderer that will be available for this Contract. Provide proof of ownership, such a **certified copy of the company's register of assets and Motor Vehicle Licensing document (MVL1) that is not older than 12months from date of tender**. Major construction equipment that will be hired for this Contract. Provide proof of availability, such as a certified letter of commitment from the owner or copy of lease of assets:*

Equipment should include but not limited to the following:

Evaluation Criteria	Minimum Required	Points obtainable
Firm's Office Building location	Firm's offices outside the provincial boundaries	0
	Firm's offices within the provincial boundaries	1
	Firm's offices within the Ehlanzeni District boundaries	2
Equipment	Minimum 8 Ton Flatbed Truck with mounted crane	2
	TLB/ Back actor	1
	Minimum 20 ton crane truck	2
Company's vehicles	Vehicles (LDV) x 2	2

Evaluation points will be awarded in accordance with physical resources capacity, age and ownership status.

All documents applicable to this Schedule must be attached as Annexure D

LIST OF MAIN PHYSICAL RESOURCES AND EQUIPMENT TO BE USED ON PROJECT:

Quantity	Description, size, capacity, manufacturing, etc.	Year/Age of equipment	Registration Number	Owned/ Hired/ Acquired/ Company	Roadworthy/ Condition
Example:					

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NB: Only bidders who score a minimum of 70 points will be further evaluated on price and Specific Goals.

The undersigned, who warrants that he / she is duly authorized to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

SIGNED AT	AUTHORIZED SIGNATURE (UNDERSIGNED)
DATE	NAME AND CAPACITY

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SCHEDULE 14

ALTERATIONS OR DEVIATIONS BY TENDERER

Should the tenderer desire to make any departures from or modifications to the General Conditions of Contract, Contract Specific Data, Specifications, Bill of Quantities (BOQ) or Drawings, or to qualify his tender in any way, he must set out his proposals clearly hereunder, or alternatively state them in a covering letter attached to his tender and referred to hereunder, failing which the tender will be deemed to be disqualified. Proper referene on line item must be made on the BOQ

If no departure or modifications are desired, the schedule hereunder must be scratched out and signed by the tenderer.

CLAUSE OR ITEM	PROPOSED ALTERATIONS

NAME OF REPRESENTATIVE	SIGNATURE	DATE

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T2.2.3 OTHER SCHEDULES & DOCUMENTS THAT WILL BE INCORPORATED INTO THE CONTRACT

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OSD 1

FORM OF INTENT TO PROVIDE A PERFORMANCE GUARANTEE

The tenderer must attach hereto a letter from the bank or institution with whom he has made the necessary arrangements, to the effect that the said bank or institution will be prepared to provide the required performance guarantee when asked to do so.

A performance guarantee equal to (Stated in JBCC) of the tender amount is required on this tender. The bidder must provide the signed performance guarantee within ten (10) working days from date of appointment/award letter of the tenderer.

The following Pro-forma is attached for tenderers to use.

PRO-FORMA FOR A PERFORMANCE GUARANTEE PERFORMANCE GUARANTEE

Employer name				
Employer address				
Tender No.				
Tender title				
WHEREAS				
	hereinafter referred to as "the employer" entered into a contract with			
	hereinafter called "the contractor"			
	on this		day of	20
For the construction of (tender title)				
	at			
	And WHEREAS it is provided by such contract that the contractor shall provide the employer with security by way of a guarantee for the due and faithful fulfillment of such contract by the contractor;			
AND WHEREAS				
	hereinafter referred to as "the guarantor" has/have at the request of the			

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NOW THEREFORE WE

Do hereby guarantee and bind ourselves jointly and severally as guarantor and co-principal debtors to the employer under renunciation of the benefits of division and exclusion for the due and faithful performance by the contractor of all the terms and conditions of the said Contract, subject to the following conditions:

1. The employer shall, without reference and/or notice to us, have complete liberty of action to act in any manner authorized and/or contemplated by the terms of the said contract, and/or to agree to any modifications, variations, alterations, directions or extensions of the completion data of the works under the said contract, and that its rights under this guarantee shall in no way be prejudiced nor our liability hereunder be affected by reason of any steps which the employer may take under such contract, or of any modification, variation, alterations of the completion date which the employer may make, give, concede or agree to under the said contract.
2. This guarantee shall be limited to the payment of a sum of money.
3. The employer shall be entitled, without reference to us, to release any guarantee held by it, and to give time to or compound or make any other arrangement with the contractor.

However, upon receipt by us of an authenticated copy of the certificate of completion in terms of the contract, the amount of liability shall be reduced by 50%, which shall be in force until the issue of the final approval certificate at expiry of the defects liability period.

4. This guarantee shall remain in full force and effect until the issue of the certificate of completion in terms of the contract, unless we are advised in writing by the employer before the issue of the said certificate of his intention to institute claims, and the particulars thereof, in which event this guarantee shall remain in full force and effect until all such claims have been paid of liquidated.
5. Our total liability hereunder shall not exceed the sum of:

	(in words)
R	(in figures)
(as per JBCC), which amount I/we agree to hold at your disposal.	

6. The guarantor reserves the right to withdraw from this guarantee by depositing the guaranteed sum with the beneficiary, whereupon the guarantor's liability hereunder shall cease.
7. I / we declare that I/we, on behalf of the guarantor, waive the legal exceptions available to a guarantor and undertake to pay the said amount or such portion thereof as may be demanded, immediately on receipt of a written demand from you.
8. A certificate under your hand shall be sufficient and satisfactory evidence as to the amount of the guarantor's liability for the purpose of enabling provisional sentence or any similar relief to be obtained against the guarantor.

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9. ~~This guarantee is neither negotiable nor transferable, and must be surrendered to the guarantor in the event of the full amount of the guarantee being paid to the employer.~~

10. I / we hereby choose our address for the serving of all notices for all purposes arising here from as

--

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

As witnesses:

	NAME	SIGNATURE
1		
2		

Duly authorized to sign on behalf of (*Guarantor*)

SIGNATURE	DATE
POSTAL ADDRESS	
PHYSICAL ADDRESS	

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EXECUTION PROGRAMME

The tenderer shall detail below or attach a preliminary programme reflecting the proposed sequence and tempo of execution of the various activities comprising the work for this contract. The programme shall be in accordance with the information supplied in the contract, requirements of the project specifications and with all other aspects of this tender.

The execution programme must be based on the completion time as specified in the contract data.

PLEASE NOTE: the cash flow projections from the contractor (to be submitted before commencement of the execution of the contract) must be in accordance with this execution plan in order to ensure proper cash flow management by the department and to minimise delayed payments.

PROGRAMME															
ACTIVITY	MONTHS														
	July	August	September	October	November	December	January	February	March	April	May	June	July	August	No. of weeks
TOTAL DELIVERY TIME / PERIOD															

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CASH FLOW PROJECTIONS	
MONTH	AMOUNT (VAT INCL.)
July	R
August	R
September	R
October	R
November	R
December	R
January	R
February	R
March	R
April	R
May	R
June	R
July	R
TOTAL AMOUNT	R

AUTHORIZED SIGNATURE	DATE

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OSD 3

OCCUPATIONAL HEALTH & SAFETY DECLARATION FORM

In terms of clause 4(4) of the OHS Act 1993 Construction Regulations 2014 (referred to as "the Regulations" hereafter), a contractor may only be appointed to perform construction work if the employer is satisfied that the contractor has the necessary competencies and resources to carry out the work safely in accordance with the Occupational Health and Safety Act No. 85 of 1993 and the OHS Act 1993 Construction Regulations 2014.

To that effect a person duly authorised by the tenderer must complete and sign the declaration hereafter in detail.

Declaration by tenderer

1	I the undersigned hereby declare and confirm that I am fully conversant with the Occupational Health and Safety Act No. 85 of 1993 (as amended by the Occupational Health and Safety Amendment Act No. 181 of 1993), and the OHS Act 1993 Construction Regulations 2014.		
2	I hereby declare that my company has the competence and the necessary resources to safely carry out the construction work under this contract in compliance with the Construction Regulations and the employer's health and safety specifications.		
3	I propose to achieve compliance with the Regulations by one of the following:		
A	From my own competent resources as detailed in 4(a) hereafter:	Yes	No
B	From my own resources still to be appointed or trained until competency is achieved, as detailed in 4(b) hereafter:	Yes	No
C	From outside sources by appointment of competent specialist sub-contractors as detailed in 4(c) hereafter: (* = delete whatever is not applicable)	Yes	No
4	Details of resources I propose: <i>(Note: Competent resources shall include safety personnel such as a construction supervisor and construction safety officer as defined in Regulation 6, and competent persons as defined in Regulations 7, 8, 10, 11, 12, 14, 15, 18, 21(1), 22, 26 and 27, as applicable to this contract)</i>		

(a) Details of the competent and qualified key persons from my company's own resources, who will form part of the contract team:

NAMES OF COMPETENT PERSONS	POSITIONS TO BE FILLED BY COMPETENT PERSONS

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- Details of training of persons from my company's own resources (or to be hired) who still have to be trained to achieve the necessary competency:

(i)	By whom will training be provided?	
(ii)	When will training be undertaken?	
(iii)	List the positions to be filled by persons to be trained or hired	

- (c) Details of competent resources to be appointed as subcontractors if competent persons cannot be supplied from own company:

Name of proposed subcontractor	
Qualifications or details of competency of the subcontractor	

- I undertake to acquaint the appropriate officials and the employees of the contractor with all relevant provisions of the Act, and the regulations promulgated in terms of the act.
- I undertake that all relevant duties, obligations and prohibitions imposed in terms of the act and regulations will be fully complied with.
- I hereby accept sole liability for such due compliance with the relevant duties, obligations and prohibitions imposed by the Act and regulations in respect of the work included in the contract.
- I shall be obliged to report forthwith to the employer any investigation, complaint, or criminal charge which may arise as a consequence of the provisions of the act and regulations pursuant to work performed on behalf of the employer, and shall, on written demand, provide full details in writing of such investigation, complaint or criminal charge.
- I hereby undertake, if my tender is accepted, to provide, before commencement of the works under the contract, a suitable and sufficiently documented health and safety plan in accordance with Regulation 5(1) of the Construction Regulations, which plan shall be subject to approval by the employer.
- I confirm that copies of my company's approved Health and Safety Plan, the employer's safety specifications as well as the OHS 1993 Construction Regulations 2003 will be provided on site and will at all times be available for inspection by the contractor's personnel, the employer's personnel, the engineer, visitors, and officials and inspectors of the Department of Labour.
- I hereby confirm that adequate provision has been made in my tendered rates and prices in the schedule of quantities to cover the cost of all resources, actions, training and all health and safety measures envisaged in the OHS 1993 Construction Regulations 2003, and that I will

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be liable for any penalties that may be applied by the employer in terms of the said Regulations (Regulation 30) for failure on the contractor's part to comply with the provisions of the act and the regulations.

12. I agree that my failure to complete and execute this declaration to the satisfaction of the employer will mean that I am unable to comply with the requirements of the OHS 1993 Construction Regulations 2014, and accept that my tender will be prejudiced and may be rejected at the discretion of the employer.

AUTHORIZED SIGNATURE	DATE

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OSD 4

CONTRACTOR'S SAFETY PLAN

The contractor must submit the contractor's health and safety plan as required in terms of Regulation 5 of the Occupational Health and Safety Act 1993 Construction Regulations 2014 before commencement of the works.

Attached a copy of the draft plan to the tender document.

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OSD 5**PRO FORMA NOTIFICATION FORM IN TERMS OF THE OCCUPATIONAL HEALTH & SAFETY ACT 1993, CONSTRUCTION REGULATIONS 2014**

The pro-forma form must be completed and prior to commencement of work on site, the final form must be completed by all contractors that qualify in terms of Regulation 3 of the Construction Regulations 2014, to the office of the Department of Labour.

1	(a)	Name and postal address of contractor	
	(b)	Postal address	
	(c)	Name of contractor's contact person	
		Telephone number	
Fax number			
		Email	
2		Contractor's workman's compensation registration number	
3	(a)	Name and postal address of employer	
	(b)	Name of employer contact person or agent	
		Telephone number	
		Fax number	
		Email	
4	(a)	Name and postal address of consultants / designer(s) for the project	
	(b)	Name of consultants / designer(s) contact person	
		Telephone number	

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	Fax number	
	Email	
5	Name of contractor's construction supervisor on site appointed in terms of Regulation 6(1)	
	Telephone number	
	Fax number	
	Email	
6	Name/s of contractor's sub-ordinate supervisors on site appointed in terms of regulation 6(2)	
7	Exact physical address of the construction site or site office	
8	Nature of the construction work	
9	Expected commencement date	
10	Expected completion date	
11	Estimated maximum number of persons on the construction site	
12	Planned number of subcontractors on the construction site accountable to contractor	
13	Name(s) of subcontractors already chosen	

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I, the undersigned certify that the information furnished on this information statement is true and correct.

CONTRACTOR / BIDDER NAME	
NAME OF AUTHORIZED REPRESENTATIVE	
SIGNATURE	
DATE	
EMPLOYER REPRESENTATIVE	
DATE	

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TRANSFER OF RIGHTS

The successful tenderer shall complete and submit a transfer of rights form to claim for materials on site with every progress payment for the project. No payment for materials on site would be granted if this document is not submitted with the progress payment being considered. This form together with the documentary proof of ownership or proof of payment by the contractor to the supplier shall accompany the contractor's claim for payment for materials on site in terms of clause 49.1.5 of the General Conditions of Contract 2015.

**TRANSFER OF RIGHTS AND INDEMNITY
(To be completed during construction by successful tenderer only)**

Claim for materials on site, payment certificate No.	
Date	
Contract No.	
For (contract title)	
I, the undersigned (name of signatory)	
in my capacity as	
of (name of contractor)	

duly authorized hereto on behalf of the contractor hereby transfer, cede and assign all the contractor's rights, title and interest in and to the materials and goods, for which evidence of bona fide ownership is attached hereto, unto and in favour of (name of employer)

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Insofar as the contractor retains actual control of the materials and goods, the right of ownership thereof passes to the Employer by *constitutum possessorium*.

I herewith indemnify the employer against any claim to and in respect of said materials by reason of the contractor's sequestration or liquidation or of any defect in the contractor's title to the materials and agree that no payment for materials on site will be made by the employer until such time as I have submitted documentary proof of bona fide ownership of the said materials and goods.

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This transfer shall become effective upon conclusion of the contractor receiving payment from the employer or from any other person on behalf of the employer for the materials and goods as materials on site, payment of retention money thereon excluded.

I further confirm that I am fully responsible for all materials and goods listed under this transfer of rights and that they have been insured adequately against all risks and will remain insured until they are built into or used in the permanent works and taken over by the employer.

This certificate of Transfer of Rights applies only to the materials and goods as listed in the following table.

DESCRIPTION OF ITEM	UNIT	QUANTITY	RATE	AMOUNT	SUPPLIER
TOTAL VALUE OF MATERIALS AND GOODS					

SIGNED BY REPRESENTATIVE	DATE
WITNESSED BY	DATE

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OSD 7

PRO FORMA: CONTRACT OF EMPLOYMENT EPWP

This contract must be completed and submitted for local and non-local labour appointed under the EPWP project

CONTRACT OF EMPLOYMENT BETWEEN

CONTRACTOR

Name of contractor	
Address	
ID	

AND

WORKER

Name of worker	
Address	
ID	

I am pleased to confirm that you have been appointed to work on a task based*/a time basis* employment contract within an Expanded Public Works Programme (EPWP) project.

Within this contract you will undertake numerous groups of tasks.

This contract must be read in conjunction with the standard terms and conditions of employment on EPWP attached.

The contract will start on	
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You must be aware that this contract is a limited term contract and not a permanent job.

The contract may be terminated for one of the following reasons:

- 1.1. If the contractor does not get additional contracts from the EPWP.
- 1.2. Funding for the programme in your area comes to an end.
- 1.3. You repeatedly do not perform in terms of the tasks set out in your work programme.

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1.4. You have worked a maximum of 24 months within a 60 month cycle.

You will be employed as a		within the team.
While you are working you will report to		

Payment

- a) You will be paid a fixed amount of R..... for completing a fixed amount of work.
- b) The amount of work required for the agreed rate of pay will vary from task to task. You will be informed at the beginning of each task or group of tasks how much work you are expected to complete per day.
- c) You will only be paid for work completed.
- d) You will be paid the amount for the number of days quoted in the contract even if you finish the work before the time or after the estimated date of completion.
- e) A contractor must pay you the production bonus (the extra days if the work is finished early) if you have completed your share of tasks.
- f) The contractor will be paid within 30 days after the work is completed. You will be paid within 5 days of the contractor being paid.

* delete whichever is not applicable.

In addition to the conditions above all the terms and conditions of employment on EPWP apply to your employment. If you breach any of these terms your contract may be terminated.

Signatures:

Signed on this		day of		20
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AUTHORIZED REPRESENTATIVE	DATE
WORKER	DATE

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WITNESS	DATE

OSD 8

PRO FORMA: MONTHLY LABOUR REPORT

This form must be submitted monthly to the relevant project coordinator for work completed on the project for the

MONTH OF

CERTIFICATE OF PAYMENT NO.

JOBS CREATED

As per Business Plan

A	B	C	D	E	F	G	H	I	J
Category	No. of persons employed in category	Rate (R/d)	Local P-days	Non-local P-days	Total P-days (D +E)	Amount expended on labour (C x F)	P-days by women	P-days by youth	P-days by disabled
Clerical									
Managerial									
Supervisory									
Skilled									
Semi-skilled									
Unskilled									
All occupations									

Actual to date

A	B	C	D	E	F	G	H	I	J
Category	No. of persons employed in category	Rate (R/d)	Local P-days	Non-local P-days	Total P-days (D +E)	Amount expended on labour (C x F)	P-days by women	P-days by youth	P-days by disabled
Clerical									
Managerial									
Supervisory									
Skilled									

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Semi-skilled									
Unskilled									
All occupations									

Summary

- Planned person-days target (see cell F8 of business plan)
- Tendered construction period (months)
- Overall person-days target per month
- Months represented by this report
- Person-day target for this month
- Achieved person-days to date (see cell F8 of actual)
- Person-days ahead/behind target

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THE CONTRACT

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C1 AGREEMENT AND CONTRACT DATA

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C1.1 FORM OF OFFER & ACCEPTANCE

C1.1.1 FORM OF OFFER

The employer, identified in the acceptance signature block, has solicited offers to enter into a contract for the following project:

Bid / Tender Number	NKO 09/2025
Tender Title	RE ADVERT FOR APPOINTMENT OF A PANEL OF MAXIMUM 10 (TEN) CONTRACTORS FOR THE REFURBISHMENT AND REPLACEMENT OF CIVIL WORKS, MECHANICAL AND ELECTRICAL EQUIPMENTS AT WATER, WASTE WATER TREATMENT WORKS AS AND WHEN REQUIRED FOR 36 MONTHS.

The tenderer, identified in the offer signature block, has examined the documents listed in the tender data and addenda thereto as listed in the returnable schedules, and by submitting this offer has accepted the conditions of tender.

By the representative of the tenderer, deemed to be duly authorized, signing this part of this form of offer and acceptance, the tenderer offers to perform all of the obligations and liabilities of the service provider / consultant 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 THE FOLLOWING:

AMOUNT IN WORDS (INCL. VAT)	AMOUNT IN FIGURES (INCL VAT)
RAND	R

(Amount must be in words as well as figures)

This offer may be accepted by the employer by communicating such acceptance in writing to the tenderer or by signing the acceptance part of this Form of Offer and Acceptance and returning one copy thereof to the tenderer, whereupon the tenderer becomes the party named as the provider . consultant in the conditions of contract identified in the contract data.

SIGNATURE BLOCK: TENDERER			
Signature		Date	
Name			
Capacity			
Name of organization			
Address of organization			

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Signature of witness		Date	
Name of witness			

C1.1.2 FORM OF 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 service provider / consultant the amounts due in accordance with the conditions of contract identified in the contract data. Acceptance of the tenderer’s offers 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.
- Service Level Agreement as signed by the parties.

and documents or parts thereof, which may be incorporated by reference into Parts C1 to C3 above.

Deviations from and amendments to the documents listed in the tender data and any addenda thereto as listed in the tender schedules, will only be valid if reduced to writing and signed by both parties..

The tenderer shall within two weeks after receiving a completed copy of this agreement 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. Failure to fulfill any of these obligations in accordance with those terms shall constitute a repudiation of this agreement.

Unless otherwise specified elsewhere in this bidding document or any subsequent written agreement entered into between the parties, this agreement comes into effect on the date when the Employer communicates the acceptance and/or conditions of acceptance of the tenderer’s offer in writing or signs the acceptance part of this Form of Offer, whichever event occurs first.

SIGNATURE BLOCK: EMPLOYER			
Signature		Date	
Name			
Capacity			
Name of organization			
Address of organization			

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Signature of witness		Date	
Name of witness			

C1.1.3 SCHEDULE OF DEVIATIONS

Standardized items of Schedule of Deviations:

- Any clarification of the terms of the offer by the tenderer in writing;
- Any clarification, confirmation or changes to the documents provided by the Employer in writing prior to or simultaneous with award / written acceptance of the offer.

1	Subject	
	Details	
2	Subject	
	Details	
3	Subject	
	Details	
4	Subject	
	Details	

By the duly authorized representatives signing this agreement, 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 changes to the terms of the offer agreed by the tenderer and the employer during this process of offer and acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the tenderer of written

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acceptance of its offer shall have any meaning or effect in the contract between the parties arising from this agreement.

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C1.2 CONTRACT DATA

The General Conditions of Contract for Construction Works, (2015) published by the South African Institution of Civil Engineering, Private Bag X200, Halfway House, 1685, is applicable to this Contract. Copies of these conditions of contract may be obtained from the South African Institution of Civil Engineering (Tel: 011-805 5947 / www.saice.org.za).

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

Each item of data given below is cross-referenced to the clause in the General Conditions of Contract for construction works to which it mainly applies.

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C1.2.1 CONDITIONS OF CONTRACT

Contract Specific Data

The following contract specific data, referring to the General Conditions of Contract for Construction Works,(2015) are applicant to this Contract.

The Contract Specific Conditions of contract are as numbered and set out below. These clauses are the only variations from and/or additions to the clauses of the General Conditions of Contract.

CLAUSE	CONTRACT SPECIFIC DATA
1.1.13	Add the following to the end of this definition: "This clause shall apply <i>mutatis mutandis</i> to any portion or phase of the works that may be described in the scope of works or in the contract data, or agreed subsequently between the Contractor and the Employer, and committed to writing".
1.1.13	The Defects Liability Period applicable to this Contract is 12 (twelve) months measured from the date of Certificate of Completion.
1.1.1.14	The time for achieving Practical Completion will be determined upon allocation of projects, including special non-working days and the year-end break.
1.1.1.15	The name of the Employer is NKOMAZI LOCAL MUNICIPALITY.
1.1.1.16	The name of the Employer's Agent will be communicated upon allocation of projects.
1.1.1.26	The Pricing Strategy is Re-measurement Contracts.
1.2.1.2	The address of the Employer is: The address of the Employer's Agent will be communicated upon allocation of projects.
3.2.3	The Employer's Agent is, in terms of his appointment by the Employer for the design and administration of the works included in the contract, required to obtain the specific approval of the Employer for the execution of the following duties: 3.2.3.1 The issuing of an order to suspend the progress of the works, the extra cost resulting from which order is to be borne by the Employer in terms of clause 5.11.2 or the effect of which is liable to give rise to a claim by the Contractor for an extension of time under clause 10.1 of these conditions. 3.2.3.2 The issuing of an instruction or order to vary the nature or quantity of the works in terms of clause 6.3, the estimated effect of which will be to increase the contract price by an amount exceeding 15% of the Contract Sum, the valuation of all variation orders in terms of clause 6.4 and the adjustment of the sum(s) tendered for general items in terms of clause 6.11.

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CLAUSE	CONTRACT SPECIFIC DATA
	<p>3.2.3.3 The approval of any claim submitted by the Contractor in terms of clause 10.1.</p> <p>3.2.4</p>
4.1	<p>Add the following new clause after 4.1.2:</p> <p>4.1.3 The Contractor shall provide the following to the Employer's Agent for retention by the Employer or his assignee in respect of all works designed by the Contractor:</p> <p>4.1.3.1 a Certificate of Stability of the Works signed by a registered professional engineer confirming that all such works have been designed in accordance with the appropriate codes of practice.</p> <p>4.1.3.2 proof of registration and of adequate and current professional indemnity insurance cover held by the designer(s).</p> <p>4.1.3.3 design calculations should the Employer's Agent request a copy thereof.</p> <p>4.1.3.4 engineering drawings and workshop details (both signed by the relevant professional engineer), in order to allow the Employer's Agent to compare the design with the specified requirements and to record any comments he may have with respect thereto.</p> <p>4.1.3.5 "As-Built" drawings in DXF electronic format after completion of the works. The Contractor shall be responsible for the design of the temporary works.</p>
4.3	<p>Add the following new clause after 4.3.2:</p> <p>4.3.3 The Contractor shall comply with the Occupational Health and Safety Specification prepared by the Employer in terms of the Construction Regulations, 2014 promulgated in terms of section 43 of the Occupational Health and Safety Act (Act No. 85 of 1993).</p> <p>Without limiting the Contractor's obligations in terms of the contract, the Contractor shall before commencement of the works or any part thereof, be in the possession of an approved Health and Safety Plan. The Contractor shall submit an approved Health and Safety Plan to the Employer's Agent within 14 days of the commencement date.</p>
4.3	<p>Add the following new clause after 4.3.3:</p> <p>4.3.4 Contractor's liability as mandatory</p> <p>Notwithstanding any actions which the Employer may take, the Contractor accepts sole liability for due compliance with the relevant duties, obligations, prohibitions, arrangements and procedures imposed by the Occupational Health and Safety Act, 1993 (Act 85 of 1993), and</p>

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CLAUSE	CONTRACT SPECIFIC DATA
	all its regulations, including the Construction Regulations, 2014, for which he is liable as mandatory. By entering into this contract it shall be deemed that the parties have agreed in writing to the above provisions in terms of section 37(2) of the act.
4.3	<p>Add the following new clause after 4.3.4:</p> <p>4.3.5 Contractor to notify Employer</p> <p>The Employer retains an interest in all inquiries conducted under this contract in terms of section 31 and/or 32 of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and its Regulations following any incident involving the Contractor and/or sub-contractor and/or their employees. The Contractor shall notify the Employer in writing of all investigations, complaints or criminal charges which may arise pursuant to work performed under this contract in terms of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and Regulations.</p>
4.3	<p>Add the following new clause after 4.3.5:</p> <p>4.3.6 Contractor's designer</p> <p>The Contractor and his designer shall accept full responsibility and liability to comply with the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and the Construction Regulations, 2014 for the design of the temporary works and those part of the permanent works which the Contractor is responsible to design in terms of the contract.</p>
4.4.5	<p>Delete the contents of the clause and insert the following:</p> <p>Any consent granted in accordance with clause 4.4.2 or appointment of a sub-contractor in accordance with clause 4.4.4 shall not imply a contract between the Employer and the subcontractor, or a responsibility or liability on the part of the Employer to the subcontractor and shall not relieve the Contractor from any liability or obligation under the contract and he shall be liable for the acts, defaults and neglects of any subcontractor, his agents or employees as fully as if they were the acts, defaults or neglects of the Contractor, his agents or employees.</p> <p>The Employer's Agent's consent in respect of any particular subcontractor may be withdrawn at any time should reasonable grounds be given therefore in writing to the Contractor by the Employer's Agent, in which event the Contractor shall forthwith terminate the engagement or that subcontractor on the works.</p> <p>The withdrawal by the Employer's Agent of his consent in respect of any particular sub-contractor that is engaged in the execution of any portion of the works, including any portions of the works which are sub-let by the Contractor in accordance with clause 4.4.4 shall not relieve the Contractor of any of his obligations under the contract, nor of any of his obligations to sub-let the particular portions of the works concerned.</p>
4.6	Add the following new clause after 4.6.2:

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CLAUSE	CONTRACT SPECIFIC DATA
	4.6.3 The copyright in all documents, drawings and records (prepared by the Employer's Agent) related in any manner to the Works shall vest in the Employer or the Employer's Agent or both (according to the dictates of the contract that has been entered into by the Employer's Agent and the Employer for the works), and the Contractor shall not furnish any information in connection with the works to any person or organisation without the prior approval of the Employer to this effect.
4.11	Add the following new clause after 4.11.2: 4.11.3 The Contractor shall use local labour in accordance with the requirements contained within the scope of work.
5.1.1 and 5.8.1	The non-working days are Sundays. The Special non-working days are the following statutory public holidays as declared by National or Regional Government: New Year's Day, Human Rights Day, Good Friday, Family Day, Freedom Day, Workers Day, Youth Day, National Women's Day, Heritage Day, Day of Reconciliation, Christmas Day and the Day of Goodwill including the construction industry year-end break. The year-end break commences on the first working day after 15 December and ends on the first working day after 5 January of the next year.
5.3.1	The documentation required before commencing with the Works are: 1. Health and Safety Plan (Refer to Clause 4.3) 2. Initial programme (Refer to Clause 5.6) 3. Security (Refer to Clause 6.2) 4. Insurance (Refer to Clause 8.6) 5. Detailed cash flow forecast
5.3.1	The Contractor shall, subject to compliance with clause 5.3.1 and 5.3.2, commence with the Works within 28 (twenty eight) days of the Commencement Date.
5.3.2	The time to submit the documentation required before commencement of the Works is 14 (fourteen) days.
5.6.1	Add the following to the end of clause 5.6.1: In this regard the Contractor shall have regard for the phases and sub-phases (if applicable) for the development, which shall also be the order in which the permanent works shall be constructed, unless otherwise agreed between the parties and committed to writing. If phased construction is applicable, the phases and sub-phases will be described in the specifications and/or will be indicated on the phasing plan, which forms part of the drawings.
5.12.2.2	Add the following new clause after 5.12.2.2: 5.12.2.2.1 Should the Contractor consider that he may, during the course of the contract, wish to invoke "abnormal climatic conditions" as a circumstance entitling him to an extension of time for the completion of the works, he shall, before commencing any of the permanent works, establish an approved weather recording station with an approved observer who shall record daily the weather conditions

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CLAUSE	CONTRACT SPECIFIC DATA
	<p>that the Contractor may wish to invoke. The records shall be submitted weekly to the Employer's Agent's representative, together with a statement recording the Contractor's opinion of the effect on his programme of any weather condition that he may consider to be abnormal.</p> <p>5.12.2.2.2 Extension of time in respect of abnormal climatic conditions shall be calculated in accordance with the method and data given in the specification data / scope of work.</p> <p>5.12.2.2.3 Extension of time due to abnormal rainfall</p> <p>Extension of time for completion of the contract shall be allowed in the event of abnormal rainfall in accordance with the following formula:</p> $V = (Nw - Nn) + (Rw - Rn)/20$ <p>Where:</p> <p>V = Extension of time in calendar days for the calendar month under consideration</p> <p>Nw = Actual number of days during the calendar month under consideration on which a rainfall of 10mm and more is recorded</p> <p>Rw = Actual total rainfall in mm recorded during the calendar month under consideration</p> <p>Nn = Average number of days, derived from rainfall records, on which a rainfall of 10mm and more was recorded during the relevant calendar month as per the data tabulated hereinafter</p> <p>Rn = Average total rainfall in mm for the relevant calendar month, derived from rainfall records, as tabulated hereinafter</p> <p>Where the extension of time due to abnormal rainfall has to be calculated for 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 Nn, then V shall be taken as being equal to minus Nn. 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.</p> <p>Rainfall records for the period of construction shall be taken on site. The Contractor shall provide and install all the necessary equipment 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. The Employer's Agent or his representative shall take and record the daily rainfall readings. The Contractor shall be permitted to attend these readings, in the company of the Employer's Agent's representative. Access to the measuring gauge(s) shall at all times be under the Employer's Agent's control.</p> <p>Unless otherwise provided in the site information, the value of "n" shall be taken as equal to the tendered time for completion of the works in months, rounded off to an integer.</p>

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CLAUSE	CONTRACT SPECIFIC DATA
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Extension of time during normal working days will be granted to the degree to which actual delays as determined in accordance with clause 5.12.2.2.1 hereof, exceed the number of “n” normal working days.

The value of “n” does not take into account further or concurrent delays which are caused by other abnormal climatic conditions such as floods, which have to be determined separately in accordance with clause 5.12.2.2.1 hereof.

The rainfall records applicable to this contract are those recorded at weather station Sabie climb 05554867 or Mpumalanga Kruger Airport

The following values of Nn and Rn shall apply:

MONTH	R _n (mm)	N _n (days)
January	170	
February	101	
March	83	
April	53	
May	36	
June	7	
July	5	
August	9	
September	33	
October	93	
November	256	
December	152	
TOTAL	74.83	

5.12.3	<p>Replace the first line of the clause with the following:</p> <p>“If an extension of time is granted, other than an extension resulting from abnormal climatic conditions in terms of clause 5.12.2.2, the Contractor shall be”</p>
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5.13.1	The penalty for failure to complete the Works is 0.05% of the Contract Price per calendar day.
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5.13	<p>Add the following new clauses after 5.13.2</p> <p>5.13.3 The imposition of penalties in terms of clause 5.13 shall not relieve the Contractor from his obligation to complete the works, nor from any of his obligations and liabilities under the contract.</p> <p>5.13.4 All penalties for which the Contractor becomes liable in terms of clause 5.13 shall be accumulative. The Employer may, without prejudice to any other method of recovery, deduct the amounts of all such penalties from any monies in his possession that are or may become due to the Contractor.</p>
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CLAUSE	CONTRACT SPECIFIC DATA
	5.13.5 The imposition of any penalties in terms of clause 5.13 shall not limit the right of the Employer's Agent of the Employer to act in terms of clause 9.2.1.3.4 or 9.2.1.3.6.
5.14.1	The requirements for achieving Practical Completion is for the Works to reach a state of readiness, fit for the intended purposes and occupation without danger or undue inconvenience to the Employer as determined by the Employer's Agent.
5.16.3	The latent defects period is 10 years.
6.2.1	The amount of the guarantee will be 10% of the Contract Price (including Value Added Tax) at the time that the Contract comes into effect.
6.5.1.2.3	The percentage allowance on the net cost of materials actually used in the completed work and on the gross remuneration of the workmen and foremen actually engaged is 0%, unless otherwise provided in the Bill of Quantity / Pricing Schedule.
6.6.1.2	In clause 6.6.1.2.1, the first line, after the word "sums", insert ", excluding VAT," and in clause 6.6.1.2.2, the third line, after the word "amount" insert ", excluding VAT".
6.6.2	In clause 6.6.2, line 5, after the word "price", insert ", excluding VAT".
6.8.2	Contract Price Adjustment shall be applicable to this Contract.
6.9.1	Add the following to the end of 6.9.1: "The Contractor shall where practicable before delivery, and in any event not later than 24 hours after delivery to the site, inform the Employer's Agent of any materials which are not his sole property".
6.10.1.5	The percentage advance on materials no yet built into the Permanent Works and on Plant not yet supplied to Site is 80%. This is subject to mutual agreement in terms of the provisions of clause 6.9.1.2.
6.10.3	The percentage retention on the amounts due to the contractor is 10%, excluding contract price adjustment, contingencies and VAT, and limited to 5% of the contract price, excluding contract price adjustment, contingencies and VAT, of which half will be released upon issuing of the Certificate of Completion and the other half after the expiration of the Defects Liability Period.
7.2.1	Add the following to the end of 7.2.1: "Unless otherwise directed in writing by the Employer's Agent, materials for the permanent works shall be new and unused".
8.6.1.1.2	The value of Plant and materials supplied by the Employer to be included in the insurance sum is: N/A
8.6.1.1.3	

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CLAUSE	CONTRACT SPECIFIC DATA
	The amount to cover professional fees for repairing damage and loss to be included in the insurance sum is 5% of the Contract Sum.
8.6.1.2	Special Risk Insurance issued by SASRIA is required.
8.6.1.3	The limit of indemnity for liability insurance is R2 000 000.00 for any single liability claim. Liability insurance shall include spread of fire risk.
8.6.1.3	Add the following to the end of 8.6.1.3: "The minimum amount of insurance required in terms of this clause, as stated in part 1 of the contract data, shall be per event, the number of events being unlimited."
8.6.1	Add the following new clause after 8.6.1.5: 8.6.1.6 Insurance of all materials stored off site, and intended for incorporation in the permanent works, including their delivery to the site and off-loading on site, to the value of such materials for which payment is made in terms of clause 6.10.1.5 hereof.
8.6.6	Add the following to the end of 8.6.6: Proof of insurance shall be submitted to the Employer prior to commencement of the works (clause 8.6.1), and copies of the policies and proof of due payment of all premiums shall be presented to the Employer within twenty eight (28) days of the date of commencement.
8.6	Add the following new clauses after 8.6.7: 8.6.8 In the event of any claim arising under the policies held in terms of this clause, the Contractor shall forthwith take all necessary steps to lodge his claim on the joint behalf of himself and the Employer, and to secure settlement of such claim, and he shall submit to the Employer's Agent copies of all claims and associated documents. The claim submitted by the Contractor shall cover the cost of repairing and making good as required by clauses 8.2.2.1 and 8.2.2.3. 8.6.9 With regard to the Compensation for Occupational Injuries and Diseases Act (Act No. 130 of 1993), where applicable, the Contractor shall, within such time as is stated in the appendix for the production of insurance policies in terms of sub-clause 35(6), deliver to the Employer a letter, either (a) from his insurance company certifying that the Contractor has effected insurance with the company for the full extent of his potential liability in respect of all workmen employed by him on the contract and undertaking to notify the Employer of the expiry date of the policy at least one calendar month before such date, or (b) from the Compensation Commissioner certifying that the Contractor has complied with the requirements of the above-mentioned act and is at present in good standing with the Compensation Fund.

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CLAUSE	CONTRACT SPECIFIC DATA
10.5.3	The number of Adjudication Board Members to be appointed is One (1).
11	<p>Add the following new clauses after 10:</p> <p>Conditions relevant to labour-intensive construction works:</p> <p>The following contains extracts from the Expanded Public Works Programme guidelines. Although they contain references to “task work” it is the Contractor’s responsibility as to whether he employs and manages his labour on a task work or time basis.</p> <p>Payment for the labour-intensive component of the works:</p> <p>Payment for works identified in the scope of work as being labour-intensive shall only be made in accordance with the provisions of the contract if the works are constructed strictly in accordance with the provisions of the scope of work. Any non-payment for such works shall not relieve the Contractor in any way from his obligations either in contract or in delict.</p> <p>Applicable labour laws:</p> <p>The Ministerial Determination, Special Public Works Programmes, issued in terms of the Basic Conditions of Employment Act of 1997 by the Minister of Labour in Government Notice No. R63 of 25 January 2002, as reproduced below, shall apply to works described in the scope of work as being labour intensive and which are undertaken by unskilled or semi-skilled workers.</p> <p>1. Introduction</p> <p>1.1 This clause contains the standard terms and conditions for workers employed in elementary occupations on a Special Public Works Programme hereinafter called the Expanded Public Works Programme (EPWP). These terms and conditions do NOT apply to persons employed in the supervision and management of EPWP contracts.</p> <p>1.2 In this document –</p> <ul style="list-style-type: none"> (a) “department” means any department of the state or implementing agent; (b) “employer” means any department, implementing agency or contractor that hires workers to work in elementary occupations on a EPWP; (c) “worker” means any person working in an elementary occupation on a EPWP; (d) “elementary occupation” means any occupation involving unskilled or semi-skilled work; (e) “management” means any person employed by a department or implementing agency to administer or execute an EPWP; (f) “task” means a fixed quantity of work; (g) “task-based work” means work in which a worker is paid a fixed rate for performing a task; (h) “task-rated worker” means a worker paid on the basis of the number of tasks completed;

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CLAUSE	CONTRACT SPECIFIC DATA
	<p>(i) "time-rated worker" means a worker paid on the basis of the length of time worked.</p> <p>2. Terms of work</p> <p>2.1 Workers on an EPWP are employed on a temporary basis.</p> <p>2.2 A worker may NOT be employed for longer than 24 months in any 10 (TEN)-year cycle on an EPWP.</p> <p>2.3 Employment on an EPWP does not qualify as employment as a contributor for the purposes of the Unemployment Insurance Act 30 of 1966.</p> <p>3. Normal hours of work</p> <p>3.1 An employer may not set tasks or hours of work that require a worker to work;</p> <p>(a) more than forty hours in any week</p> <p>(b) on more than 10 (TEN) days in any week; and</p> <p>(c) for more than eight hours on any day.</p> <p>3.2 An employer and worker may agree that a worker will work four days per week. The worker may then work up to ten hours per day.</p> <p>3.3 A task-rated worker may not work more than a total of 55 hours in any week to complete the tasks allocated (based on a 40-hour week) to that worker.</p> <p>4. Meal breaks</p> <p>4.1 A worker may not work for more than 10 (TEN) hours without taking a meal break of at least thirty minutes duration.</p> <p>4.2 An employer and worker may agree on longer meal breaks.</p> <p>4.3 A worker may not work during a meal break. However, an employer may require a worker to perform duties during a meal break if those duties cannot be left unattended and cannot be performed by another worker. An employer must take reasonable steps to ensure that a worker is relieved of his or her duties during the meal break.</p> <p>4.4 A worker is not entitled to payment for the period of a meal break. However, a worker who is paid on the basis of time worked must be paid if the worker is required to work or to be available for work during the meal break.</p> <p>5. Special conditions for security guards</p> <p>5.1 A security guard may work up to 55 hours per week and up to eleven hours per day.</p>

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CLAUSE	CONTRACT SPECIFIC DATA
	<p>5.2 A security guard who works more than ten hours per day must have a meal break of at least one hour or two breaks of at least 30 minutes each.</p>
	<p>6. Daily rest period</p> <p>Every worker is entitled to a daily rest period of at least eight consecutive hours. The daily rest period is measured from the time the worker ends work on one day until the time the worker starts work on the next day.</p>
	<p>7. Weekly rest period</p> <p>Every worker must have two days off every week. A worker may only work on their day off to perform work which must be done without delay and cannot be performed by workers during their ordinary hours of work (“emergency work”).</p>
	<p>8. Work on Sundays and public holidays</p>
	<p>8.1 A worker may only work on a Sunday or public holiday to perform emergency or security work.</p>
	<p>8.2 Work on Sundays is paid at the ordinary rate of pay.</p>
	<p>8.3 A task-rated worker who works on a public holiday must be paid –</p> <ul style="list-style-type: none"> (a) the worker’s daily task rate, if the worker works for less than four hours; (b) double the worker’s daily task rate, if the worker works for more than four hours.
	<p>8.4 A time-rated worker who works on a public holiday must be paid –</p> <ul style="list-style-type: none"> (a) the worker’s daily rate of pay, if the worker works for less than four hours on the public holiday; (b) double the worker’s daily rate of pay, if the worker works for more than four hours on the public holiday.
	<p>9. Sick leave</p>
	<p>9.1 Only workers who work four or more days per week have the right to claim sick-pay in terms of this clause.</p>
	<p>9.2 A worker who is unable to work on account of illness or injury is entitled to claim one day’s paid sick leave for every full month that the worker has worked in terms of a contract.</p>
	<p>9.3 A worker may accumulate a maximum of twelve days’ sick leave in a year.</p>
	<p>9.4 Accumulated sick-leave may not be transferred from one contract to another contract.</p>

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CLAUSE	CONTRACT SPECIFIC DATA
	<p>9.5 An employer must pay a task-rated worker the worker's daily task rate for a day's sick leave.</p> <p>9.6 An employer must pay a time-rated worker the worker's daily rate of pay for a day's sick leave.</p> <p>9.7 An employer must pay a worker sick pay on the worker's usual payday.</p> <p>9.8 Before paying sick-pay, an employer may require a worker to produce a certificate stating that the worker was unable to work on account of sickness or injury if the worker is –</p> <p style="padding-left: 40px;">(a) absent from work for more than two consecutive days; or</p> <p style="padding-left: 40px;">(b) absent from work on more than two occasions in any eight-week period.</p> <p>9.9 A medical certificate must be issued and signed by a medical practitioner, a qualified nurse or a clinic staff member authorized to issue medical certificates indicating the duration and reason for incapacity.</p> <p>9.10 A worker is not entitled to paid sick-leave for a work-related injury or occupational disease for which the worker can claim compensation under the Compensation for Occupational Injuries and Diseases Act.</p> <p>10. Maternity leave</p> <p>10.1 A worker may take up to four consecutive months' unpaid maternity leave.</p> <p>10.2 A worker is not entitled to any payment or employment-related benefits during maternity leave.</p> <p>10.3 A worker must give her employer reasonable notice of when she will start maternity leave and when she will return to work.</p> <p>10.4 A worker is not required to take the full period of maternity leave. However, a worker may not work for four weeks before the expected date of birth of her child or for six weeks after the birth of her child, unless a medical practitioner, midwife or qualified nurse certifies that she is fit to do so.</p> <p>10.5 A worker may begin maternity leave –</p> <p style="padding-left: 40px;">(a) four weeks before the expected date of birth; or</p> <p style="padding-left: 40px;">(b) on an earlier date –</p> <p style="padding-left: 80px;">(j) if a medical practitioner, midwife or certified nurse certifies that it is necessary for the health of the worker or that of her unborn child; or</p> <p style="padding-left: 80px;">(ii) if agreed to between employer and worker; or</p> <p style="padding-left: 40px;">(c) on a later date, if a medical practitioner, midwife or certified nurse has certified that the worker is able to continue to work</p>

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without endangering her health.

10.6 A worker who has a miscarriage during the third trimester of pregnancy or bears a stillborn child may take maternity leave for up to six weeks after the miscarriage or stillbirth.

10.7 A worker who returns to work after maternity leave, has the right to start a new cycle of twenty-four months employment, unless the EPWP on which she was employed has ended.

11. Family responsibility leave

11.1 Workers, who work for at least four days per week, are entitled to three days paid family responsibility leave each year in the following circumstances –

- (a) when the employee’s child is born;
- (b) when the employee’s child is sick;
- (c) in the event of a death of –
 - (i) the employee’s spouse or life partner;
 - (ii) the employee’s parent, adoptive parent, grandparent, child, adopted child, grandchild or sibling.

12. Statement of conditions

12.1 An employer must give a worker a statement containing the following details at the start of employment –

- (a) the employer’s name and address and the name of the EPWP;
- (b) the tasks or job that the worker is to perform; and
- (c) the period for which the worker is hired or, if this is not certain, the expected duration of the contract;
- (d) the worker’s rate of pay and how this is to be calculated;
- (e) the training that the worker will receive during the EPWP.

12.2 An employer must ensure that these terms are explained in a suitable language to any employee who is unable to read the statement.

12.3 An employer must supply each worker with a copy of these conditions of employment.

13. Keeping records

13.1 Every employer must keep a written record of at least the following:

- (a) the worker’s name and position;
- (b) in the case of a task-rated worker, the number of tasks completed by the worker;
- (c) in the case of a time-rated worker, the time worked by the worker;
- (d) payments made to each worker (see 21 below).

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13.2 The employer must keep this record for a period of at least three years after the completion of the EPWP.

14. Payment

14.1 An employer must pay all wages at least monthly in cash or by cheque or into a bank account.

14.2 A task-rated worker will only be paid for tasks that have been completed.

14.3 An employer must pay a task-rated worker within 10 (TEN) weeks of the work being completed and the work having been approved by the manager or the contractor having submitted an invoice to the employer.

14.4 A time-rated worker will be paid at the end of each month.

14.5 Payment must be made in cash, by cheque or by direct deposit into a bank account designated by the worker.

14.6 Payment in cash or by cheque must take place –

- (a) at the workplace or at a place agreed to by the worker;
- (b) during the worker's working hours or within fifteen minutes of the start or finish of work;
- (c) in a sealed envelope which becomes the property of the worker.

14.7 An employer must give a worker the following information in writing

- (a) the period for which payment is made;
- (b) the numbers of tasks completed or hours worked;
- (c) the worker's earnings;
- (d) any money deducted from the payment;
- (e) the actual amount paid to the worker.

14.8 If the worker is paid in cash or by cheque, this information must be recorded on the envelope and the worker must acknowledge receipt of payment by signing for it

14.9 If a worker's employment is terminated, the employer must pay all monies owing to that worker within one month of the termination of employment.

15. Deductions

15.1 An employer may not deduct money from a worker's payment unless the deduction is required in terms of a law.

15.2 An employer must deduct and pay to the SA Revenue Services any income tax that the worker is required to pay.

15.3 An employer who deducts money from a worker's pay for payment to another person must pay the money to that person within the

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	<p>time period and other requirements specified in the agreement law, court order or arbitration award concerned.</p> <p>15.4 An employer may not require or allow a worker to –</p> <ul style="list-style-type: none"> (a) repay any payment except an overpayment previously made by the employer by mistake; (b) state that the worker received a greater amount of money than the employer actually paid to the worker; or (c) pay the employer or any other person for having been employed. <p>16. Health and safety</p> <p>16.1 Employers must take all reasonable steps to ensure that the working environment is healthy and safe.</p> <p>16.2 A worker must –</p> <ul style="list-style-type: none"> (a) work in a way that does not endanger his/her health and safety or that of any other person; (b) obey any health and safety instruction; (c) obey all health and safety rules of the EPWP; (d) use any personal protective equipment or clothing issued by the employer; (e) report any accident, near-miss incident or dangerous behaviour by another person to their employer or manager. <p>17. Compensation for injuries and diseases</p> <p>17.1 It is the responsibility of the employers (other than a contractor) to arrange for all persons employed on a EPWP to be covered in terms of the Compensation for Occupational Injuries and Diseases Act, 130 of 1993.</p> <p>17.2 A worker must report any work-related injury or occupational disease to their employer or manager.</p> <p>17.3 The employer must report the accident or disease to the Compensation Commissioner.</p> <p>17.4 An employer must pay a worker who is unable to work because of an injury caused by an accident at work 75% of their earnings for up to three months. The employer will be refunded this amount by the Compensation Commissioner. This does NOT apply to injuries caused by accidents outside the workplace such as road accidents or accidents at home.</p> <p>18. Training</p> <p>A worker shall be trained as specified in the specification data of the scope of work.</p> <p>19. Termination</p>

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- 19.1 The employer may terminate the employment of a worker for good cause after following a fair procedure.
- 19.2 A worker will not receive severance pay on termination.
- 19.3 A worker is not required to give notice to terminate employment. However, a worker who wishes to resign should advise the employer in advance to allow the employer to find a replacement.
- 19.4 A worker who is absent for more than three consecutive days without informing the employer of an intention to return to work will have terminated the contract. However, the worker may be re-engaged if a position becomes available for the balance of the 24-month period.
- 19.5 A worker who does not attend required training events, without good reason, will have terminated the contract. However, the worker may be re-engaged if a position becomes available for the balance of the 24-month period.

20. Certificate of service

20.1 On termination of employment, a worker is entitled to a certificate stating –

- (a) the worker's full name;
- (b) the name and address of the employer;
- (c) the EPWP on which the worker worked;
- (d) the work performed by the worker;
- (e) any training received by the worker as part of the EPWP;
- (f) the period for which the worker worked on the EPWP;
- (g) any other information agreed on by the employer and worker.

21. Reporting

The Contractor shall report the breakdown of each payment certificate into the broad categories of:

- (a) overheads,
- (b) supervision,
- (c) materials,
- (d) plant, and
- (e) labour.

The Contractor shall further report for each payment certificate the person-days of employment as set out in the pro forma, schedule: monthly labour report.

In the calculation of person-days, a day shall be taken as 8 hours and no time over and above 8 hours per day shall be used to contribute to the number of person-days reported.

22. Source of Labour

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	<p>The Contractor shall source his labour from the local area through the services of the appropriate councillor or community liaison officer or other appointed person who has contact with a labour pool in the area.</p>

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C1.2.3 PART 2: DATA PROVIDED BY THE CONTRACTOR

The following contract specific data are applicable to this contract:

REFERENCE	CONTRACT SPECIFIC DATA BY THE CONTRACTOR	
Clause 1.1.8	Name of Contractor	
Clause 1.2.2	Address of the Contractor	
	E-mail of contractor	
	Telephone No. of contractor	
	Facsimile No. of contractor	

Clause 37.2.2.3 The percentage allowance to cover all charges for the contractor’s and subcontractor’s profits, timekeeping, clerical work, insurance, establishment, superintendence and the use of hand tools is as stated in the bill of quantities / day work schedule.

Clause 46.3: The variation in cost of all special materials is to be provided in the table SM 1 for special materials.

The rates and prices for the special materials shall be furnished by the tenderer, which rates and prices shall not include VAT but shall include all other obligatory taxes and levies. The quoted price is the ruling price on the month prior to close of tender.

Table: SM1

Special material	Unit on which variation will be determined		Price for base month ex-factory, excluding transport, labour or any other costs
	Containers	Delivered in bulk	

* Contractor to indicate the type, unit and rate of special material to be listed. When called upon to do so, the contractor shall substantiate the above rates or prices with acceptable documentary evidence. Contractor to provide any other special materials if deemed necessary

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C1.2.2 PART 1 - DATA PROVIDED BY THE EMPLOYER

The following contract specific data are applicable to this contract:

REFERENCE	CONTRACT SPECIFIC DATA BY THE EMPLOYER	
Clause 1.1.14	Name of Employer	NKOMAZI LOCAL MUNICIPALITY
Clause 1.2.2		
	Telephone	(013) 790 0245
	Facsimile	(013) 790 0886
	Email	richard.mabuza@nkomazi.gov.za
Clause 1.1.15	Name of Engineer	N/A
Clause 1.2.2	Address of Engineer	N/A
	Telephone	N/A
	Email	N/A

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C1.2.3 PART 2: DATA PROVIDED BY THE CONTRACTOR

The following contract specific data are applicable to this contract:

REFERENCE	CONTRACT SPECIFIC DATA BY THE CONTRACTOR	
Clause 1.1.8	Name of Contractor	
Clause 1.2.2	Address of the Contractor	
	E-mail of contractor	
	Telephone No. of contractor	
	Facsimile No. of contractor	

Clause 37.2.2.3 The percentage allowance to cover all charges for the contractor’s and subcontractor’s profits, timekeeping, clerical work, insurance, establishment, superintendence and the use of hand tools is as stated in the bill of quantities / day work schedule.

Clause 46.3: The variation in cost of all special materials is to be provided in the table SM 1 for special materials.

The rates and prices for the special materials shall be furnished by the tenderer, which rates and prices shall not include VAT but shall include all other obligatory taxes and levies. The quoted price is the ruling price on the month prior to close of tender.

Table: SM1

Special material	Unit on which variation will be determined		Price for base month ex-factory, excluding transport, labour or any other costs
	Containers	Delivered in bulk	

* Contractor to indicate the type, unit and rate of special material to be listed. When called upon to do so, the contractor shall substantiate the above rates or prices with acceptable documentary evidence. Contractor to provide any other special materials if deemed necessary

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CONTRACT PRICE ADJUSTMENT SCHEDULE	
Clause	Contract Data
1.	<p>The price adjustment formula provided in the general conditions of contract will apply, together with the following coefficients and the definition of the relevant indices indicated below;</p> <p>X=0,15 a=0,20 b=0,30 c=0,35 d=0,15</p>
2.	<p>Replace the definitions of the relevant indices with the following:</p> <p>“L” is the “Labour Index” and shall be the “Consumer Price Index” for the urban area of Nelspruit / Witbank as published in the Consumer Price Index Statistical Release PO 141.1 (Table 21 – Consumer Price Index and percentage change according to Urban Area) of Statistics South Africa.</p> <p>“P” is the “Plant Index” and shall be the “Civil Engineering Plant” index as published in the Production Price Index Statistical Release PO 142.1 (Table 16 – Price Index for selected materials) of Statistics South Africa.</p> <p>“M” is the “Materials Index” and shall be the “Civil Engineering” index as published in the Production Price Index Statistical Release PO 142.1 (Table 15 – Production Price for materials used in certain industries) of Statistics South Africa.</p> <p>“F” is the “Fuel Index” and shall be the “Diesel oil – Coast and Witwatersrand” index as published in the Production Price Index Statistical Release PO 142.1 (Table 16 - Production Price Index for selected materials) of Statistics South Africa.</p>

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C2 PRICING DATA

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C2.1 PRICING INSTRUCTIONS

1. General

The pricing instructions describe the criteria and assumptions which will be assumed in the contract that the Tenderer has taken into account when developing his prices. The bills of quantities record the contractor's rates for providing supplies, services, engineering and construction works in accordance with the scope of work.

The terms of payment and the provisions for price adjustment, if applicable, are established in the contract data. These items are not described in the pricing data.

The tenderer's obligations in pricing the tender offer and the employer's undertakings in the checking and correction of arithmetical errors are dealt with in the standard conditions of tender contained in annexure F of SANS 294, as amended in and read in conjunction with the tender data.

2. Documents mutually explanatory

The documents forming the Contract are to be taken as mutually explanatory of one another. The bill of quantities forms an integral part of the contract documents and shall be read in conjunction with the tender data, contract data, scope of work, site information general and special conditions of contract, the specifications and the drawings.

3. Definitions

For the purpose of this bill of quantities, the following words shall have the meanings hereby assigned to them:

Unit	The unit of measurement for each item of work as defined in the scope of work and site information
Quantity	The number of units of work for each item.
Rate	The payment per unit of measurement at which the contractor contracts to do the work.
Amount	The product of the quantity and the rate tendered for an item.
Sum	An amount contracted for an item, the extent of which is described in the bill of quantities, the specifications or elsewhere but the quantity of work of which is not measured in any units.

4. Descriptions

Descriptions in the bill of quantities are abbreviated and comply generally with those in the standardised specifications. Clause 8 of each standardised specification, read together with the relevant clauses of the 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, the requirements of the standardised specification or scope of work, as applicable, shall prevail.

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5. References

The clauses in a specification in which further information regarding the schedule item can be obtained appear under "reference clause" in the bill. The reference clauses indicated are not necessarily the only sources of information in respect of scheduled items. Further information and specifications may be found elsewhere in the contract documents. Standardised specifications are identified by the letter or letters which follow SABS in the SABS 1200 series of specifications, eg. G for SABS 1200 G.

6. Units of measurement

The units of measurement indicated in the bill of quantities are metric units.

The following abbreviations are used in the bill of quantities:

%	per cent
h	hour
ha	hectare
kg	kilogram
kl	kilolitre
km	kilometre
km-pass	kilometre-pass
kW	kilowatt
l	litre
m	metre
mm	millimetre
MN	mega newton
MN-m	mega newton-metre
MPa	mega Pascal
m ²	square metre
m ³	cubic metre
m ³ -km	cubic metre-kilometre
m ² -pass	square metre-pass
no	number
PC sum	Prime Cost sum
Prov Sum	Provisional Sum
sum	lump sum
t	ton (1 000 kg)

7. Net measurements

Unless otherwise stated, items are measured net in accordance with the drawings, and no allowance is made for off-cuts and waste.

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8. **Quantities**

The quantities set out in the bill of quantities are the estimated quantities of the contract works, but the contractor will be required to undertake whatever quantities may be directed by the engineer from time to time. The contract price for the completed contract shall be computed from the actual quantities of work accepted and certified for payment.

9. **Currency**

All rates and sums of money quoted in the bill of quantities shall be in Rand and whole cents. Fractions of a cent shall be discounted.

10. **Value Added Tax**

Value Added Tax shall be excluded from the rates and sums contracted for the various items of work included in the bill of quantities. VAT will be added as a single entry to the summary.

11. **Rates and prices**

11.1 General

- a) The contractor must price each item in the bill of quantities in BLACK INK. Reproduced computer printouts of the bills of quantities will not be acceptable.
- b) The rates and prices to be inserted in the bill of quantities shall cover all the services and incidentals for the work described under the several items. Such prices and rates shall cover all costs and expenses that may be required in and for the execution of the work described, and shall cover the cost of all general risks, liabilities and obligations set forth or implied in the documents on which the tender is based, as well as overhead charges and profit. Reasonable prices shall be inserted as these will be used as a basis for assessment of payment for additional work that may have to be carried out.
- c) Where the contractor is required to furnish detailed drawings and designs or other information in terms of the contract data, all costs thereof shall be deemed to have been provided for and included in the unit rates and sum amounts contracted for the items scheduled in the bill of quantities. Separate additional payments will not be made.
- e) A rate is to be entered against each item in the Schedule of Fees and Disbursements. An item against which no rate is entered will invalidate your offer. Alterations must be acknowledged as per clause 2.11 of '1.3 STANDARD CONDITIONS OF TENDER'.
- e) Should the contractor group a number of items and contract one lump sum for such group of items, this single lump sum shall apply to that group of items and not to each individual item.
- f) Should the contractor indicate against any item that compensation for such item is included in another item, the rate for the item included in another item shall be deemed nil.

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- g) A submission may be regarded as non-responsive if any rates or lump sums in the bill of quantities are, in the opinion of the employer, unreasonable or out of proportion.

11.2 "Rate only" items

The contractor shall fill in a rate (in the rate column) against all items where the words "rate only" appear in the amount column, which rate will constitute payment for work which may be done in terms of this item. Such "rate-only" items are used where it is estimated that little or no work will be required under the item or where the item is to be considered as an alternative to another item for which a quantity is given.

11.3 Arithmetic

Excepting where sum amounts are required or where provisional sums have been indicated, the contractor shall enter an applicable rate in the rate column of the bill of quantities for each scheduled item. He shall also enter an appropriate sum in the Amount column for each scheduled item, by determining in the applicable line item the product of the quantity and the unit rate.

If there is an error in the line item resulting from the product of the unit rate and the quantity, the rate shall be binding and the error of extension as entered in the tender offer will be corrected by the employer in determining the contract price.

Where there is an error in addition, either as a result of other corrections required by this checking process or in the tenderer's addition of prices, such error will be corrected by the employer in determining the contract price.

12. Variation in text

No alteration, erasure or addition is to be made in the text of the bill of quantities. Should any alteration, erasure or addition be made, it will not be recognized; the original wording of the bill of quantities will be adhered to.

13. Construction

- a) Attention is drawn to clause 44.1 of the general conditions of contract and the contractor must not order the quantities of materials stated in the bill of quantities until he has confirmed from the construction drawings or measurement on site that such quantities are in fact the correct quantities.
- b) Items marked "L" in the bill of quantities shall be carried out using labour intensive methods.

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C2.2 MBD 3.1 BID PRICE

Bid Number NKO 09/2025

(Note : Contract amount to be carried over to Form of Offer C1.1.1)

The following Schedule will be the basis of the tender

Tenderer(s) are not permitted to change the basis upon which they have been asked to tender. Any variation from the Pricing Instructions will invalidate this tender.

PREAMBLES FOR TRADES

The Model Preambles for Trades (2008 edition) as published by the Association of South African Quantity Surveyors shall be deemed to be incorporated in these bills of quantities and no claim arising from brevity of description of items fully described in the said Model Preambles for Trades will be entertained. Supplementary preambles to the Model Preambles covering clauses of a general nature, clauses pertaining to specific materials and amendments to clauses in the Model Preambles are incorporated in these bills of quantities to satisfy the requirements of this project. The contractor's prices for all items throughout these bills of quantities must take account of and include for all of the obligations, requirements and specifications given in the Model Preambles and in any supplementary preambles.

PRICES TO INCLUDE MATERIAL AND LABOUR UNLESS STATED

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SECTION A - PRELIMINARY AND GENERAL

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
	SABS 1200 AA	PRELIMINARY AND GENERAL				
		Allow for all costs and expenses to cover Preliminary and general, ie Contractual requirements (performance guarantee and insurance) , site establishment				
A.1	8,3	FIXED-CHARGE AND VALUE-RELATED ITEMS				
		for project values ranging from:				
A.1.1		R 0 - R 5 000,000	%	R2 500 000	.....%	R
A.1.2		R 5 000,001 - R 15 000,000	%	R10 000 000	.....%	R
A.1.3		R 15,000,001 - R 25,000,000	%	R20 000 000	.....%	R
A.1.4		> R 25,000,000	%	R25 000 000	.....%	R
		-				
A.2	8,4	TIME RELATED ITEMS				
		for project values ranging from:				
A.2.1		R 0 - R 5 000,000	%	R2 500 000	.....%	R
A.2.2		R 5 000,001 - R 15 000,000	%	R10 000 000	.....%	R
A.2.3		R 15,000,001 - R 25,000,000	%	R20 000 000	.....%	R
A.2.4		> R 25,000,000	%	R25 000 000	.....%	R
		-				
A.3	8,5	SUMS STATED PROVISIONALLY BY ENGINEER				
A.3.1	a)	Provisional Sum for control testing to be carried out by an approved independent laboratory	Prov. Sum	1	R200 000.00	R200 000.00
A.3.2	b)	Provisional Sum for staking and levelling to be carried out by an independent Engineering surveyor	Prov. Sum	1	R200 000.00	R200 000.00
A.3.3	c)	Community Liaison Officer (CLO) Salary	Prov.	1	As per council resolution	As per council resolution
A.3.4	d)	Pressure testing of existing pipelines	Prov. Sum	1	R200 000.00	R200 000.00
A.3.5	e)	Percentage mark-up on above items for contractors overheads, administration charge and profit	%	R600 000	.....%	R

TOTAL SECTION A TO SUMMARY

NB: Cost for P & G shall not exceed 15% of the project Value

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SECTION B - DAYWORKS						
ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
	SABS	<u>DAYWORKS</u>				
B.1	1200 A	<u>LABOUR</u>				
B1.1		(a) Skilled	hr	8	R	R
B1.2		(b) Semi-skilled	hr	8	R	R
B1.3		(c) Un-skilled	hr	8	R	R
B1.4		(d) Artisan	hr	8	R	R
B1.5		(e) Technicians (registered professional)	hr	8	R	R
B1.6		(f) Technologist (registered professional)	hr	8	R	R
B1.7		(g) Engineer (registered professional)				
B1.8		(h) specialist				
		<u>PLANTHIRE (WORK RATES ON SITE)</u>				
B.2		<u>TRUCKS</u>				
B.2.1		1. Tipper trucks (specify capacity)				
B.2.1.1		(a) Capacity 6 m ³ (small)	hr	8	R	R
B.2.1.2		(b) Capacity 10 m ³ (medium)	Hr	8	R	R
B.2.1.3		(c) Capacity 15 m ³ (large)	Hr	8	R	R
B.2.2		2. Flatbed trucks (specify capacity)				
B.2.2.1		(a) Capacity 5 ton (small)	Hr	8	R	R
B.2.2.2		(b) Capacity 10 ton m ³ (medium)	Hr	8	R	R
B.2.2.3		(c) Capacity 20 ton m ³ (large)	Hr	8	R	R
B.3		<u>LDV'S</u>				
B.3.1		3. LDV				
B.3.1.1		(a) LDV	Km	100	R	R
B.4		<u>WATERTANKERS</u>				
B.4.1		4. Water tankers (specify capacity)				
B.4.1.1		(a) Capacity up to 10 000 liter	Hr	8	R	R
B.4.1.2		(b) Capacity up to 20 000 liter	Hr	8	R	R
B.4.1.3		(c) Capacity up to 30 000 liter	Hr	8	R	R
B.4.1.4		(d.) Waste water vacuum tanker up to 10 000 liters	Hr	8	R	R
B.4.1.5		(a) Waste water vacuum tanker up to 20 000 liters	Hr	8	R	R
B.5		<u>LOADERS</u>				
B.5.1		5. Wheel loaders (specify capacity)				
B.5.1.1		(a) up 100kW (small)	Hr	8	R	R
		(b) up 200kW (medium)	Hr	8	R	R
		(b) up 400kW (large)	Hr	8	R	R
B.6		<u>GRADERS</u>				
B.6.1		6. Motor Graders				

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B.6.1.1		(a) 16ft grader	Hr	8	R	R
B.7		<u>EXCAVATORS</u>				
B.7.1		7. Crawler excavators				
B.7.1.1		(a) Mini/ Compact <6 tons	Hr	8	R	R
B.7.1.2		(b) Midi 6-10 tons	Hr	8	R	R
B.7.1.3		(c) Standard >10-15 tons	Hr	8	R	R
SECTION CARRIED FORWARD TO NEXT PAGE						

SECTION B - DAYWORKS – continued						
ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION B BROUGHT FORWARD FROM PREVIOUS PAGE						
B.8		<u>TLB'S</u>				
B.8.1		10. Tractor loader backhoe (TLB)				
B.8.1.1		(a) 72kW/610mm Bucket	Hr	8	R	R
B.8.1.3		(a) 4x4 wheel Drive TLB	Hr	8	R	R
B.9		<u>WALK BEHIND ROLLERS</u>				
B.9.1		11. Walk behind vibrating rollers				
B.9.1.1		(a) Model BW 61 or similar (small)	Hr	8	R	R
B.9.1.2		(b) Model BW 76 or similar (medium)	Hr	8	R	R
B.9.1.3		(c) Model BW 90 or similar (large)	Hr	8	R	R
B.10		<u>COMPACTORS</u>				
B.10.1		12. Plate compactors				
B.10.1.1		(a) 6 horsepower	Hr	8	R	R
B.10.2		13. Wackers				
B.10.2.1		(a) 3 Kw	Hr	8	R	R
B.11		<u>OTHER EQUIPMENTS</u>				
B.11.1		14. Concrete Mixer (a) 400L drum size	Hr	8	R	R
B.11.2		Mobile VIP toilets (2 male and female)	Hr	8	R	R
B.11.3		Portable generator set 3.2Kva/ 3200w, Fuel	Hr	8	R	R
B.11.4		Portable generator set 7Kva/ 7000w, Fuel	Hr	8	R	R
B.11.5		Portable water pump, dia 50mm, up to 7m suction head	Hr	8	R	R
B.11.6		Portable water pump, dia 80mm, up to 10m suction head	Hr	8	R	R
B.11.7		High Pressure Jetting Machine upto 200bar, 1000 liter tanker, mounted on trailer.	Hr	8	R	R
B.12		<u>TRANSPORT (COST TO AND FROM SITE)</u>				
		<u>Note: Distance shall be measured one way only (tender rates shall include for transport in both directions to and from site)</u>				

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B.12.1		1. Low bed				
B.12.1.1		(a) Low bed (suitable for the largest piece of equipment above)	Km	50	R	R
B.12.2		2. Tipper trucks				
B.12.2.1		(a) Small (up to 10 tons)	Km	20	R	R
B.12.2.2		(b) Medium (up to 20 tons)	Km	20	R	R
B.12.2.3		(c) Large (up to 30tons)	Km	20	R	R
SECTION CARRIED FORWARD TO NEXT PAGE						

SECTION B - DAYWORKS – continued						
ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION B BROUGHT FORWARD FROM PREVIOUS PAGE						
B.13		<u>TEMPORARY WORKS</u>				
B.13.1		Accommodation of traffic	Sum	1	R	R
B.14		<u>WORK TO EXISTING SERVICES</u>				
B.14.1		<u>Existing services</u>				
B.14.1		(c) Excavation by hand in soft material to expose services	m ³	150	R	R
B.15		<u>SCAFFOLDING</u>				
B.15.1		Standard 5ft scaffold frame (x4) supplied, delivered and assembled on site.	No.	5	R	R
B.16		<u>HAND TOOLS</u>				
B.16.1		Supply of general hand tools to site for use by general workers including necessary PPE required for specific tool	No.	25	R	R
B.17		<u>MATERIAL</u>				
B.17.1		Overheads, charges plus profit on materials (max 15%)	%		....%	Rate only
B.18		<u>Plant</u>				
B.18.1		Overheads, charges plus profit on plant (max 15%)	%		....%	Rate only
B.19		<u>Labour</u>				
B.19.1		Overheads, charges plus profit on labour (max 15%)	%	%	Rate only

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SECTION C - CIVIL WORKS/CONSTRUCTION						
ITEM	PAYMENT	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
NO	REF					
SECTION B BROUGHT FORWARD FROM PREVIOUS PAGE						
C.1		HEALTH AND SAFETY				
C1.1		Health and Safety Act (Compliance)				
		To include compilation of health & safety file	Sum	1	R	R
C1.2		Re-imburement of on site Safety Officer	Sum	1	R	R
		Prime costs for Health & Safety Act (incl. initial safety equipment/PPE for all labour) - LED Procurement locally & embroidery	Sum	1	R	R
C1.3		Time related obligation to items above	Sum	1	R	R
		Health and safety specialist	Prov. Sum	1	R250 000,00	R250 000,00
		Training	Per person	1	R	R
C.2	8,8	TEMPORARY WORKS				
C.2.1		Hand excavation to expose existing services	m ³	150	R	R
C.2.2		<u>Protect existing services:</u>				
C.2.2.1		Sewer + water pipes (upto 600mm dia.)	No.	10	R	R
C.2.2.2		Overhead Electrical cables & poles	No.	10	R	R
C.2.2.3		Telecommunication cables & poles	No.	5	R	R
C.2.2.4		Electrical cables	m	2	R	R
C.3		<u>DESIGN, CONSTRUCTION AND SUPPLY OF SST'S ROTATING BRIDGES</u>				
		-				
		OPTION 1				
		Allow for all costs and expenses in connection with the design, manufacture, quality management, painting, testing, supply, delivery, offloading and storage of the following materials and equipment, including quality assurance, setting out of works and checking work carried out by others:				
		ROTATING BRIDGES				
		Design, submit for approval and replace all mechanical equipment to suit the final refurbished existing SST civil infrastructure complete with motorized rotating bridges, stilling wells and flocculation baffles suction lift and				

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		scraper mechanisms etc., all as specified for SST diameter				
C.3.1		20.0 - 25.0 m SST Diameter Rotating Bridges	Sum	1	R	R
C.3.2		25.0 - 30.0 m SST Diameter Diameter Rotating Bridges	Sum	1	R	R
C.3.3		>30.0 m SST Diameter Rotating Bridges	Sum	1	R	R
C.3.4		Supply of >20.0m diameter steel plate	Sum	1	R	R
SECTION CARRIED FORWARD TO NEXT PAGE						

SECTION C - CIVIL WORKS/CONSTRUCTION – continued						
ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION B BROUGHT FORWARD FROM PREVIOUS PAGE						
C.4		<u>REFURBISHMENT OF SST</u>				
		-				
		OPTION 2				
C.4.1		Refurbishment of motorized rotating bridges, stilling wells and flocculation baffles suction lift and scraper mechanisms	Sum	1	R	R
C.4.2		Refurbishment of motorized rotating bridges, stilling wells and flocculation baffles suction lift and scraper mechanisms. Bridge diameter 28.0m	Sum	1	R	R
		Refurbishment of motorized rotating bridges, stilling wells and flocculation baffles suction lift and scraper mechanisms. Bridge diameter 30.0m	Sum	1	R	R
C.4.4		Allow for all costs and expenses, including double handling (if stored) and final painting (if applicable), in connection with the Site installation, testing, commissioning and upholding during the Trial Operation Period and Defects Notification Period of the following:	Sum	1	R	R
C.4.5		All other site installation and general items not included above but which are nevertheless necessary to meet the Scope of Work and/or are required for the proper, safe and effective operation of the plant	Sum	1	R	R
C.5	SABS 1200 GA	<u>STRUCTURAL CONCRETE</u>				
		<u>Supply, pore and/or installation of the following structural concrete:</u>				
C.5.1	8.4.2	15 Mpa/19mm concrete	m ³	10	R	R
C.5.2		20 Mpa/19mm concrete	m ³	10	R	R
C.5.3		25 Mpa/19mm concrete	m ³	10	R	R
C.5.4		30 Mpa/19mm concrete	m ³	10	R	R
C.5.5		35 Mpa/19mm concrete	m ³	10	R	R
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SECTION C - CIVIL WORKS/CONSTRUCTION – continued						
ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION C BROUGHT FORWARD FROM PREVIOUS PAGE						
		Testing				
C.5.5		Making of 150x150x150 test cubes, over and above 1 per batch of concrete used as specified in SABS 1200 GA, inclusive of subjection to testing procedure and provision of test results, all done by an independent laboratory	No.	5	R	R
C.7		REINFORCEMENT				
		High tensile steel reinforcement to structural concrete work:				
C.7.1		High tensile round bars	t	2	R	R
		-				
C.8		FORMWORK				
		Supply, delivery and erection of formwork:				
		1) Steel Formwork	m ²	25	R	R
		2) Wooden Formwork	m ²	25	R	R
		-				
C.9	SABS 1200 H	SUPPLY AND FABRICATION OF STEELWORK				
		-				
		-				
		BEAMS, PLATE GIRDERS AND RAFTERS				
		<u>Beams, plate girders and rafters (including latticed assemblies), including end connections, splice materials, notches, haunches, stiffeners, cleats etc.</u>				
C.9.1	8.3.1.2	Supply & Fabrication of Steel Work				
C.9.1.1		Truss Assembly	t	5	R	R
C.9.1.2		Purlins	t	5	R	R
C.9.1.3		Bracing, Beams & Posts	t	5	R	R
C.9.1.4		Steel hand rail (Supply and install), Coated yellow and black.	m	85	R	R
C.9.1.5		Galvanized steel grating heavy duty	m ²	25	R	R
C.9.2		CLADDING AND ROOF SHEETING				
		<u>Quantities include connection and splice material.</u>				
		<u>Supply, deliver, handle and fix sheeting.</u>				
C.9.2.1		IBR Cladding up to 0,5 mm thickness	m ²	5	R	R
C.9.2.2		IBR Sheeting up to 0,8mm thickness	m ²	5	R	R
C.9.2.3		Corrugated iron sheets up to 0,5mm thick	m ²	5	R	R
SECTION CARRIED FORWARD TO NEXT PAGE						

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SECTION C - CIVIL WORKS/CONSTRUCTION – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION C BROUGHT FORWARD FROM PREVIOUS PAGE						
C.9.3	8.3.4	<u>FASTENERS</u>				
C.9.3.1	8.3.4.1	HD Bolts with nuts & washers	t	1	R	R
C.11	8.3.3	<u>OFFLOADING, SITE STORAGE AND ERECTION</u>				
C.11.1	8.3.3.1	Structural steelwork and fasteners	t	10	R	R
C.12	8.3.13	<u>CORROSION PROTECTION</u>				
		<u>AT WORKSHOP</u>				
		<u>Extra-over on above items for Corrosion Protection (Structure in General - SPRAY PAINTED):</u>				
C.12.1		Two (2) coats Coarscote etch primer (Red Oxide) Code A05 to SABS 1091	t	5	R	R
C.12.2		Final two (2) coats to be an alkyd enamel 35-40 microns dft. Colour of structure to be confirmed by Architect	t	5	R	R
C.12.3		Testing where ordered (Provisional)	Sum	1	R	R
C.13		<u>CONCRETE REPAIRS</u>				
C.13.1		Qualified specialist diagnostic of all concrete works, including call out fees, physical, chemical and other tests to be carried out in-situ and in the laboratory, giving test results and conclusions in a detailed concrete diagnostic report.	Sum	1	R	R
C.13.2	PH3.13	Concrete crack repairs as per specification PH 3.13 for cracks exceeding 0.1mm.	m	25	R	R
C.13.3	PH3.12	Concrete spalling repairs as per specification PH 3.12.	m ²	10	R	R
C.13.4		Apply corrosion inhibitor Sika Ferroguard or similar approved product, that penetrates the concrete and forms a protective monomolecular protective layer on the surface of the reinforcing steel, applied at no less than 0.5 l/m ² , to ensure complete saturation and/or as per the relevant supplier instructions.	m ²	5	R	R
SECTION CARRIED FORWARD TO NEXT PAGE						

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SECTION C - CIVIL WORKS/CONSTRUCTION – continued						
ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION B BROUGHT FORWARD FROM PREVIOUS PAGE						
C.14		<u>CONTAINERIZED PUBLIC TOILET</u>				
		CONTAINERS				
C.14.1		Supply and Delivery of 6m x 2.4m Toilet Ablution	Sum	1	R	R
C.15		<u>PLUMBING</u>				
		Supply, deliver and install (includes connection to existing plumbing where applicable) SABS approved				
C.15.1		a) 1/2 inch chrome plated tap (or similar) including fittings	No.	1	R	R
C.15.2		b) 15mm tap	No.	1	R	R
C.15.3		c) Urinal set, flush system including fittings	No.	1	R	R
C.15.4		d) Flushable toilet including, seat, cistern and fittings	No.	1	R	R
C.15.5		e) Basin set including all fittings	No.	1	R	R
C.15.6		Vandal shower head	No.	1	R	R
C.15.7		Shower Mixer	No.	1	R	R
C.15.8		15mm dia copper pipe	M	1	R	R
C.15.9		22mm dia copper pipe	M	1	R	R
C.15.10		Copper pipe fitting i.e bend, t-piece, reducer, for 15mm pipe per item	No.	1	R	R
C.15.11		Copper pipe fitting i.e bend, t-piece for 22mm pipe per item	No.	1	R	R
C.15.12		Geysers 150 liters including fittings	No.	1	R	R
C.15.13		Geysers 250 liters including fittings	No.	1	R	R
C.15.12		50mm Pvc pipe	m	1	R	R
C.15.12		110mm Pvc pipe	m	1	R	R
C.15.13		Plumbing miscellaneous	Prov sum	1	R200 000	R200 000
C.16		<u>MISCELLANEOUS</u>				
C.16.1		a) 50mm wood-floated screed	m ²	1	R	R
C.16.2		b) Supply, deliver install (replace where applicable) of glass windows	m ²	1	R	R
C.16.3		c) Supply, delivery and installation of 1.2m fluorescent light including two 36W lamps, LED	No.	1	R	R
C.16.4		d) 20W LED floodlight including day/night switch	No.	1	R	R
C.16.5		e) "Ball" type handrail - Top mounted stanchions (galvanised)	No.	1	R	R
C.16.6		f) Electrical switch socket - double (4 x 4 - 16A)	No.	1	R	R
C.16.7		g) Two coats waterbased PVA paint on concrete and brick surfaces (colour to be confirmed by client)	m ²	1	R	R
C.16.8		h) Two coats Plaster with gypsum finish on brickwork or concrete work	m ²	1	R	R
C.16.9		Wall tile (supply and install), complete including floor levelling, trim, skidding and cement and grout.	m ²	1	R	R
C.16.10		Floor tile (supply and install), complete including floor levelling, trim, skidding, paste and grout.	m ²	1	R	R
C.16.11		Floor tile Mosaic (supply and install), complete including floor levelling, trim, skidding, paste and grout.	m ²	1	R	R
C.16.12		Masonry Brick wall, clay brick, full brick wall, supply, deliver and erect. 15mpa	m ²	1	R	R
C.16.13		Masonry Brick wall, clay brick, face brick wall, supply, deliver and erect.	m ²	1	R	R
C.16.12		Masonry Brick wall, clay brick, face brick wall, supply, deliver and erect. 25Mpa	m ²	1	R	R
C.16.14		Plaster plastering	m ²	1	R	R
		<u>LOAD TESTING</u>				

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C.17.1		Load testing of support beams on site by an accredited company including load test certificate	No.	1	R	R
		SITE CLEANING				
C.18.1		Cleaning of the building and cart-away rubbles	Sum	1	R	R
SECTION CARRIED FORWARD TO NEXT PAGE						

SECTION C - CIVIL WORKS/CONSTRUCTION – continued						
ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION C BROUGHT FORWARD FROM PREVIOUS PAGE						
C.19		HANDRAILS:				
C.19.1		Handrail assembly:				
C.19.2		Handrails from Hollow Sections (Hot dipped Galvanised)	m	25	R	R
C.19.3		Kneerails from Hollow Sections (Hot dipped Galvanised)	m	30	R	R
C.19.4		Stanchions from Hollow Sections (Hot dipped Galvanised) with HD bolts	No.	40	R	R
C.19.5		Bends and end closures (Hot dipped Galvanised)	No.	20	R	R
C.20		FLOORING, COMPLETE AND INSTALLED WITH FRAMES:				
C.20.1		Open grid floors				
		Hot dipped Galvanised Mild Steel RS 40 with 40x4.5 bearer bar	m ²	15	R	R
C.20.2		Frames				
		Hot dipped Galvanised Cast In Angle Frame for RS 40	m	10	R	R
C.21		GABIONS AND PITCHING				
		Surface preparation for bedding of gabions:				
C.21.1		Cavities filled with approved excavated material or rock for: Surface water drainage structure	m ²	10	R	R
C.21.2		Grouted Stone Pitching:				
		Medium stone pitching for: Surface water drainage structure	m ³	15	R	R
C.22.2		Geotextile:				
		Bidum Geotextile or approved equivalent	m ²	20	R	R
C.23	SANS 1200 LB	BEDDING (PIPES)				
		BEDDING FOR WATER PIPES				
	8.2.2.3	Supply only of bedding by importation:				
		From commercial sources				
C.23.1		Selected granular material	m ³	30	R	R
C.23.2		Selected fill material	m ³	30	R	R

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SECTION C - CIVIL WORKS/CONSTRUCTION – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION C BROUGHT FORWARD FROM PREVIOUS PAGE						
C.24		- EXCAVATION				
C.24.1		(a) Excavating soft material situated within the following depth ranges below the surface level				
C.24.1.1		(i) 0m up to 1,5m	m ³	50	R	R
C.24.1.2		(ii) Exceeding 1,5m and up to 3,0m	m ³	50	R	R
C.24.2		(b) Extra over subitem 22.01(a) for excavation in hard material irrespective of depth	m ³	25	R	R
C.25		BACKFILLING				
		Backfilling				
C.25.1		(a) Using the excavated material	m ³	100	R	R
C.25.2		(b) Using imported selected material	m ³	100	R	R
C.26		PIPE CULVERTS				
		Concrete pipe culverts				
C.26.1		(a) On class B bedding - Spigot & Socket - Class 50D				
		(i) 600mm	m	20	R	R
		Concrete pipe culverts				
C.26.2		(a) On class B bedding - Spigot & Socket - Class 100D				
		(i) 600mm	m	20	R	R
C.27		MANHOLES, CATCHPITS, Etc.				
		Manholes, catchpits, precast inlet and outlet structures complete				
		(a) Manholes as per drawing				
C.27.1		(i) Type A, up to 2.5m deep	no	5	R	R
C.27.2		(ii) Type A, up to 5.0m deep	no	5	R	R
		Cast insitu base slab, 100mm thick, 25Mpa concrete including 2 layers of ref.193 mesh, on bedding prepared.	no	5	R	R
		(b) Catchpits (kerbmaster or similar)				
C.27.3		(ii) 3,35m long for outgoing pipe up to 600mm dia	no	5	R	R
		(c) Precast outlet structures				
		(i) For Pipe culverts upto 1200mm dia. Outlets. As per Typical DWG	no	5	R	R
C.28		PLASTER AND BENCHING				

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C.28.1		Plaster	m ²	30	R	R
C.28.2		Benching (20mm average thick)	m ²	25	R	R
C.29		<u>ACCESSORIES</u> Accessories				
C.29.1		(a) Manhole cover and frame	no	15	R	R

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SECTION C - CIVIL WORKS/CONSTRUCTION – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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SECTION C BROUGHT FORWARD FROM PREVIOUS PAGE

C.30	SANS 1200 ME	<u>SUBBASE</u>				
C.30.1		Construct the subbase course with material from commercial sources (C4)	m ³	300	R	R
C.30.2		Construct the base course with material from commercial sources (C3)	m ³	280	R	R
C.30.3		Process subbase/base material by one of the following processes, as relevant, and use in the subbase/base:				
		Stabilization	m ³	580	R	R
C.30.4		Stabilizing agent:				
		Portland cement	t	20	R	R
C.31	SANS 1200 MJ	<u>SEGMENTED PAVING</u>				
C.31.1		Provision of edge restraints:				
C.31.1.1		For straight edging	m ³	12	R	R
C.31.1.2		For curved edging	m ³	8	R	R
		NB: Separate items from Clause 8 of SANS 1200 MK to be scheduled				
C.31.2		Construction of paving complete:				
		Type S-A blocks Class 25:				
C.31.2.1		80 mm thick interlocking paving blocks (including 20 mm sand layer)	m ²	250	R	R
C.31.2.2		60 mm thick interlocking paving blocks (including 20 mm sand layer)	m ²	150	R	R
C.31.2.3		50 mm thick paving blocks (including 20 mm sand layer)	m ²	100	R	R
C.31.3		Trial section, not part of permanent work, approximate area	m ²	15	R	R

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SECTION C - CIVIL WORKS/CONSTRUCTION – continued

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C.32	SANS 1200 MK	KERBING AND CHANNELLING				
C.32.1		Cast-in-situ kerbing: Grade 25 concrete: 200 mm x 200 mm edge beam	m	125	R	R
C.32.2		Precast concrete kerbing: SANS 927 fig 3:				
C.32.2.1		Radius up to 4 m	m	50	R	R
C.32.2.2		Radius over 4 m up to 20 m	m	25	R	R
C.32.2.3		Radius over 20 m and straight sections	m	60	R	R
C.32.2.4		SANS 927 fig 8b: Radius up to 4 m	m	20	R	R
C.32.2.5		Radius over 4 m up to 20 m	m	50	R	R
C.32.2.6		Radius over 20 m and straight sections	m	100	R	R
C.33		Inlet, outlet, transition and similar structures: Transition sections				
C.33.1		2 m sections Kerb outlet	No.	6	R	R
C.33.2		2 m wide opening in kerb	No.	6	R	R
C.33.3		Concrete Lined Open Drains 25MPa/19mm concrete	m ³	40	R	R
	SANS 1200 GE	FENCING Precast Palisade Concrete Fencing Supply, deliver and install 2.4m High Precast Palisade Concrete Boundary Fencing including 400x400x600mm deep concrete anchor post foundation @2m c/c	m	100	R	R
		Mesh Panel Fencing Supply, deliver and install 2.4m High Mesh Panel Fencing (Anti-climb, anti-cut, anti-vandal) including anchor post foundation and a single row of flatwrap razor fencing	m	100	R	R
	SABS 1200 G	CONCRETE (STRUCTURAL)				
	8,2	FORMWORK				

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	8.2.2	Smooth				
		Horizontal plane	m ²	1000	R	R
		Vertical plane	m ²	1000	R	R
	8.2.6	Box Out Holes/Forms Voids				
	a)	<u>Small, circular of diameter up to and including 0.35m</u>				
		1) Over 0 and up to and including 0.5m deep	No.	8	R	R
		<u>Large, other than circular, of area over 0.1m² and up to and including 0.5m²</u>				
	d)	1) Over 0 and up to and including 0.5m deep	No.	4	R	R

SECTION C CARRIED TO SUMMARY

SECTION D – MECHANICAL

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
D.1		<u>PUMPS</u> Supply, delivery and replace self priming Centrifugal pump system set with drive and motor. (Below are required pumps or similar to match pump performance and size) <u>PLEASE NOTE: ALL PUMPS MUST BE PURCHASED WITHOUT ACCOMPANYING BASE</u>				
D.1.1		<u>Solids Handling Pumps</u> Materials of Construction: Cast Iron, CD4MCu, Ductile Iron, Stainless Steel Max Capacity: 3400 GPM Max Head: 130' (40m) Max Solids: 3" (76mm)				
D.1.1.1		2" (50x 50mm)	No.	1	R	R
D.1.1.2		3" (80 x80m)	No.	1	R	R
D.1.1.3		4" (100x100mm)	No.	1	R	R
D.1.1.4		6" (150 x 150mm)	No.	1	R	R
D.1.1.5		8" (200x 200mm)	No.	1	R	R
D.1.1.6		10" (250x250mm)	No.	1	R	R
		Materials of Construction: Cast Iron, CD4MCu, Stainless Steel Max Capacity: 1900 GPM Max Head: 325' (99m) Max Solids: 3" (76mm)				
D.1.1.7		3" (80mm)	No.	1	R	R
D.1.1.8		4" (100mm)	No.	1	R	R
D.1.1.9		6" (150mm)	No.	1	R	R
D.1.1.10		Supply, deliver and install complete solids handling pump set for water works, Pump specification to be provided for Engineer approval	Prov Sum.	1	R2 000 000.00	R2 000 000.00
D.1.1.11		Pump manifold pipework, valve and all fittings for design, modification, fabrication, supply, deliver and install. Specification and design to be approved.	Prov Sum	1	R3 000 000.00	R3 000 000.00
D.1.2		<u>Solids Handling Pumps</u> Bare Shaft Self Priming Pumps Materials of Construction: Ductile Iron, 17-4 PH Stainless Steel Seal: Silicon Carbide/Viton				
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D.1.2.1	3" Flanged, Max Flow: 550GPM, Max Head: 132' TDH, Max Solid Size: 2.5"	No.	1	R	R
D.1.2.2	4" Flanged, Max Flow: 900GPM, Max Head: 150' TDH, Max Solid Size: 3"	No.	1	R	R
D.1.2.3	6" Flanged, Max Flow: 1680GPM, Max Head: 170' TDH, Max Solid Size: 3"	No.	1	R	R
D.1.2.4	8" Flanged, Max Flow: 2880GPM, Max Head: 216' TDH, Max Solid Size: 3"	No.	1	R	R
D.1.3	<u>Centrifugal Pump</u>				
	<u>Volute Casing: Cast Iron</u>				
	<u>Impeller: Cast Iron</u>				
	<u>Shaft: Carbon (*Chrome) St</u>				
	<u>Shaft Sleeve: St Steel</u>				
	<u>Seal: Packed Gland</u>				
	<u>Size:</u>				
D.1.3.1	DN in: 40mm; DN out: 25mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
D.1.3.2	DN in: 40mm; DN out: 25mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
D.1.3.3	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 125mm; Flow<168/min	No.	1	R	R
D.1.3.4	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 160mm; Flow<386l/min	No.	1	R	R
D.1.3.5	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 200mm; Flow<420l/min	No.	1	R	R
D.1.3.6	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 250mm; Flow<368l/min	No.	1	R	R
D.1.3.7	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 125mm; Flow<638l/min	No.	1	R	R
D.1.3.8	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 160mm; Flow<620l/min	No.	1	R	R
D.1.3.9	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 200mm; Flow<604l/min	No.	1	R	R
D.1.3.10	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 250mm; Flow<638l/min	No.	1	R	R
D.1.3.11	DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 125mm	No.	1	R	R

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SECTION D - MECHANICAL – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION D BROUGHT FORWARD FROM PREVIOUS PAGE						
D.1.3.12		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
D.1.3.13		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
D.1.3.14		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
D.1.3.15		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
D.1.3.16		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 125mm	No.	1	R	R
D.1.3.17		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
D.1.3.18		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
D.1.3.19		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
D.1.3.20		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
D.1.3.21		DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 125mm	No.	1	R	R

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D.1.3.22	DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
D.1.3.23	DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
D.1.3.24	DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
D.1.3.25	DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
D.1.3.26	DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
D.1.3.27	DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
D.1.3.28	DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
D.1.3.29	DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
D.1.3.30	DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 400mm	No.	1	R	R
D.1.3.31	DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
D.1.3.32	DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
D.1.3.33	DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
D.1.3.34	DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
D.1.3.35	DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 400mm	No.	1	R	R
D.1.3.36	DN in: 150mm; DN out: 125mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
D.1.3.37	DN in: 150mm; DN out: 125mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
D.1.3.38	DN in: 150mm; DN out: 125mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
D.1.3.39	DN in: 150mm; DN out: 125mm; Nominal Impeller Dia.: 400mm	No.	1	R	R
D.1.3.40	DN in: 200mm; DN out: 150mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
D.1.3.41	DN in: 200mm; DN out: 150mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
D.1.3.42	DN in: 200mm; DN out: 150mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
D.1.3.43	DN in: 200mm; DN out: 150mm; Nominal Impeller Dia.: 400mm	No.	1	R	R
D.1.3.44	Supply, deliver and install complete pump set for water works, Pump specification to be provided for Engineer approval.	Prov Sum.	1	R2 000 000.00	R2 000 000.00
D.1.3.45	Pump manifold pipework, valve and all fittings for design, modification, fabrication, supply and install. Specification and design to be approved by Engineer.	Prov Sum	1	R3 000 000.00	R3 000 000.00
D.1.4	<u>Dry Installed Pumps (Horizontal single- or two-stage centrifugal pumps with volute casing)</u>				
	<u>Volute Casing: Cast Iron</u>				
	<u>Impeller: Cast Iron</u>				
	<u>Shaft: Carbon St</u>				
	<u>Shaft Sleeve: Cast Iron</u>				
	<u>Seal: Packed Gland</u>				
	<u>Size:</u>				
D.1.4.1	80-40/2	No.	1	R	R
D.1.4.2	100-40	No.	1	R	R
D.1.4.3	100-50/2	No.	1	R	R
D.1.4.4	125-40	No.	1	R	R
D.1.4.5	125-50/2	No.	1	R	R
D.1.4.6	150-50	No.	1	R	R
D.1.4.7	200-23	No.	1	R	R
D.1.4.8	200-33	No.	1	R	R
D.1.4.9	200-40	No.	1	R	R

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D.1.4.10		200-50	No.	1	R	R
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SECTION D - MECHANICAL – continued

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D.1.4.11		250-29	No.	1	R	R
D.1.4.12		250-33	No.	1	R	R
D.1.4.13		250-40	No.	1	R	R
D.1.4.14		250-50	No.	1	R	R
D.1.4.15		300-35	No.	1	R	R
D.1.5		<u>Dry Installed Single-Stage axially split volute casing pumps for horizontal or vertical installation:</u>				
		Volute Casing: Cast Iron				
		Impeller: St Steel				
		Shaft: Chrome Steel				
		Shaft Sleeve: Chrome Steel				

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		<u>Seal: Packed Gland</u>				
		<u>Size (DN-Impeller):</u>				
D.1.5.1		80-210A*	No.	1	R	R
D.1.5.2		80-270A	No.	1	R	R
D.1.5.3		30-370A*	No.	1	R	R
D.1.5.4		100-250A*	No.	1	R	R
D.1.5.5		100-310A*	No.	1	R	R
D.1.5.6		100-375A	No.	1	R	R
D.1.5.7		125-230A	No.	1	R	R
D.1.5.8		125-290A	No.	1	R	R
D.1.5.9		125-365A	No.	1	R	R
D.1.5.10		125-500A	No.	1	R	R
D.1.5.11		150-290A	No.	1	R	R
D.1.5.12		150-360A	No.	1	R	R
D.1.5.13		150-460A	No.	1	R	R
D.1.5.14		150-605A	No.	1	R	R
D.1.5.15		200-320A	No.	1	R	R
D.1.5.16		200-420A	No.	1	R	R
D.1.5.17		200-520A	No.	1	R	R
D.1.5.18		200-670A	No.	1	R	R
D.1.5.19		250-370A	No.	1	R	R
D.1.5.20		250-480A	No.	1	R	R
D.1.5.21		250-600A	No.	1	R	R
D.1.5.22		300-300A	No.	1	R	R
D.1.5.23		300-435A	No.	1	R	R
D.1.5.24		300-560A	No.	1	R	R
D.1.5.25		300-700A	No.	1	R	R
D.1.5.26		350-360A	No.	1	R	R
D.1.5.27		350-430A	No.	1	R	R
D.1.5.28		350-510A	No.	1	R	R
D.1.5.29		Supply and install complete pump set for water works, Pump specification to be provided by Engineer.	Prov Sum.	1	R2 000 000.00	R2 000 000.00

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SECTION D - MECHANICAL – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION D BROUGHT FORWARD FROM PREVIOUS PAGE						
D.1.6		<u>Ring-section pumps - Multistage horizontal high-pressure centrifugal pumps in ring-section design with split suction, discharge and stage casings:</u>				
		<u>Volute Casing: Cast Iron</u>				
		<u>Impeller: Cast Iron</u>				
		<u>Shaft: Carbon Steel</u>				
		<u>Shaft Sleeve: Cast Iron</u>				
		<u>Seal: Packed Gland</u>	No.	1	R	R
		<u>Size (Discharge Nominal Bore/Stage):</u>				
D.1.6.1		32/2	No.	1	R	R

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D.1.6.2	32/3	No.	1	R	R
D.1.6.3	32/4	No.	1	R	R
D.1.6.4	32/5	No.	1	R	R
D.1.6.5	32/6	No.	1	R	R
D.1.6.6	32/7	No.	1	R	R
D.1.6.7	32/8	No.	1	R	R
D.1.6.8	32/9	No.	1	R	R
D.1.6.9	32/10	No.	1	R	R
D.1.6.10	40/2	No.	1	R	R
D.1.6.11	40/3	No.	1	R	R
D.1.6.12	40/4	No.	1	R	R
D.1.6.13	40/5	No.	1	R	R
D.1.6.14	40/6	No.	1	R	R
D.1.6.15	40/7	No.	1	R	R
D.1.6.16	50/2	No.	1	R	R
D.1.6.17	50/3	No.	1	R	R
D.1.6.18	50/4	No.	1	R	R
D.1.6.19	50/5	No.	1	R	R
D.1.6.20	50/6	No.	1	R	R
D.1.6.21	50/7	No.	1	R	R
D.1.6.22	65/2	No.	1	R	R
D.1.6.23	65/3	No.	1	R	R
D.1.6.24	65/4	No.	1	R	R
D.1.6.25	65/5	No.	1	R	R
D.1.6.26	65/6	No.	1	R	R
D.1.6.27	65/7	No.	1	R	R
D.1.6.28	65/8	No.	1	R	R
D.1.6.29	65/9	No.	1	R	R
D.1.6.30	65/10	No.	1	R	R
D.1.6.31	80/2	No.	1	R	R
D.1.6.32	80/3	No.	1	R	R
D.1.6.33	80/4	No.	1	R	R
D.1.6.34	80/5	No.	1	R	R
D.1.6.35	80/6	No.	1	R	R
D.1.6.36	80/7	No.	1	R	R
D.1.6.37	80/8	No.	1	R	R
D.1.6.38	80/9	No.	1	R	R
D.1.6.39	80/10	No.	1	R	R
D.1.6.40	100/2	No.	1	R	R
D.1.6.41	100/3	No.	1	R	R
D.1.6.42	100/4	No.	1	R	R

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SECTION D - MECHANICAL – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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D.1.6.43		100/5	No.	1	R	R
D.1.6.44		100/6	No.	1	R	R
D.1.6.45		100/7	No.	1	R	R
D.1.6.46		100/8	No.	1	R	R
D.1.6.47		100/9	No.	1	R	R
D.1.6.48		125/2	No.	1	R	R
D.1.6.49		125/3	No.	1	R	R
D.1.6.50		125/4	No.	1	R	R
D.1.6.51		125/5	No.	1	R	R
D.1.6.52		125/6	No.	1	R	R
D.1.6.53		150/2	No.	1	R	R
D.1.6.54		150/3	No.	1	R	R
D.1.6.55		150/4	No.	1	R	R
D.1.6.56		150/5	No.	1	R	R
D.1.7		<u>Submersible Motor Pumps (Vertical single-stage fully floodable submersible motor pumps in close-coupled design, with integrated level switch)</u> <u>Volute Casing: Polypropylene</u> <u>Impeller: Polypropylene</u> <u>Diffuser: N/A</u> <u>Shaft: St Steel</u> <u>Shaft Sleeve: N/A</u> <u>Seal: Mechanical</u> <u>Size:</u>				
D.1.7.1		Head: 6.5m Max; Flow: 10m3/h Max; 2m Immersion Depth	No.	1	R	R
D.1.7.2		Head: 10m Max; Flow: 12m3/h Max; 2m Immersion Depth	No.	1	R	R
D.1.7.3		Head: 12.5m Max; Flow: 14m3/h Max; 2m Immersion Depth	No.	1	R	R
D.1.7.4		Head: 8.5m Max; Flow: 16.5m3/h Max; 2m Immersion Depth	No.	1	R	R
D.1.8		<u>Submersible Motor Pumps (Vertical single-stage submersible motor pumps for waste water in close-coupled design for wet installation)</u> <u>Size:</u>				
D.1.8.1		230V; Impeller dia.:100mm; DN50	No.	1	R	R
D.1.8.2		230V; Impeller dia.:110mm; DN50	No.	1	R	R
D.1.8.3		230V; Impeller dia.:120mm; DN50	No.	1	R	R
D.1.8.4		230V; Impeller dia.:130mm; DN50	No.	1	R	R
D.1.8.5		230V; Impeller dia.:110mm; DN65	No.	1	R	R
D.1.8.6		230V; Impeller dia.:120mm; DN65	No.	1	R	R
D.1.8.7		230V; Impeller dia.:130mm; DN65	No.	1	R	R
D.1.8.8		400V; Impeller dia.:100mm; DN50	No.	1	R	R
D.1.8.9		400V; Impeller dia.:110mm; DN50	No.	1	R	R
D.1.8.10		400V; Impeller dia.:120mm; DN50	No.	1	R	R
D.1.8.11		400V; Impeller dia.:130mm; DN50	No.	1	R	R
D.1.8.12		400V; Impeller dia.:110mm; DN65	No.	1	R	R
D.1.8.13		400V; Impeller dia.:120mm; DN65	No.	1	R	R
D.1.8.14		400V; Impeller dia.:130mm; DN65	No.	1	R	R
				1	R	R

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D.1.9		<u>Submersible Motor Pumps (Vertical single-stage submersible motor pumps for wet installation with cutter)</u>				
		Size:				
D.1.9.1		S-Impeller; 32mm discharge dia.; Size 160; 160mm Impeller dia.	No.	1	R	R
D.1.9.2		S-Impeller; 50mm discharge dia.; Size 172; 120mm Impeller dia.	No.	1	R	R
D.1.9.3		S-Impeller; 50mm discharge dia.; Size 172; 140mm Impeller dia.	No.	1	R	R
D.1.9.4		S-Impeller; 50mm discharge dia.; Size 172; 160mm Impeller dia.	No.	1	R	R
D.1.9.5		S-Impeller; 50mm discharge dia.; Size 222; 175mm Impeller dia.	No.	1	R	R

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SECTION D - MECHANICAL – continued

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D.1.9.7		F-Impeller; 50mm discharge dia.; Size 170; 90mm Impeller dia.	No.	1	R	R
D.1.9.8		F-Impeller; 50mm discharge dia.; Size 170; 107mm Impeller dia.	No.	1	R	R
D.1.9.9		F-Impeller; 50mm discharge dia.; Size 170; 120mm Impeller dia.	No.	1	R	R
D.1.9.10		F-Impeller; 50mm discharge dia.; Size 170; 130mm Impeller dia.	No.	1	R	R
D.1.9.11		F-Impeller; 50mm discharge dia.; Size 170; 140mm Impeller dia.	No.	1	R	R
D.1.9.12		F-Impeller; 50mm discharge dia.; Size 220; 130mm Impeller dia.	No.	1	R	R
D.1.9.13		F-Impeller; 50mm discharge dia.; Size 220; 140mm Impeller dia.	No.	1	R	R
D.1.9.14		F-Impeller; 50mm discharge dia.; Size 220; 150mm Impeller dia.	No.	1	R	R
D.1.9.15		F-Impeller; 50mm discharge dia.; Size 220; 160mm Impeller dia.	No.	1	R	R
D.1.9.16		F-Impeller; 50mm discharge dia.; Size 220; 170mm Impeller dia.	No.	1	R	R
D.1.9.17		F-Impeller; 50mm discharge dia.; Size 220; 180mm Impeller dia.	No.	1	R	R
D.1.9.18		F-Impeller; 65mm discharge dia.; Size 170; 120mm Impeller dia.	No.	1	R	R
D.1.9.19		F-Impeller; 65mm discharge dia.; Size 170; 128mm Impeller dia.	No.	1	R	R
D.1.9.20		F-Impeller; 65mm discharge dia.; Size 170; 136mm Impeller dia.	No.	1	R	R
D.1.9.21		F-Impeller; 65mm discharge dia.; Size 170; 146mm Impeller dia.	No.	1	R	R
D.1.9.22		F-Impeller; 65mm discharge dia.; Size 170; 152mm Impeller dia.	No.	1	R	R
D.1.9.23		F-Impeller; 65mm discharge dia.; Size 170; 158mm Impeller dia.	No.	1	R	R
D.1.9.24		F-Impeller; 65mm discharge dia.; Size 220; 112mm Impeller dia.	No.	1	R	R
D.1.9.25		F-Impeller; 65mm discharge dia.; Size 220; 125mm Impeller dia.	No.	1	R	R
D.1.9.26		F-Impeller; 65mm discharge dia.; Size 220; 135mm Impeller dia.	No.	1	R	R
D.1.9.27		F-Impeller; 65mm discharge dia.; Size 220; 145mm Impeller dia.	No.	1	R	R
D.1.9.28		F-Impeller; 65mm discharge dia.; Size 220; 155mm Impeller dia.	No.	1	R	R
D.1.9.29		F-Impeller; 65mm discharge dia.; Size 220; 165mm Impeller dia.	No.	1	R	R
D.1.9.30		F-Impeller; 65mm discharge dia.; Size 220; 175mm Impeller dia.	No.	1	R	R
D.1.9.31		F-Impeller; 65mm discharge dia.; Size 220; 185mm Impeller dia.	No.	1	R	R

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D.1.9.32	F-Impeller; 65mm discharge dia.; Size 220; 195mm Impeller dia.	No.	1	R	R
D.1.9.33	F-Impeller; 80mm discharge dia.; Size 220; 120mm Impeller dia.	No.	1	R	R
D.1.9.34	F-Impeller; 80mm discharge dia.; Size 220; 135mm Impeller dia.	No.	1	R	R
D.1.9.35	F-Impeller; 80mm discharge dia.; Size 220; 150mm Impeller dia.	No.	1	R	R
D.1.9.36	F-Impeller; 80mm discharge dia.; Size 220; 165mm Impeller dia.	No.	1	R	R
D.1.9.37	F-Impeller; 80mm discharge dia.; Size 220; 180mm Impeller dia.	No.	1	R	R
D.1.9.38	F-Impeller; 80mm discharge dia.; Size 220; 195mm Impeller dia.	No.	1	R	R
D.1.9.39	F-Impeller; 80mm discharge dia.; Size 220; 210mm Impeller dia.	No.	1	R	R
D.1.9.40	F-Impeller; 100mm discharge dia.; Size 220; 120mm Impeller dia.	No.	1	R	R
D.1.9.41	F-Impeller; 100mm discharge dia.; Size 220; 135mm Impeller dia.	No.	1	R	R
D.1.9.42	F-Impeller; 100mm discharge dia.; Size 220; 150mm Impeller dia.	No.	1	R	R
D.1.9.43	F-Impeller; 100mm discharge dia.; Size 220; 165mm Impeller dia.	No.	1	R	R
D.1.9.44	F-Impeller; 100mm discharge dia.; Size 220; 180mm Impeller dia.	No.	1	R	R
D.1.9.45	F-Impeller; 100mm discharge dia.; Size 220; 195mm Impeller dia.	No.	1	R	R
D.1.9.46	F-Impeller; 100mm discharge dia.; Size 220; 210mm Impeller dia.	No.	1	R	R
D.1.9.47	D-Impeller; 80mm discharge dia.; Size 220; 154mm Impeller dia.	No.	1	R	R
D.1.9.48	D-Impeller; 80mm discharge dia.; Size 220; 168mm Impeller dia.	No.	1	R	R
D.1.9.49	D-Impeller; 80mm discharge dia.; Size 220; 180mm Impeller dia.	No.	1	R	R
D.1.9.50	D-Impeller; 80mm discharge dia.; Size 220; 190mm Impeller dia.	No.	1	R	R
D.1.9.51	D-Impeller; 100mm discharge dia.; Size 220; 195mm Impeller dia.	No.	1	R	R
D.1.9.52	D-Impeller; 100mm discharge dia.; Size 220; 209mm Impeller dia.	No.	1	R	R
D.1.9.53	D-Impeller; 100mm discharge dia.; Size 220; 220mm Impeller dia.	No.	1	R	R

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D.1.10		<u>Other centrifugal pumps- Manufacturer to be specified and pump performance</u>				
D.1.10.1		3" or 80mm pump with head up to 30m	No.	1	R	R
D.1.10.2		4" pump, head up to 30m	No.	1	R	R
D.1.10.3		6" Pump, Head up to 30m	No.	1	R	R
D.1.10.4		8" pump, Head up to 30m	No.	1	R	R
D.1.10.5		10" pump, Head up to 30m	No.	1	R	R
D.1.10.6		12" pump, 4" pump, head up to 30m	No.	1	R	R
D.1.11		<u>Submersible Pump</u>				
		50Hz	No.	1	R	R
D.1.11.1		Power rate 1.5 kw – 2.4 kw with discharge size from 50mm -80mm, max Q- 55l/s , max head 40m	No.	1	R	R
D.1.11.2		Power rate 1.3 kw – 2.4 kw with discharge size of 80mm, max Q- 55l/s , max head 40m	No.	1	R	R

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D.1.11.3		3.1 kw – 4.5 kw with discharge size from 50mm -80mm, max Q- 70l/s , max head 50m	No.	1	R	R
D.1.11.4		4,7 kw – 8,5 kw with discharge size from 50mm -80mm, max Q- 90l/s , max head 70m	No.	1	R	R
D.1.11.5		Power rate from 7,5 kw -15 kw, discharge size from 80mm to 250mm,	No.	1	R	R
D.1.11.6		Power rate 15 kw – 22 kw, discharge 100 to 250mm.	No.	1	R	R
D.1.11.7		Power rate 15 kw – 22 kw, discharge 100 to 300mm.	No.	1	R	R
D.1.11.8		Power rate 37 kw – 50kw, discharge 150 to 350mm.	No.	1	R	R
D.1.11.9		Power rate 50 kw – 70 kw, discharge 150 to 350mm.	No.	1	R	R
D.1.11.10		Power rate 48 kw – 80 kw, discharge 150 to 350mm.	No.	1	R	R
D.1.11.11		Power rate 80 kw – 105 kw, discharge 150 to 350mm.	No.	1	R	R
D.1.11.12		Power rate 70 kw – 150 kw, discharge size 200mm.	No.	1	R	R
D.1.11.13		Power rate 150kw – 215 kw, discharge size 200mm.	No.	1	R	R
D.1.11.14		Power rate 58 kw – 100 kw, discharge size 300mm.	No.	1	R	R
D.1.11.15		Power rate 40 kw – 150 kw, discharge size 500mm.	No.	1	R	R
D.1.11.16		Power rate 150kw – 310 kw, discharge size 500mm	No.	1	R	R
D.1.12		Other Submersible Pump, specify manufactures and pump performance:				
D.1.12.1		1.5kw submersible	No.	1	R	R
D.1.12.2		2,4kw submersible	No.	1	R	R
D.1.12.3		3,1kw submersible	No.	1	R	R
D.1.12.4		4,5 kw submersible	No.	1	R	R

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D.1.12.5		7,5 kw submersible	No.	1	R	R
D.1.12.6		11kw submersible	No.	1	R	R
D.1.12.7		15kw submersible	No.	1	R	R
D.1.12.8		22,5kw submersible	No.	1	R	R
D.1.12.9		30kw submersible	No.	1	R	R
D.1.12.10		45kw submersible	No.	1	R	R
D.1.12.11		60kw submersible	No.	1	R	R
D.1.12.12		90 kw submersible	No.	1	R	R
D.1.12.13		Pump guide rails,galvanized steel tubes, brakets, galvanized chain and fitting for submersible pump sump at the water works.	Prov Sum	1	R 500 000.00	R 500 000.00
D.1.12.14		Pump manifold pipework, valve and all fittings for design, modification, fabrication, supply, deliver and install. Specification and design to be approved. Submersible pump.	Prov Sum	1	R3 000 000.00	R3 000 000.00
D.1.13		<u>DEWATERING/SLUDGE REMOVAL PUMPS</u>				
D.1.13.1		Portable Centrifugal Engine driven pump mouted on a trailer, solid handling, Size 250mm Suction and 250mm discharge, Max capacity 221 lps, Max head 43m, casing cast iron , imperller ductile iron, Max temperature 71C, complete with suction 20 suction pipe and 50 m discharge	No.	1	R	R

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		pipe , Diesel Engine, include trailer road worthy and license registration.				
D.1.13.2						
		Portable Submersible pump, Solid handling, Maxium head 30m, power range 30kw, 50Hz, discharge size 80mm, high quality submersible cable. 50m 3" discharge pipe, Chain block.	No.	1	R	R
D.1.13.3						
		Portable Submersible pump, Solid handling, Maxium head 20m , 7 lps, power range 5.6kw, 50Hz, discharge size 80mm, high quality submersible cable. 50m 3" discharge pipe, Chain block to have pump weight.	No.	1	R	R
D.1.14		<u>PORTABLE WATER PUMP</u>				
D.1.14.1		Potable water pump, total head 26m, suction head 8m, inlet and outlet dia = 100mm, pumping capacity 1640 lpm, open frame size 735x 536 x 563mm, Engine 4 stroke, petrol, 389cc,fuel tank 6.1 L. max power output @3600rpm.	No.	1	R	R
D.1.15		<u>OTHER EQUIPMENTS</u>				
D.1.15.1		Motor driven digital display mettering pump (Chemical dosing pump)	No.	1	R	R
D.1.15.2		Solenoid Driven Chemical dosing and metering pump	No.	1	R	R
D.1.15.3		Chlorine cylinder Scale (for 70kg Cylinder)	No.	1	R	R
D.1.15.4		Chlorine cylinder Scale (for 952kg Cylinder)	No.	1	R	R
D.1.15.5		Refurbishment of chlorine dosing system (pump, instrumentation and piping) for the water works.	Prov sum.	1	R2 000 000.00	R2 000 000.00
		Allow for site assessment,provide assessment report.				
		Refurbish and commisioning.				
D.1.15.6		Calibration of flow meter at the water works.	Prov sum.			
		Allow for removing of flow meter,install pipe distance piece or temporary meter, calibrate and provide certificate		1	R700 000.00	R700 000.00
D.1.15.7		Refurbushment of flow meter and flow meter components for the water works.	Prov sum.	1	R2 000 000.00	R2 000 000.00
		Allow for site assessment,provide assessment report.				
		Refurbish and commisioning.				
D.2		<u>AERATOR</u>	-	-		
		Surface Aerators: Vertical Shaft				
D.2.1.1		0,55 kw up to 3, 5kw aerator unit.	No.	1	R	R

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SECTION D - MECHANICAL – continued

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D.2.1.2		3,6 kw to 7,5kw aerator unit	No.	1	R	R
D.2.1.3		7,6 kw up to 11 kw aerator unit	No.	1	R	R
D.2.1.4		11kw up to 15,5 kw aerator unit	No.	1	R	R
D.2.1.5		15,5kw up to 22,5 kw aerator unit	No.	1	R	R
D.2.1.6		22,6 kw up to 30 kw aerator unit	No.	1	R	R
D.2.1.7		31 kw up to 45kw aerator unit	No.	1	R	R
D.2.1.8		46 kw up to 60kw aerator unit	No.	1	R	R
D.2.1.9		61kw up to 80kw aerator unit	No.	1	R	R
D.2.1.10		81kw up to 109kw aerator unit	No.	1	R	R
D.2.1.11		110kw up to 150kw aerator unit	No.	1	R	R
D.2.2		Surface Air Mixer Supply, install and commission complete set Mixer for waste water treatment plant including gearbox, electrical motor, baseplate, blade turbine, and fittings, mounted to prevent any movement, capable of transferring required aeration. Electrical motor: IEC certified and SABS approved, 3 phase				
D.2.2.1		0,55 kw up to 3, 5kw Mixer unit.	No.	1	R	R
D.2.2.2		3,6 kw to 7,5kw Mixer unit	No.	1	R	R
D.2.2.3		7,6 kw up to 11 kw Mixer unit	No.	1	R	R
D.2.2.4		11kw up to 15,5 kw Mixer unit	No.	1	R	R
D.2.2.5		15,5kw up to 22,5 kw Mixer unit	No.	1	R	R
D.2.2.6		22,6 kw up to 30 kw Mixer unit	No.	1	R	R
D.2.2.7		31kw up to 45kw mixer unit	No.	1	R	R
D.2.3		Horizontal Shaft :Surface Aerator Supply, install and commission complete set horizontal shaft surface aerator for waste water treatment plant including gearbox, electrical motor, gear baseplate , Brush and fittings, mounted to prevent any movement, capable of transferring required aeration. Electrical motor: IEC certified and SABS approved, 3 phase. Brush: baseplate, brush diameter 700mm and 1000mm.				
D.2.3.1		5.5kw aerator unit, brush Dia.0.7m, length of Axle up to 3m, 10 kg O2/ h	No.	1	R	R
D.2.3.2		7.5kw aerator unit, brush Dia.0.7m, length of Axle up to 4.5m, 14 kg O2/ h	No.	1	R	R
D.2.3.3		11 kw aerator unit , brush Dia.0.7m, length of Axle up to 6m, 20 kg O2/ h	No.	1	R	R
D.2.3.4		15kw kw aerator unit, brush Dia.1m, length of Axle up to 3m, 27 kg O2/ h	No.	1	R	R
D.2.3.5		22 kwaerator unit, brush Dia.1m, length of Axle up to 4.5m, 40 kg O2/ h	No.	1	R	R
D.2.3.6		30 Kw aerator unit, brush Dia.1m, length of Axle up to 6m, 54 kg O2/ h	No.	1	R	R
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D.2.3.7		37 kw aerator unit, brush Dia.1m, length of Axle up to 7.5m, 67 kg O2/ h.	No.	1	R	R
D.2.3.8		45kw aerator unit, , brush Dia.1m, length of Axle up to 9m, 81 kg O2/ h	No.	1	R	R
D.2.3.9		81kw up to 109kw aerator unit	No.	1	R	R
D.2.4		Floating Aerator Supply, install and commission complete set floating aspirating aerator for the water works including gearbox, electrical motor, mounted on floating pontoons and anchored to eliminate movement capable of transferring efficient aeration. Electrical motor: IEC certified and SABS approved, 3 phase. Floating pontoons or float: design and mount gear and motor.				
D.2.4.1		0,55 kw up to 3, 5kw aerator unit.	No.	1	R	R
D.2.4.2		3,6 kw to 7,5kw aerator unit	No.	1	R	R
D.2.4.3		7,6 kw up to 11 kw aerator unit	No.	1	R	R
D.2.4.4		11kw up to 15,5 kw aerator unit	No.	1	R	R
D.2.4.5		15,5kw up to 22 kw aerator unit	No.	1	R	R
D.2.4.6		23 kw up to 30 kw aerator unit	No.	1	R	R
D.2.4.7		31 kw up to 45kw aerator unit	No.	1	R	R
D.2.4.8		46 kw up to 60kw aerator unit	No.	1	R	R
D.2.4.9		61kw up to 80kw aerator unit	No.	1	R	R
D.2.5		<u>DESIGN, MANUFACTURE AND SUPPLY OF HORIZONTAL AERATOR EQUIPMENT</u>				
D.2.5.1		Replace coupling - two per aerator bank - drive and centre couplings	No.	1	R	R
D.2.5.2		Replace drive end bearing (fixed type) - two per aerator bank	No.	1	R	R
D.2.5.2		Replace non drive end bearing (floating type) - two per aerator bank	No.	1	R	R
D.3		<u>SCREENS</u>				
D.3.1		Mechanical screen Supply, deliver and install of front rake mechanical screen, consists of spaced steel bar screen, chain, frame, discharge chute, gearmotor, conveyer unit, Stainless steel constructed.				
D.3.1.1		Screen: Front Rake Mechanical screen, width up to 0.5m and up to 1.5m deep. Gearmotor rating 0.5 kw.	No.	1	R	R
D.3.1.2		Front Rake Mechanical screen, width up to 1.0m and depth up to 1.5m. Gearmotor rated 0,7 kw	No.	1	R	R
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SECTION D - MECHANICAL – continued

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D.3.1.3		Front Rake Mechanical screen, width up to 1.0m and depth up to 3m. Gear motor power rated 1 kw	No.	1	R	R
D.3.1.4		Front Rake Mechanical screen, width up to 2m and depth up to 4m. Gear motor power rated 1.1 kw	No.	1	R	R
D.3.1.5		Front Rake Mechanical screen, width up to 3.2m and depth up to 5m. Gearmotor power rated 1.5kw	No.	1	R	R
D.3.2		Hand Rake Screen				
		Tear drop shape, material components 304/316 stainless screen, (size width x depth)				
D.3.2.1		1m x 1m	No.	1	R	R
D.3.2.2		1m x 1,5m	No.	1	R	R
D.3.2.3		1,5m x 2m	No.	1	R	R
D.3.2.4		1,5m x 4m	No.	1	R	R
D.4		VALVES				
		<u>PLEASE NOTE THAT ALL VALVES PURCHASED MUST FIT INTO EXISTING LINE / WHERE REPLACEMENT IS REQUIRED</u>				
		<u>GATE VALVES (ISOLATION)</u>				
D.4.1		<u>Supply and install on the suction and discharge piping of the pump, pipeline, or chamber, with bolt and nut, SANS 664 compliant, flanged face to face, cast iron, PN 16 , DN:</u>				
D.4.1.1		a) 50mm dia.	No.	1	R	R
D.4.1.2		b) 65mm dia.	No.	1	R	R
D.4.1.3		c) 80mm dia.	No.	1	R	R
D.4.1.4		d) 100mm dia.	No.	1	R	R
D.4.1.5		e) 125mm dia.	No.	1	R	R
D.4.1.6		f) 150mm dia.	No.	1	R	R
D.4.1.7		g) 200mm dia.	No.	1	R	R
D.4.1.8		h) 250mm dia.	No.	1	R	R
D.4.1.9		i) 300mm dia.	No.	1	R	R
D.4.1.10		j) 350mm dia.	No.	1	R	R
D.4.1.11		k) 400 mm	No.	1	R	R
D.4.1.12		L) 450mm	No.	1	R	R
D.4.1.13		M) 500mm	No.	1	R	R
D.4.1.14		O) 600mm	No.	1	R	R
D.4.1.15		P) 700mm	No.	1	R	R
D.4.1.16		Q) 800mm	No.	1	R	R
D.4.1.17		R) 900mm	No.	1	R	R
		<u>GATE VALVES (ISOLATION)</u>				
D.4.2		<u>Supply and install on the suction and discharge piping of the pump, pipeline, or chamber, with bolt and nut, SANS 664 compliant, flanged face to face, cast iron, PN 25 , DN:</u>				
D.4.2.1		a) 50mm dia.	No.	1	R	R
SECTION CARRIED FORWARD TO NEXT PAGE						

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SECTION D - MECHANICAL – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION D BROUGHT FORWARD FROM PREVIOUS PAGE						
D.4.2.2		b) 65mm dia.	No.	1	R	R
D.4.2.3		c) 80mm dia.	No.	1	R	R
D.4.2.4		d) 100mm dia.	No.	1	R	R
D.4.2.5		e) 125mm dia.	No.	1	R	R
D.4.2.6		f) 150mm dia.	No.	1	R	R
D.4.2.7		g) 200mm dia.	No.	1	R	R
D.4.2.8		h) 250mm dia.	No.	1	R	R
D.4.2.9		i) 300mm dia.	No.	1	R	R
D.4.2.10		j) 350mm dia.	No.	1	R	R
D.4.2.11		k) 400 mm	No.	1	R	R
D.4.2.12		L) 450mm	No.	1	R	R
D.4.2.13		M) 500mm	No.	1	R	R
D.4.2.14		O) 600mm	No.	1	R	R
D.4.2.15		P) 700mm	No.	1	R	R
D.4.2.16		Q) 800mm	No.	1	R	R
D.4.2.17		R) 900mm	No.	1	R	R
		<u>GATE SWING CHECK VALVES (NON RETURN)</u>				
D.4.3		<u>Supply and install on the suction and discharge piping of the pump, pipeline, or chamber, with bolt and nut, SANS 664 compliant, flanged face to face, cast iron, PN 16 , DN:</u>				
D.4.3.1		a) 50mm dia.	No.	1	R	R
D.4.3.2		b) 65mm dia.	No.	1	R	R
D.4.3.3		c) 80mm dia.	No.	1	R	R
D.4.3.4		d) 100mm dia.	No.	1	R	R
D.4.3.5		e) 125mm dia.	No.	1	R	R
D.4.3.6		f) 150mm dia.	No.	1	R	R
D.4.3.7		g) 200mm dia.	No.	1	R	R
D.4.3.8		h) 250mm dia.	No.	1	R	R
D.4.3.9		i) 300mm dia.	No.	1	R	R
D.4.3.10		j) 350mm dia.	No.	1	R	R
D.4.3.11		k) 400 mm	No.	1	R	R
D.4.3.12		L) 450mm	No.	1	R	R
D.4.3.13		M) 500mm	No.	1	R	R
D.4.3.14		O) 600mm	No.	1	R	R
D.4.3.15		P) 700mm	No.	1	R	R
D.4.3.16		Q) 800mm	No.	1	R	R
D.4.3.17		R) 900mm	No.	1	R	R
		<u>GATE SWING CHECK VALVES (NON RETURN)</u>				
D.4.4		<u>Supply and install to waterworks, clockwise closing, non-rising spindle, with cap top, with bolt and nut, SANS 664 compliant, flanged face to face, cast iron, PN 25 , DN:</u>				
D.4.4.1		a) 50mm dia.	No.	1	R	R
D.4.4.2		b) 65mm dia.	No.	1	R	R
D.4.4.3		c) 80mm dia.	No.	1	R	R

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D.4.4.4		d) 100mm dia.	No.	1	R	R
SECTION CARRIED FORWARD TO NEXT PAGE						
SECTION D - MECHANICAL – continued						
ITEM	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION D BROUGHT FORWARD FROM PREVIOUS PAGE						
D.4.4.5		e) 125mm dia.	No.	1	R	R
D.4.4.6		f) 150mm dia.	No.	1	R	R
D.4.4.7		g) 200mm dia.	No.	1	R	R
D.4.4.8		h) 250mm dia.	No.	1	R	R
D.4.4.9		i) 300mm dia.	No.	1	R	R
D.4.4.10		j) 350mm dia.	No.	1	R	R
D.4.4.11		k) 400 mm	No.	1	R	R
D.4.4.12		L) 450mm	No.	1	R	R
D.4.4.13		M) 500mm	No.	1	R	R
D.4.4.14		O) 600mm	No.	1	R	R
D.4.4.15		P) 700mm	No.	1	R	R
D.4.4.16		Q) 800mm	No.	1	R	R
D.4.4.17		R) 900mm	No.	1	R	R
		<u>GATE VALVES (SLUICE VALVES)</u>				
D.4.5		<u>Supply, joint, cut pipes to length and test sluice valves to waterworks pattern, PN16, clockwise closing, non-rising spindle, with cap top, complying with SABS 664 AND FITTED WITH RESILIAN SEAL SEATS COUPLINGS</u>				
D.4.5.1		a) 50mm dia.	No.	1	R	R
D.4.5.2		b) 65mm dia.	No.	1	R	R
D.4.5.3		c) 80mm dia.	No.	1	R	R
D.4.5.4		d) 100mm dia.	No.	1	R	R
D.4.5.5		e) 125mm dia.	No.	1	R	R
D.4.5.6		f) 150mm dia.	No.	1	R	R
D.4.5.7		g) 200mm dia.	No.	1	R	R
D.4.5.8		h) 250mm dia.	No.	1	R	R
D.4.5.9		i) 300mm dia.	No.	1	R	R
D.4.5.10		j) 350mm dia.	No.	1	R	R
D.4.5.11		k) 400 mm	No.	1	R	R
D.4.5.12		L) 450mm	No.	1	R	R
D.4.5.13		M) 500mm	No.	1	R	R
D.4.5.14		O) 600mm	No.	1	R	R
D.4.5.15		P) 700mm	No.	1	R	R
D.4.5.16		Q) 800mm	No.	1	R	R
D.4.5.17		R) 900mm	No.	1	R	R
		<u>GATE VALVES (BUTTERFLY)</u>				
D.4.6		<u>valves to waterworks pattern, Class16 clockwise closing, non-rising spindle, with cap top, complying with SABS 664 AND FITTED WITH RESILIAN SEAL SEATS</u>				
D.4.6.1		a) 50mm dia.	No.	1	R	R
D.4.6.2		b) 65mm dia.	No.	1	R	R
D.4.6.3		c) 80mm dia.	No.	1	R	R
D.4.6.4		d) 100mm dia.	No.	1	R	R
D.4.6.5		e) 125mm dia.	No.	1	R	R

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D.4.6.6		f) 150mm dia.	No.	1	R	R
D.4.6.7		g) 200mm dia.	No.	1	R	R
D.4.6.8		h) 250mm dia.	No.	1	R	R

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SECTION D - MECHANICAL – continued

ITEM	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION D BROUGHT FORWARD FROM PREVIOUS PAGE						
D.4.6.9		i) 300mm dia.	No.	1	R	R
D.4.6.10		j) 350mm dia.	No.	1	R	R
D.4.6.11		k) 400 mm	No.	1	R	R
D.4.6.12		L) 450mm	No.	1	R	R
D.4.6.13		M) 500mm	No.	1	R	R
D.4.6.14		O) 600mm	No.	1	R	R
D.4.6.15		P) 700mm	No.	1	R	R
D.4.6.16		Q) 800mm	No.	1	R	R
D.4.6.17		R) 900mm	No.	1	R	R
		<u>OTHER VALVES</u>				
D.4.7		<u>Supply, joint, cut pipes to length and test approved Pressure control valves:</u>				
D.4.7.1		80NB PN 16	No.	1	R	R
D.4.7.2		100NB PN 16	No.	1	R	R
D.4.7.3		125NB PN 16	No.	1	R	R
D.4.7.4		150NB PN 16	No.	1	R	R
D.4.7.5		200NB PN 16	No.	1	R	R
D.4.7.6		250NB PN 16	No.	1	R	R
D.4.7.7		300NB PN 16	No.	1	R	R
D.4.7.8		400NB PN 16	No.	1	R	R
D.4.7.9		500NB PN 16	No.	1	R	R
D.4.7.10		600NB PN 16	No.	1	R	R
D.4.7.11		700NB PN 16	No.	1	R	R
D.4.7.12		800NB PN 16	No.	1	R	R
D.4.8		<u>Supply, joint, cut pipes to length and test approved Resilient seated Swing Check valves:</u>				
D.4.8.1		50NB PN16	No.	1	R	R
D.4.8.2		65NB PN16	No.	1	R	R
D.4.8.3		80NB PN 16	No.	1	R	R
D.4.8.4		100NB PN 16	No.	1	R	R
D.4.8.5		125NB PN 16	No.	1	R	R
D.4.8.6		150NB PN 16	No.	1	R	R
D.4.8.7		200NB PN 16	No.	1	R	R
D.4.8.8		250NB PN 16	No.	1	R	R
D.4.8.9		300NB PN 16	No.	1	R	R
D.4.9		<u>Supply, joint, cut pipes to length and test approved DOUBLE ECCENTRIC BUTTERFLY VALVE, PN16 756/218-005 Integral seat, IP67 gearbox, DN 200-600, plate disc, short, AISI 420 shaft:</u>				
D.4.9.1		200NB PN16	No.	1	R	R
D.4.9.2		250NB PN16	No.	1	R	R
D.4.9.3		300NB PN 16	No.	1	R	R

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D.4.9.4		350NB PN 16	No.	1	R	R
D.4.9.5		400NB PN 16	No.	1	R	R
D.4.9.6		450NB PN 16	No.	1	R	R
D.4.9.7		500NB PN 16	No.	1	R	R
D.4.9.8		600NB PN 16	No.	1	R	R

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SECTION D - MECHANICAL – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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SECTION D BROUGHT FORWARD FROM PREVIOUS PAGE

D.4.10		<u>Supply, joint, cut pipes to length and test approved Resilient seated Flanged Ball Check Valves:</u>				
D.4.10.1		50NB PN16	No.	1	R	R
D.4.10.2		65NB PN16	No.	1	R	R
D.4.10.3		80NB PN 16	No.	1	R	R
D.4.10.4		100NB PN 16	No.	1	R	R
D.4.10.5		125NB PN 16	No.	1	R	R
D.4.10.6		150NB PN 16	No.	1	R	R
D.4.10.7		200NB PN 16	No.	1	R	R
D.4.10.8		250NB PN 16	No.	1	R	R
D.4.10.9		300NB PN 16	No.	1	R	R
D.4.10.10		350NB PN 16	No.	1	R	R
D.4.10.11		400NB PN 16	No.	1	R	R
D.4.10.12		450NB PN 16	No.	1	R	R
D.4.10.13		500NB PN 16	No.	1	R	R
D.4.10.14		600NB PN 16	No.	1	R	R
D.4.10.15		Design, fabricate, supply and install valve, manual and actuator valve for water works. Design and specification to be approved by Engineer	Prov Sum	1	R3 500 000.00	R3 500 000.00
D.5		<u>MECHANICAL COMPONENTS</u>				
D.5.1		2 Ton Electric Chain Hoist	No.	1	R	R
D.5.2		6 Ton Electric Chain Hoist	No.	1	R	R
D.5.3		T10 R Rotating Rotating Assembly 10A3S-B	No.	1	R	R
D.6		<u>GEARBOXES AND OTHER MISCELLANEOUS</u>				
D.6.1		3 kW Clarifier Gearbox	No.	1	R	R
D.6.2		22 kW Clarifier Gearbox	No.	1	R	R
D.6.3		45 kW Clarifier Gearbox	No.	1	R	R
D.6.4		3 kW Aerator Gearbox	No.	1	R	R
D.6.5		22 kW Aerator Gearbox	No.	1	R	R
D.6.6		45 kW Aerator Gearbox	No.	1	R	R
D.6.7		Gearbox type DF108-738-LA71m4	No.	1	R	R
D.6.8		0.37 kW Gearbox 2.9rpm	No.	1	R	R
D.6.9		Solid Air, 0.15 cubic meter compressor	No.	1	R	R
D.6.10		Spiral Model VF40L lime feeders	No.	1	R	R
D.6.11		Spherical roller bearings (22222MBKW33 BTC)	No.	1	R	R
D.6.12		Sleves (H322)	No.	1	R	R
D.6.13		Taper Lock Bush (3525 × 100 mm)	No.	1	R	R

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D.6.14		SNU U-lock seals (U522)	No.	1	R	R
D.6.15		Couplings 280	No.	1	R	R
D.6.16		Element HRC 280	No.	1	R	R
D.6.17		Dewatering Belts	No.	1	R	R
D.6.18		Sieves (H322)	No.	1	R	R

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SECTION D - MECHANICAL – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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SECTION D BROUGHT FORWARD FROM PREVIOUS PAGE

D.7		<u>BEARING HOUSE ASSEMBLY</u>				
D.7.1		Heavy Duty 65mm	No.	1	R	R
D.7.2		Heavy Duty 80mm	No.	1	R	R
D.8		<u>V BELTS</u>				
D.8.1		17 X 1210	No.	1	R	R
D.8.2		17 X 1400	No.	1	R	R
D.8.3		17 X 1450	No.	1	R	R
D.8.4		17 X 1470	No.	1	R	R
D.8.5		17 X 1510	No.	1	R	R
D.8.6		17 X 1530	No.	1	R	R
D.8.7		17 X 1670	No.	1	R	R
D.8.8		17 X 1600	No.	1	R	R
D.8.9		17 X 1620	No.	1	R	R
D.8.10		17 X 1530	No.	1	R	R
D.8.11		17 X 1670	No.	1	R	R
D.8.12		17 X 1520	No.	1	R	R
D.8.13		17 X 1340	No.	1	R	R
D.8.14		17 X 1620	No.	1	R	R
D.8.15		17 X 1470	No.	1	R	R
D.8.16		17 X 1440	No.	1	R	R
D.8.17		17 X 1430	No.	1	R	R
D.8.18		17 X 1310	No.	1	R	R
D.8.19		17 x 1260	No.	1	R	R
D.8.20		17 X 1570	No.	1	R	R
D.8.21		17 X 1440	No.	1	R	R
D.8.22		17 X 1430	No.	1	R	R
D.8.23		17 x 1420	No.	1	R	R
D.8.24		17 X 1350	No.	1	R	R
D.8.25		17 x 1200	No.	1	R	R
D.8.26		17 X 1250	No.	1	R	R
D.8.27		17 X 1275	No.	1	R	R
D.8.28		17 X 1320	No.	1	R	R
D.8.29		17 X 1390	No.	1	R	R
D.8.30		17 X 1316	No.	1	R	R
D.8.31		17 x 1735	No.	1	R	R
D.9		<u>COMPLETE SET OF COLUMNS WITH BOBBING BEARINGS & RODS.</u>				

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D.9.1		40 mm diameter	No.	1	R	R
D.9.2		50 mm diameter	No.	1	R	R
D.9.3		65 mm diameter	No.	1	R	R
D.9.4		80 mm diameter	No.	1	R	R
D.9.5		100mm diameter	No.	1	R	R
D.10		Pump spares/ parts not specified above for repairs and services, pumps, aerators, motors.	Prov sum	1	R3 000 000.00	R3 000 000.00

TOTALSECTION D TO SUMMARY

SECTION E – ELECTRICAL

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
E.1		<u>ELECTRICAL MOTORS (Supply and Install, induction motors, SABS approved)</u>				
E.1.1		0.18 kW x 380 V	No.	1	R	R
E.1.2		1.1 kW x 380 V	No.	1	R	R
E.1.3		2.2 kW x 380 V	No.	1	R	R
E.1.4		5,5 kW x 380 V	No.	1	R	R
E.1.5		7,5 kW x 380 V	No.	1	R	R
E.1.6		11 kW x 380 V	No.	1	R	R
E.1.7		15 kW x 380 V	No.	1	R	R
E.1.8		18,5 kW x 380 V	No.	1	R	R
E.1.9		22 kW x 380 V	No.	1	R	R
E.1.10		26k kW x 380 V	No.	1	R	R
E.1.11		30k kW x 380 V	No.	1	R	R
E.1.12		45k kW x 380 V	No.	1	R	R
E.1.13		75k kW x 380 V	No.	1	R	R
E.1.14		90kW x 380 V	No.	1	R	R
E.1.15		132 kW x 380 V	No.	1	R	R
E.1.16		160 kW x 380 V	No.	1	R	R
E.1.17		200 kw x 380v	No.	1	R	R
E.1.18		239 kW x 380 V	No.	1	R	R
E.1.19		250 kW x 380 V	No.	1	R	R
E.1.20		300 kW x 380 V	No.	1	R	R
E.1.21		350 kW x 380 V	No.	1	R	R
E.1.22		400 kW x 380 V	No.	1	R	R
E.1.23		500 kW x 380 V	No.	1	R	R
E.1.24		600 kW x 380 V	No.	1	R	R

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SECTION E - ELECTRICAL – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION E BROUGHT FORWARD FROM PREVIOUS PAGE						
E.2		<u>MOTOR CONTROL CENTER (MOTOR ELECTRICAL PANEL)</u>				
E.2.1		DESIGN, MANUFACTURE, SUPPLY, INSTALLATION AND COMMISSIONING MCC CONTROL CABINET: to consists of input circuit break, soft starter/VDS starters/ (star delta for motor less than 7.5kw), bypass contactor, Busbar, indicator, hour meter, Secondary side control, cables, advanced display and necessary components, for electrical motor range				
		-				
E.2.1.1		Up to 1 kw	No.	1	R	R
E.2.1.2		Up to 3 kw	No.	1	R	R
E.2.1.3		Up to 7.5 kw	No.	1	R	R
E.2.1.4		Up to 18.5 Kw	No.	1	R	R
E.2.1.5		Up to 30 kw	No.	1	R	R
E.2.1.6		Up to 60kw	No.	1	R	R
E.2.1.7		Up to 90 kw	No.	1	R	R
E.2.1.7		Up to 150 kw	No.	1	R	R
E.2.1.8		Up to 200kw	No.	1	R	R
E.2.1.9		Up to 350 kw	No.	1	R	R
E.2.1.10		Up to 450kw	No.	1	R	R
E.2.1.10		Up to 600kw	No.	1	R	R
E.2.2		<u>Supply, install and program of Variable Speed Drive (VSD) in the MCC cabinet: VSD motor starters for electric Motor range:</u>				
E.2.2.1		VSD to run motor up to 4.5kW.	No.	1	R	R
E.2.2.2		VSD for motor up to 7.5kW	No.	1	R	R
E.2.2.3		VSD for motor up to 11kW	No.	1	R	R
E.2.2.4		VSD for motor up to 18kW	No.	1	R	R
E.2.2.5		VSD for motor up to 22kW	No.	1	R	R
E.2.2.6		VSD for motor up to 30kW	No.	1	R	R
E.2.2.7		VSD for motor up to 55kW	No.	1	R	R
E.2.2.8		VSD for motor up to 90kW	No.	1	R	R
E.2.2.9		VSD for motor up to 110kW	No.	1	R	R
E.2.2.10		VSD for motor up to 185kW	No.	1	R	R
E.2.2.11		VSD for motor up to 220kW	No.	1	R	R
E.2.3.12		VSD for motor up to 300kW	No.	1	R	R
E.2.2.13		VSD for motor up to 400kW	No.	1	R	R
E.2.2.14		VSD for motor up to 500kW	No.	1	R	R
E.2.2.15		VSD for motor up to 600kW	No.	1	R	R
E.2.2.16		VSD to run motor up to 600kW.	No.	1	R	R

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SECTION E - ELECTRICAL - continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION E BROUGHT FORWARD FROM PREVIOUS PAGE						
E.2.3		<u>SOFT STARTER for electrical motor. Supply, install and programme for motor range:</u>				
E.2.3.1		Soft Starter for motor up to 3.5kW	No.	1	R	R
E.2.3.2		Soft Starter for motor up to 7.5kW	No.	1	R	R
E.2.3.3		Soft Starter for motor up to 11kW	No.	1	R	R
E.2.3.4		Soft Starter for motor up to 18kW	No.	1	R	R
E.2.3.5		Soft Starter for motor up to 22kW	No.	1	R	R
E.2.3.6		Soft Starter for motor up to 30kW	No.	1	R	R
E.2.3.7		Soft Starter for motor up to 55kW	No.	1	R	R
E.2.3.8		Soft Starter for motor up to 90kW	No.	1	R	R
E.2.3.9		Soft Starter for motor up to 110kW	No.	1	R	R
E.2.3.10		Soft Starter for motor up to 185kW	No.	1	R	R
E.2.3.11		Soft Starter for motor up to 220kW	No.	1	R	R
E.2.3.12		Soft Starter for motor up to 300kW	No.	1	R	R
E.2.3.13		Soft Starter for motor up to 400kW	No.	1	R	R
E.2.3.14		Soft Starter for motor up to 500kW	No.	1	R	R
E.2.3.15		Soft Starter for motor up to 600kW	No.	1	R	R
E.2.4		CIRCUIT BREAKERS				
		<u>Supply and install for rated current. MOUNTED IN MCC/ MINISUBS/ TRANSFORMER</u>				
E.2.4.1		MCB 5A 1P	No.	1	R	R
E.2.4.2		MCB 10A 1P	No.	1	R	R
E.2.4.3		MCB 15A 1P	No.	1	R	R
E.2.4.4		MCB 20A 1P	No.	1	R	R
E.2.4.5		MCB 25A 1P	No.	1	R	R
E.2.4.6		MCB 60A 1P	No.	1	R	R
E.2.4.7		MCCB 40A 2P	No.	1	R	R
E.2.4.8		MCB 60A 2P	No.	1	R	R
E.2.4.9		MCB 10A 3P	No.	1	R	R
E.2.4.10		MCCB 30A 3P	No.	1	R	R
E.2.4.11		MCCB 35A 3P	No.	1	R	R
E.2.4.12		MCB 50A 3P	No.	1	R	R
E.2.4.13		MCCB 70A 3P	No.	1	R	R
E.2.4.14		MCCB 80A 3P	No.	1	R	R
E.2.4.15		200A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS	No.	1	R	R
E.2.4.16		225A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS.	No.	1	R	R
E.2.4.17		250A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS.	No.	1	R	R
E.2.4.18		300A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS.	No.	1	R	R
E.2.4.19		350A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS	No.	1	R	R
E.2.4.20		400A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS MOUNTED IN MINISUBS/ TRANSFORMER	No.	1	R	R

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E.2.4.21		500A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS MOUNTED IN MINISUBS/ TRANSFORMER	No.	1	R	R
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SECTION E - ELECTRICAL – continued

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E.3		<u>CABLES</u>				
E.3.1		<u>LV CABLES</u> Allow for all the costs and expenses in connection with the design, manufacture, routine testing, factory acceptance testing (if indicated), supply, delivery, offloading and storage of the following <u>CU/PVC/PVC/SWA/PVC 600/1000V multicore cable including labels</u>				
E.3.1.1		2.5mm ² x 3 core	m	1	R	R
E.3.1.2		2.5mm ² x 4 core	m	1	R	R
E.3.1.3		4mm ² x 4 core	m	1	R	R
E.3.1.4		6mm ² x 4 core	m	1	R	R
E.3.1.5		10mm ² x 4 core	m	1	R	R
E.3.1.6		16mm ² x 4 core	m	1	R	R
E.3.1.7		25mm ² x 4 core	m	1	R	R
E.3.1.8		35mm ² x 4 core	m	1	R	R
E.3.1.9		50mm ² x 4 core	m	1	R	R
E.3.1.10		70mm ² x 4 core	m	1	R	R
E.3.1.11		95mm ² x 4 core	m	1	R	R
E.3.1.12		120mm ² x 4 core	m	1	R	R
E.3.1.15		150mm ² x 4 core	m	1	R	R
E.3.1.16		185mm ² x 4 core	m	1	R	R
E.3.2		<u>Cable Terminations for CU/PVC/PVC/SWA/PVC 600/1000V multicore cable</u>				
E.3.2.1		2.5mm ² x 3 core	No.	1	R	R
E.3.2.2		2.5mm ² x 4 core	No.	1	R	R
E.3.2.3		4mm ² x 4 core	No.	1	R	R
E.3.2.4		6mm ² x 4 core	No.	1	R	R
E.3.2.5		10mm ² x 4 core	No.	1	R	R
E.3.2.6		16mm ² x 4 core	No.	1	R	R
E.3.2.7		25mm ² x 4 core	No.	1	R	R
E.3.2.8		35mm ² x 4 core	No.	1	R	R
E.3.2.9		50mm ² x 4 core	No.	1	R	R
E.3.2.10		70mm ² x 4 core	No.	1	R	R
E.3.2.11		95mm ² x 4 core	No.	1	R	R
E.3.2.12		120mm ² x 4 core	No.	1	R	R
E.3.2.13		150mm ² x 4 core	No.	1	R	R
E.3.2.14		185mm ² x 4 core	No.	1	R	R
E.3.3		<u>Bare Copper Earth cable (BCEC) with stranded conductors including labels.</u>				
E.3.3.1		2.5mm ² x 3 core	m	1	R	R

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E.3.3.2	2.5mm ² x 4 core	m	1	R	R
E.3.3.3	4mm ² x 4 core	m	1	R	R
E.3.3.4	6mm ² x 4 core	m	1	R	R
E.3.3.5	10mm ² x 4 core	m	1	R	R
E.3.3.6	16mm ² x 4 core	m	1	R	R
E.3.3.7	25mm ² x 4 core	m	1	R	R
E.3.3.8	35mm ² x 4 core	m	1	R	R
E.3.3.9	50mm ² x 4 core	m	1	R	R
E.3.3.10	70mm ² x 4 core	m	1	R	R
E.3.3.11	95mm ² x 4 core	m	1	R	R
E.3.3.12	120mm ² x 4 core	m	1	R	R
E.3.3.13	150mm ² x 4 core	m	1	R	R
E.3.3.14	185mm ² x 4 core	m	1	R	R
E.3.4	<u>Cable terminations for bare copper earth cables, complete, including gland shroud, lugs, number tags, etc and connection.</u> <u>Terminations for Bare Copper Earth Conductors (BCEC)</u>				
E.3.4.1	2.5mm ² x 3 core	No.	1	R	R
E.3.4.2	2.5mm ² x 4 core	No.	1	R	R
E.3.4.3	4mm ² x 4 core	No.	1	R	R
E.3.4.4	6mm ² x 4 core	No.	1	R	R
E.3.4.5	10mm ² x 4 core	No.	1	R	R
E.3.4.6	16mm ² x 4 core	No.	1	R	R
E.3.4.7	25mm ² x 4 core	No.	1	R	R
E.3.4.8	35mm ² x 4 core	No.	1	R	R
E.3.4.9	50mm ² x 4 core	No.	1	R	R
E.3.4.10	70mm ² x 4 core	No.	1	R	R
E.3.4.11	95mm ² x 4 core	No.	1	R	R
E.3.4.12	120mm ² x 4 core	No.	1	R	R
E.3.4.13	150mm ² x 4 core	No.	1	R	R
E.3.3.14	185mm ² x 4 core	No.	1	R	R
	<u>CABLE SUPPORT</u>				
E.3.5	<u>Allow for all the costs and expenses in connection with the design, manufacture, routine testing, factory acceptance testing (if indicated), supply, delivery, offloading and storage of the following</u> <u>Heavy Duty Hot Dipped Galvanised Mild Steel cable ladder including mounting brackets, fasteners and supports.</u>				
E.3.5.1	50 x 50mm (W x H)	No.	1	R	R
E.3.5.2	100 x 100mm (W x H)	No.	1	R	R
E.3.5.3	200 x 100mm (W x H)	No.	1	R	R
E.3.5.4	300 x 100mm (W x H)	No.	1	R	R
E.3.5.5	600 x 100mm (W x H)	No.	1	R	R
E.3.5.6	800 x 100mm (W x H)	No.	1	R	R
E.3.5.7	1000 x 100mm (W x H)	No.	1	R	R

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SECTION E - ELECTRICAL – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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E.3.6.		<u>Heavy Duty Hot Dipped Galvanised Mild Steel cable ladder Tee off / 90° deg horizontal elbow / internal Riser / dropper pieces including mounting brackets, fasteners and supports.</u>				
E.3.6.1		50 x 50mm (W x H)	No.	1	R	R
E.3.6.2		100 x 100mm (W x H)	No.	1	R	R
E.3.6.3		200 x 100mm (W x H)	No.	1	R	R
E.3.6.4		300 x 100mm (W x H)	No.	1	R	R
E.3.6.5		600 x 100mm (W x H)	No.	1	R	R
E.3.6.6		800 x 100mm (W x H)	No.	1	R	R
E.3.6.7		1000 x 100mm (W x H)	No.	1	R	R
E.3.7		<u>Hot Dipped Galvanised Wire Mesh Cable Tray including mounting brackets, fasteners and supports</u>				
E.3.7.1		50 x 50mm (W x H)	No.	1	R	R
E.3.7.2		100 x 100mm (W x H)	No.	1	R	R
E.3.7.3		200 x 100mm (W x H)	No.	1	R	R
E.3.7.4		300 x 100mm (W x H)	No.	1	R	R
E.3.7.5		600 x 100mm (W x H)	No.	1	R	R
E.3.7.6		800 x 100mm (W x H)	No.	1	R	R
E.3.7.7		1000 x 100mm (W x H)	No.	1	R	R
E.3.8		<u>Hot Dipped Galvanised Steel Conduit - complete with couplers, boxes and all other ancillary equipment.</u>				
E.3.8.1		20mm diameter	m	1	R	R
E.3.8.2		25mm diameter	m	1	R	R
E.3.8.3		32mm Diameter	m	1	R	R
E.4.		<u>MEDIUM VOLTAGE NETWORK</u>				
		<u>(SUPPLY AND INSTALL)</u>				
4,1		<u>1 Core, 500mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)</u>				
(a)		6.6/11kV 1 CORE ARMoured CABLE	m	1	R	R
4,2		<u>1 Core, 400mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)</u>				
(a)		6.6/11kV 1 CORE ARMoured CABLE	m	1	R	R
4,3		<u>3 Core, 300mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)</u>				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
4,4		<u>3 Core, 240 mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)</u>				

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(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
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SECTION E - ELECTRICAL – continued

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4,5		3 Core, 150mm ² , Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
4,6		3 Core, 70mm ² , Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
4,7		3 Core, 300mm ² Aluminium SWA XLPE manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
4,8		3 Core, 240mm ² Aluminium SWA XLPE manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
4,9		3 Core, 185mm ² Aluminium SWA XLPE manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
4,10		3 Core, 150mm ² Aluminium SWA XLPE manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
4,11		Cable work (XLPE/PILC)				
(a)		Indoor termination 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(b)		Cable joint 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(c)		Indoor termination 6.6/11kV for XLPE Cable (35 mm ² to 500 mm ²) single core	No.	1	R	R
(d)		Cable joint 6.6/11kV for XLPE Cable (35 mm ² to 500 mm ²) single core	No.	1	R	R
(e)		Indoor termination 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(f)		Cable joint 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(g)		Indoor termination 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
(h)		Cable joint 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
(i)		Indoor termination 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
(j)		Cable joint 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
(k)		Outdoor termination 11kV for ABC	No.	1	R	R
(l)		Outdoor Cable joint for 11kV ABC	No.	1	R	R
(m)		Outdoor termination 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(n)		Outdoor termination 6.6/11kV for XLPE Cable (35 mm ² to 500 mm ²) single core	No.	1	R	R

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(o)		Outdoor termination 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
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SECTION E - ELECTRICAL – continued

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E.5		MINISUBSTATION				
E.5.1		<u>Minisubstation: supply new/ replacement. Allow for the design, manufacture, test, supply and install. To comply with SANS spec. of the size:</u>				
E.5.1.1		1000 kVA MINIATURE SUBSTATION COMPLETE WITH 1500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
E.5.1.2		650 kVA MINIATURE SUBSTATION COMPLETE WITH 1000A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
E.5.1.3		500 kVA MINIATURE SUBSTATION COMPLETE WITH 800A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
E.5.1.4		315 kVA MINIATURE SUBSTATION COMPLETE WITH 500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
E.5.1.5		200 kVA MINIATURE SUBSTATION COMPLETE WITH 300A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
E.5.1.6		315 kVA MINIATURE SUBSTATION COMPLETE WITH 500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
E.5.1.7		1000 kVA MINIATURE SUBSTATION COMPLETE WITH 1500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
E.5.1.8		650 kVA MINIATURE SUBSTATION COMPLETE WITH 1000A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
E.5.1.9		500 kVA MINIATURE SUBSTATION COMPLETE WITH 800A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
E.5.1.10		315 kVA MINIATURE SUBSTATION COMPLETE WITH 500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
E.5.1.11		200 kVA MINIATURE SUBSTATION COMPLETE WITH 300A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
E.5.1.12		PRE-CAST CONCRETE FOUNDATION FOR MINIATURE SUBSTATION	No.	1	R	R
E.5.2		EARTH MAT				
E.5.2.1		Earth mat (complete with connection to Minisub) and certificate	No.	1	R	R
E.5.3		DISCONNECT THE OLD MINISUBSTATION				
E.5.3.1		DISCONNECTING THE OLD MINISUBSTATION	No.	1	R	R

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E.5.4		SERVICE/ MAINTENANCE OF MINI SUBSATION/ TRANSFORMER. <u>Standard routine Service to include Change of consumables, test of compontents, for the size:</u>				
E.5.4.1		50KVA (11 000V/6600/400V)	No.	1	R	R
E.5.4.2		150KVA (11 000V/6600/400V)	No.	1	R	R
E.5.4.3		200 kVA 3 PHASE (11 000V/6600/400V)	No.	1	R	R
E.5.4.4		315 kVA 3 PHASE (11 000V/6600/400V)	No.	1	R	R
E.5.4.5		500 KVA 3 PHASE (11 000V/6600/400V)	No.	1	R	R
E.5.4.6		650 KVA 3 PHASE (11 000V/6600/400V)	No.	1	R	R
E.5.4.7		800 Kva 3 PHASE (11 000V/6600/400V)	No.	1	R	R
E.5.4.8		1000 Kva 3 phase (11 000V/6600/400V)	No.	1	R	R
E.5.4.9		Up to 2000 KVA (11 000V/6600/400V)	No.	1	R	R

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E.6		<u>DIESEL GENERATOR (POWER SUPPLY EQUIPMENT)</u> <u>Design, manufacture , fabricate, assembly, Supply, delivery and on site installation in compliance with SANS specification, efficience performance, low fuel consumption, vandal proof Structure and user friendly. To consists of Diesel Engine, Engine mounted Instrument Panel fitted with and having digital display, Alternator, Base Frame & Foundation, Fuel Tank, Exhaust System, Starting System, Control Cables, Earthing</u> <u>For sizes specified below:</u>				
E.6.1		20 kVA generator	No.	1	R	R
E.6.2		30 kVA generator	No.	1	R	R
E.6.3		60 kVA generator set	No.	1	R	R
E.6.4		100 kVA generator set	No.	1	R	R
E.6.5		150 kVA generator set	No.	1	R	R
E.6.6		200 kVA generator set	No.	1	R	R
E.6.7		250 kVA generator set	No.	1	R	R
E.6.8		300 kVA generator set	No.	1	R	R
E.6.9		400 kVA generator set	No.	1	R	R
E.6.10		500 kVA generator set	No.	1	R	R
E.6.11		800 kVA generator set	No.	1	R	R
E.6.12		1000 KVA generator set	No.	1	R	R
E.6.13		1400 kVA generator set	No.	1	R	R
E.6.14		From 1401 to 2000 kVA generator set	No.	1	R	R
		<u>SERVICING OF DIESEL GENERATOR.</u> <u>Routine Servicing/ maintenance of DG, test, set with change of consumables /filters/ Mobil oil, tesl componensts, as per standard. For Generator Size.</u>				
E.6.1		20 kVA generator	No.	1	R	R
E.6.2		30 kVA generator	No.	1	R	R
E.6.3		60 kVA generator set	No.	1	R	R
E.6.4		100 kVA generator set	No.	1	R	R
E.6.5		150 kVA generator set	No.	1	R	R

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E.6.6		200 kVA generator set	No.	1	R	R
E.6.7		250 kVA generator set	No.	1	R	R
E.6.8		300 kVA generator set	No.	1	R	R
E.6.9		400 kVA generator set	No.	1	R	R
E.6.10		500 kVA generator set	No.	1	R	R
E.6.11		800 kVA generator set	No.	1	R	R
E.6.12		1000 KVA generator set	No.	1	R	R
E.6.13		1400 kVA generator set	No.	1	R	R
E.6.14		From 1401 to 2000 kVA generator set	No.	1	R	R
		<u>CERTIFICATE OF COMPLIANCE (CoC)</u>				
		Test and issue CoC	No.	1	R	R

TOTAL SECTION E TO SUMMARY

SECTION G – INSTRUMENTATION

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
G.1		DR300 POCKET COLORIMETER, CHLORINE, FREE + TOTAL, MR, WITH BOX or similar	No.	1	R	R
G.2		GENERAL USE PH PROBE: MODELS PHC20101 or similar	No.	1	R	R
G.3		HACH 2100Q PORTABLE TURBIDIMETER or similar	No.	1	R	R
G.4		HACH CDC401 LABORATORY 4-POLES GRAPHITE CONDUCTIVITY CELL, 1m CABLE or similar	No.	1	R	R
G.5		HACH HQ40D PORTABLE MULTI METER PH, CONDUCTIVITY, SALINITY, TDS, DISSOLVED OXYGEN (DO), ORP AND ISE FOR WATER or similar	No.	1	R	R
G.6		DR 2800 PORTABLE SPECTROPHOTOMETER or similar	No.	1	R	R

TOTAL SECTION G TO SUMMARY

SECTION H - SUPPLY ONLY

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
H.1		PUMPS Supply and delivery ONLY of the pumps listed below (or similar to match pump performance and size)				
H.1.1		Solids Handling Pumps Materials of Construction: Cast Iron, CD4MCu, Ductile Iron, Stainless Steel Max Capacity: 3400 GPM Max Head: 130' (40m) Max Solids: 3" (76mm)				
H.1.1.1		2" (50x 50mm)	No.	1	R	R
H.1.1.2		3" (80 x80m)	No.	1	R	R
H.1.1.3		4" (100x100mm)	No.	1	R	R

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H.1.1.4		6" (150 x 150mm)	No.	1	R	R
H.1.1.5		8" (200x 200mm)	No.	1	R	R
H.1.1.6		10" (250x250mm)	No.	1	R	R
		<u>Materials of Construction: Cast Iron, CD4MCu, Stainless Steel</u>				
		<u>Max Capacity: 1900 GPM</u>				
		<u>Max Head: 325' (99m)</u>				
		<u>Max Solids: 3" (76mm)</u>				
H.1.1.6		3" (80mm)	No.	1	R	R
H.1.1.6		4" (100mm)	No.	1	R	R
H.1.1.6		6" (150mm)	No.	1	R	R
H.1.2		<u>Solids Handling Pumps</u>				
		<u>Bare Shaft Self Priming Pumps</u>				
		<u>Materials of Construction: Ductile Iron, 17-4 PH Stainless Steel</u>				
		<u>Seal: Silicon Carbide/Viton</u>				
		-				
H.1.2.1		3" Flanged, Max Flow: 550GPM, Max Head: 132' TDH, Max Solid Size: 2.5"	No.	1	R	R
H.1.2.2		4" Flanged, Max Flow: 900GPM, Max Head: 150' TDH, Max Solid Size: 3"	No.	1	R	R
H.1.2.3		6" Flanged, Max Flow: 1680GPM, Max Head: 170' TDH, Max Solid Size: 3"	No.	1	R	R
H.1.2.4		8" Flanged, Max Flow: 2880GPM, Max Head: 216' TDH, Max Solid Size: 3"	No.	1	R	R
H.1.3		<u>Centrifugal Pump</u>				
		<u>Volute Casing: Cast Iron</u>				
		<u>Impeller: Cast Iron</u>				
		<u>Shaft: Carbon (*Chrome) St</u>				
		<u>Shaft Sleeve: St Steel</u>				
		<u>Seal: Packed Gland</u>				
		<u>Size:</u>				
H.1.3.1		DN in: 40mm; DN out: 25mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
H.1.3.2		DN in: 40mm; DN out: 25mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
H.1.3.3		DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 125mm; Flow<168/min	No.	1	R	R
H.1.3.4		DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 160mm; Flow<386l/min	No.	1	R	R
H.1.3.5		DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 200mm; Flow<420l/min	No.	1	R	R
H.1.3.6		DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 250mm; Flow<368l/min	No.	1	R	R
H.1.3.7		DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 125mm; Flow<638l/min	No.	1	R	R
H.1.3.8		DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 160mm; Flow<620l/min	No.	1	R	R
H.1.3.9		DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 200mm; Flow<604l/min	No.	1	R	R
H.1.3.10		DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 250mm; Flow<638l/min	No.	1	R	R

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SECTION H - SUPPLY ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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H.1.3.11		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 125mm	No.	1	R	R
H.1.3.12		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
H.1.3.13		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
H.1.3.14		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
H.1.3.15		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
H.1.3.16		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 125mm	No.	1	R	R
H.1.3.17		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
H.1.3.18		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
H.1.3.19		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
H.1.3.20		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
H.1.3.21		DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 125mm	No.	1	R	R
H.1.3.22		DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
H.1.3.23		DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
H.1.3.24		DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
H.1.3.25		DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
H.1.3.26		DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
H.1.3.27		DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
H.1.3.28		DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
H.1.3.29		DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
H.1.3.30		DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 400mm	No.	1	R	R
H.1.3.31		DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
H.1.3.32		DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
H.1.3.33		DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
H.1.3.34		DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
H.1.3.35		DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 400mm	No.	1	R	R
H.1.3.36		DN in: 150mm; DN out: 125mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
H.1.3.37		DN in: 150mm; DN out: 125mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
H.1.3.38		DN in: 150mm; DN out: 125mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
H.1.3.39		DN in: 150mm; DN out: 125mm; Nominal Impeller Dia.: 400mm	No.	1	R	R
H.1.3.40		DN in: 200mm; DN out: 150mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
H.1.3.41		DN in: 200mm; DN out: 150mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
H.1.3.42		DN in: 200mm; DN out: 150mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
H.1.3.43		DN in: 200mm; DN out: 150mm; Nominal Impeller Dia.: 400mm	No.	1	R	R
H.1.4		<u>Dry Installed Pumps (Horizontal single- or two-stage centrifugal pumps with volute casing)</u>				
		<u>Volute Casing: Cast Iron</u>				
		<u>Impeller: Cast Iron</u>				
		<u>Shaft: Carbon St</u>				
		<u>Shaft Sleeve: Cast Iron</u>				
		<u>Seal: Packed Gland</u>				
		<u>Size:</u>				

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H.1.4.1		80-40/2	No.	1	R	R
H.1.4.2		100-40	No.	1	R	R
H.1.4.3		100-50/2	No.	1	R	R
H.1.4.4		125-40	No.	1	R	R
H.1.4.5		125-50/2	No.	1	R	R
H.1.4.6		150-50	No.	1	R	R
H.1.4.7		200-23	No.	1	R	R
H.1.4.8		200-33	No.	1	R	R

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SECTION H - SUPPLY ONLY – continued

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H.1.4.9		200-40	No.	1	R	R
H.1.4.10		200-50	No.	1	R	R
H.1.4.11		250-29	No.	1	R	R
H.1.4.12		250-33	No.	1	R	R
H.1.4.13		250-40	No.	1	R	R
H.1.4.14		250-50	No.	1	R	R
H.1.4.15		300-35	No.	1	R	R
H.1.5		<u>Dry Installed Single-Stage axially split volute casing pumps for horizontal or vertical installation:</u>				
		<u>Volute Casing: Cast Iron</u>				
		<u>Impeller: St Steel</u>				
		<u>Shaft: Chrome Steel</u>				
		<u>Shaft Sleeve: Chrome Steel</u>				
		<u>Seal: Packed Gland</u>				
		<u>Size (DN-Impeller):</u>				
H.1.5.1		80-210A*	No.	1	R	R
H.1.5.2		80-270A	No.	1	R	R
H.1.5.3		30-370A*	No.	1	R	R
H.1.5.4		100-250A*	No.	1	R	R
H.1.5.5		100-310A*	No.	1	R	R
H.1.5.6		100-375A	No.	1	R	R
H.1.5.7		125-230A	No.	1	R	R
H.1.5.8		125-290A	No.	1	R	R
H.1.5.9		125-365A	No.	1	R	R
H.1.5.10		125-500A	No.	1	R	R
H.1.5.11		150-290A	No.	1	R	R
H.1.5.12		150-360A	No.	1	R	R
H.1.5.13		150-460A	No.	1	R	R
H.1.5.14		150-605A	No.	1	R	R
H.1.5.15		200-320A	No.	1	R	R
H.1.5.16		200-420A	No.	1	R	R
H.1.5.17		200-520A	No.	1	R	R
H.1.5.18		200-670A	No.	1	R	R

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H.1.5.19		250-370A	No.	1	R	R
H.1.5.20		250-480A	No.	1	R	R
H.1.5.21		250-600A	No.	1	R	R
H.1.5.22		300-300A	No.	1	R	R
H.1.5.23		300-435A	No.	1	R	R
H.1.5.24		300-560A	No.	1	R	R
H.1.5.25		300-700A	No.	1	R	R
H.1.5.26		350-360A	No.	1	R	R
H.1.5.27		350-430A	No.	1	R	R
H.1.5.28		350-510A	No.	1	R	R
H.1.6		<u>Ring-section pumps - Multistage horizontal high-pressure centrifugal pumps in ring-section design with split suction, discharge and stage casings:</u>				
		<u>Volute Casing: Cast Iron</u>				
		<u>Impeller: Cast Iron</u>				
		<u>Shaft: Carbon Steel</u>				
		<u>Shaft Sleeve: Cast Iron</u>				

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SECTION H - SUPPLY ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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SECTION H BROUGHT FORWARD FROM PREVIOUS PAGE

		<u>Seal: Packed Gland</u>				
		<u>Size (Discharge Nominal Bore/Stage):</u>				
H.1.6.1		32/2	No.	1	R	R
H.1.6.2		32/3	No.	1	R	R
H.1.6.3		32/4	No.	1	R	R
H.1.6.4		32/5	No.	1	R	R
H.1.6.5		32/6	No.	1	R	R
H.1.6.6		32/7	No.	1	R	R
H.1.6.7		32/8	No.	1	R	R
H.1.6.8		32/9	No.	1	R	R
H.1.6.9		32/10	No.	1	R	R
H.1.6.10		40/2	No.	1	R	R
H.1.6.11		40/3	No.	1	R	R
H.1.6.12		40/4	No.	1	R	R
H.1.6.13		40/5	No.	1	R	R
H.1.6.14		40/6	No.	1	R	R
H.1.6.15		40/7	No.	1	R	R
H.1.6.16		50/2	No.	1	R	R
H.1.6.17		50/3	No.	1	R	R
H.1.6.18		50/4	No.	1	R	R
H.1.6.19		50/5	No.	1	R	R
H.1.6.20		50/6	No.	1	R	R
H.1.6.21		50/7	No.	1	R	R
H.1.6.22		65/2	No.	1	R	R
H.1.6.23		65/3	No.	1	R	R

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H.1.6.24		65/4	No.	1	R	R
H.1.6.25		65/5	No.	1	R	R
H.1.6.26		65/6	No.	1	R	R
H.1.6.27		65/7	No.	1	R	R
H.1.6.28		65/8	No.	1	R	R
H.1.6.29		65/9	No.	1	R	R
H.1.6.30		65/10	No.	1	R	R
H.1.6.31		80/2	No.	1	R	R
H.1.6.32		80/3	No.	1	R	R
H.1.6.33		80/4	No.	1	R	R
H.1.6.34		80/5	No.	1	R	R
H.1.6.35		80/6	No.	1	R	R
H.1.6.36		80/7	No.	1	R	R
H.1.6.37		80/8	No.	1	R	R
H.1.6.38		80/9	No.	1	R	R
H.1.6.39		80/10	No.	1	R	R
H.1.6.40		100/2	No.	1	R	R
H.1.6.41		100/3	No.	1	R	R
H.1.6.42		100/4	No.	1	R	R
H.1.6.43		100/5	No.	1	R	R
H.1.6.44		100/6	No.	1	R	R
H.1.6.45		100/7	No.	1	R	R
H.1.6.46		100/8	No.	1	R	R
H.1.6.47		100/9	No.	1	R	R

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SECTION H - SUPPLY ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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SECTION H BROUGHT FORWARD FROM PREVIOUS PAGE

H.1.6.48		125/2	No.	1	R	R
H.1.6.49		125/3	No.	1	R	R
H.1.6.50		125/4	No.	1	R	R
H.1.6.51		125/5	No.	1	R	R
H.1.6.52		125/6	No.	1	R	R
H.1.6.53		150/2	No.	1	R	R
H.1.6.54		150/3	No.	1	R	R
H.1.6.55		150/4	No.	1	R	R
H.1.6.56		150/5	No.	1	R	R

H.1.7		<u>Submersible Motor Pumps (Vertical single-stage fully floodable submersible motor pumps in close-coupled design, with integrated level switch)</u> <u>Volute Casing: Polypropylene</u> <u>Impeller: Polypropylene</u> <u>Diffuser: N/A</u> <u>Shaft: St Steel</u> <u>Shaft Sleeve: N/A</u> <u>Seal: Mechanical</u>				
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		<u>Size:</u>				
H.1.7.1		Head: 6.5m Max; Flow: 10m3/h Max; 2m Immersion Depth	No.	1	R	R
H.1.7.2		Head: 10m Max; Flow: 12m3/h Max; 2m Immersion Depth	No.	1	R	R
H.1.7.3		Head: 12.5m Max; Flow: 14m3/h Max; 2m Immersion Depth	No.	1	R	R
H.1.7.4		Head: 8.5m Max; Flow: 16.5m3/h Max; 2m Immersion Depth	No.	1	R	R
H.1.8		<u>Submersible Motor Pumps (Vertical single-stage submersible motor pumps for waste water in close-coupled design for wet installation)</u>				
		<u>Size:</u>				
H.1.8.1		230V; Impeller dia.:100mm; DN50	No.	1	R	R
H.1.8.2		230V; Impeller dia.:110mm; DN50	No.	1	R	R
H.1.8.3		230V; Impeller dia.:120mm; DN50	No.	1	R	R
H.1.8.4		230V; Impeller dia.:130mm; DN50	No.	1	R	R
H.1.8.5		230V; Impeller dia.:110mm; DN65	No.	1	R	R
H.1.8.6		230V; Impeller dia.:120mm; DN65	No.	1	R	R
H.1.8.7		230V; Impeller dia.:130mm; DN65	No.	1	R	R
H.1.8.8		400V; Impeller dia.:100mm; DN50	No.	1	R	R
H.1.8.9		400V; Impeller dia.:110mm; DN50	No.	1	R	R
H.1.8.10		400V; Impeller dia.:120mm; DN50	No.	1	R	R
H.1.8.11		400V; Impeller dia.:130mm; DN50	No.	1	R	R
H.1.8.12		400V; Impeller dia.:110mm; DN65	No.	1	R	R
H.1.8.13		400V; Impeller dia.:120mm; DN65	No.	1	R	R
H.1.8.14		400V; Impeller dia.:130mm; DN65	No.	1	R	R
H.1.9		<u>Submersible Motor Pumps (Vertical single-stage submersible motor pumps for wet installation with cutter)</u>				
		<u>Size:</u>				
H.1.9.1		S-Impeller; 32mm discharge dia.; Size 160; 160mm Impeller dia.	No.	1	R	R
H.1.9.2		S-Impeller; 50mm discharge dia.; Size 172; 120mm Impeller dia.	No.	1	R	R
H.1.9.3		S-Impeller; 50mm discharge dia.; Size 172; 140mm Impeller dia.	No.	1	R	R
H.1.9.4		S-Impeller; 50mm discharge dia.; Size 172; 160mm Impeller dia.	No.	1	R	R
H.1.9.5		S-Impeller; 50mm discharge dia.; Size 222; 175mm Impeller dia.	No.	1	R	R
H.1.9.7		F-Impeller; 50mm discharge dia.; Size 170; 90mm Impeller dia.	No.	1	R	R
H.1.9.8		F-Impeller; 50mm discharge dia.; Size 170; 107mm Impeller dia.	No.	1	R	R
H.1.9.9		F-Impeller; 50mm discharge dia.; Size 170; 120mm Impeller dia.	No.	1	R	R
H.1.9.10		F-Impeller; 50mm discharge dia.; Size 170; 130mm Impeller dia.	No.	1	R	R

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SECTION H - SUPPLY ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION H BROUGHT FORWARD FROM PREVIOUS PAGE						
H.1.9.11		F-Impeller; 50mm discharge dia.; Size 170; 140mm Impeller dia.	No.	1	R	R
H.1.9.12		F-Impeller; 50mm discharge dia.; Size 220; 130mm Impeller dia.	No.	1	R	R

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H.1.9.13	F-Impeller; 50mm discharge dia.; Size 220; 140mm Impeller dia.	No.	1	R	R
H.1.9.14	F-Impeller; 50mm discharge dia.; Size 220; 150mm Impeller dia.	No.	1	R	R
H.1.9.15	F-Impeller; 50mm discharge dia.; Size 220; 160mm Impeller dia.	No.	1	R	R
H.1.9.16	F-Impeller; 50mm discharge dia.; Size 220; 170mm Impeller dia.	No.	1	R	R
H.1.9.17	F-Impeller; 50mm discharge dia.; Size 220; 180mm Impeller dia.	No.	1	R	R
H.1.9.18	F-Impeller; 65mm discharge dia.; Size 170; 120mm Impeller dia.	No.	1	R	R
H.1.9.19	F-Impeller; 65mm discharge dia.; Size 170; 128mm Impeller dia.	No.	1	R	R
H.1.9.20	F-Impeller; 65mm discharge dia.; Size 170; 136mm Impeller dia.	No.	1	R	R
H.1.9.21	F-Impeller; 65mm discharge dia.; Size 170; 146mm Impeller dia.	No.	1	R	R
H.1.9.22	F-Impeller; 65mm discharge dia.; Size 170; 152mm Impeller dia.	No.	1	R	R
H.1.9.23	F-Impeller; 65mm discharge dia.; Size 170; 158mm Impeller dia.	No.	1	R	R
H.1.9.24	F-Impeller; 65mm discharge dia.; Size 220; 112mm Impeller dia.	No.	1	R	R
H.1.9.25	F-Impeller; 65mm discharge dia.; Size 220; 125mm Impeller dia.	No.	1	R	R
H.1.9.26	F-Impeller; 65mm discharge dia.; Size 220; 135mm Impeller dia.	No.	1	R	R
H.1.9.27	F-Impeller; 65mm discharge dia.; Size 220; 145mm Impeller dia.	No.	1	R	R
H.1.9.28	F-Impeller; 65mm discharge dia.; Size 220; 155mm Impeller dia.	No.	1	R	R
H.1.9.29	F-Impeller; 65mm discharge dia.; Size 220; 165mm Impeller dia.	No.	1	R	R
H.1.9.30	F-Impeller; 65mm discharge dia.; Size 220; 175mm Impeller dia.	No.	1	R	R
H.1.9.31	F-Impeller; 65mm discharge dia.; Size 220; 185mm Impeller dia.	No.	1	R	R
H.1.9.32	F-Impeller; 65mm discharge dia.; Size 220; 195mm Impeller dia.	No.	1	R	R
H.1.9.33	F-Impeller; 80mm discharge dia.; Size 220; 120mm Impeller dia.	No.	1	R	R
H.1.9.34	F-Impeller; 80mm discharge dia.; Size 220; 135mm Impeller dia.	No.	1	R	R
H.1.9.35	F-Impeller; 80mm discharge dia.; Size 220; 150mm Impeller dia.	No.	1	R	R
H.1.9.36	F-Impeller; 80mm discharge dia.; Size 220; 165mm Impeller dia.	No.	1	R	R
H.1.9.37	F-Impeller; 80mm discharge dia.; Size 220; 180mm Impeller dia.	No.	1	R	R
H.1.9.38	F-Impeller; 80mm discharge dia.; Size 220; 195mm Impeller dia.	No.	1	R	R
H.1.9.39	F-Impeller; 80mm discharge dia.; Size 220; 210mm Impeller dia.	No.	1	R	R
H.1.9.40	F-Impeller; 100mm discharge dia.; Size 220; 120mm Impeller dia.	No.	1	R	R
H.1.9.41	F-Impeller; 100mm discharge dia.; Size 220; 135mm Impeller dia.	No.	1	R	R
H.1.9.42	F-Impeller; 100mm discharge dia.; Size 220; 150mm Impeller dia.	No.	1	R	R
H.1.9.43	F-Impeller; 100mm discharge dia.; Size 220; 165mm Impeller dia.	No.	1	R	R
H.1.9.44	F-Impeller; 100mm discharge dia.; Size 220; 180mm Impeller dia.	No.	1	R	R
H.1.9.45	F-Impeller; 100mm discharge dia.; Size 220; 195mm Impeller dia.	No.	1	R	R
H.1.9.46	F-Impeller; 100mm discharge dia.; Size 220; 210mm Impeller dia.	No.	1	R	R
H.1.9.47	D-Impeller; 80mm discharge dia.; Size 220; 154mm Impeller dia.	No.	1	R	R
H.1.9.48	D-Impeller; 80mm discharge dia.; Size 220; 168mm Impeller dia.	No.	1	R	R
H.1.9.49	D-Impeller; 80mm discharge dia.; Size 220; 180mm Impeller dia.	No.	1	R	R

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H.1.9.50		D-Impeller; 80mm discharge dia.; Size 220; 190mm Impeller dia.	No.	1	R	R
H.1.9.51		D-Impeller; 100mm discharge dia.; Size 220; 195mm Impeller dia.	No.	1	R	R
H.1.9.52		D-Impeller; 100mm discharge dia.; Size 220; 209mm Impeller dia.	No.	1	R	R
H.1.9.53		D-Impeller; 100mm discharge dia.; Size 220; 220mm Impeller dia.	No.	1	R	R
H.1.10		- <u>Other centrifugal pumps- Manufacturer to be specified and pump performance</u>				
H.1.10.1		3" or 80mm pump with head up to 30m	No.	1	R	R

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H.1.10.2		4" pump, head up to 30m	No.	1	R	R
H.1.10.3		6" Pump, Head up to 30m	No.	1	R	R
H.1.10.4		8" pump, Head up to 30m	No.	1	R	R
H.1.10.5		10" pump, Head up to 30m	No.	1	R	R
H.1.10.6		12" pump, 4" pump, up to 30m	No.	1	R	R
H.1.11		<u>Submersible Pump</u>				
H.1.11.1		50Hz	No.	1	R	R
H.1.11.2		Power rate 1.5 kw – 2.4 kw with discharge size from 50mm -80mm, max Q- 55l/s , max head 40m	No.	1	R	R
H.1.11.3		Power rate 1.3 kw – 2.4 kw with discharge size of 80mm, max Q- 55l/s , max head 40m	No.	1	R	R
H.1.11.4		3.1 kw – 4.5 kw with discharge size from 50mm -80mm, max Q- 70l/s , max head 50m	No.	1	R	R
H.1.11.5		4,7 kw – 8,5 kw with discharge size from 50mm -80mm, max Q- 90l/s , max head 70m	No.	1	R	R
H.1.11.6		Power rate from 7,5 kw -15 kw, discharge size from 80mm to 250mm,	No.	1	R	R
H.1.11.7		Power rate 15 kw – 22 kw, discharge 100 to 250mm.	No.	1	R	R
H.1.11.8		Power rate 15 kw – 22 kw, discharge 100 to 300mm.	No.	1	R	R
H.1.11.9		Power rate 37 kw – 50kw, discharge 150 to 350mm.	No.	1	R	R
H.1.11.10		Power rate 50 kw – 70 kw, discharge 150 to 350mm.	No.	1	R	R
H.1.11.11		Power rate 48 kw – 80 kw, discharge 150 to 350mm.	No.	1	R	R
H.1.11.12		Power rate 80 kw – 105 kw, discharge 150 to 350mm.	No.	1	R	R
H.1.11.13		Power rate 70 kw – 150 kw, discharge size 200mm.	No.	1	R	R
H.1.11.14		Power rate 150kw – 215 kw, discharge size 200mm.	No.	1	R	R
H.1.11.15		Power rate 58 kw – 100 kw, discharge size 300mm.	No.	1	R	R
H.1.11.17		Power rate 40 kw – 150 kw, discharge size 500mm.	No.	1	R	R
H.1.11.18		Power rate 150kw – 310 kw, discharge size 500mm	No.	1	R	R
H.1.12		<u>Other Submersible Pump. specify manufactures and pump performance</u>				
H.1.12.1		1.5kw submersible	No.	1	R	R
H.1.12.2		2,4kw submersible	No.	1	R	R

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H.1.12.3		3,1kw submersible	No.	1	R	R
H.1.12.4		4,5 kw submersible	No.	1	R	R

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H.1.12.5		7,5 kw submersible	No.	1	R	R
H.1.12.6		11kw submersible	No.	1	R	R
H.1.12.7		15kw submersible	No.	1	R	R
H.1.12.8		22,5kw submersible	No.	1	R	R
H.1.12.9		30kw submersible	No.	1	R	R
H.1.12.10		45kw submersible	No.	1	R	R
H.1.12.11		60kw submersible	No.	1	R	R
H.1.12.12		90 kw submersible	No.	1	R	R

H.1.13 DEWATERING/SLUDGE REMOVAL PUMPS

H.1.13.1		Portable Centrifugal Engine driven pump mouted on a trailer, solid handling, Size 250mm Suction and 250mm discharge, Max capacity 221 lps, Max head 43m, casing cast iron , imperler ductile iron, Max temperature 71C, complete with suction 20 suction pipe and 50 m discharge pipe , Diesel Engine, include trailer road worthy and license registration.	No.	1	R	R
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H.1.13.2		Portable Submersible pump, Solid handling, Maxium head 30m, power range 30kw, 50Hz, discharge size 80mm, high quality submersible cable. 50m 3" discharge pipe, Chain block.	No.	1	R	R
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H.1.14 PORTABLE WATER PUMP

H.1.14.1		Potable water pump, total head 26m, suction head 8m, inlet and outlet dia = 100mm, pumping capacity 1640 lpm, open frame size 735x 536 x 563mm, Engine 4 stroke, petrol, 389cc,fuel tank 6.1 L. max power output @3600rpm.	No.	1	R	R
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H.1.15 OTHER PUMPS

H.1.15.1		Motor driven digital display mettering pump (Chemical dosing pump)	No.	1	R	R
H.1.15.2		Solenoid Driven Chemical dosing and metering pump	No.	1	R	R

H.2 AERATORS

Supply and delivery ONLY of the aerators listed below:

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H.2.1		Surface Aerators: Vertical Shaft Complete set surface aerator for waste water treatment plant including gearbox, electrical motor, base, turbine and fittings, mounted to prevent any movement, capable of transferring required aeration.				
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H.2.1.1		0,55 kw up to 3, 5kw aerator unit.	No.	1	R	R
H.2.1.2		3,6 kw to 7,5kw aerator unit	No.	1	R	R
H.2.1.3		7,6 kw up to 11 kw aerator unit	No.	1	R	R
H.2.1.4		11kw up to 15,5 kw aerator unit	No.	1	R	R
H.2.1.5		15,5kw up to 22,5 kw aerator unit	No.	1	R	R
H.2.1.6		22,6 kw up to 30 kw aerator unit	No.	1	R	R
H.2.1.7		31 kw up to 45kw aerator unit	No.	1	R	R
H.2.1.8		46 kw up to 60kw aerator unit	No.	1	R	R
H.2.1.9		61kw up to 80kw aerator unit	No.	1	R	R
H.2.1.10		81kw up to 109kw aerator unit	No.	1	R	R
H.2.1.11		110kw up to 150kw aerator unit	No.	1	R	R
H.2.2		Surface Air Mixer				
		Complete set Mixer for waste water treatment plant including gearbox, electrical motor, baseplate, blade turbine, and fittings, mounted to prevent any movement, capable of transferring required aeration. Electrical motor: IEC certified and SABS approved, 3 phase				
H.2.2.1		0,55 kw up to 3, 5kw Mixer unit.	No.	1	R	R
H.2.2.2		3,6 kw to 7,5kw Mixer unit	No.	1	R	R
H.2.2.3		7,6 kw up to 11 kw Mixer unit	No.	1	R	R
H.2.2.4		11kw up to 15,5 kw Mixer unit	No.	1	R	R
H.2.2.5		15,5kw up to 22,5 kw Mixer unit	No.	1	R	R
H.2.2.6		22,6 kw up to 30 kw Mixer unit	No.	1	R	R
H.2.2.7		31kw up to 45kw Mixer unit	No.	1	R	R
H.2.3		Horizontal Shaft :Surface Aerator				
		Complete set horizontal shaft surface aerator for waste water treatment plant including gearbox, electrical motor, gear baseplate , Brush and fittings, mounted to prevent any movement, capable of transferring required aeration. Electrical motor: IEC certified and SABS approved, 3 phase. Brush: baseplate, brush diameter 700mm and 1000mm.				

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ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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H.2.3.1		5.5kw aerator unit, brush Dia.0.7m, length of Axle up to 3m, 10 kg O2/ h	No.	1	R	R
H.2.3.2		7.5kw aerator unit, brush Dia.0.7m, length of Axle up to 4.5m, 14 kg O2/ h	No.	1	R	R
H.2.3.3		11 kw aerator unit , brush Dia.0.7m, length of Axle up to 6m, 20 kg O2/ h	No.	1	R	R
H.2.3.4		15kw kw aerator unit, brush Dia.1m, length of Axle up to 3m, 27 kg O2/ h	No.	1	R	R
H.2.3.5		22 kwaerator unit, brush Dia.1m, length of Axle up to 4.5m, 40 kg O2/ h	No.	1	R	R
H.2.3.6		30 Kw aerator unit, brush Dia.1m, length of Axle up to 6m, 54 kg O2/ h	No.	1	R	R
H.2.3.7		37 kw aerator unit, brush Dia.1m, length of Axle up to 7.5m, 67 kg O2/ h.	No.	1	R	R
H.2.3.8		45kw aerator unit, , brush Dia.1m, length of Axle up to 9m, 81 kg O2/ h	No.	1	R	R
H.2.3.9		81kw up to 109kw aerator unit	No.	1	R	R

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H.2.4		Floating Aerator Complete set floating aspirating aerator for the water works including gearbox, electrical motor, mounted on floating pontoons and anchored to eliminate movement capable of transferring efficient aeration. Electrical motor: IEC certified and SABS approved, 3 phase. Floating pontoons or float: design and mount gear and motor.				
H.2.4.1		0,55 kw up to 3, 5kw aerator unit.	No.	1	R	R
H.2.4.2		3,6 kw to 7,5kw aerator unit	No.	1	R	R
H.2.4.3		7,6 kw up to 11 kw aerator unit	No.	1	R	R
H.2.4.4		11kw up to 15,5 kw aerator unit	No.	1	R	R
H.2.4.5		15,5kw up to 22 kw aerator unit	No.	1	R	R
H.2.4.6		23 kw up to 30 kw aerator unit	No.	1	R	R
H.2.4.7		31 kw up to 45kw aerator unit	No.	1	R	R
H.2.4.8		46 kw up to 60kw aerator unit	No.	1	R	R
H.2.4.9		61kw up to 80kw aerator unit	No.	1	R	R
H.3		SCREENS Mechanical screen Supply and delivery ONLY of front rake mechanical screen, consists of spaced steel bar screen, chain, frame, discharge chute, gearmotor, conveyer unit, Stainless steel constructed. Screen:				

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SECTION H - SUPPLY ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION H BROUGHT FORWARD FROM PREVIOUS PAGE						
H.3.1		Front Rake Mechanical screen, width up to 0.5m and up to 1.5m deep. Gearmotor rating 0.5 kw.	No.	1	R	R
H.3.2		Front Rake Mechanical screen, width up to 1.0m and depth up to 1.5m. Gearmotor rated 0,7 kw	No.	1	R	R
H.3.3		Front Rake Mechanical screen, width up to 1.0m and depth up to 3m. Gear motor power rated 1 kw	No.	1	R	R
H.3.4		Front Rake Mechanical screen, width up to 2m and depth up to 4m. Gear motor power rated 1.1 kw	No.	1	R	R
H.3.5		Front Rake Mechanical screen, width up to 3.2m and depth up to 5m. Gearmotor power rated 1.5kw	No.	1	R	R
		Hand Rake Screen Supply and delivery ONLY of a Tear drop shape, material components 304/316 stainless screen, (size width x depth)				
H.3.6		1m x 1m	No.	1	R	R
H.3.7		1m x 1,5m	No.	1	R	R
H.3.8		1,5m x 2m	No.	1	R	R
H.3.9		1,5m x 4m	No.	1	R	R
H.4		VALVES				
H.4.1		GATE VALVES (ISOLATION) Supply and delivery ONLY SANS 664 compliant, flanged face to face, cast iron, PN 16 , DN:				
H.4.1.1		a) 50mm dia.	No.	1	R	R

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H.4.1.2		b) 65mm dia.	No.	1	R	R
H.4.1.3		c) 80mm dia.	No.	1	R	R
H.4.1.4		d) 100mm dia.	No.	1	R	R
H.4.1.5		e) 125mm dia.	No.	1	R	R
H.4.1.6		f) 150mm dia.	No.	1	R	R
H.4.1.7		g) 200mm dia.	No.	1	R	R
H.4.1.8		h) 250mm dia.	No.	1	R	R
H.4.1.9		i) 300mm dia.	No.	1	R	R
H.4.1.10		j) 350mm dia.	No.	1	R	R
H.4.1.11		k) 400 mm	No.	1	R	R
H.4.1.12		L) 450mm	No.	1	R	R
H.4.1.13		M) 500mm	No.	1	R	R
H.4.1.14		O) 600mm	No.	1	R	R
H.4.1.15		P) 700mm	No.	1	R	R

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H.4.1.16		Q) 800mm	No.	1	R	R
H.4.1.17		R) 900mm	No.	1	R	R
H.4.2		<u>GATE VALVES (ISOLATION)</u>				
		Supply and delivery ONLY SANS 664 compliant, flanged face to face, cast iron, PN 25 , DN:				
H.4.2.1		a) 50mm dia.	No.	1	R	R
H.4.2.2		b) 65mm dia.	No.	1	R	R
H.4.2.3		c) 80mm dia.	No.	1	R	R
H.4.2.4		d) 100mm dia.	No.	1	R	R
H.4.2.5		e) 125mm dia.	No.	1	R	R
H.4.2.6		f) 150mm dia.	No.	1	R	R
H.4.2.7		g) 200mm dia.	No.	1	R	R
H.4.2.8		h) 250mm dia.	No.	1	R	R
H.4.2.9		i) 300mm dia.	No.	1	R	R
H.4.2.10		j) 350mm dia.	No.	1	R	R
H.4.2.11		k) 400 mm	No.	1	R	R
H.4.2.12		L) 450mm	No.	1	R	R
H.4.2.13		M) 500mm	No.	1	R	R
H.4.2.14		O) 600mm	No.	1	R	R
H.4.2.15		P) 700mm	No.	1	R	R
H.4.2.16		Q) 800mm	No.	1	R	R
H.4.2.17		R) 900mm	No.	1	R	R
H.4.3		<u>GATE SWING CHECK VALVES (NON RETURN)</u>				
		Supply and delivery ONLY SANS 664 compliant, flanged face to face, cast iron, PN 16 , DN:				
H.4.3.1		a) 50mm dia.	No.	1	R	R
H.4.3.2		b) 65mm dia.	No.	1	R	R

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H.4.3.3		c) 80mm dia.	No.	1	R	R
H.4.3.4		d) 100mm dia.	No.	1	R	R
H.4.3.5	12	e) 125mm dia.	No.	1	R	R
H.4.3.6		f) 150mm dia.	No.	1	R	R
H.4.3.7		g) 200mm dia.	No.	1	R	R
H.4.3.8		h) 250mm dia.	No.	1	R	R
H.4.3.9		i) 300mm dia.	No.	1	R	R
H.4.3.10		j) 350mm dia.	No.	1	R	R
H.4.3.11		k) 400 mm	No.	1	R	R
H.4.3.12		L) 450mm	No.	1	R	R
H.4.3.13		M) 500mm	No.	1	R	R
H.4.3.14		O) 600mm	No.	1	R	R
H.4.3.15		P) 700mm	No.	1	R	R
H.4.3.16		Q) 800mm	No.	1	R	R
H.4.3.17		R) 900mm	No.	1	R	R

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H.4.4		<u>GATE SWING CHECK VALVES (NON RETURN)</u> Supply and delivery ONLY SANS 664 compliant, flanged face to face, cast iron, PN 25 , DN:				
H.4.4.1		a) 50mm dia.	No.	1	R	R
H.4.4.2		b) 65mm dia.	No.	1	R	R
H.4.4.3		c) 80mm dia.	No.	1	R	R
H.4.4.4		d) 100mm dia.	No.	1	R	R
H.4.4.5		e) 125mm dia.	No.	1	R	R
H.4.4.6		f) 150mm dia.	No.	1	R	R
H.4.4.7		g) 200mm dia.	No.	1	R	R
H.4.4.8		h) 250mm dia.	No.	1	R	R
H.4.4.9		i) 300mm dia.	No.	1	R	R
H.4.4.10		j) 350mm dia.	No.	1	R	R
H.4.4.11		k) 400 mm	No.	1	R	R
H.4.4.12		L) 450mm	No.	1	R	R
H.4.4.13		M) 500mm	No.	1	R	R
H.4.4.14		O) 600mm	No.	1	R	R
H.4.4.15		P) 700mm	No.	1	R	R
H.4.4.16		Q) 800mm	No.	1	R	R
H.4.4.17		R) 900mm	No.	1	R	R
H.4.5		<u>GATE VALVES (SLUICE VALVES)</u> Supply and delivery ONLY of sluice valves to waterworks pattern, PN16, clockwise closing, non-rising spindle, with cap top, complying with SABS 664 AND FITTED WITH RESILIENT SEAL SEATS AND COUPLINGS				
H.4.5.1		a) 50mm dia.	No.	1	R	R

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H.4.5.2		b) 65mm dia.	No.	1	R	R
H.4.5.3		c) 80mm dia.	No.	1	R	R
H.4.5.4		d) 100mm dia.	No.	1	R	R
H.4.5.5		e) 125mm dia.	No.	1	R	R
H.4.5.6		f) 150mm dia.	No.	1	R	R
H.4.5.7		g) 200mm dia.	No.	1	R	R
H.4.5.8		h) 250mm dia.	No.	1	R	R
H.4.5.9		i) 300mm dia.	No.	1	R	R
H.4.5.10		j) 350mm dia.	No.	1	R	R
H.4.5.11		k) 400 mm	No.	1	R	R
H.4.5.12		L) 450mm	No.	1	R	R
H.4.5.13		M) 500mm	No.	1	R	R
H.4.5.14		O) 600mm	No.	1	R	R
H.4.5.15		P) 700mm	No.	1	R	R
H.4.5.16		Q) 800mm	No.	1	R	R
H.4.5.17		R) 900mm	No.	1	R	R

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H.4.6		<u>GATE VALVES (BUTTERFLY)</u>				
		Supply and delivery ONLY of valves to waterworks pattern, Class16 clockwise closing, non-rising spindle, with cap top, complying with SABS 664 AND FITTED WITH RESILIENT SEAL SEATS				
H.4.6.1		a) 50mm dia.	No.	1	R	R
H.4.6.2		b) 65mm dia.	No.	1	R	R
H.4.6.3		c) 80mm dia.	No.	1	R	R
H.4.6.4		d) 100mm dia.	No.	1	R	R
H.4.6.5		e) 125mm dia.	No.	1	R	R
H.4.6.6		f) 150mm dia.	No.	1	R	R
H.4.6.7		g) 200mm dia.	No.	1	R	R
H.4.6.8		h) 250mm dia.	No.	1	R	R
H.4.6.9		i) 300mm dia.	No.	1	R	R
H.4.6.10		j) 350mm dia.	No.	1	R	R
H.4.6.11		k) 400 mm	No.	1	R	R
H.4.6.12		L) 450mm	No.	1	R	R
H.4.6.13		M) 500mm	No.	1	R	R
H.4.6.14		O) 600mm	No.	1	R	R
H.4.6.15		P) 700mm	No.	1	R	R
H.4.6.16		Q) 800mm	No.	1	R	R
H.4.6.17		R) 900mm	No.	1	R	R
		<u>OTHER VALVES</u>				
H.4.7		Supply and delivery ONLY of approved Pressure control valves:				
H.4.7.1		80NB PN 16	No.	1	R	R

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H.4.7.2		100NB PN 16	No.	1	R	R
H.4.7.3		125NB PN 16	No.	1	R	R
H.4.7.4		150NB PN 16	No.	1	R	R
H.4.7.5		200NB PN 16	No.	1	R	R
H.4.7.6		250NB PN 16	No.	1	R	R
H.4.7.7		300NB PN 16	No.	1	R	R
H.4.7.8		400NB PN 16	No.	1	R	R
H.4.7.9		500NB PN 16	No.	1	R	R
H.4.7.10		600NB PN 16	No.	1	R	R
H.4.7.11		700NB PN 16	No.	1	R	R
H.4.7.12		800NB PN 16	No.	1	R	R
H.4.8		Supply and delivery ONLY of approved Resilient seated Swing Check valves:				
H.4.8.1		50NB PN16	No.	1	R	R
H.4.8.2		65NB PN16	No.	1	R	R
H.4.8.3		80NB PN 16	No.	1	R	R
H.4.8.4		100NB PN 16	No.	1	R	R
H.4.8.5		125NB PN 16	No.	1	R	R

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H.4.8.6		150NB PN 16	No.	1	R	R
H.4.8.7		200NB PN 16	No.	1	R	R
H.4.8.8		250NB PN 16	No.	1	R	R
H.4.8.9		300NB PN 16	No.	1	R	R
H.4.9		Supply and delivery ONLY of approved DOUBLE ECCENTRIC BUTTERFLY VALVE, PN16 756/218-005 Integral seat, IP67 gearbox, DN 200-600, plate disc, short, AISI 420 shaft:				
H.4.9.1		200NB PN16	No.	1	R	R
H.4.9.2		250NB PN16	No.	1	R	R
H.4.9.3		300NB PN 16	No.	1	R	R
H.4.9.4		350NB PN 16	No.	1	R	R
H.4.9.5		400NB PN 16	No.	1	R	R
H.4.9.6		450NB PN 16	No.	1	R	R
H.4.9.7		500NB PN 16	No.	1	R	R
H.4.9.8		600NB PN 16	No.	1	R	R
H.4.10		Supply and delivery ONLY of approved Resilient seated Flanged Ball Check Valves:				
H.4.10.1		50NB PN16	No.	1	R	R
H.4.10.2		65NB PN16	No.	1	R	R
H.4.10.3		80NB PN 16	No.	1	R	R
H.4.10.4		100NB PN 16	No.	1	R	R
H.4.10.5		125NB PN 16	No.	1	R	R

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H.4.10.6		150NB PN 16	No.	1	R	R
H.4.10.7		200NB PN 16	No.	1	R	R
H.4.10.8		250NB PN 16	No.	1	R	R
H.4.10.9		300NB PN 16	No.	1	R	R
H.4.10.10		350NB PN 16	No.	1	R	R
H.4.10.11		400NB PN 16	No.	1	R	R
H.4.10.12		450NB PN 16	No.	1	R	R
H.4.10.13		500NB PN 16	No.	1	R	R
H.4.10.14		600NB PN 16	No.	1	R	R
H.5		GEARBOXES AND OTHER MISCELLANEOUS				
		Supply and delivery ONLY of the following items:				
H.5.1		3 kW Clarifier Gearbox	No.	1	R	R
H.5.2		22 kW Clarifier Gearbox	No.	1	R	R
H.5.3		45 kW Clarifier Gearbox	No.	1	R	R
H.5.4		3 kW Aerator Gearbox	No.	1	R	R
H.5.5		22 kW Aerator Gearbox	No.	1	R	R
H.5.6		45 kW Aerator Gearbox	No.	1	R	R
H.5.7		Gearbox type DF108-738-LA71m4	No.	1	R	R
H.5.8		0.37 kW Gearbox 2.9rpm	No.	1	R	R
H.5.9		Solid Air, 0.15 cubic meter compressor	No.	1	R	R
H.5.10		Spiral Model VF40L lime feeders	No.	1	R	R

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SECTION H - SUPPLY ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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H.5.11		Spherical roller bearings (22222MBKW33 BTC)	No.	1	R	R
H.5.12		Sleves (H322)	No.	1	R	R
H.5.13		Taper Lock Bush (3525 × 100 mm)	No.	1	R	R
H.5.14		SNU U-lock seals (U522)	No.	1	R	R
H.5.15		Couplings 280	No.	1	R	R
H.5.16		Element HRC 280	No.	1	R	R
H.5.17		Dewatering Belts	No.	1	R	R
H.5.18		Sleves (H322)	No.	1	R	R
H.6		V BELTS				
		Supply and delivery ONLY of the following V Belts:				
H.6.1		17 X 1210	No.	1	R	R
H.6.2		17 X 1400	No.	1	R	R
H.6.3		17 X 1450	No.	1	R	R
H.6.4		17 X 1470	No.	1	R	R
H.6.5		17 X 1510	No.	1	R	R
H.6.6		17 X 1530	No.	1	R	R
H.6.7		17 X 1670	No.	1	R	R
H.6.8		17 X 1600	No.	1	R	R

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H.6.9		17 X 1620	No.	1	R	R
H.6.10		17 X 1530	No.	1	R	R
H.6.11		17 X 1670	No.	1	R	R
H.6.12		17 X 1520	No.	1	R	R
H.6.13		17 X 1340	No.	1	R	R
H.6.14		17 X 1620	No.	1	R	R
H.6.15		17 X 1470	No.	1	R	R
H.6.16		17 X 1440	No.	1	R	R
H.6.17		17 X 1430	No.	1	R	R
H.6.18		17 X 1310	No.	1	R	R
H.6.19		17 x 1260	No.	1	R	R
H.6.20		17 X 1570	No.	1	R	R
H.6.21		17 X 1440	No.	1	R	R
H.6.22		17 X 1430	No.	1	R	R
H.6.23		17 x 1420	No.	1	R	R
H.6.24		17 X 1350	No.	1	R	R
H.6.25		17 x 1200	No.	1	R	R
H.6.26		17 X 1250	No.	1	R	R
H.6.27		17 X 1275	No.	1	R	R
H.6.28		17 X 1320	No.	1	R	R
H.6.29		17 X 1390	No.	1	R	R
H.6.30		17 X 1316	No.	1	R	R
H.6.31		17 x 1735	No.	1	R	R

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SECTION H - SUPPLY ONLY - continued

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H.7		SUPPLY AND DELIVERY ONLY OF COMPLETE SET OF COLUMNS WITH BOBBING BEARINGS & RODS.				
H.7.1		40 mm diameter	No.	1	R	R
H.7.2		50 mm diameter	No.	1	R	R
H.7.3		65 mm diameter	No.	1	R	R
H.7.4		80 mm diameter	No.	1	R	R
H.7.5		100mm diameter	No.	1	R	R
H.8		<u>ELECTRICAL MOTORS (Supply Only, induction motors, SABS approved)</u>				
H.8.1		0.18 kW x 380 V	No.	1	R	R
H.8.2		1.1 kW x 380 V	No.	1	R	R
H.8.3		2.2 kW x 380 V	No.	1	R	R
H.8.4		5,5 kW x 380 V	No.	1	R	R
H.8.5		7,5 kW x 380 V	No.	1	R	R
H.8.6		11 kW x 380 V	No.	1	R	R
H.8.7		15 kW x 380 V	No.	1	R	R
H.8.8		18,5 kW x 380 V	No.	1	R	R
H.8.9		22 kW x 380 V	No.	1	R	R

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H.8.10		26k kW x 380 V	No.	1	R	R
H.8.11		30k kW x 380 V	No.	1	R	R
H.8.12		45k kW x 380 V	No.	1	R	R
H.8.13		75k kW x 380 V	No.	1	R	R
H.8.14		90kW x 380 V	No.	1	R	R
H.8.15		132 kW x 380 V	No.	1	R	R
H.8.16		160 kW x 380 V	No.	1	R	R
H.8.17		200 kw x 380v	No.	1	R	R
H.8.18		239 kW x 380 V	No.	1	R	R
H.8.19		250 kW x 380 V	No.	1	R	R
H.8.20		300 kW x 380 V	No.	1	R	R
H.8.21		350 kW x 380 V	No.	1	R	R
H.8.22		400 kW x 380 V	No.	1	R	R
H.8.23		500 kW x 380 V	No.	1	R	R
H.8.24		600 kW x 380 V	No.	1	R	R
H.9		<u>MOTOR CONTROL CENTER (MOTOR ELECTRICAL PANEL)</u>				
H.9.1		SUPPLY ONLY MCC CONTROL CABINET: to consists of input circuit break, soft starter/VDS starters/ (star delta for motor less than 7.5kw), bypass contactor, Busbar, indicator, hour meter, Secondary side control, cables, advanced dsplay and necessary components, ,for electrical motor range				
H.9.1.1		Up to 1 kw	No.	1	R	R
H.9.1.2		Up to 3 kw	No.	1	R	R
H.9.1.3		Up to 7.5 kw	No.	1	R	R
H.9.1.4		Up to 18.5 Kw	No.	1	R	R
H.9.1.5		Up to 30 kw	No.	1	R	R
H.9.1.6		Up to 60kw	No.	1	R	R
H.9.1.7		Up to 90 kw	No.	1	R	R
H.9.1.8		Up to 150 kw	No.	1	R	R
H.9.1.9		Up to 200kw	No.	1	R	R
H.9.1.10		Up to 350 kw	No.	1	R	R
H.9.1.11		Up to 450kw	No.	1	R	R
H.9.1.12		Up to 600kw	No.	1	R	R

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SECTION H - SUPPLY ONLY – continued

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H.9.2		- <u>Supply Only of Variable Speed Drive (VSD) in the MCC cabinet: VSD motor starters for electric Motor range:</u>				
H.9.2.1		VSD to run motor up to 4.5kW.	No.	1	R	R
H.9.2.2		VSD for motor up to 7.5kW	No.	1	R	R
H.9.2.3		VSD for motor up to 11kW	No.	1	R	R
H.9.2.4		VSD for motor up to 18kW	No.	1	R	R
H.9.2.5		VSD for motor up to 22kW	No.	1	R	R

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H.9.2.6		VSD for motor up to 30kW	No.	1	R	R
H.9.2.7		VSD for motor up to 55kW	No.	1	R	R
H.9.2.8		VSD for motor up to 90kW	No.	1	R	R
H.9.2.9		VSD for motor up to 110kW	No.	1	R	R
H.9.2.10		VSD for motor up to 185kW	No.	1	R	R
H.9.2.11		VSD for motor up to 220kW	No.	1	R	R
H.9.2.12		VSD for motor up to 300kW	No.	1	R	R
H.9.2.13		VSD for motor up to 400kW	No.	1	R	R
H.9.2.14		VSD for motor up to 500kW	No.	1	R	R
H.9.2.15		VSD for motor up to 600kW	No.	1	R	R
H.9.2.16		VSD to run motor up to 600kW.	No.	1	R	R
		-				
H.9.3		<u>SOFT STATER for electrical motor, Supply Only for motor range:</u>				
H.9.3.1		Soft Starter for motor up to 3.5kW	No.	1	R	R
H.9.3.2		Soft Starter for motor up to 7.5kW	No.	1	R	R
H.9.3.3		Soft Starter for motor up to 11kW	No.	1	R	R
H.9.3.4		Soft Starter for motor up to 18kW	No.	1	R	R
H.9.3.5		Soft Starter for motor up to 22kW	No.	1	R	R
H.9.3.6		Soft Starter for motor up to 30kW	No.	1	R	R
H.9.3.7		Soft Starter for motor up to 55kW	No.	1	R	R
H.9.3.8		Soft Starter for motor up to 90kW	No.	1	R	R
H.9.3.9		Soft Starter for motor up to 110kW	No.	1	R	R
H.9.3.10		Soft Starter for motor up to 185kW	No.	1	R	R
H.9.3.11		Soft Starter for motor up to 220kW	No.	1	R	R
H.9.3.12		Soft Starter for motor up to 300kW	No.	1	R	R
H.9.3.13		Soft Starter for motor up to 400kW	No.	1	R	R
H.9.3.14		Soft Starter for motor up to 500kW	No.	1	R	R
H.9.3.15		Soft Starter for motor up to 600kW	No.	1	R	R
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SECTION H - SUPPLY ONLY – continued

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H.9.4		CIRCUIT BREAKERS <u>Supply Only for rated current. MOUNTED IN MCC/ MINISUBS/ TRANSFORMER</u>				
H.9.4.1		MCB 5A 1P	No.	1	R	R
H.9.4.2		MCB 10A 1P	No.	1	R	R
H.9.4.3		MCB 15A 1P	No.	1	R	R
H.9.4.4		MCB 20A 1P	No.	1	R	R
H.9.4.5		MCB 25A 1P	No.	1	R	R
H.9.4.6		MCB 60A 1P	No.	1	R	R
H.9.4.7		MCCB 40A 2P	No.	1	R	R
H.9.4.8		MCB 60A 2P	No.	1	R	R

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H.9.4.9		MCB 10A 3P	No.	1	R	R
H.9.4.10		MCCB 30A 3P	No.	1	R	R
H.9.4.11		MCCB 35A 3P	No.	1	R	R
H.9.4.12		MCB 50A 3P	No.	1	R	R
H.9.4.13		MCCB 70A 3P	No.	1	R	R
H.9.4.14		MCCB 80A 3P	No.	1	R	R
H.9.4.15		200A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS	No.	1	R	R
H.9.4.16		225A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS.	No.	1	R	R
H.9.4.17		250A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS.	No.	1	R	R
H.9.4.18		300A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS.	No.	1	R	R
H.9.4.19		350A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS	No.	1	R	R
H.9.4.20		400A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS MOUNTED IN MINISUBS/ TRANSFORMER	No.	1	R	R
H.9.4.21		500A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS MOUNTED IN MINISUBS/ TRANSFORMER	No.	1	R	R
H.10		<u>CABLES</u>				
H.10.1		<u>LV CABLES</u>				
		Supply Only of the following <u>CU/PVC/PVC/SWA/PVC 600/1000V multicore cable including labels</u>				
H.10.1.1		2.5mm ² x 3 core	m	1	R	R
H.10.1.2		2.5mm ² x 4 core	m	1	R	R
H.10.1.3		4mm ² x 4 core	m	1	R	R
H.10.1.4		6mm ² x 4 core	m	1	R	R
H.10.1.5		10mm ² x 4 core	m	1	R	R
H.10.1.6		16mm ² x 4 core	m	1	R	R
H.10.1.7		25mm ² x 4 core	m	1	R	R
H.10.1.8		35mm ² x 4 core	m	1	R	R
H.10.1.9		50mm ² x 4 core	m	1	R	R
H.10.1.10		70mm ² x 4 core	m	1	R	R
H.10.1.11		95mm ² x 4 core	m	1	R	R
H.10.1.12		120mm ² x 4 core	m	1	R	R
H.10.1.13		150mm ² x 4 core	m	1	R	R
H.10.1.14		185mm ² x 4 core	m	1	R	R

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SECTION H - SUPPLY ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION H BROUGHT FORWARD FROM PREVIOUS PAGE						
H.10.2		<u>Cable Terminations for CU/PVC/PVC/SWA/PVC 600/1000V multicore cable</u>				
H.10.2.1		2.5mm ² x 3 core	No.	1	R	R
H.10.2.2		2.5mm ² x 4 core	No.	1	R	R
H.10.2.3		4mm ² x 4 core	No.	1	R	R

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H.10.2.4	6mm ² x 4 core	No.	1	R	R
H.10.2.5	10mm ² x 4 core	No.	1	R	R
H.10.2.6	16mm ² x 4 core	No.	1	R	R
H.10.2.7	25mm ² x 4 core	No.	1	R	R
H.10.2.8	35mm ² x 4 core	No.	1	R	R
H.10.2.9	50mm ² x 4 core	No.	1	R	R
H.10.2.10	70mm ² x 4 core	No.	1	R	R
H.10.2.11	95mm ² x 4 core	No.	1	R	R
H.10.2.12	120mm ² x 4 core	No.	1	R	R
H.10.2.13	150mm ² x 4 core	No.	1	R	R
H.10.2.14	185mm ² x 4 core	No.	1	R	R
H.10.3	<u>Bare Copper Earth cable (BCEC) with stranded conductors including labels.</u>				
H.10.3.1	2.5mm ² x 3 core	m	1	R	R
H.10.3.2	2.5mm ² x 4 core	m	1	R	R
H.10.3.3	4mm ² x 4 core	m	1	R	R
H.10.3.4	6mm ² x 4 core	m	1	R	R
H.10.3.5	10mm ² x 4 core	m	1	R	R
H.10.3.6	16mm ² x 4 core	m	1	R	R
H.10.3.7	25mm ² x 4 core	m	1	R	R
H.10.3.8	35mm ² x 4 core	m	1	R	R
H.10.3.9	50mm ² x 4 core	m	1	R	R
H.10.3.10	70mm ² x 4 core	m	1	R	R
H.10.3.11	95mm ² x 4 core	m	1	R	R
H.10.3.12	120mm ² x 4 core	m	1	R	R
H.10.3.13	150mm ² x 4 core	m	1	R	R
H.10.3.14	185mm ² x 4 core	m	1	R	R
H.10.4	<u>Cable terminations for bare copper earth cables, complete, including gland shroud, lugs, number tags, etc and connection.</u>				
	<u>Terminations for Bare Copper Earth Conductors (BCEC)</u>				
H.10.4.1	2.5mm ² x 3 core	No.	1	R	R
H.10.4.2	2.5mm ² x 4 core	No.	1	R	R
H.10.4.3	4mm ² x 4 core	No.	1	R	R
H.10.4.4	6mm ² x 4 core	No.	1	R	R
H.10.4.5	10mm ² x 4 core	No.	1	R	R
H.10.4.6	16mm ² x 4 core	No.	1	R	R
H.10.4.7	25mm ² x 4 core	No.	1	R	R
H.10.4.8	35mm ² x 4 core	No.	1	R	R
H.10.4.9	50mm ² x 4 core	No.	1	R	R
H.10.4.10	70mm ² x 4 core	No.	1	R	R
H.10.4.11	95mm ² x 4 core	No.	1	R	R
H.10.4.12	120mm ² x 4 core	No.	1	R	R

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H.10.4.1 3		150mm ² x 4 core	No.	1	R	R
H.10.4.1 4		185mm ² x 4 core	No.	1	R	R
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SECTION CARRIED FORWARD TO NEXT PAGE						
SECTION H - SUPPLY ONLY – continued						
ITEM NO	PAYMEN T REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION H BROUGHT FORWARD FROM PREVIOUS PAGE						
		<u>CABLE SUPPORT</u>				
H.10.5		<u>Supply Only of the following</u>				
		<u>Heavy Duty Hot Dipped Galvanised Mild Steel cable ladder including mounting brackets, fasteners and supports.</u>				
H.10.5.1		50 x 50mm (W x H)	No.	1	R	R
H.10.5.2		100 x 100mm (W x H)	No.	1	R	R
H.10.5.3		200 x 100mm (W x H)	No.	1	R	R
H.10.5.4		300 x 100mm (W x H)	No.	1	R	R
H.10.5.5		600 x 100mm (W x H)	No.	1	R	R
H.10.5.6		800 x 100mm (W x H)	No.	1	R	R
H.10.5.7		1000 x 100mm (W x H)	No.	1	R	R
H.10.6		<u>Supply Only of Heavy Duty Hot Dipped Galvanised Mild Steel cable ladder Tee off / 90° deg horizontal elbow / internal Riser / dropper pieces including mounting brackets, fasteners and supports.</u>				
H.10.6.1		50 x 50mm (W x H)	No.	1	R	R
H.10.6.2		100 x 100mm (W x H)	No.	1	R	R
H.10.6.3		200 x 100mm (W x H)	No.	1	R	R
H.10.6.4		300 x 100mm (W x H)	No.	1	R	R
H.10.6.5		600 x 100mm (W x H)	No.	1	R	R
H.10.6.6		800 x 100mm (W x H)	No.	1	R	R
H.10.6.7		1000 x 100mm (W x H)	No.	1	R	R
H.10.7		<u>Supply Only of Hot Dipped Galvanised Wire Mesh Cable Tray including mounting brackets, fasteners and supports</u>				
H.10.7.1		50 x 50mm (W x H)	No.	1	R	R
H.10.7.2		100 x 100mm (W x H)	No.	1	R	R
H.10.7.3		200 x 100mm (W x H)	No.	1	R	R
H.10.7.4		300 x 100mm (W x H)	No.	1	R	R
H.10.7.5		600 x 100mm (W x H)	No.	1	R	R
H.10.7.6		800 x 100mm (W x H)	No.	1	R	R
H.10.7.7		1000 x 100mm (W x H)	No.	1	R	R
H.10.8		<u>Supply Only of Hot Dipped Galvanised Steel Conduit - complete with couplers, boxes and all other ancillary equipment.</u>				
H.10.8.1		20mm diameter	m	1	R	R
H.10.8.2		25mm diameter	m	1	R	R
H.10.8.3		32mm Diameter	m	1	R	R

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H.11		MEDIUM VOLTAGE NETWORK				
		(SUPPLY ONLY)				
H.11.1		1 Core, 500mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)				
(a)		6.6/11kV 1 CORE ARMoured CABLE	m	1	R	R
H.11.2		1 Core, 400mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)				
(a)		6.6/11kV 1 CORE ARMoured CABLE	m	1	R	R
H.11.3		3 Core, 300mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
H.11.4		3 Core, 240 mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R

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SECTION H - SUPPLY ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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H.11.5		3 Core, 150mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
H.11.6		3 Core, 70mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
H.11.7		3 Core, 300mm² Aluminium SWA XLPE manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
H.11.8		3 Core, 240mm² Aluminium SWA XLPE manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
H.11.9		3 Core, 185mm² Aluminium SWA XLPE manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
H.11.10		3 Core, 150mm² Aluminium SWA XLPE manufactured locally (SABS)				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
H.11.11		<u>Cable work (XLPE/PILC)</u>				
(a)		Indoor termination 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(b)		Cable joint 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(c)		Indoor termination 6.6/11kV for XLPE Cable (35 mm ² to 500 mm ²) single core	No.	1	R	R
(d)		Cable joint 6.6/11kV for XLPE Cable (35 mm ² to 500 mm ²) single core	No.	1	R	R
(e)		Indoor termination 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(f)		Cable joint 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(g)		Indoor termination 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
(h)		Cable joint 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
(i)		Indoor termination 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
(j)		Cable joint 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R

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(k)		Outdoor termination 11kV for ABC	No.	1	R	R
(l)		Outdoor Cable joint for 11kV ABC	No.	1	R	R
(m)		Outdoor termination 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(n)		Outdoor termination 6.6/11kV for XLPE Cable (35 mm ² to 500 mm ²) single core	No.	1	R	R
(o)		Outdoor termination 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
H.12		MINISUBSTATION				
H.12.1		<u>Minisubstation: Supply Only; To comply with SANS spec. of the size:</u>				
H.12.1.1		1000 kVA MINIATURE SUBSTATION COMPLETE WITH 1500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
H.12.1.2		650 kVA MINIATURE SUBSTATION COMPLETE WITH 1000A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
H.12.1.3		500 kVA MINIATURE SUBSTATION COMPLETE WITH 800A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
H.12.1.4		315 kVA MINIATURE SUBSTATION COMPLETE WITH 500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
H.12.1.5		200 kVA MINIATURE SUBSTATION COMPLETE WITH 300A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
H.12.1.6		315 kVA MINIATURE SUBSTATION COMPLETE WITH 500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
H.12.1.7		1000 kVA MINIATURE SUBSTATION COMPLETE WITH 1500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
H.12.1.8		650 kVA MINIATURE SUBSTATION COMPLETE WITH 1000A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
H.12.1.9		500 kVA MINIATURE SUBSTATION COMPLETE WITH 800A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
H.12.1.10		315 kVA MINIATURE SUBSTATION COMPLETE WITH 500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
H.12.1.11		200 kVA MINIATURE SUBSTATION COMPLETE WITH 300A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
H.12.1.12		PRE-CAST CONCRETE FOUNDATION FOR MINIATURE SUBSTATION	No.	1	R	R

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SECTION H - SUPPLY ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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H.13		<u>DIESEL GENERATOR (POWER SUPPLY EQUIPMENT)</u> <u>Supply Only in compliance with SANS specification, efficiency performance, low fuel consumption, vandal proof Structure and user friendly. To consists of Diesel Engine, Engine mounted Instrument Panel fitted with and having digital display, Alternator, Base Frame & Foundation, Fuel Tank, Exhaust System, Starting System, Control Cables, Earthing</u> <u>For sizes specified below:</u>				
H.13.1		20 kVA generator	No.	1	R	R
H.13.2		30 kVA generator	No.	1	R	R
H.13.3		60 kVA generator set	No.	1	R	R
H.13.4		100 kVA generator set	No.	1	R	R

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H.13.5		150 kVA generator set	No.	1	R	R
H.13.6		200 kVA generator set	No.	1	R	R
H.13.7		250 kVA generator set	No.	1	R	R
H.13.8		300 kVA generator set	No.	1	R	R
H.13.9		400 kVA generator set	No.	1	R	R
H.13.10		500 kVA generator set	No.	1	R	R
H.13.11		800 kVA generator set	No.	1	R	R
H.13.12		1000 KVA generator set	No.	1	R	R
H.13.13		1400 kVA generator set	No.	1	R	R
H.13.14		From 1401 to 2000 kVA generator set	No.	1	R	R

SECTION H CARRIED FORWARD TO SUMMARY

SECTION I - INSTALLATION ONLY

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
I.1		<u>PUMPS</u> Installation ONLY of the pumps listed below (or similar to match pump performance and size)				
I.1.1		<u>Solids Handling Pumps</u> <u>Materials of Construction: Cast Iron, CD4MCu, Ductile Iron, Stainless Steel</u> <u>Max Capacity: 3400 GPM</u> <u>Max Head: 130' (40m)</u> <u>Max Solids: 3" (76mm)</u>				
I.1.1.1		2" (50x 50mm)	No.	1	R	R
I.1.1.2		3" (80 x80mm)	No.	1	R	R
I.1.1.3		4" (100x100mm)	No.	1	R	R
I.1.1.4		6" (150 x 150mm)	No.	1	R	R
I.1.1.5		8" (200x 200mm)	No.	1	R	R
I.1.1.6		10" (250x250mm) <u>Materials of Construction: Cast Iron, CD4MCu, Stainless Steel</u> <u>Max Capacity: 1900 GPM</u> <u>Max Head: 325' (99m)</u> <u>Max Solids: 3" (76mm)</u>				
I.1.1.7		3" (80mm)	No.	1	R	R
I.1.1.8		4" (100mm)	No.	1	R	R
I.1.1.9		6" (150mm)	No.	1	R	R
I.1.2		<u>Solids Handling Pumps</u> <u>Bare Shaft Self Priming Pumps</u> <u>Materials of Construction: Ductile Iron, 17-4 PH Stainless Steel</u>				

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		Seal: Silicon Carbide/Viton				
		-				
I.1.2.1		3" Flanged, Max Flow: 550GPM, Max Head: 132' TDH, Max Solid Size: 2.5"	No.	1	R	R
I.1.2.2		4" Flanged, Max Flow: 900GPM, Max Head: 150' TDH, Max Solid Size: 3"	No.	1	R	R
I.1.2.3		6" Flanged, Max Flow: 1680GPM, Max Head: 170' TDH, Max Solid Size: 3"	No.	1	R	R
I.1.2.4		8" Flanged, Max Flow: 2880GPM, Max Head: 216' TDH, Max Solid Size: 3"	No.	1	R	R
I.1.3		Centrifugal Pump				
		<u>Volute Casing: Cast Iron</u>				
		<u>Impeller: Cast Iron</u>				
		<u>Shaft: Carbon (*Chrome) St</u>				
		<u>Shaft Sleeve: St Steel</u>				
		<u>Seal: Packed Gland</u>				
		<u>Size:</u>				
I.1.3.1	I.1.3.1	DN in: 40mm; DN out: 25mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
I.1.3.2	I.1.3.2	DN in: 40mm; DN out: 25mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
I.1.3.3	I.1.3.3	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 125mm; Flow<168/min	No.	1	R	R
I.1.3.4	I.1.3.4	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 160mm; Flow<386l/min	No.	1	R	R
I.1.3.5	I.1.3.5	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 200mm; Flow<420l/min	No.	1	R	R
I.1.3.6	I.1.3.6	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 250mm; Flow<368l/min	No.	1	R	R
I.1.3.7	I.1.3.7	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 125mm; Flow<638l/min	No.	1	R	R
I.1.3.8	I.1.3.8	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 160mm; Flow<620l/min	No.	1	R	R
I.1.3.9	I.1.3.9	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 200mm; Flow<604l/min	No.	1	R	R
I.1.3.10	I.1.3.10	DN in: 50mm; DN out: 32mm; Nominal Impeller Dia.: 250mm; Flow<638l/min	No.	1	R	R

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SECTION I - INSTALLATION ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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I.1.3.11		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 125mm	No.	1	R	R
I.1.3.12		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
I.1.3.13		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
I.1.3.14		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
I.1.3.15		DN in: 65mm; DN out: 40mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
I.1.3.16		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 125mm	No.	1	R	R
I.1.3.17		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
I.1.3.18		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
I.1.3.19		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
I.1.3.20		DN in: 65mm; DN out: 50mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
I.1.3.21		DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 125mm	No.	1	R	R
I.1.3.22		DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
I.1.3.23		DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
I.1.3.24		DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 250mm	No.	1	R	R

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I.1.3.25		DN in: 80mm; DN out: 65mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
I.1.3.26		DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
I.1.3.27		DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
I.1.3.28		DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
I.1.3.29		DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
I.1.3.30		DN in: 100mm; DN out: 80mm; Nominal Impeller Dia.: 400mm	No.	1	R	R
I.1.3.31		DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 160mm	No.	1	R	R
I.1.3.32		DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
I.1.3.33		DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
I.1.3.34		DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
I.1.3.35		DN in: 125mm; DN out: 100mm; Nominal Impeller Dia.: 400mm	No.	1	R	R
I.1.3.36		DN in: 150mm; DN out: 125mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
I.1.3.37		DN in: 150mm; DN out: 125mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
I.1.3.38		DN in: 150mm; DN out: 125mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
I.1.3.39		DN in: 150mm; DN out: 125mm; Nominal Impeller Dia.: 400mm	No.	1	R	R
I.1.3.40		DN in: 200mm; DN out: 150mm; Nominal Impeller Dia.: 200mm	No.	1	R	R
I.1.3.41		DN in: 200mm; DN out: 150mm; Nominal Impeller Dia.: 250mm	No.	1	R	R
I.1.3.42		DN in: 200mm; DN out: 150mm; Nominal Impeller Dia.: 315mm	No.	1	R	R
I.1.3.43		DN in: 200mm; DN out: 150mm; Nominal Impeller Dia.: 400mm	No.	1	R	R
I.1.4		<u>Dry Installed Pumps (Horizontal single- or two-stage centrifugal pumps with volute casing)</u>		-		
		<u>Volute Casing: Cast Iron</u>		-		
		<u>Impeller: Cast Iron</u>		-		
		<u>Shaft: Carbon St</u>		-		
		<u>Shaft Sleeve: Cast Iron</u>		-		
		<u>Seal: Packed Gland</u>		-		
		<u>Size:</u>		-		
I.1.4.1		80-40/2	No.	1	R	R
I.1.4.2		100-40	No.	1	R	R
I.1.4.3		100-50/2	No.	1	R	R
I.1.4.4		125-40	No.	1	R	R
I.1.4.5		125-50/2	No.	1	R	R
I.1.4.6		150-50	No.	1	R	R
I.1.4.7		200-23	No.	1	R	R
I.1.4.8		200-33	No.	1	R	R

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SECTION I - INSTALLATION ONLY - continued

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SECTION I BROUGHT FORWARD FROM PREVIOUS PAGE						
I.1.4.9		200-40	No.	1	R	R

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I.1.4.10		200-50	No.	1	R	R
I.1.4.11		250-29	No.	1	R	R
I.1.4.12		250-33	No.	1	R	R
I.1.4.13		250-40	No.	1	R	R
I.1.4.14		250-50	No.	1	R	R
I.1.4.15		300-35	No.	1	R	R
I.1.5		<u>Dry Installed Single-Stage axially split volute casing pumps for horizontal or vertical installation:</u>				
		<u>Volute Casing: Cast Iron</u>				
		<u>Impeller: St Steel</u>				
		<u>Shaft: Chrome Steel</u>				
		<u>Shaft Sleeve: Chrome Steel</u>				
		<u>Seal: Packed Gland</u>				
		<u>Size (DN-Impeller):</u>				
I.1.5.1		80-210A*	No.	1	R	R
I.1.5.2		80-270A	No.	1	R	R
I.1.5.3		30-370A*	No.	1	R	R
I.1.5.4		100-250A*	No.	1	R	R
I.1.5.5		100-310A*	No.	1	R	R
I.1.5.6		100-375A	No.	1	R	R
I.1.5.7		125-230A	No.	1	R	R
I.1.5.8		125-290A	No.	1	R	R
I.1.5.9		125-365A	No.	1	R	R
I.1.5.10		125-500A	No.	1	R	R
I.1.5.11		150-290A	No.	1	R	R
I.1.5.12		150-360A	No.	1	R	R
I.1.5.13		150-460A	No.	1	R	R
I.1.5.14		150-605A	No.	1	R	R
I.1.5.15		200-320A	No.	1	R	R
I.1.5.16		200-420A	No.	1	R	R
I.1.5.17		200-520A	No.	1	R	R
I.1.5.18		200-670A	No.	1	R	R
I.1.5.19		250-370A	No.	1	R	R
I.1.5.20		250-480A	No.	1	R	R
I.1.5.21		250-600A	No.	1	R	R
I.1.5.22		300-300A	No.	1	R	R
I.1.5.23		300-435A	No.	1	R	R
I.1.5.24		300-560A	No.	1	R	R
I.1.5.25		300-700A	No.	1	R	R
I.1.5.26		350-360A	No.	1	R	R
I.1.5.27		350-430A	No.	1	R	R
I.1.5.28		350-510A	No.	1	R	R
I.1.6		-				
		<u>Ring-section pumps - Multistage horizontal high-pressure centrifugal pumps in ring-section design with split suction, discharge and stage casings:</u>				
		<u>Volute Casing: Cast Iron</u>				
		<u>Impeller: Cast Iron</u>				

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Shaft: Carbon Steel

Shaft Sleeve: Cast Iron

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SECTION I BROUGHT FORWARD FROM PREVIOUS PAGE

Seal: Packed Gland

Size (Discharge Nominal Bore/Stage):

I.1.6.1		32/2	No.	1	R	R
I.1.6.2		32/3	No.	1	R	R
I.1.6.3		32/4	No.	1	R	R
I.1.6.4		32/5	No.	1	R	R
I.1.6.5		32/6	No.	1	R	R
I.1.6.6		32/7	No.	1	R	R
I.1.6.7		32/8	No.	1	R	R
I.1.6.8		32/9	No.	1	R	R
I.1.6.9		32/10	No.	1	R	R
I.1.6.10		40/2	No.	1	R	R
I.1.6.11		40/3	No.	1	R	R
I.1.6.12		40/4	No.	1	R	R
I.1.6.13		40/5	No.	1	R	R
I.1.6.14		40/6	No.	1	R	R
I.1.6.15		40/7	No.	1	R	R
I.1.6.16		50/2	No.	1	R	R
I.1.6.17		50/3	No.	1	R	R
I.1.6.18		50/4	No.	1	R	R
I.1.6.19		50/5	No.	1	R	R
I.1.6.20		50/6	No.	1	R	R
I.1.6.21		50/7	No.	1	R	R
I.1.6.22		65/2	No.	1	R	R
I.1.6.23		65/3	No.	1	R	R
I.1.6.24		65/4	No.	1	R	R
I.1.6.25		65/5	No.	1	R	R
I.1.6.26		65/6	No.	1	R	R
I.1.6.27		65/7	No.	1	R	R
I.1.6.28		65/8	No.	1	R	R
I.1.6.29		65/9	No.	1	R	R
I.1.6.30		65/10	No.	1	R	R
I.1.6.31		80/2	No.	1	R	R
I.1.6.32		80/3	No.	1	R	R
I.1.6.33		80/4	No.	1	R	R
I.1.6.34		80/5	No.	1	R	R
I.1.6.35		80/6	No.	1	R	R
I.1.6.36		80/7	No.	1	R	R
I.1.6.37		80/8	No.	1	R	R

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I.1.6.38		80/9	No.	1	R	R
I.1.6.39		80/10	No.	1	R	R
I.1.6.40		100/2	No.	1	R	R
I.1.6.41		100/3	No.	1	R	R
I.1.6.42		100/4	No.	1	R	R
I.1.6.43		100/5	No.	1	R	R
I.1.6.44		100/6	No.	1	R	R
I.1.6.45		100/7	No.	1	R	R
I.1.6.46		100/8	No.	1	R	R
I.1.6.47		100/9	No.	1	R	R

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I.1.6.48		125/2	No.	1	R	R
I.1.6.49		125/3	No.	1	R	R
I.1.6.50		125/4	No.	1	R	R
I.1.6.51		125/5	No.	1	R	R
I.1.6.52		125/6	No.	1	R	R
I.1.6.53		150/2	No.	1	R	R
I.1.6.54		150/3	No.	1	R	R
I.1.6.55		150/4	No.	1	R	R
I.1.6.56		150/5	No.	1	R	R

I.1.7
Submersible Motor Pumps (Vertical single-stage fully floodable submersible motor pumps in close-coupled design, with integrated level switch)

Volute Casing: Polypropylene

Impeller: Polypropylene

Diffuser: N/A

Shaft: St Steel

Shaft Sleeve: N/A

Seal: Mechanical

Size:

I.1.7.1		Head: 6.5m Max; Flow: 10m3/h Max; 2m Immersion Depth	No.	1	R	R
I.1.7.2		Head: 10m Max; Flow: 12m3/h Max; 2m Immersion Depth	No.	1	R	R
I.1.7.3		Head: 12.5m Max; Flow: 14m3/h Max; 2m Immersion Depth	No.	1	R	R
I.1.7.4		Head: 8.5m Max; Flow: 16.5m3/h Max; 2m Immersion Depth	No.	1	R	R

I.1.8
Submersible Motor Pumps (Vertical single-stage submersible motor pumps for waste water in close-coupled design for wet installation)

Size:

I.1.8.1		230V; Impeller dia.:100mm; DN50	No.	1	R	R
I.1.8.2		230V; Impeller dia.:110mm; DN50	No.	1	R	R
I.1.8.3		230V; Impeller dia.:120mm; DN50	No.	1	R	R
I.1.8.4		230V; Impeller dia.:130mm; DN50	No.	1	R	R
I.1.8.5		230V; Impeller dia.:110mm; DN65	No.	1	R	R

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I.1.8.6		230V; Impeller dia.:120mm; DN65	No.	1	R	R
I.1.8.7		230V; Impeller dia.:130mm; DN65	No.	1	R	R
I.1.8.8		400V; Impeller dia.:100mm; DN50	No.	1	R	R
I.1.8.9		400V; Impeller dia.:110mm; DN50	No.	1	R	R
I.1.8.10		400V; Impeller dia.:120mm; DN50	No.	1	R	R
I.1.8.11		400V; Impeller dia.:130mm; DN50	No.	1	R	R
I.1.8.12		400V; Impeller dia.:110mm; DN65	No.	1	R	R
I.1.8.13		400V; Impeller dia.:120mm; DN65	No.	1	R	R
I.1.8.14		400V; Impeller dia.:130mm; DN65	No.	1	R	R
I.1.9		<u>Submersible Motor Pumps (Vertical single-stage submersible motor pumps for wet installation with cutter)</u>				
		<u>Size:</u>				
I.1.9.1		S-Impeller; 32mm discharge dia.; Size 160; 160mm Impeller dia.	No.	1	R	R
I.1.9.2		S-Impeller; 50mm discharge dia.; Size 172; 120mm Impeller dia.	No.	1	R	R
I.1.9.3		S-Impeller; 50mm discharge dia.; Size 172; 140mm Impeller dia.	No.	1	R	R
I.1.9.4		S-Impeller; 50mm discharge dia.; Size 172; 160mm Impeller dia.	No.	1	R	R
I.1.9.5		S-Impeller; 50mm discharge dia.; Size 222; 175mm Impeller dia.	No.	1	R	R
I.1.9.7		F-Impeller; 50mm discharge dia.; Size 170; 90mm Impeller dia.	No.	1	R	R
I.1.9.8		F-Impeller; 50mm discharge dia.; Size 170; 107mm Impeller dia.	No.	1	R	R
I.1.9.9		F-Impeller; 50mm discharge dia.; Size 170; 120mm Impeller dia.	No.	1	R	R
I.1.9.10		F-Impeller; 50mm discharge dia.; Size 170; 130mm Impeller dia.	No.	1	R	R

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I.1.9.11		F-Impeller; 50mm discharge dia.; Size 170; 140mm Impeller dia.	No.	1	R	R
I.1.9.12		F-Impeller; 50mm discharge dia.; Size 220; 130mm Impeller dia.	No.	1	R	R
I.1.9.13		F-Impeller; 50mm discharge dia.; Size 220; 140mm Impeller dia.	No.	1	R	R
I.1.9.14		F-Impeller; 50mm discharge dia.; Size 220; 150mm Impeller dia.	No.	1	R	R
I.1.9.15		F-Impeller; 50mm discharge dia.; Size 220; 160mm Impeller dia.	No.	1	R	R
I.1.9.16		F-Impeller; 50mm discharge dia.; Size 220; 170mm Impeller dia.	No.	1	R	R
I.1.9.17		F-Impeller; 50mm discharge dia.; Size 220; 180mm Impeller dia.	No.	1	R	R
I.1.9.18		F-Impeller; 65mm discharge dia.; Size 170; 120mm Impeller dia.	No.	1	R	R
I.1.9.19		F-Impeller; 65mm discharge dia.; Size 170; 128mm Impeller dia.	No.	1	R	R
I.1.9.20		F-Impeller; 65mm discharge dia.; Size 170; 136mm Impeller dia.	No.	1	R	R
I.1.9.21		F-Impeller; 65mm discharge dia.; Size 170; 146mm Impeller dia.	No.	1	R	R
I.1.9.22		F-Impeller; 65mm discharge dia.; Size 170; 152mm Impeller dia.	No.	1	R	R
I.1.9.23		F-Impeller; 65mm discharge dia.; Size 170; 158mm Impeller dia.	No.	1	R	R

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I.1.9.24		F-Impeller; 65mm discharge dia.; Size 220; 112mm Impeller dia.	No.	1	R	R
I.1.9.25		F-Impeller; 65mm discharge dia.; Size 220; 125mm Impeller dia.	No.	1	R	R
I.1.9.26		F-Impeller; 65mm discharge dia.; Size 220; 135mm Impeller dia.	No.	1	R	R
I.1.9.27		F-Impeller; 65mm discharge dia.; Size 220; 145mm Impeller dia.	No.	1	R	R
I.1.9.28		F-Impeller; 65mm discharge dia.; Size 220; 155mm Impeller dia.	No.	1	R	R
I.1.9.29		F-Impeller; 65mm discharge dia.; Size 220; 165mm Impeller dia.	No.	1	R	R
I.1.9.30		F-Impeller; 65mm discharge dia.; Size 220; 175mm Impeller dia.	No.	1	R	R
I.1.9.31		F-Impeller; 65mm discharge dia.; Size 220; 185mm Impeller dia.	No.	1	R	R
I.1.9.32		F-Impeller; 65mm discharge dia.; Size 220; 195mm Impeller dia.	No.	1	R	R
I.1.9.33		F-Impeller; 80mm discharge dia.; Size 220; 120mm Impeller dia.	No.	1	R	R
I.1.9.34		F-Impeller; 80mm discharge dia.; Size 220; 135mm Impeller dia.	No.	1	R	R
I.1.9.35		F-Impeller; 80mm discharge dia.; Size 220; 150mm Impeller dia.	No.	1	R	R
I.1.9.36		F-Impeller; 80mm discharge dia.; Size 220; 165mm Impeller dia.	No.	1	R	R
I.1.9.37		F-Impeller; 80mm discharge dia.; Size 220; 180mm Impeller dia.	No.	1	R	R
I.1.9.38		F-Impeller; 80mm discharge dia.; Size 220; 195mm Impeller dia.	No.	1	R	R
I.1.9.39		F-Impeller; 80mm discharge dia.; Size 220; 210mm Impeller dia.	No.	1	R	R
I.1.9.40		F-Impeller; 100mm discharge dia.; Size 220; 120mm Impeller dia.	No.	1	R	R
I.1.9.41		F-Impeller; 100mm discharge dia.; Size 220; 135mm Impeller dia.	No.	1	R	R
I.1.9.42		F-Impeller; 100mm discharge dia.; Size 220; 150mm Impeller dia.	No.	1	R	R
I.1.9.43		F-Impeller; 100mm discharge dia.; Size 220; 165mm Impeller dia.	No.	1	R	R
I.1.9.44		F-Impeller; 100mm discharge dia.; Size 220; 180mm Impeller dia.	No.	1	R	R
I.1.9.45		F-Impeller; 100mm discharge dia.; Size 220; 195mm Impeller dia.	No.	1	R	R
I.1.9.46		F-Impeller; 100mm discharge dia.; Size 220; 210mm Impeller dia.	No.	1	R	R
I.1.9.47		D-Impeller; 80mm discharge dia.; Size 220; 154mm Impeller dia.	No.	1	R	R
I.1.9.48		D-Impeller; 80mm discharge dia.; Size 220; 168mm Impeller dia.	No.	1	R	R
I.1.9.49		D-Impeller; 80mm discharge dia.; Size 220; 180mm Impeller dia.	No.	1	R	R
I.1.9.50		D-Impeller; 80mm discharge dia.; Size 220; 190mm Impeller dia.	No.	1	R	R
I.1.9.51		D-Impeller; 100mm discharge dia.; Size 220; 195mm Impeller dia.	No.	1	R	R
I.1.9.52		D-Impeller; 100mm discharge dia.; Size 220; 209mm Impeller dia.	No.	1	R	R
I.1.9.53		D-Impeller; 100mm discharge dia.; Size 220; 220mm Impeller dia.	No.	1	R	R
		-				
I.1.10		<u>Other centrifugal pumps- Manufacturer to be specified and pump performance</u>				
I.1.10.1		3" or 80mm pump with head up to 30m	No.	1	R	R

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I.1.10.2		4" pump, head up to 30m	No.	1	R	R
I.1.10.3		6" Pump, Head up to 30m	No.	1	R	R
I.1.10.4		8" pump, Head up to 30m	No.	1	R	R
I.1.10.5		10" pump, Head up to 30m	No.	1	R	R
I.1.10.6		12" pump, 4" pump, head up to 30m	No.	1	R	R
I.1.11		Submersible Pump				
I.1.11.2		Power rate 1.5 kw – 2.4 kw with discharge size from 50mm -80mm, max Q- 55l/s , max head 40m	No.	1	R	R
I.1.11.3		Power rate 1.3 kw – 2.4 kw with discharge size of 80mm, max Q- 55l/s , max head 40m	No.	1	R	R
I.1.11.4		3.1 kw – 4.5 kw with discharge size from 50mm -80mm, max Q- 70l/s , max head 50m	No.	1	R	R
I.1.11.5		4,7 kw – 8,5 kw with discharge size from 50mm -80mm, max Q- 90l/s , max head 70m	No.	1	R	R
I.1.11.6		Power rate from 7,5 kw -15 kw, discharge size from 80mm to 250mm,	No.	1	R	R
I.1.11.7		Power rate 15 kw – 22 kw, discharge 100 to 250mm.	No.	1	R	R
I.1.11.8		Power rate 15 kw – 22 kw, discharge 100 to 300mm.	No.	1	R	R
I.1.11.9		Power rate 37 kw – 50kw, discharge 150 to 350mm.	No.	1	R	R
I.1.11.10		Power rate 50 kw – 70 kw, discharge 150 to 350mm.	No.	1	R	R
I.1.11.11		Power rate 48 kw – 80 kw, discharge 150 to 350mm.	No.	1	R	R
I.1.11.12		Power rate 80 kw – 105 kw, discharge 150 to 350mm.	No.	1	R	R
I.1.11.13		Power rate 70 kw – 150 kw, discharge size 200mm.	No.	1	R	R
I.1.11.14		Power rate 150kw – 215 kw, discharge size 200mm.	No.	1	R	R
I.1.11.15		Power rate 58 kw – 100 kw, discharge size 300mm.	No.	1	R	R
I.1.11.16		Power rate 40 kw – 150 kw, discharge size 500mm.	No.	1	R	R
I.1.11.17		Power rate 150kw – 310 kw, discharge size 500mm	No.	1	R	R
I.1.12		Other Submersible Pump, specify manufactures and pump performance				
I.1.12.1		1,5kw submersible	No.	1	R	R
I.1.12.2		2,4kw submersible	No.	1	R	R
I.1.12.3		3,1kw submersible	No.	1	R	R
I.1.12.4		4,5 kw submersible	No.	1	R	R

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I.1.12.5		7,5 kw submersible	No.	1	R	R
I.1.12.6		11kw submersible	No.	1	R	R
I.1.12.7		15kw submersible	No.	1	R	R
I.1.12.8		22,5kw submersible	No.	1	R	R
I.1.12.9		30kw submersible	No.	1	R	R
I.1.12.10		45kw submersible	No.	1	R	R
I.1.12.11		60kw submersible	No.	1	R	R

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I.1.12.12		90 kw submersible	No.	1	R	R
I.1.13		DEWATERING/SLUDGE REMOVAL PUMPS				
H.1.13.1		Portable Centrifugal Engine driven pump mounted on a trailer, solid handling, Size 250mm Suction and 250mm discharge, Max capacity 221 lps, Max head 43m, casing cast iron, impeller ductile iron, Max temperature 71C, complete with suction 20 suction pipe and 50 m discharge pipe, Diesel Engine, include trailer road worthy and license registration.	No.	1	R	R
I.1.13.2		Portable Submersible pump, Solid handling, Maximum head 30m, power range 30kw, 50Hz, discharge size 80mm, high quality submersible cable. 50m 3" discharge pipe, Chain block.	No.	1	R	R
I.1.14		PORTABLE WATER PUMP				
I.1.14.1		Potable water pump, total head 26m, suction head 8m, inlet and outlet dia = 100mm, pumping capacity 1640 lpm, open frame size 735x 536 x 563mm, Engine 4 stroke, petrol, 389cc, fuel tank 6.1 L. max power output @3600rpm.	No.	1	R	R
I.1.15		OTHER PUMPS				
I.1.15.1		Motor driven digital display metering pump (Chemical dosing pump)	No.	1	R	R
I.1.15.2		Solenoid Driven Chemical dosing and metering pump	No.	1	R	R
I.2		AERATORS				
		Installation ONLY of the aerators listed below:				

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I.2.1		Surface Aerators: Vertical Shaft				
		Complete set surface aerator for waste water treatment plant including gearbox, electrical motor, base, turbine and fittings, mounted to prevent any movement, capable of transferring required aeration. Electrical motor: IEC certified and SABS approved, 3 phase.				
I.2.1.1		0,55 kw up to 3, 5kw aerator unit.	No.	1	R	R
I.2.1.2		3,6 kw to 7,5kw aerator unit	No.	1	R	R
I.2.1.3		7,6 kw up to 11 kw aerator unit	No.	1	R	R
I.2.1.4		11kw up to 15,5 kw aerator unit	No.	1	R	R
I.2.1.5		15,5kw up to 22,5 kw aerator unit	No.	1	R	R
I.2.1.6		22,6 kw up to 30 kw aerator unit	No.	1	R	R
I.2.1.7		31 kw up to 45kw aerator unit	No.	1	R	R
I.2.1.8		46 kw up to 60kw aerator unit	No.	1	R	R
I.2.1.9		61kw up to 80kw aerator unit	No.	1	R	R
I.2.1.10		81kw up to 109kw aerator unit	No.	1	R	R
I.2.1.11		110kw up to 150kw aerator unit	No.	1	R	R
I.2.2		Surface Air Mixer				
		Installation only Complete set Mixer for waste water treatment plant including gearbox, electrical motor, baseplate, blade turbine, and fittings, mounted to prevent any movement, capable of transferring required aeration. Electrical motor: IEC certified and SABS approved, 3 phase				

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I.2.2.1		0,55 kw up to 3, 5kw Mixer unit.	No.	1	R	R
I.2.2.2		3,6 kw to 7,5kw Mixer unit	No.	1	R	R
I.2.2.3		7,6 kw up to 11 kw Mixer unit	No.	1	R	R
I.2.2.4		11kw up to 15,5 kw Mixer unit	No.	1	R	R
I.2.2.5		15,5kw up to 22,5 kw Mixer unit	No.	1	R	R
I.2.2.6		22,6 kw up to 30 kw Mixer unit	No.	1	R	R
I.2.2.7		31kw up to 45kw Mixer unit	No.	1	R	R
I.2.3		Horizontal Shaft :Surface Aerator Complete set horizontal shaft surface aerator for waste water treatment plant including gearbox, electrical motor, gear baseplate , Brush and fittings, mounted to prevent any movement, capable of transferring required aeration. Electrical motor: IEC certified and SABS approved, 3 phase. Brush: baseplate, brush diameter 700mm and 1000mm.				

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I.2.3.1		5.5kw aerator unit, brush Dia.0.7m, length of Axle up to 3m, 10 kg O2/ h	No.	1	R	R
I.2.3.2		7.5kw aerator unit, brush Dia.0.7m, length of Axle up to 4.5m, 14 kg O2/ h	No.	1	R	R
I.2.3.3		11 kw aerator unit , brush Dia.0.7m, length of Axle up to 6m, 20 kg O2/ h	No.	1	R	R
I.2.3.4		15kw kw aerator unit, brush Dia.1m, length of Axle up to 3m, 27 kg O2/ h	No.	1	R	R
I.2.3.5		22 kwaerator unit, brush Dia.1m, length of Axle up to 4.5m, 40 kg O2/ h	No.	1	R	R
I.2.3.6		30 Kw aerator unit, brush Dia.1m, length of Axle up to 6m, 54 kg O2/ h	No.	1	R	R
I.2.3.7		37 kw aerator unit, brush Dia.1m, length of Axle up to 7.5m, 67 kg O2/ h.	No.	1	R	R
I.2.3.8		45kw aerator unit, , brush Dia.1m, length of Axle up to 9m, 81 kg O2/ h	No.	1	R	R
I.2.3.9		81kw up to 109kw aerator unit	No.	1	R	R
I.2.4		Floating Aerator Complete set floating aspirating aerator for the water works including gearbox, electrical motor, mounted on floating pontoons and anchored to eliminate movement capable of transferring efficient aeration. Electrical motor: IEC certified and SABS approved, 3 phase. Floating pontoons or float: design and mount gear and motor.				
I.2.4.1		0,55 kw up to 3, 5kw aerator unit.	No.	1	R	R
I.2.4.2		3,6 kw to 7,5kw aerator unit	No.	1	R	R
I.2.4.3		7,6 kw up to 11 kw aerator unit	No.	1	R	R
I.2.4.4		11kw up to 15,5 kw aerator unit	No.	1	R	R
I.2.4.5		15,5kw up to 22 kw aerator unit	No.	1	R	R
I.2.4.6		23 kw up to 30 kw aerator unit	No.	1	R	R
I.2.4.7		31 kw up to 45kw aerator unit	No.	1	R	R
I.2.4.8		46 kw up to 60kw aerator unit	No.	1	R	R
I.2.4.9		61kw up to 80kw aerator unit	No.	1	R	R

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I.3		SCREENS				
		Mechanical screen				
		Supply, delivery and installation ONLY of front rake mechanical screen, consists of spaced steel bar screen, chain, frame, discharge chute, gearmotor, conveyer unit, Stainless steel constructed.				
		Screen:				

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I.3.1		Front Rake Mechanical screen, width up to 0.5m and up to 1.5m deep. Gearmotor rating 0.5 kw.	No.	1	R	R
I.3.2		Front Rake Mechanical screen, width up to 1.0m and depth up to 1.5m. Gearmotor rated 0,7 kw	No.	1	R	R
I.3.3		Front Rake Mechanical screen, width up to 1.0m and depth up to 3m. Gear motor power rated 1 kw	No.	1	R	R
I.3.4		Front Rake Mechanical screen, width up to 2m and depth up to 4m. Gear motor power rated 1.1 kw	No.	1	R	R
I.3.5		Front Rake Mechanical screen, width up to 3.2m and depth up to 5m. Gearmotor power rated 1.5kw	No.	1	R	R
		Hand Rake Screen				
		Installation ONLY of a Tear drop shape, material components 304/316 stainless screen, (size width x depth)				
I.3.6		1m x 1m	No.	1	R	R
I.3.7		1m x 1,5m	No.	1	R	R
I.3.8		1,5m x 2m	No.	1	R	R
I.3.9		1,5m x 4m	No.	1	R	R
I.4		VALVES				
I.4.1		GATE VALVES (ISOLATION)				
		Supply, delivery and installation ONLY SANS 664 compliant, flanged face to face, cast iron, PN 16 , DN:				
I.4.1.1		a) 50mm dia.	No.	1	R	R
I.4.1.2		b) 65mm dia.	No.	1	R	R
I.4.1.3		c) 80mm dia.	No.	1	R	R
I.4.1.4		d) 100mm dia.	No.	1	R	R
I.4.1.5		e) 125mm dia.	No.	1	R	R
I.4.1.6		f) 150mm dia.	No.	1	R	R
I.4.1.7		g) 200mm dia.	No.	1	R	R
I.4.1.8		h) 250mm dia.	No.	1	R	R
I.4.1.9		i) 300mm dia.	No.	1	R	R
I.4.1.10		j) 350mm dia.	No.	1	R	R
I.4.1.11		k) 400 mm	No.	1	R	R
I.4.1.12		L) 450mm	No.	1	R	R
I.4.1.13		M) 500mm	No.	1	R	R
I.4.1.14		O) 600mm	No.	1	R	R
I.4.1.15		P) 700mm	No.	1	R	R

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SECTION I - INSTALLATION ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION I BROUGHT FORWARD FROM PREVIOUS PAGE						
I.4.1.16		Q) 800mm	No.	1	R	R
I.4.1.17		R) 900mm	No.	1	R	R
I.4.2		GATE VALVES (ISOLATION) Installation ONLY SANS 664 compliant, flanged face to face, cast iron, PN 25 , DN:				
I.4.2.1		a) 50mm dia.	No.	1	R	R
I.4.2.2		b) 65mm dia.	No.	1	R	R
I.4.2.3		c) 80mm dia.	No.	1	R	R
I.4.2.4		d) 100mm dia.	No.	1	R	R
I.4.2.5		e) 125mm dia.	No.	1	R	R
I.4.2.6		f) 150mm dia.	No.	1	R	R
I.4.2.7		g) 200mm dia.	No.	1	R	R
I.4.2.8		h) 250mm dia.	No.	1	R	R
I.4.2.9		i) 300mm dia.	No.	1	R	R
I.4.2.10		j) 350mm dia.	No.	1	R	R
I.4.2.11		k) 400 mm	No.	1	R	R
I.4.2.12		L) 450mm	No.	1	R	R
I.4.2.13		M) 500mm	No.	1	R	R
I.4.2.14		O) 600mm	No.	1	R	R
I.4.2.15		P) 700mm	No.	1	R	R
I.4.2.16		Q) 800mm	No.	1	R	R
I.4.2.17		R) 900mm	No.	1	R	R
I.4.3		GATE SWING CHECK VALVES (NON RETURN) Installation ONLY SANS 664 compliant, flanged face to face, cast iron, PN 16 , DN:				
I.4.3.1		a) 50mm	No.	1	R	R
I.4.3.2		b) 65mm	No.	1	R	R
I.4.3.3		c) 80mm.	No.	1	R	R
I.4.3.4		d) 100mm	No.	1	R	R
I.4.3.5		e) 125mm	No.	1	R	R
I.4.3.6		f) 150mm	No.	1	R	R
I.4.3.7		g) 200mm	No.	1	R	R
I.4.3.8		h) 250mm.	No.	1	R	R
I.4.3.9		i) 300mm.	No.	1	R	R
I.4.3.10		j) 350mm	No.	1	R	R
I.4.3.11		k) 400 mm	No.	1	R	R
I.4.3.12		L) 450mm	No.	1	R	R
I.4.3.13		M) 500mm	No.	1	R	R
I.4.3.14		O) 600mm	No.	1	R	R
I.4.3.15		P) 700mm	No.	1	R	R
I.4.3.16		Q) 800mm	No.	1	R	R

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I.4.3.17		R) 900mm	No.	1	R	R
SECTION CARRIED FORWARD TO NEXT PAGE						
SECTION I - INSTALLATION ONLY – continued						
ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION B BROUGHT FORWARD FROM PREVIOUS PAGE						
I.4.4		<u>GATE SWING CHECK VALVES (NON RETURN)</u> Installation ONLY SANS 664 compliant, flanged face to face, cast iron, PN 25 , DN:				
I.4.4.1		a) 50mm	No.	1	R	R
I.4.4.2		b) 65mm	No.	1	R	R
I.4.4.3		c) 80mm	No.	1	R	R
I.4.4.4		d) 100mm	No.	1	R	R
I.4.4.5		e) 125mm	No.	1	R	R
I.4.4.6		f) 150mm	No.	1	R	R
I.4.4.7		g) 200mm	No.	1	R	R
I.4.4.8		h) 250mm	No.	1	R	R
I.4.4.9		i) 300mm	No.	1	R	R
I.4.4.10		j) 350mm	No.	1	R	R
I.4.4.11		k) 400 mm	No.	1	R	R
I.4.4.12		L) 450mm	No.	1	R	R
I.4.4.13		M) 500mm	No.	1	R	R
I.4.4.14		O) 600mm	No.	1	R	R
I.4.4.15		P) 700mm	No.	1	R	R
I.4.4.16		Q) 800mm	No.	1	R	R
I.4.4.17		R) 900mm	No.	1	R	R
I.4.5		<u>GATE VALVES (SLUICE VALVES)</u> Installation ONLY of sluice valves to waterworks pattern, PN16, clockwise closing, non-rising spindle, with cap top, complying with SABS 664 AND FITTED WITH RESILIENT SEAL SEATS AND COUPLINGS				
I.4.5.1		a) 50mm	No.	1	R	R
I.4.5.2		b) 65mm	No.	1	R	R
I.4.5.3		c) 80mm	No.	1	R	R
I.4.5.4		d) 100mm.	No.	1	R	R
I.4.5.5		e) 125mm	No.	1	R	R
I.4.5.6		f) 150mm	No.	1	R	R
I.4.5.7		g) 200mm	No.	1	R	R
I.4.5.8		h) 250mm	No.	1	R	R
I.4.5.9		i) 300mm	No.	1	R	R
I.4.5.10		j) 350mm	No.	1	R	R
I.4.5.11		k) 400 mm	No.	1	R	R
I.4.5.12		L) 450mm	No.	1	R	R
I.4.5.13		M) 500mm	No.	1	R	R
I.4.5.14		O) 600mm	No.	1	R	R
I.4.5.15		P) 700mm	No.	1	R	R
I.4.5.16		Q) 800mm	No.	1	R	R
I.4.5.17		R) 900mm	No.	1	R	R

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SECTION I - INSTALLATION ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION B BROUGHT FORWARD FROM PREVIOUS PAGE						
I.4.6		<u>GATE VALVES (BUTTERFLY)</u> Installation ONLY of valves to waterworks pattern, Class16 clockwise closing, non-rising spindle, with cap top, complying with SABS 664 AND FITTED WITH RESILIENT SEAL SEATS				
I.4.6.1		a) 50mm dia.	No.	1	R	R
I.4.6.2		b) 65mm dia.	No.	1	R	R
I.4.6.3		c) 80mm dia.	No.	1	R	R
I.4.6.4		d) 100mm dia.	No.	1	R	R
I.4.6.5		e) 125mm dia.	No.	1	R	R
I.4.6.6		f) 150mm dia.	No.	1	R	R
I.4.6.7		g) 200mm dia.	No.	1	R	R
I.4.6.8		h) 250mm dia.	No.	1	R	R
I.4.6.9		i) 300mm dia.	No.	1	R	R
I.4.6.10		j) 350mm dia.	No.	1	R	R
I.4.6.11		k) 400 mm	No.	1	R	R
I.4.6.12		L) 450mm	No.	1	R	R
I.4.6.13		M) 500mm	No.	1	R	R
I.4.6.14		O) 600mm	No.	1	R	R
I.4.6.15		P) 700mm	No.	1	R	R
I.4.6.16		Q) 800mm	No.	1	R	R
I.4.6.17		R) 900mm	No.	1	R	R
		<u>OTHER VALVES</u>				
I.4.7		installation ONLY of approved Pressure control valves:				
I.4.7.1		80NB PN 16	No.	1	R	R
I.4.7.2		100NB PN 16	No.	1	R	R
I.4.7.3		125NB PN 16	No.	1	R	R
I.4.7.4		150NB PN 16	No.	1	R	R
I.4.7.5		200NB PN 16	No.	1	R	R
I.4.7.6		250NB PN 16	No.	1	R	R
I.4.7.7		300NB PN 16	No.	1	R	R
I.4.7.8		400NB PN 16	No.	1	R	R
I.4.7.9		500NB PN 16	No.	1	R	R
I.4.7.10		600NB PN 16	No.	1	R	R
I.4.7.11		700NB PN 16	No.	1	R	R
I.4.7.12		800NB PN 16	No.	1	R	R
I.4.8		installation ONLY of approved Resilient seated Swing Check valves:				
I.4.8.1		50NB PN16	No.	1	R	R
I.4.8.2		65NB PN16	No.	1	R	R
I.4.8.3		80NB PN 16	No.	1	R	R
I.4.8.4		100NB PN 16	No.	1	R	R

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I.4.8.5		125NB PN 16	No.	1	R	R
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SECTION I - INSTALLATION ONLY – continued						
ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
SECTION I BROUGHT FORWARD FROM PREVIOUS PAGE						
I.4.8.6		150NB PN 16	No.	1	R	R
I.4.8.7		200NB PN 16	No.	1	R	R
I.4.8.8		250NB PN 16	No.	1	R	R
I.4.8.9		300NB PN 16	No.	1	R	R
I.4.9		installation ONLY of approved DOUBLE ECCENTRIC BUTTERFLY VALVE, PN16 756/218-005 Integral seat, IP67 gearbox, DN 200-600, plate disc, short, AISI 420 shaft:				
I.4.9.1		200NB PN16	No.	1	R	R
I.4.9.2		250NB PN16	No.	1	R	R
I.4.9.3		300NB PN 16	No.	1	R	R
I.4.9.4		350NB PN 16	No.	1	R	R
I.4.9.5		400NB PN 16	No.	1	R	R
I.4.9.6		450NB PN 16	No.	1	R	R
I.4.9.7		500NB PN 16	No.	1	R	R
I.4.9.8		600NB PN 16	No.	1	R	R
I.4.10		Installation ONLY of approved Resilient seated Flanged Ball Check Valves:				
I.4.10.1		50NB PN16	No.	1	R	R
I.4.10.2		65NB PN16	No.	1	R	R
I.4.10.3		80NB PN 16	No.	1	R	R
I.4.10.4		100NB PN 16	No.	1	R	R
I.4.10.5		125NB PN 16	No.	1	R	R
I.4.10.6		150NB PN 16	No.	1	R	R
I.4.10.7		200NB PN 16	No.	1	R	R
I.4.10.8		250NB PN 16	No.	1	R	R
I.4.10.9		300NB PN 16	No.	1	R	R
I.4.10.10		350NB PN 16	No.	1	R	R
I.4.10.11		400NB PN 16	No.	1	R	R
I.4.10.12		450NB PN 16	No.	1	R	R
I.4.10.13		500NB PN 16	No.	1	R	R
I.4.10.14		600NB PN 16	No.	1	R	R
I.5		GEARBOXES AND OTHER MISCELLANEOUS				
		installation ONLY of the following items:				
I.5.1		3 kW Clarifier Gearbox	No.	1	R	R
I.5.2		22 kW Clarifier Gearbox	No.	1	R	R
I.5.3		45 kW Clarifier Gearbox	No.	1	R	R
I.5.4		3 kW Aerator Gearbox	No.	1	R	R
I.5.5		22 kW Aerator Gearbox	No.	1	R	R
I.5.6		45 kW Aerator Gearbox	No.	1	R	R
I.5.7		Gearbox type DF108-738-LA71m4	No.	1	R	R

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I.5.8		0.37 kW Gearbox 2.9rpm	No.	1	R	R
I.5.9		Solid Air, 0.15 cubic meter compressor	No.	1	R	R
I.5.10		Spiral Model VF40L lime feeders	No.	1	R	R

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SECTION I - INSTALLATION ONLY – continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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SECTION I BROUGHT FORWARD FROM PREVIOUS PAGE

I.5.11		Spherical roller bearings (22222MBKW33 BTC)	No.	1	R	R
I.5.12		Sleves (H322)	No.	1	R	R
I.5.13		Taper Lock Bush (3525 × 100 mm)	No.	1	R	R
I.5.14		SNU U-lock seals (U522)	No.	1	R	R
I.5.15		Couplings 280	No.	1	R	R
I.5.16		Element HRC 280	No.	1	R	R
I.5.17		Dewatering Belts	No.	1	R	R
I.5.18		Sleves (H322)	No.	1	R	R
I.5.19		V BELTS				
		installation ONLY of the following V Belts:				
I.6.1		17 X 1210	No.	1	R	R
I.6.2		17 X 1400	No.	1	R	R
I.6.3		17 X 1450	No.	1	R	R
I.6.4		17 X 1470	No.	1	R	R
I.6.5		17 X 1510	No.	1	R	R
I.6.6		17 X 1530	No.	1	R	R
I.6.7		17 X 1670	No.	1	R	R
I.6.8		17 X 1600	No.	1	R	R
I.6.9		17 X 1620	No.	1	R	R
I.6.10		17 X 1530	No.	1	R	R
I.6.11		17 X 1670	No.	1	R	R
I.6.12		17 X 1520	No.	1	R	R
I.6.13		17 X 1340	No.	1	R	R
I.6.14		17 X 1620	No.	1	R	R
I.6.15		17 X 1470	No.	1	R	R
I.6.16		17 X 1440	No.	1	R	R
I.6.17		17 X 1430	No.	1	R	R
I.6.18		17 X 1310	No.	1	R	R
I.6.19		17 x 1260	No.	1	R	R
I.6.20		17 X 1570	No.	1	R	R
I.6.21		17 X 1440	No.	1	R	R
I.6.22		17 X 1430	No.	1	R	R
I.6.23		17 x 1420	No.	1	R	R
I.6.24		17 X 1350	No.	1	R	R
I.6.25		17 x 1200	No.	1	R	R
I.6.26		17 X 1250	No.	1	R	R
I.6.27		17 X 1275	No.	1	R	R
I.6.28		17 X 1320	No.	1	R	R

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I.6.29		17 X 1390	No.	1	R	R
I.6.30		17 X 1316	No.	1	R	R
I.6.31		17 x 1735	No.	1	R	R
I.7		<u>INSTALLATION ONLY OF COMPLETE SET OF COLUMNS WITH BOBBING BEARINGS & RODS.</u>				
I.7.1		40 mm diameter	No.	1	R	R
I.7.2		50 mm diameter	No.	1	R	R

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SECTION I - INSTALLATION ONLY - continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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I.7.3		65 mm diameter	No.	1	R	R
I.7.4		80 mm diameter	No.	1	R	R
I.7.5		100mm diameter	No.	1	R	R
I.8		<u>ELECTRICAL MOTORS (Installation Only, induction motors, SABS approved)</u>				
I.8.1		0.18 kW x 380 V	No.	1	R	R
I.8.2		1.1 kW x 380 V	No.	1	R	R
I.8.3		2.2 kW x 380 V	No.	1	R	R
I.8.4		5,5 kW x 380 V	No.	1	R	R
I.8.5		7,5 kW x 380 V	No.	1	R	R
I.8.6		11 kW x 380 V	No.	1	R	R
I.8.7		15 kW x 380 V	No.	1	R	R
I.8.8		18,5 kW x 380 V	No.	1	R	R
I.8.9		22 kW x 380 V	No.	1	R	R
I.8.10		26k kW x 380 V	No.	1	R	R
I.8.11		30k kW x 380 V	No.	1	R	R
I.8.12		45k kW x 380 V	No.	1	R	R
I.8.13		75k kW x 380 V	No.	1	R	R
I.8.14		90kW x 380 V	No.	1	R	R
I.8.15		132 kW x 380 V	No.	1	R	R
I.8.16		160 kW x 380 V	No.	1	R	R
I.8.17		200 kw x 380v	No.	1	R	R
I.8.18		239 kW x 380 V	No.	1	R	R
I.8.19		250 kW x 380 V	No.	1	R	R
I.8.20		300 kW x 380 V	No.	1	R	R
I.8.21		350 kW x 380 V	No.	1	R	R
I.8.22		400 kW x 380 V	No.	1	R	R
I.8.23		500 kW x 380 V	No.	1	R	R
I.8.24		600 kW x 380 V	No.	1	R	R

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I.9		MOTOR CONTROL CENTER (MOTOR ELECTRICAL PANEL)				
I.9.1		INSTALLATION ONLY MCC CONTROL CABINET: to consists of input circuit break, soft starter/VDS starters/ (star delta for motor less than 7.5kw), bypass contactor, Busbar, indicator, hour meter, Secondary side control, cables, advanced dsplay and necessary components, ,for electrical motor range				
		-				
I.9.1.1		Up to 1 kw	No.	1	R	R
I.9.1.2		Up to 3 kw	No.	1	R	R
I.9.1.3		Up to 7.5 kw	No.	1	R	R
I.9.1.4		Up to 18.5 Kw	No.	1	R	R
I.9.1.5		Up to 30 kw	No.	1	R	R
I.9.1.6		Up to 60kw	No.	1	R	R
I.9.1.7		Up to 90 kw	No.	1	R	R
I.9.1.8		Up to 150 kw	No.	1	R	R
I.9.1.9		Up to 200kw	No.	1	R	R
I.9.1.10		Up to 350 kw	No.	1	R	R
I.9.1.11		Up to 450kw	No.	1	R	R
I.9.1.12		Up to 600kw	No.	1	R	R

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SECTION I - INSTALLATION ONLY - continued

ITEM NO	PAYMENT REF	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
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SECTION I BROUGHT FORWARD FROM PREVIOUS PAGE

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I.9.2		<u>Installation Only of Variable Speed Drive (VSD) in the MCC cabinet:</u> VSD motor starters for electric Motor range:				
I.9.2.1		VSD to run motor up to 4.5kW.	No.	1	R	R
I.9.2.2		VSD for motor up to 7.5kW	No.	1	R	R
I.9.2.3		VSD for motor up to 11kW	No.	1	R	R
I.9.2.4		VSD for motor up to 18kW	No.	1	R	R
I.9.2.5		VSD for motor up to 22kW	No.	1	R	R
I.9.2.6		VSD for motor up to 30kW	No.	1	R	R
I.9.2.7		VSD for motor up to 55kW	No.	1	R	R
I.9.2.8		VSD for motor up to 90kW	No.	1	R	R
I.9.2.9		VSD for motor up to 110kW	No.	1	R	R
I.9.2.10		VSD for motor up to 185kW	No.	1	R	R
I.9.2.11		VSD for motor up to 220kW	No.	1	R	R
I.9.2.12		VSD for motor up to 300kW	No.	1	R	R
I.9.2.13		VSD for motor up to 400kW	No.	1	R	R
I.9.2.14		VSD for motor up to 500kW	No.	1	R	R
I.9.2.15		VSD for motor up to 600kW	No.	1	R	R
I.9.2.16		VSD to run motor up to 600kW.	No.	1	R	R
		-				
I.9.3		<u>SOFT STATER for electrical motor. Installation Only for motor range:</u>				
I.9.3.1		Soft Starter for motor up to 3.5kW	No.	1	R	R
I.9.3.2		Soft Starter for motor up to 7.5kW	No.	1	R	R
I.9.3.3		Soft Starter for motor up to 11kW	No.	1	R	R

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I.9.3.4		Soft Starter for motor up to 18kW	No.	1	R	R
I.9.3.5		Soft Starter for motor up to 22kW	No.	1	R	R
I.9.3.6		Soft Starter for motor up to 30kW	No.	1	R	R
I.9.3.7		Soft Starter for motor up to 55kW	No.	1	R	R
I.9.3.8		Soft Starter for motor up to 90kW	No.	1	R	R
I.9.3.9		Soft Starter for motor up to 110kW	No.	1	R	R
I.9.3.10		Soft Starter for motor up to 185kW	No.	1	R	R
I.9.3.11		Soft Starter for motor up to 220kW	No.	1	R	R
I.9.3.12		Soft Starter for motor up to 300kW	No.	1	R	R
I.9.3.13		Soft Starter for motor up to 400kW	No.	1	R	R
I.9.3.14		Soft Starter for motor up to 500kW	No.	1	R	R
I.9.3.15		Soft Starter for motor up to 600kW	No.	1	R	R
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I.9.4		CIRCUIT BREAKERS				
		<u>Installation Only for rated current. MOUNTED IN MCC/ MINISUBS/ TRANSFORMER</u>				
I.9.4.1		MCB 5A 1P	No.	1	R	R
I.9.4.2		MCB 10A 1P	No.	1	R	R
I.9.4.3		MCB 15A 1P	No.	1	R	R
I.9.4.4		MCB 20A 1P	No.	1	R	R
I.9.4.5		MCB 25A 1P	No.	1	R	R
I.9.4.6		MCB 60A 1P	No.	1	R	R
I.9.4.7		MCCB 40A 2P	No.	1	R	R
I.9.4.8		MCB 60A 2P	No.	1	R	R
I.9.4.9		MCB 10A 3P	No.	1	R	R
I.9.4.10		MCCB 30A 3P	No.	1	R	R
I.9.4.11		MCCB 35A 3P	No.	1	R	R
I.9.4.12		MCB 50A 3P	No.	1	R	R
I.9.4.13		MCCB 70A 3P	No.	1	R	R
I.9.4.14		MCCB 80A 3P	No.	1	R	R
I.9.4.15		200A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS	No.	1	R	R
I.9.4.16		225A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS.	No.	1	R	R
I.9.4.17		250A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS.	No.	1	R	R
I.9.4.18		300A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS.	No.	1	R	R
I.9.4.19		350A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS	No.	1	R	R
I.9.4.20		400A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS MOUNTED IN MINISUBS/ TRANSFORMER	No.	1	R	R
I.9.4.21		500A 25kA(J25S) 3 PHASE CIRCUIT BREAKERS MOUNTED IN MINISUBS/ TRANSFORMER	No.	1	R	R
I.10		<u>CABLES</u>				
I.10.1		<u>LV CABLES</u>				
		Installation Only of the following				

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		<u>CU/PVC/PVC/SWA/PVC 600/1000V multicore cable including labels</u>				
I.10.1.1		2.5mm ² x 3 core	m	1	R	R
I.10.1.2		2.5mm ² x 4 core	m	1	R	R
I.10.1.3		4mm ² x 4 core	m	1	R	R
I.10.1.4		6mm ² x 4 core	m	1	R	R
I.10.1.5		10mm ² x 4 core	m	1	R	R
I.10.1.6		16mm ² x 4 core	m	1	R	R
I.10.1.7		25mm ² x 4 core	m	1	R	R
I.10.1.8		35mm ² x 4 core	m	1	R	R
I.10.1.9		50mm ² x 4 core	m	1	R	R
I.10.1.10		70mm ² x 4 core	m	1	R	R
I.10.1.11		95mm ² x 4 core	m	1	R	R
I.10.1.12		120mm ² x 4 core	m	1	R	R
I.10.1.13		150mm ² x 4 core	m	1	R	R
I.10.1.14		185mm ² x 4 core	m	1	R	R

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I.10.2		<u>Cable Terminations for CU/PVC/PVC/SWA/PVC 600/1000V multicore cable</u>				
I.10.2.1		2.5mm ² x 3 core	No.	1	R	R
I.10.2.2		2.5mm ² x 4 core	No.	1	R	R
I.10.2.3		4mm ² x 4 core	No.	1	R	R
I.10.2.4		6mm ² x 4 core	No.	1	R	R
I.10.2.5		10mm ² x 4 core	No.	1	R	R
I.10.2.6		16mm ² x 4 core	No.	1	R	R
I.10.2.7		25mm ² x 4 core	No.	1	R	R
I.10.2.8		35mm ² x 4 core	No.	1	R	R
I.10.2.9		50mm ² x 4 core	No.	1	R	R
I.10.2.10		70mm ² x 4 core	No.	1	R	R
I.10.2.11		95mm ² x 4 core	No.	1	R	R
I.10.2.12		120mm ² x 4 core	No.	1	R	R
I.10.2.13		150mm ² x 4 core	No.	1	R	R
I.10.2.14		185mm ² x 4 core	No.	1	R	R
I.10.3		<u>Bare Copper Earth cable (BCEC) with stranded conductors including labels.</u>				
I.10.3.1		2.5mm ² x 3 core	m	1	R	R
I.10.3.2		2.5mm ² x 4 core	m	1	R	R
I.10.3.3		4mm ² x 4 core	m	1	R	R
I.10.3.4		6mm ² x 4 core	m	1	R	R
I.10.3.5		10mm ² x 4 core	m	1	R	R
I.10.3.6		16mm ² x 4 core	m	1	R	R
I.10.3.7		25mm ² x 4 core	m	1	R	R
I.10.3.8		35mm ² x 4 core	m	1	R	R
I.10.3.9		50mm ² x 4 core	m	1	R	R
I.10.3.10		70mm ² x 4 core	m	1	R	R

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I.10.3.11		95mm ² x 4 core	m	1	R	R
I.10.3.12		120mm ² x 4 core	m	1	R	R
I.10.3.13		150mm ² x 4 core	m	1	R	R
I.10.3.14		185mm ² x 4 core	m	1	R	R
I.10.4		<u>Cable terminations for bare copper earth cables, complete, including gland shroud, lugs, number tags, etc and connection.</u>				
		<u>Terminations for Bare Copper Earth Conductors (BCEC)</u>				
I.10.4.1		2.5mm ² x 3 core	No.	1	R	R
I.10.4.2		2.5mm ² x 4 core	No.	1	R	R
I.10.4.3		4mm ² x 4 core	No.	1	R	R
I.10.4.4		6mm ² x 4 core	No.	1	R	R
I.10.4.5		10mm ² x 4 core	No.	1	R	R
I.10.4.6		16mm ² x 4 core	No.	1	R	R
I.10.4.7		25mm ² x 4 core	No.	1	R	R
I.10.4.8		35mm ² x 4 core	No.	1	R	R
I.10.4.9		50mm ² x 4 core	No.	1	R	R
I.10.4.10		70mm ² x 4 core	No.	1	R	R
I.10.4.11		95mm ² x 4 core	No.	1	R	R
I.10.4.12		120mm ² x 4 core	No.	1	R	R
I.10.4.13		150mm ² x 4 core	No.	1	R	R
I.10.4.14		185mm ² x 4 core	No.	1	R	R

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		<u>CABLE SUPPORT</u>				
I.10.5		<u>Installation Only of the following</u>				
		<u>Heavy Duty Hot Dipped Galvanised Mild Steel cable ladder including mounting brackets, fasteners and supports.</u>				
I.10.5.1		50 x 50mm (W x H)	No.	1	R	R
I.10.5.2		100 x 100mm (W x H)	No.	1	R	R
I.10.5.3		200 x 100mm (W x H)	No.	1	R	R
I.10.5.4		300 x 100mm (W x H)	No.	1	R	R
I.10.5.5		600 x 100mm (W x H)	No.	1	R	R
I.10.5.6		800 x 100mm (W x H)	No.	1	R	R
I.10.5.7		1000 x 100mm (W x H)	No.	1	R	R
I.10.6		<u>Installation Only of Heavy Duty Hot Dipped Galvanised Mild Steel cable ladder Tee off / 90° deg horizontal elbow / internal Riser / dropper pieces including mounting brackets, fasteners and supports.</u>				
I.10.6.1		50 x 50mm (W x H)	No.	1	R	R
I.10.6.2		100 x 100mm (W x H)	No.	1	R	R
I.10.6.3		200 x 100mm (W x H)	No.	1	R	R
I.10.6.4		300 x 100mm (W x H)	No.	1	R	R
I.10.6.5		600 x 100mm (W x H)	No.	1	R	R
I.10.6.6		800 x 100mm (W x H)	No.	1	R	R
I.10.6.7		1000 x 100mm (W x H)	No.	1	R	R

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I.10.7		<u>Installation Only of Hot Dipped Galvanised Wire Mesh Cable Tray including mounting brackets, fasteners and supports</u>				
I.10.7.1		50 x 50mm (W x H)	No.	1	R	R
I.10.7.2		100 x 100mm (W x H)	No.	1	R	R
I.10.7.3		200 x 100mm (W x H)	No.	1	R	R
I.10.7.4		300 x 100mm (W x H)	No.	1	R	R
I.10.7.5		600 x 100mm (W x H)	No.	1	R	R
I.10.7.6		800 x 100mm (W x H)	No.	1	R	R
I.10.7.7		1000 x 100mm (W x H)	No.	1	R	R
I.10.8		<u>Installation Only of Hot Dipped Galvanised Steel Conduit - complete with couplers, boxes and all other ancillary equipment.</u>				
I.10.8.1		20mm diameter	m	1	R	R
I.10.8.2		25mm diameter	m	1	R	R
I.10.8.3		32mm Diameter	m	1	R	R
I.11		<u>MEDIUM VOLTAGE NETWORK</u>				
		<u>(INSTALLATION ONLY)</u>				
I.11.1		<u>1 Core, 500mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)</u>				
(a)		6.6/11kV 1 CORE ARMoured CABLE	m	1	R	R
I.11.2		<u>1 Core, 400mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)</u>				
(a)		6.6/11kV 1 CORE ARMoured CABLE	m	1	R	R
I.11.3		<u>3 Core, 300mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)</u>				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
I.11.4		<u>3 Core, 240 mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)</u>				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R

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I.11.5		<u>3 Core, 150mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)</u>				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
I.11.6		<u>3 Core, 70mm², Cu conductors with galvanized SWA, XLPE cable manufactured locally (SABS)</u>				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
I.11.7		<u>3 Core, 300mm² Aluminium SWA XLPE manufactured locally (SABS)</u>				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
I.11.8		<u>3 Core, 240mm² Aluminium SWA XLPE manufactured locally (SABS)</u>				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
I.11.9		<u>3 Core, 185mm² Aluminium SWA XLPE manufactured locally (SABS)</u>				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
I.11.10		<u>3 Core, 150mm² Aluminium SWA XLPE manufactured locally (SABS)</u>				
(a)		6.6/11kV 3 CORE ARMoured CABLE	m	1	R	R
I.11.11		<u>Cable work (XLPE/PILC)</u>				

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(a)		Indoor termination 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(b)		Cable joint 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(c)		Indoor termination 6.6/11kV for XLPE Cable (35 mm ² to 500 mm ²) single core	No.	1	R	R
(d)		Cable joint 6.6/11kV for XLPE Cable (35 mm ² to 500 mm ²) single core	No.	1	R	R
(e)		Indoor termination 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(f)		Cable joint 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(g)		Indoor termination 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
(h)		Cable joint 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
(i)		Indoor termination 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
(j)		Cable joint 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
(k)		Outdoor termination 11kV for ABC	No.	1	R	R
(l)		Outdoor Cable joint for 11kV ABC	No.	1	R	R
(m)		Outdoor termination 6.6/11kV for XLPE Cable (35 mm ² to 300 mm ²) 3 core	No.	1	R	R
(n)		Outdoor termination 6.6/11kV for XLPE Cable (35 mm ² to 500 mm ²) single core	No.	1	R	R
(o)		Outdoor termination 6.6/11kV for PILC Cable (35 mm ² to 300 mm ²) single core	No.	1	R	R
I.12		MINISUBSTATION				
I.12.1		<u>Minisubstation: Installation Only; To comply with SANS spec. of the size:</u>				
I.12.1.1		1000 kVA MINIATURE SUBSTATION COMPLETE WITH 1500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
I.12.1.2		650 kVA MINIATURE SUBSTATION COMPLETE WITH 1000A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
I.12.1.3		500 kVA MINIATURE SUBSTATION COMPLETE WITH 800A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
I.12.1.4		315 kVA MINIATURE SUBSTATION COMPLETE WITH 500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
I.12.1.5		200 kVA MINIATURE SUBSTATION COMPLETE WITH 300A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 3 WAY SF6 RMU	No.	1	R	R
I.12.1.6		315 kVA MINIATURE SUBSTATION COMPLETE WITH 500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
I.12.1.7		1000 kVA MINIATURE SUBSTATION COMPLETE WITH 1500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
I.12.1.8		650 kVA MINIATURE SUBSTATION COMPLETE WITH 1000A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
I.12.1.9		500 kVA MINIATURE SUBSTATION COMPLETE WITH 800A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
I.12.1.10		315 kVA MINIATURE SUBSTATION COMPLETE WITH 500A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
I.12.1.11		200 kVA MINIATURE SUBSTATION COMPLETE WITH 300A 25kA 3 PHASE MAIN BREAKER MOUNTED IN MINISUBS AND 4 WAY SF6 RMU	No.	1	R	R
I.12.1.12		PRE-CAST CONCRETE FOUNDATION FOR MINIATURE SUBSTATION	No.	1	R	R

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I.13	DIESEL GENERATOR (POWER SUPPLY EQUIPMENT)				
	Installation Only in compliance with SANS specification, efficiency performance, low fuel consumption, vandal proof Structure and user friendly. To consists of Diesel Engine, Engine mounted Instrument Panel fitted with and having digital display, Alternator, Base Frame & Foundation, Fuel Tank, Exhaust System, Starting System, Control Cables, Earthing				
	For sizes specified below:				
I.13.1	20 kVA generator	No.	1	R	R
I.13.2	30 kVA generator	No.	1	R	R
I.13.3	60 kVA generator set	No.	1	R	R
I.13.4	100 kVA generator set	No.	1	R	R
I.13.5	150 kVA generator set	No.	1	R	R
I.13.6	200 kVA generator set	No.	1	R	R
I.13.7	250 kVA generator set	No.	1	R	R
I.13.8	300 kVA generator set	No.	1	R	R
I.13.9	400 kVA generator set	No.	1	R	R
I.13.10	500 kVA generator set	No.	1	R	R
I.13.11	800 kVA generator set	No.	1	R	R
I.13.12	1000 KVA generator set	No.	1	R	R
I.13.13	1400 kVA generator set	No.	1	R	R
I.13.14	From 1401 to 2000 kVA generator set	No.	1	R	R
I.10	INSTRUMENTATION				
	Installation ONLY of the following instrumentation:				
I.10.1	POCKET COLORIMETER, CHLORINE, FREE + TOTAL, MR, WITH BOX or similar	No.	1	R	R
I.10.2	GENERAL USE PH PROBE:	No.	1	R	R
I.10.3	PORTABLE TURBIDIMETER or similar	No.	1	R	R
I.10.4	4-POLES GRAPHITE CONDUCTIVITY CELL, 1m CABLE or similar	No.	1	R	R
I.10.5	PORTABLE MULTI METER PH, CONDUCTIVITY, SALINITY, TDS, DISSOLVED OXYGEN (DO), ORP AND ISE FOR WATER or similar	No.	1	R	R
I.10.6	PORTABLE SPECTROPHOTOMETER or similar	No.	1	R	R
TOTALSECTION I TO SUMMARY					

Summary		
Section A	Preliminary and Generals	R
Section B	Dayworks	R
Section C	Civil	R
Section D	Mechanical	R
Section E	Electrical	R

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Section G	Instrumentation	R
Section H	Supply Only	R
Section I	Installation Only	R
	Sub-total	R
	Add 10% contingencies (This amount is under the sole discretion of the Engineer and may be omitted partially or wholly)	R
	Sub-Total	R
	15% VAT	R
	Total	R

N.B: ALL WORK TO BE MEASURE PRIOR COMMENCEMENT AND ON COMPLETION

OFFER TO BE VALID FOR 90 DAYS FROM THE CLOSING DATE OF BID

BIDDERS MUST FILL IN (BILL OF QUANTITIES) C2.2 MBD 3.1 BID PRICE IN FULL, NO OPEN SPACES (RATE NOT PRICED) ON BOQ WILL BE ACCEPTED, FAILURE TO COMPLY BIDDER WILL BE DISQUALIFIED.

SCOPE OF WORK MAY BE REDUCED TO ACCOMMODATE THE BUDGETED AMOUNT.

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C2.3 DAY WORK SCHEDULE

The tenderer must insert in this day work schedule the percentages which he proposes to claim for labour and on the actual net cost of materials and must state the rates for the use of such construction equipment as he proposes to have available upon the site to use for day work. (See clause 6.5.4 of the general conditions of contract, 2015, 3rd Edition).

The labour and materials percentages, and rates of hire quoted will be held to include for all items as detailed in General Conditions of Contract, 2015, 3rd Edition.

Rates for the use of construction equipment must be the overall charge, excluding VAT, to the employer.

(a) Labour

Percentage allowance on gross remuneration of workmen actually engaged %

(b) Material

Percentage allowance on net cost of materials delivered on Site %

(c) Construction Equipment

Construction Equipment: (insert details)	Hourly rate (Excluding VAT)	
	R	c

Date	Signed on behalf of the Tenderer

NOTES

- (i) If the percentage allowances are not stated by the tenderer in (a) and (b) above, or in the contract data, the percentages will be held to be:
 - 15% on the gross remuneration of workmen actually engaged,
 - 15% on the net cost of materials.
- (ii) Payments under Items (a) and (b) above will not be subject to price adjustment, but payments based on the rates under Item (c) will be adjusted in terms of clause 46.2 of the general conditions of contract.

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SCOPE OF WORK

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C3.1 STANDARD SPECIFICATIONS

C3.2 PROJECT SPECIFICATIONS

PART A

GENERAL

PS-1	Project description
PS-2	Description of the site and access
PS-3	Details of the works
PS-4	Construction management requirements
PS-5	Site facilities available
PS-6	Facilities required on site
PS-7	Features of the contract requiring special attention
PS-8	Rainfall figures
PS-9	Security clearance of personnel
PS-10	Safety
PS-11	Subcontractors
PS-12	Deviation from construction programme
PS-13	Delay in completion
PS-14	Supply of materials
PS-15	Execution of works
PS-16	Information that will be provided by the municipality
PS-17	Key performance indicators
PS-18	Payments
PS-19	Period of tender
PS-20	Accept of offer
PS-21	Evaluation
PS-22	Validity period
PS-23	Estimate timeframes

PART B

VARIATIONS, AMENDMENTS & ADDITIONS TO THE STANDARD SPECIFICATIONS

C3.3 PARTICULAR SPECIFICATIONS

PO:	Occupational health and safety specifications
Annexures	1, 2 & 3

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C3: SCOPE OF WORK

APPOINTMENT OF A PANEL OF MAXIMUM 10 (TEN) CONTRACTORS FOR THE REFURBISHMENT AND REPLACEMENT OF CIVIL WORKS, MECHANICAL AND ELECTRICAL EQUIPMENTS AT WATER, WASTE WATER TREATMENT WORKS AS AND WHEN REQUIRED FOR 36 MONTHS.

The work involves the supply of equipment, materials and labours and construction.

All work shall be undertaken in accordance with all Acts, Codes, regulations and "SABS" Standards.

DESCRIPTIONS OF WORKS

The Nkomazi Local Municipality (NLM) is inviting tenders for the appointment of a panel of maximum 10 (TEN) qualified and experienced contractors to undertake refurbishment works on water and wastewater treatment facilities within the municipality's jurisdiction. This tender is designed to create a ready pool of contractors who can be swiftly engaged on an "as and when required" basis to address refurbishment needs as they arise.

The scope of work under this tender includes, but is not limited to, the following:

- Assessment and Repair: Conduct thorough assessments of existing water and wastewater treatment facilities to identify areas requiring refurbishment and repair.
- Replacement of Components: Replace or upgrade outdated, damaged, or inefficient components of the treatment systems to enhance technical evaluation and efficiency.
- Structural Improvements: Undertake structural repairs and improvements to ensure the integrity and longevity of the treatment facilities.
- Compliance Upgrades: Ensure all refurbishment works comply with relevant regulations and standards to maintain the safety and environmental integrity of the treatment processes.
- Preventive Maintenance: Implement measures to prevent future deterioration and extend the operational life of the facilities.

The primary objectives of this tender are:

- Enhanced Service Delivery: Ensure the continuous and reliable operation of water and wastewater treatment facilities to provide high-quality services to the community.
- Efficiency and Sustainability: Improve the efficiency and sustainability of the treatment processes through timely and effective refurbishment works.
- Cost-Effectiveness: Achieve cost savings by having a panel of pre-qualified contractors who can be engaged quickly without the need for a lengthy procurement process for each project.
- Regulatory Compliance: Ensure all refurbishment works meet regulatory requirements and industry standards to safeguard public health and the environment.
- Flexibility and Responsiveness: Maintain the ability to respond promptly to refurbishment needs as they are identified, minimizing downtime and service disruptions.

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By establishing a panel of 10 (TEN) contractors through this tender, the Nkomazi Local Municipality aims to ensure the efficient and effective refurbishment of its water and wastewater treatment facilities. This strategic approach will enhance service delivery, ensure regulatory compliance, and provide cost-effective solutions to meet the municipality's ongoing infrastructure needs.

Client's Objective

It is a specific goal of this project that the labour component be maximized where it is economically feasible, and that the use of this labour goes hand in hand with on the job training of the labour force. The project is thus process and product orientated, and it is expected that the contractor will pursue these goals in the execution of the project.

Extend of the Works

The major items of work to be executed by the Contractor are as follows:

a) General

- i) Contractual requirements and Site establishment.
- ii) Locating of existing service.
- iii) Verifications of dimension for setting-out purposes.

b) Supplementary Works

- i) Rendering of maintenance manuals.
- ii) The maintenance of the works during construction and for 12 months from the date of the Certificate of Completion.

Deviation report on construction drawings issued.

The successful tenderer shall provide before commencement of any work on the site the following information:

- Current Public Liability Insurance Policy Number and details of policy
- Current Workers Compensation Policy details
- Proof of Accreditation under the Building Services "CIDB" Authority

PS2 DESCRIPTION OF THE SITE AND ACCESS

2.1 Location of site

Projects are located within Nkomazi Local Municipality.

2.2 Access to site

Tenderer's must allow for all conditions on site in their tenders, since extra claims arising from difficult site conditions in respect to transport, handling, loading, off-loading, labour, housing, etc., will not be entertained.

Access routes to the site shall at all times be kept serviceable, or alternatives shall be provided. These include road entrances that may have to be kept closed

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overnight.

PS3 DETAILS OF THE WORKS

3.1 Brief description of works

Refurbishment works of water and wastewater treatment work facilities in the jurisdiction of Nkomazi Local Municipality.

3.2 Nature of stratum on site

Existing services such as water and sewer pipelines need to be exposed before excavations takes place to prevent damages.

3.3 Construction in confined areas

It may be necessary for the contractor to work within confined areas. Except where provided for in the specifications, no additional payment shall be made for work done in restricted areas. In certain places excavation, construction and filling works will have to be performed in a small ($\pm 1,0$ m width) working space. The method of construction in these confined areas largely depends on the contractor's constructional plant. The contractor shall note that, unless provided for in terms of the scheduled payment items of the project specifications, measurement and payment shall be in accordance with the specified excavation, construction and filling works, irrespective of the method used for achieving these cross sections and dimensions, and that the tendered rates and amounts shall include full compensation for all special equipment and construction methods and for all difficulties encountered when working in confined areas and narrow widths, and at or around obstructions, and that no extra payment shall be made nor shall any claim for additional payment be considered in such cases.

PS4 CONSTRUCTION PROGRAMME

PS 4.1 General

The submission of a construction programme as stated per clause 15 of the general conditions of contract is compulsory.

Before any work is to be commenced on the site (within a period as stated in clause 15.2 of the general conditions of contract), the contractor must submit a detailed project programme for the construction of the works to the engineer for his approval.

In preparation of the construction programme the contractor must liaise with the engineer and the programme must take into account the coordination of all activities. The programme must consist of a detailed schedule or block diagram covering all aspects of the works and the planned time thereof must, with the contract period as time basis, be shown.

Rainfall conditions will be taken as abnormal when the average rainfall, as shown in clause PS 8, is exceeded and the contractor must then apply in writing for extension of the contract period using clause 50(5) of the special conditions of contract.

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The contractor shall submit to the engineer a realistic, detailed programme not later than 14 days after receipt of the letter of acceptance. The programme shall be in bar-chart format showing in detail how the contractor proposes to complete the work covered by this contract by the due completion date.

The following details must be stated:

- i) The quantity of work applicable to each bar item as well as the rate at which the work will be completed.
- ii) A budget of the value of completed work, month by month, for the full contract period.
- iii) The contractor's plant commitment on the contract for every fortnight.
- iv) The critical path.

The programme shall be kept up to date. If a contractor fails to maintain progress in terms of the programme, he shall produce a revised programme showing the modifications to the original programme necessary to ensure completion of the works before the due completion date.

The approval of any programme by the engineer shall have no contractual significance, other than satisfying the engineer that the work is carried out according to such programme and that the contractor undertakes to carry out the work in accordance with the programme. The engineer will have the right to instruct the contractor to revise the programme if necessitated by circumstances.

PS 4.2 **Time for completion**

Project timelines are project specific and will be communicated upon project identification.

PS 5 **SITE FACILITIES AVAILABLE**

PS 5.1 **Water supply**

Fresh water will be available for domestic and construction purposes, but the contractor must supply all necessary materials for the water connection at a position pointed out by the engineer. The availability of water cannot be guaranteed by the municipality and in the event of water no longer being freely available, the contractor must make his own arrangements to acquire it. **It should be noted that no contractor shall be permitted to draw water from Municipal fire hydrants.**

The rates tendered for the relevant items in the preliminary and general section of the schedule shall include all costs for the establishment and maintenance of water supply to the works and the contractor shall make his own arrangements for the possible conveyance and storage of water if necessary. The contractor will be held responsible for any wastage of water due to negligence.

PS 5.2 **Power supply**

Electrical power cannot be guaranteed by the municipality. During power failures and

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shortages, the contractor must make his own arrangements for the provision of electricity.

The rates tendered for the relevant items in the preliminary and general section of the schedule shall include all costs for the establishment and maintenance of a power supply to the works.

PS 6 FACILITIES REQUIRED ON SITE

PS 6.1 Facilities for the engineer

The municipality will determine if the site office of the engineer is required or not however bidders must take into consideration on their pricing.

PS 6.2 Facilities for the contractor

The following facilities are required on the site for the contractor in addition to the facilities required by the contractor for his own purposes:

Ablution and sanitary facilities

The contractor shall erect and maintain on the site proper ablution facilities. The contractor shall service and maintain the facilities in a clean and hygienic state for the duration of the contract period and on completion of the works it from the site.

Site establishment

The engineer shall indicate the location for the site office before the contractor establishes site.

PS 6.3 Laboratory facilities (clause 7 SABS 1200A)

The contractor shall provide Laboratory facilities at an SABS accredited laboratory to conduct tests as required or as specified/measured in the bills of quantity.

PS 6.4 Municipal name board

Applicable to each specific site.

PS 6.5 Housing for the engineer and/or his representative

No housing is required for the engineer or his representative.

PS 6.6 Telephone Facilities

Telephone facilities are not needed on the site. The contractor's representative on site shall at all times be reachable by cell phone.

PS 6.7 Rail facilities

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PS 7 FEATURES OF THE CONTRACT REQUIRING SPECIAL ATTENTION

The execution of this contract is primarily the replacing of roof. Construction work is to be conducted in areas of presumably unstable sub-surface conditions and the tenderer shall provide special insurance to cover the works, machinery and his and the employer’s personnel in the event of ground movement during execution of work.

The engineer or employer shall not be responsible or liable for any losses or damages incurred by the contractor irrespective if it is due to the execution of work as per specifications or as directed in writing or verbally by the employer or engineer.

PS 8 RAINFALL FIGURES

The following figures are applicable for clause 50(5) of the special conditions of contract:

INFORMATION SOURCE National Weather Bureau, Department of Transport
Pretoria, Tel.: (012) 309 3911
PERIOD From January 1961 to December 1990

MONTH	Nn	Rn
JANUARY	170	
FEBRUARY	101	
MARCH	83	
APRIL	53	
MAY	36	
JUNE	7	
JULY	5	
AUGUST	9	
SEPTEMBER	33	
OCTOBER	93	
NOVEMBER	256	
DECEMBER	152	
ANNUAL AVERAGE	74.83	

Nn = Average amount of days on which a rainfall of 10 mm or more has been

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recorded
 R_n = Average monthly rainfall in mm

PS 9 SECURITY CLEARANCES OF PERSONNEL

Tenderers to note that the Nkomazi Local Municipality may require that security clearance investigations be conducted on any number of the tenderer's personnel.

If so required, by the Nkomazi Local Municipality, the tenderer must remove personnel as indicated immediately and ensure that they have no access to the works or documentation or any other information pertaining to the site.

The employer shall not be liable for any cost concerning the removal of personnel or the effect thereof on the execution of the work.

PS 10 SAFETY

PS10.1 Safety of workmen

The safe conduct of the works shall be a primary consideration and the entire works shall be carried out in conformity with all applicable statutory regulations and requirements and tenderers must price their tenders accordingly.

The contractor shall provide and maintain in readiness on the site, all equipment, and materials necessary to render first aid in case of accidents or other emergencies. The contractor shall also assign to the works and designate for this purpose, trained employees who are able to render first aid.

PS10.2 Health and safety requirements

It is a requirement of this contract that the contractor shall provide a safe working environment and to direct all his activities in such a manner that his employees and any other persons who may be directly affected by his activities are not exposed to hazards to their health and safety.

To this end the contractor shall conform to all the stipulations of the Occupational Health and Safety Act (Act 85 of 1993) and the regulations applicable at the time of tender, which inter alia provide for the designation of a health and safety representative (or representatives) when an employer has more than 20 employees in his employ.

PS 11 SUB-CONTRACTORS

The employer shall have the right to cede any sub-contract under this contract to a pre-approved subcontractor, in accordance with the provisions of clause 9 of the general conditions of contract.

PS 12 DEVIATION FROM CONSTRUCTION PROGRAMME

The programme of work as required in terms of the "General Conditions of Contract

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–2015” shall be submitted to the engineer not later than fourteen days after the commencement date.

The contractor shall take into account the requirements of the Occupational Health and Safety Act, as well as the construction regulations in the drafting of the programme.

The format shall not be in the form of a bar chart only, but shall also clearly indicate the anticipated quantity of work to be executed each month. The construction programme shall also clearly indicate the local and foreign labour to be utilised for the duration of the Contract.

If during the progress of the work, the quantities of the work performed per month fall below the expected indicated in the construction programme, or if the sequence of operation is altered, or if the programme is deviated from in any other way, the contractor shall, within one week after being notified by the engineer, submit a revised construction programme.

Such a revised construction programme shall be based on the tempo of work achieved by the contractor up to the date of revision. Any proposal to increase the tempo of work must be accompanied by positive steps to increase production by providing more labour and plant on site or by using the available labour and plant in a more efficient manner.

Failure on the part of the contractor to work according to the programme or revised programmes shall be sufficient reason for the Engineer to take steps as provided for in the “General Conditions of Contract –(2015)”.

PS 13 DELAY IN COMPLETION

The contractor shall organise the works in such a manner that no delays occur. Delay due to faulty organisation or lack or shortage of materials or labour or co-operation with other parties or to any other cause within the control of the contractor will not be countenanced and full power is reserved by the engineer to order the contractor to expedite the work should the work, in the opinion of the engineer, not progress in a satisfactory way.

PS 14 SUPPLY OF MATERIALS

All material to be used in the works is to be supplied by the contractor.

The contractor shall ensure that the work is not delayed due to the lack of materials on site, by placing orders for material required under this contract as soon as possible. No extension of time will be allowed for any delay due to the supply of materials.

Although the quantities have been carefully calculated, it must be considered as approximate only and the contractor, before ordering any materials, should check the quantities required. The bill of quantities is provisional.

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PS 15 EXECUTION OF THE WORKS

PS 15.1 Inspection by the engineer

No portion of the work shall be proceeded with until the engineer or his representative has examined and approved the previous stage. If any work is covered or hidden from view before the engineer or his representative has inspected the work, the contractor shall at his own cost expose the covered or hidden work for inspection. The contractor shall also be responsible for making good any work damaged during the uncovering.

PS 15.2 Certificate of completion

When all the work under the contract have been completed to the entire satisfaction of the engineer, he will issue a certificate of completion to the contractor informing the contractor of the date the date at which the works are deemed to be completed and accepted by the employer.

The sureties provided by the contractor for the fulfilment and completion of the contract in terms of the form of agreement will be released upon the issue of the certificate of completion.

PS 16 INFORMATION THAT WILL BE PROVIDED BY THE MUNICIPALITY

To be made available on non-compulsory site briefing

PS 17 KEY PERFORMANCE INDICATORS

(Indicate and Key performance indicators or measurement to be supplied by contractor to monitor the performance of the bidder. For example:

The following Key Performance Indicators will be used to assess the performance of the service provider:

- 17.1 Monthly reports indicating the progress on site shall be submitted at every technical or special meetings arranged by council;
- 17.2 EPWP job creation reports
- 17.3 Close –out Report.

PS 18 PAYMENTS

Payment will be in accordance with the tendered pricing schedule and the Key Performance Indicators indicated in the Terms of Reference. All prices should be inclusive of VAT. A valid tax invoice must be submitted within 5 working days after approval of workdone and measurement on site with all mandatory information and reporting as indicated in the scope of work. Payment will be made within 30 days from receipt of invoice by the finance department.

PS 19 PERIOD OF TENDER

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Thirty-Six (36) Months

PS20 ACCEPTANCE OF OFFER

The municipality reserves the right not to award the tender or any part of the tender subject to the availability of budgetary funds.

PS 22 VALIDITY PERIOD

The tender shall be valid for 90 days from date of opening the tender.

PART B: VARIATIONS, AMENDMENTS AND ADDITIONS TO THE STANDARDIZED SPECIFICATIONS

C3.3 PARTICULAR SPECIFICATIONS

In addition to the standardised and project specifications, the following particular specifications shall apply to this contract and are bound in hereafter.

CLAUSE	DESCRIPTION
PO	Occupational Health and Safety Specifications

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SPECIFICATIONS FOR THE CIVIL WORKS

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PART A: CIVIL

PS3 DETAILS OF THE WORKS

3.1 Brief description of works

This section covers the civil works to to be done on this contract at the waste water treatment works and pump station.

The scope of work shall include the design and construction of the following

3.1.1 Refurbishment of structurtes

- i. Concrete Work
Pump concrete base
- ii. Concrete Repairs
Repairs on concrete structures
- iii. Pipeline
- iv. Precast Concrete

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C3.2 SPECIFICATIONS FOR THE CIVIL WORKS

The standard specifications to apply for Civil works on this Contract is the entire SANS 1200 series available from the SABS (South African Bureau of Standards).

Variations and amendments to the SANS 1200 series are contained in this document and are denoted by the prefix PS. The letters and numbers following these prefixes respectively indicate the relevant Standardized Specification and clause numbers in SANS 1200. The variations and additions to the standardized specification applicable on this Contract are listed below:

VARIATIONS TO THE STANDARD SPECIFICATIONS

PSA	GENERAL
PSD	EARTHWORKS
PSDB	EARTHWORKS PIPE TRENCH
PSG	CONCRETE STRUCTURAL
PSH	STRUCTURAL STEEL
PSHC	CORROSION PROTECTION OF STRUCTURAL STEEL
PSLC	CABLE DUCTS

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VARIATIONS TO STANDARDISED SPECIFICATIONS

PSA : GENERAL

(Applicable to SANS 1200A-1986)

PSA 2 INTERPRETATIONS

PSA 2.1 Applicable edition of standards

Add at the beginning of Subclause 2.2:

"Unless a specific edition is specified (see the List of Applicable Specifications)"

PSA 2.8 Items in Schedule of Quantities

In the fourth line of Subclause 2.8.1, after the word "specification", add: "or in the Measurement and Payment clause of the Particular Specification, or Project Specification".

PSA 3 MATERIALS

PSA 3.1 Quality of Materials

Add to the Sub-Clause:

No used or recycled material may be used in the Works unless expressly authorised by the Engineer.

All materials to be provided under this Contract shall bear the mark of the South African Bureau of Standards wherever such materials are the subject of an SABS standard.

Materials bearing the SABS or BS mark will not be subjected to tests to determine whether they comply with the relevant specifications. The Engineer may in his discretion require any material not bearing such mark to be tested in accordance with the relevant specifications; should he do so the Contractor shall arrange for such tests to be carried out at the Contractor's cost by the South African Bureau of Standards or other approved body. Should the tests prove that any material complies with the Specifications the Contractor will be reimbursed the value of the testing body's account for carrying out the tests required by the Engineer.

PSA 3.3 Delay Due to Supply of Materials

Add the following new sub-clause:

The Contractor shall ensure that the work is not delayed, due to the lack of materials on the site of the works, by placing orders with suppliers for the materials required under this contract timeously.

The Contractor shall, by producing copies of written orders or written enquiries for supplies, prove to the satisfaction of the Engineer that any delay occasioned by non-availability of materials has been caused by the inability of suppliers to supply and not by his own lack of

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timely ordering or lack of exhaustive enquiry for supplies, before any extensions of the contract time will be allowed due to such delays.

PSA 4 PLANT
PSA 4.1 Contractor's Offices

PSA 4.2 Medical facilities and safety equipment

The suitable first aid services in terms of Subclause 4.2 of SANS 1200 A shall include, inter alia, a First Aid cabinet fully equipped and maintained with at least the minimum contents as listed in the Annexure (Regulation 3) to the General Safety Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993), to deal with accidents and ailments which are likely to occur during the construction period.

The Contractor shall provide personal safety equipment and facilities as required by Regulation 2 of the General Safety Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) – reference is to be made to the Health and Safety specifications forming part of this Contract Document found in section C3.6 Annexes

PSA 4.3 Latrine facilities

The Contractor shall make all the necessary arrangements with the relevant local authority or an approved private contractor for the disposal of the contents of the toilets on a regular basis.

PSA 5 CONSTRUCTION

PSA 5.1.1 Setting out of the Works

Before commencing any construction, the Contractor shall check the relative positions and levels of all reference pegs, bench marks and line pegs and inform the Engineer of any discrepancy.

The Contractor shall advise the Engineer of any conflict between the position of any part of the Works and an existing feature.

PSA 5.4 Existing Services

Action by Contractor

The Contractor shall not commence work in any area until proper arrangements have been made for supervision of any work by the relevant authority in connection with services that may exist.

PSA 5.5 Dealing with Water on the Works

Add the following to this clause:

For the purposes of this contract the term "water" shall also include for discharge from broken water pipes, flow from sewerage installations and broken sewerage pipes, whether caused by

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the Contractor or not as well as for ground water, stormwater, etc.

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PSA 5.7 Safety

Add to the Sub-Clause :

All work and particularly work carried out in the proximity of buildings, bridges, tanks or other structures shall be carried out in compliance with the regulations framed under the Occupational Health and Safety Act, No 85 of 1993 and the Minerals Act, (Act 50 of 1991) (including shoring where necessary) to ensure the safety of structures that are at risk.

The Contractor shall make available for the duration of the contract safety helmets, safety boots, gum boots and any other necessary safety equipment for sole use by the Engineer and his representative(s) – reference is to be made to the Health and Safety specification found in Section C3.6 Annexes, forming part of this Contract Document.

PSA 5.9 Security
PSA 5.9.1 Security of Contractor's Plant and Personnel

The Tenderer shall note that, notwithstanding the insurances affected by the Employer, the Contractor shall be responsible for the effecting of safety and security of plant and personnel on and around the site of the works, and that no claims in this regard will be entertained by the Employer.

The Contractor's attention is drawn to the fact that the work is to be carried out in an area where there might be a high incidence of criminal activity.

The sum entered by the Contractor in the Schedule of Quantities for effecting of safety and security of plant and personnel on and around the site of the works shall be deemed to include full compensation for all the measures necessary to affect the safety and security.

PSA 6 TOLERANCES
PSA 6.2 Degrees of Accuracy

Add to the Sub-Clause:

Degree of Accuracy I shall be applicable to the following parts of the Works unless stated to the contrary elsewhere;

Weirs, measuring flumes

Degree of Accuracy III shall be applicable to the following parts of the Works unless stated to the contrary elsewhere:

Building foundations, pipe encasements.

PSA 8 MEASUREMENT AND PAYMENT
PSA 8.3 Scheduled fixed-charge and value-related items

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PSA 8.3.2.1 Facilities for Engineer

Delete sub-items (a), (b) and (c) and substitute:

- | | | |
|----|---|------------|
| a) | Office Furniture | Unit : Sum |
| b) | Car ports (number stated) | Unit : Sum |
| c) | Cellular telephones (number stated) | Unit : Sum |
| d) | Combination photocopying, fax and telephone machine | Unit : Sum |
| e) | Laptop and Printer | Unit : Sum |
| f) | Name boards (Number stated) | Unit : Sum |
| g) | Survey | Unit : Sum |
| h) | LDV | Unit : Sum |

Add the following new item:

PSA 8.3.5 Security of Contractor's Plant & Personnel Unit : Sum

The tendered sum shall include full compensation for all costs incurred in effecting the safety and security of plant and personnel on site as described in Clause PSA 5.9.1.

PSA 8.4 Scheduled Time-Related Items

PSA 8.4.2.1 Facilities for the Engineer

Delete sub-items (a), (b), (c) and (d) and substitute:

- | | | |
|-----|---|------------|
| a) | Office Furniture | Unit : Sum |
| b) | Car ports (number stated) | Unit : Sum |
| c) | Cellular telephones (number stated) | Unit : Sum |
| d) | Combination photocopying, fax and telephone machine | Unit : Sum |
| e) | Laptop and Printer | Unit : Sum |
| f) | Name boards (number stated) | Unit : Sum |
| g) | Survey Assistants and survey materials | Unit : Sum |
| hi) | LDV | Unit : Sum |

PSA 8.4.2.2 Facilities for the Contractor

Add the following new item:

PSA 8.4.6 Security of Contractor's Plant and Personnel Unit : Sum

The tendered sum shall include full compensation for all costs incurred in effecting the safety and security of plant and personnel on site as described in Clause PSA 5.9.1.

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PSAB: ENGINEER'S OFFICE

(Applicable to SANS 1200AB-1986)

PSAB 1 SCOPE

PSAB 1.1 Delete this sub-clause and substitute:

This Specification covers the requirements for office, laboratory, store room, locker room, car ports, laboratory equipment and the minimum associated facilities for the use of the Engineer on the site.

THE CONTRACTOR SHALL NOTE THAT THESE ARE GENERAL REQUIREMENTS AND THAT ONLY THOSE ITEMS THAT ARE SPECIFICALLY ITEMISED IN THE SCHEDULE OF QUANTITIES ARE REQUIRED ON THIS CONTRACT.

When the Contract is awarded, the Engineer shall give the Contractor full details in writing regarding the number, type and layout of all the units required, as well as details of fittings and equipment required. The Contractor shall not order any buildings, material, equipment or fittings on the basis of what is specified or scheduled without written confirmation from the Engineer.

The offices, laboratory, store room, locker room and car ports shall, unless otherwise agreed or instructed, be erected in close proximity to the Contractor's offices and laboratory and the entire area shall be fenced with security fencing and provided with a gate. The Contractor shall take all reasonable precautions to prevent unauthorised entry to the offices and laboratories and to ensure the general security of the offices.

PSAB 2 INTERPRETATIONS

PSAB 2.3 Definitions

Add the following definitions:

Laboratory: A laboratory constructed on site, or a mobile, semi-mobile or prefabricated unit.

Store Room: A store room constructed on site, or a mobile, semi-mobile or prefabricated unit.

Locker Room: A locker room constructed on site, or a mobile, semi-mobile or prefabricated unit.

Car Port: A roofed shelter constructed on site for one or more cars as specified or scheduled.

PSAB 3 MATERIALS

PSAB 3.2 Office Building(s)

Delete this sub-clause entirely and retitle the sub-clause "FACILITIES FOR ENGINEER".

Add the following sub-clauses:

PSAB 3.2.1 Office Buildings

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The Contractor shall provide, furnish and equip one or more offices (as scheduled) for the use of the Engineer.

Office buildings shall be painted with an approved paint and the paintwork shall be maintained in good repair throughout the contract period.

All accommodation shall meet with the approval of the Engineer.

Furniture and equipment:

Each office shall be equipped with the following:

- i) Office desk with a surface area of at least 1,5 m² and having at least 3 drawers, one of which can be locked.
- ii) General purpose steel cabinet with doors, lock and two keys with at least 1,5 m² shelf areas and a volume of 0,7 m³.
- iii) Two office chairs.
- iv) Sufficient racks and hangers for hanging contract drawings. The hangers shall be of the "Barhold" type, with one hanger to 10 (TEN) drawings.
- v) Double 80 watt fluorescent light fittings complete with ballast and tubes (three per Type 1 office, and one per Type 2 office).
- vi) Drawing table with a smooth flat top having an area of at least 3m²

In addition to the above the office shall be equipped with the following:

- vii) Conference table large enough to accommodate twelve people and have a surface area of at least 4 m².
- viii) Ten office chairs.
- ix) Steel filing cabinet fitted with four drawers on runners. Cabinet shall be fitted with locks and shall be 1300mm high, 460mm wide and 600mm from front to back.
- x) Survey equipment as listed below:

One automatic level and tripod
One levelling staff (4 m long, 1 cm gradations)
Two tachometric staves; (5 m long, 1 cm chess board pattern)
Two staff angle bubbles
One metal change-point for levelling
One separate plumb-bob
One spirit level (one metre long)
Six steel-tipped ranging rods each 2,5 m long
Two canvas carry-bags

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One 100 m stilton tape
One 25 m stilton tape
One 5 m steel tape
One hammer (2 kg)
One electronic detector for locating underground services
Steel pegs in sufficient quantities as required

The tachometer may be shared by arrangement between the Contractor and the Engineer, but the remaining instruments shall be provided for the exclusive use of the Engineer. The Contractor shall keep the equipment continuously insured against any loss, damage, or breakage and he shall indemnify the Engineer and Employer against any claims in this regard.

On completion of the Works, ownership of the furnishings and equipment shall revert to the Contractor who shall remove them from the Site.

PSAB 3.2.2 Air-Conditioning Units

Where required by the Engineer, the Contractor shall provide, install and maintain air-conditioning units.

The air-conditioning unit shall be an electricity operated compressor type with closed circuit, and not an evaporation type. The capacity of the air-conditioning units shall be at least 2,2 kW each.

On completion of the Works, ownership of the air-conditioning units shall revert to the Contractor who shall remove them from the Site.

PSAB 3.2.3 Special Testing of Materials

Except when specifically directed by the Engineer, the Contractor shall be responsible for the execution of all tests required for quality and compaction control, and shall provide all necessary staff and equipment to the satisfaction of the Engineer for this purpose on the site of the works. No payment will be made for tests carried out by the Contractor except for specific tests ordered by the Engineer.

Over and above the normal check tests carried out by the Engineer on site the Engineer may from time to time order the Contractor to arrange special check tests to be carried out by an approved independent laboratory. Where such testing is contemplated in advance, allowance shall be made for the cost thereof by the inclusion of a Provisional Sum.

PSAB 3.2.4 Printer/ Photocopying Machine

The Contractor shall arrange for the provision, installation and maintenance of an approved photocopying machine, capable of making up to A3-sized copies, within the Engineer's office. The price shall include for all accessories such as paper, etc. for making a maximum of 1 000 A4-sized copies per month.

Upon completion of the whole of the works, the ownership of the photocopying machine shall revert to the Contractor who shall remove it from the site.

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PSAB 3.2.5 Telefax Machine

NOT APPLICABLE

PSAB 4 PLANT

PSAB 4.1 Telephone

Add the following:

"The Contractor shall provide a cell phone for the use of the Engineer."

PSAB 5 CONSTRUCTION

PSAB 5.4 Telephone

Delete the last sentence of this sub-clause and substitute:

"The cost of installation of the telephone, telephone rental and the cost of the Engineer's local calls, as well as all the costs associated with the provision, licensing, insurance, etc. of the portable telephone, shall be deemed to be covered by the Contractor's rates for the provision of the telephone service."

PSAB 5.5 Survey Assistants

Delete this Sub-clause and substitute:

"The Contractor shall make available to the Engineer on a part-time basis a cleaner/office assistant and in addition, when required, a suitably trained and approved survey assistant and labourers necessary to assist the Engineer in carrying out survey work, setting out and measurement of the works. The Contractor shall supply all pegs and concrete necessary for the setting out of the work. The wages of the cleaner/office assistant, survey assistant and labourers shall be paid by the Contractor."

PSAB 8 MEASUREMENT AND PAYMENT

PSAB 8.1 Scheduled Items

Add to the Sub-Clause:

The Tenderer is to include, under the Time Related Charges, a Prime Cost Sum calculated at a rate of R500.00 per week, for a period of time equal to the tendered Time for Completion of the Contract (see Appendix) to cover the cost of the Engineer's telephone calls and the related telephone rental and contractors costs and profits.

PSD : EARTHWORKS

(Applicable to SANS 1200 D - 1982)

PSD 1 SCOPE

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PSD 1.1 Delete the words "short trenches" in the second line.

PSD 2.3 Definitions

Add the following definitions:

The term "embankment" and the term "fill" shall be synonymous

The term "dispose" and the term "spoil" shall be synonymous.

Topsoil: The top layer of soil to a depth of 150 mm including the vegetal matter in the soil and above the ground.

PSD 3 MATERIALS
PSD 3.1 Classification for Excavation Purposes
PSD 3.1.1 Method of Classifying

After the first paragraph add:

Inspection of the material for any classification other than soft excavation shall be undertaken by the Engineer prior to any excavation. Levels of the occurrence of intermediate and hard rock excavation shall be measured and agreed, recorded and signed by both the Engineer and the Contractor before commencement of intermediate or hard rock excavation.

PSD 3.1.2 Classes of Excavation

Add the following:

Notwithstanding the provisions of this sub-clause of anything to the contrary in these Specifications or the Schedule of Quantities, Boulder Excavation Class A and Class B shall be classified as Intermediate Material, with the proviso that boulders requiring drilling and blasting in order to be removed or loaded as specified in Sub-Clauses 3.1.2(a)(1) and (2) will be measured separately as Hard Rock Excavation.

PSD 3.3.2 Backfilling and Embankments

Delete this sub-clause and replace with the following:

"Sufficient material arising from excavations for accesses, structures, terraces, foundations etc. and which is suitable for backfilling round and beneath structures, footings etc., embankments and the like, shall be stockpiled in the vicinity of its final destination or point of use. The Contractor shall ensure that the site(s) selected for such stockpiling are well clear of all works to be constructed and that such siting will not hamper construction activities.

All surplus material suitable for backfilling and embankments and all material which the Engineer considers to be unsuitable for backfilling and embankments shall be disposed of as directed by the engineer. For this particular Contract, unsuitable material arising from the site shall be disposed of in the designated landscape berms or as instructed by the Engineer, and suitable surplus material shall be used to fill the future SST terrace thereafter any remaining surplus material shall be used to form designated landscape berms. Tenderers shall therefore allow in their prices for all temporary stockpiling and double handling arising from this

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requirement.

The Contractor shall be entirely responsible for deciding whether or not excavated material suitable for backfilling is surplus to that required for the full construction and reinstatement of the Works. Should it become necessary to reclaim material previously disposed of or to import additional material from spoil dumps as a result of the Contractor's failure to comply with the above requirement for any reason whatever, then the Contractor shall bear all additional costs connected with such reclamation and/or importation."

PSD 5 CONSTRUCTION
PSD 5.1 Precautions
PSD 5.1.1 Safety

PSD 5.1.1.1 Barricading and lighting

Delete the Sub-Clause and substitute:

Without diminishing any obligation which the Contractor may have in terms of any Act, Ordinance or other legislation, the Contractor shall ensure that all excavations which are accessible to the public or which are adjacent to a public road or thoroughfare, or by which the safety of persons may be endangered are protected as set out in Clause 13 of the General Safety Regulations of the Occupational Health and Safety Act, 1993 and that watchmen are employed to ensure that barricades, barriers and lights are effective at all times.

Trench excavations shall be protected by means of at least three horizontal strands of 2.50 mm diameter galvanised wire. Double sided "red/white" chevron tapes shall be tied to the wires in a zigzag vertical pattern at maximum spacing of 1 m. The wires shall be stretched tightly between supports along both sides and ends of the excavation. The supports shall consist of poles or iron standards securely planted in solid ground at not more than 5 m centres so as to enclose the spoil and the excavations.

Bridges for vehicles and / or pedestrians shall be provided along the route of the work as and where may be considered necessary by the Engineer. They shall consist of a number of suitably sized steel plates laid across open excavated trenches. They shall be protected on each side by a stout two rail timber fence, at least 1 m high, consisting of 150 mm x 75 mm timber verticals set firmly into the ground, with 75 mm x 50 mm rails securely fastened to them. At least 4 lamps or reflective markers must be provided at each crossing.

Where construction is in, or across, public roads the barricades or barriers and temporary road signs shall be erected so as to comply with the requirements set out in Road Note 13 read in conjunction with the SA Road Traffic Signs Manual.

PSD 5.1.1.2 Safeguarding of excavations

Delete the first three lines and substitute the following:

The Contractor or his agent or representative appointed in writing shall be deemed to be and shall be both the "employer" and "a person who is competent to pronounce on the safety" of all bracing and shoring as set out in Regulation 13 (Demolition and Excavation) of the General Safety Regulations of the Occupational Health and Safety Act, No 85 of 1993.

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PSD 5 1.1.3 Explosives

The following shall be added to the end of this sub-clause:

"No specific allowance for overbreak will be made for this Contract, and any overbreak beneath foundations and all structures shall be made well with Class 10/19 concrete at the Contractor's expense".

PSD 5.1.2 Existing services and other works

The provisions of this sub clause shall be deleted and replaced with the following:

"The Contractor shall at all times exercise the utmost care that existing services and permanent or temporary works constructed by others are not disturbed, disrupted or damaged in any way by his activities.

Although the drawings may show the approximate position of existing services the Employer and/or the Engineer takes no responsibility for the accuracy thereof nor any omission that may have been made; and it is stressed that no claims for additional payment and/or extensions of time will be considered or granted for crossing or working alongside services not shown on the drawings or services which are not in the positions indicated on the drawings.

The Contractor shall exercise the greatest care when working in the vicinity of such services and shall take all necessary steps to protect any existing works whatsoever against damage which may arise as a result of his operations on site. The Contractor shall bear the cost of the repair of damage to any service the possible existence of which could reasonably have been ascertained by him in good time.

Where the Contractor is responsible for the cost of repairs carried out by the Employer or an outside Authority to services damaged by the Contractor's operations, and where the Contractor fails to make payment to the Authority concerned for the cost of such repairs, the Employer reserves the right to make such payment directly to the relevant Authority and to recover the costs thereof from the Contractor by means of a deduction from the Contractor's monthly Payment Certificate.

The Contractor shall adequately support in position and protect from damage any work which may become exposed by his excavation or rendered liable to damage by reason of the work in hand.

No specific payment will be made for the temporary protection of all existing services and works which will, or may be affected by this Contract during its execution, the cost of such protection being deemed to be covered by the rates tendered for other items of work.

The Contractor shall allow in his rates (for other items of work) for all work, whether of a temporary or permanent nature (including exposure), entailed in protecting these current existing services and works against damage or disruption resulting from his activities.

If, during the tenure of this Contract any permanent work, temporary work or construction activity by others on site of the works or on the construction roads, borrow pits, spoil areas and the like used by the Contractor, is likely to seriously disrupt or otherwise adversely affect the

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Contract, the Contractor shall immediately notify the Engineer of the facts in writing. It is stressed that no claims resulting from any delays by the Contractor in providing such notice will be considered or paid."

PSD 5.1.3 Stormwater and groundwater

The second paragraph of sub-clause 5.1.3 shall be deleted and replaced with the following:

"The Contractor shall take every precaution to prevent water from any source entering excavations. The Engineer may order additional precautions to be taken where he is not satisfied with the Contractor's arrangements. Any water, including seepage, entering excavations shall be removed immediately by the Contractor".

Where the bottoms or sides of excavations in which bases are to be cast deteriorates or are softened on account of negligence on the part of the Contractor in allowing storm or other water to enter the excavations, the softened material shall be removed and replaced with foundation fill as described in Sub-clause PSD 5.2.2.1 as directed by the Engineer, at the Contractor's expense.

PSD 5.2.1.3 Stripping or removal of overburden

The following shall be added to the end of sub clause 5.2.1.3:

"The removal of overburden (after stripping of topsoil has been completed) will be scheduled under the appropriate bulk excavation item."

PSD 5.2.1.4 Erosion Control

Add new Clause:

"During construction, the Contractor shall protect all areas susceptible to erosion by installing such drainage works or other measures as may be necessary to prevent the concentration of surface water and scouring of slopes, banks and other areas. All erosion, such as runnels, channels or sheet erosion, that develops during the Construction Period and Defects Liability Period shall be backfilled and consolidated and the areas restored to their proper condition at the Contractor's expense. The Contractor shall not allow erosion to develop on a large scale before effecting repairs and all erosion damage shall be repaired to the approval of the Engineer. All topsoil or other material accumulated in side drains shall be removed at the same time. Topsoil washed away shall be replaced.

PSD 5.2.2.1 Excavations for general earthworks and structures

The following shall be added after (a):

"Any extraordinary feature such as fossils, unexpected ground water, or an unexpected geological feature shall be reported to the Engineer before it is removed or covered."

The following shall be added after (b):

"In the event of surfaces to the underside of structure foundations being over-excavated below

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the authorised horizontal and/or sloping surfaces the Contractor shall make good such over-excavation at his own cost with compacted material complying with the requirements stipulated in sub clause 3.2.2, compacted cement or lime stabilised material, or Class 10/19 concrete as directed by the Engineer; the decision as to which material is to be used and the degree of compaction and stabilisation (where applicable) shall rest solely with the Engineer".

The following shall be added after (c):

"Working space for structures will be defined by pay lines shown on the Drawings. Where no such pay lines are shown on the Drawings and form work is scheduled to the outer concrete surfaces of such structures which are to be in contact with soil surfaces below finished ground level, the working space allowed or scheduled will be 600 mm beyond the nett foundation plan outline of the structure concerned. Where structures have protruding footings or nibs clause PSD 8.1(d) will apply

Working space for minor structures such as concrete valve chambers, concrete channels and the like for which form work to the outer faces of concrete to be in contact with soil surfaces below ground level is required and is scheduled will be 600 mm beyond the nett foundation plan of the structure concerned".

PSD 5.2.3.1 Embankments

In the fourteenth line delete "600 mm" and substitute "500 mm".
In the seventeenth line delete "300 mm" and substitute "200 mm".

PSD 5.2.3.2 Backfilling and compaction round and beneath structures

The following shall be added to sub-clause 5.2.3.2:

c) Degree of compaction. Unless specifically called up in the Schedule of Quantities or shown on the Drawings each layer shall be compacted in layers not exceeding 200 mm thick to at least 98% of modified AASHTO maximum density beneath structures and at least 95% modified AASHTO maximum density around and against structures.

PSD 5.2.4.1 Final grading

The following new paragraph shall be added to sub-clause 5.2.4.1

"All earthworks shall be neatly trimmed to the lines and levels shown on the Drawings or directed by the Engineer. The degree of finish for all slopes flatter than 1:4 shall be that normally attainable with a motor grader operated by an experienced operator. Slopes steeper than 1:4 shall be finished to a uniform neat appearance without any readily noticeable break, the quality of finish being that normally attainable by hand shovel operations".

PSD 5.2.4.2 Topsoiling

Delete "75 mm" in the fourth line and substitute "100 mm".

PSD 5.2.4.6 Final finishing and clearing up

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Add the following new sub clause 5.2.4.6:

After completion of construction, including kerbing, stormwater structures and bituminous surfacing, the site shall be cleaned of all loose stones, waste material, rubble and debris resulting from the operations of the Contractor.

Drainage structures, culvert inlets and outlets, culvert barrels and open drains shall be cleared of debris, soil, silt and other material.

The slopes of cuttings and fills, sidewalks, verges, medians and islands shall be trimmed to neat uniform slopes and the entire site left in a neat and workmanlike condition.

All temporary deviations shall be ripped and levelled off with the original ground surface in such a way that soil erosion is prevented. Any bituminous surfacing on deviations shall be removed and disposed of as directed by the Engineer.

The Contractor shall take care not to damage existing works during finishing and clearing up operations. Any damage to roads, kerbing and channelling, drains, cut and fills slopes and services caused by Contractor's final finishing and clearing up operations shall be repaired by the Contractor at his own cost to the satisfaction of the Engineer.

PSD 5.2.5 Transport for earthworks

Sub clause 5.2.5.1 (b) shall be deleted and the following substituted therefore:

"(b) Surplus excavated material shall be first used to fill the Inlet Works terrace. No specific payment will be made for the handling, hauling, disposal, spreading, contouring, etc. of surplus excavated material under this Contract, the cost thereof being deemed to be included in the rates tendered for excavation."

PSD 5.2.5.1 Free haul

Delete the last sentence and substitute:

In the event of the information listed in (b) above being omitted from the Contract documents, and provided that no other free haul distance has been specified elsewhere in the Contract documents, the free haul distance within which the Contractor will be required to move material without separate compensation shall be 2,0 km.

PSD 5.3 Construction

Add the following new sub clause 5.3:

5.3 Soilcrete

Where ordered by the Engineer or where shown on the drawings, foundation fill under structures or buildings shall be provided using soilcrete. Soilcrete shall consist of an approved soil or gravel with 5% by weight of Portland Cement and sufficient water to increase the moisture content of the material to the optimum value for the compaction equipment employed and the density required.

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The methods of construction shall be in accordance with clause 5.5 of SABS 1200ME.

PSD6 TOLERANCES
PSD6.2 Moisture Content and Density

The following shall be added to sub clause 6.2:

"The degree of accuracy for moisture content and density shall be Degree of Accuracy II".

PSDB : EARTHWORKS (PIPE TRENCHES)
 (Applicable to SANS 1200 DB - 1989)

PSDB 1 SCOPE

Add the following to this Clause:

The provisions of this specification shall apply mutatis mutandis to portal and rectangular precast concrete culverts.

PSDB 3 MATERIALS
PSDB 3.1 Classes of Excavation

Add to Sub-Clause:

Notwithstanding the provisions of Sub-Clause 3.1, the materials excavated other than hard rock will not be classified for purposes of measurement and payment. The unit rate for excavation shall cover excavation in all materials other than hard rock.

PSDB 3.5 Backfill Material

In paragraph (a) insert "and (c)" after "b" in the first line and in the third line delete "150 mm" and substitute "100 mm".

Re-number paragraph (b) as "(c)" and insert the following new paragraph (b):

In the particular area subject to road traffic which lies between lines 2,0 m beyond edge of roadway where mountable kerbs are used and 1,0 m beyond back of kerb for barrier kerbs, hereinafter referred to as "areas under roadways", the material used for backfill shall be one of the following:

- i) A subbase quality material conforming to the requirements of SANS 1200ME compacted in 150 mm layers to 93% Mod. AASHTO density.
- ii) An approved selected granular material compacted in 150 mm layers to 93% Mod. AASHTO density.

Amend paragraph (c) by the insertion after the word "traffic" of the words "other than under roadways". Add "The materials specified herein shall be used for backfill under paved sidewalks and in other areas ordered by the Engineer."

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PSDB 3.5(d) Cement Stabilised Backfill

Add the following new Sub-Clause:

Where scheduled, or directed by the Engineer, backfill shall be stabilised with 5% cement by mass. The backfill material shall have a plasticity index not exceeding 10 and all material must pass through a sieve of aperture size not exceeding that specified in SANS 1200 LB, Sub-Clause 3.2, as amended.

The dry materials shall first be mixed in a concrete mixer where after sufficient water is to be added to produce the stiffest consistency available for placing with vibrators.

PSDB 3.6 Materials for Reinstatement of Roads and Paved Areas

Delete the Sub-Clause and substitute:

Material used in the reinstatement of roadways shall fall into the following relevant categories:

- a) Foundation material recovered from the excavation of trenches across existing roadways which, if so instructed by the Engineer, shall be set aside and re-used as sub-base material.
- b) New material which shall conform to the requirements of
 - i) Clause 3.2.1 of SANS 1200 ME for the Sub-base
 - ii) Clauses 3.2 and 3.3 of SANS 1200 MF for the Base course
 - iii) Clause 3.2.2 of SANS 1200 ME for the Gravel Wearing Course

PSDB 3.7 Selection

Delete the second sentence and substitute the following:

The Contractor is not required to use selective methods of excavating but shall, if so instructed by the Engineer, screen excavated material in order to produce material suitable for the bedding cradle or the bedding blanket.

PSDB 4 PLANT

PSDB 4.1 Excavation Equipment

Add to the Sub-Clause:

Should any portion of a pipe trench exceed the specified depth, the Contractor will be held responsible for any additional costs which may arise as a result of such over-excavation. Concrete filling or imported compacted fill may be ordered by the Engineer to be placed below the bottom of the trench.

PSDB 5 CONSTRUCTION

PSDB 5.1 Precautions

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PSDB 5.1.2 Stormwater, Seepage and Dewatering of Excavations

PSDB 5.1.2.2 Special Water Hazards

Add the following:

No specific items will be scheduled for special water hazards; the Contractor shall include for dealing with all water in his tendered rates for earthworks. Refer Clause PSA 5.5 of the Project Specifications.

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PSDB 5.1.2.3 Sloping Ground

Delete the Sub-Clause and substitute:

The Contractor shall be responsible throughout the duration of the Contract, inclusive of the Defects Liability Period, for the provision of all soil erosion preventative measures necessary to protect the trenches, pipeline(s) and land utilised by the Contractor during the Contract from any adverse effects of soil erosion, settlement, scour, etc., resulting from the construction of the Works.

Cross embankments, generally extending across the full width of the working strip, consisting of low earth mounds shaped to rounded form and so oriented as to have a fall of 1% along their length, shall be constructed with compacted material having a minimum density of 90% modified AASHTO density and minimum dimensions and maximum spacings dependent on the slope of the ground along the length of the pipeline, as indicated in the following table:

Slope of Ground	Minimum Height	Minimum Base Width	Maximum Spacing
0% - 2%	No cross-embankments required		
2% - 5%	300 mm	1,2 m	55 m
5% - 10%	300 mm	1,2 m	40 m
10% - 15%	375 mm	1,5 m	30 m
Greater than 15%	450 mm	1,7 m	20 m

The top width of all cross-embankments shall be at least 300 mm.

The height of the cross-embankments for a distance of 1 metre on either side of the trench centreline shall be raised 150 mm above the remainder of the cross-embankment to allow for settlement. In order to form a satisfactory drainage channel upstream of each cross-embankment (at a slope of 1%) the crown over the backfilled trench shall be removed for a distance of 0,5 m upstream of the cross-embankment.

Cross-embankments shall be constructed to the same minimum standards and dimensions indicated above wherever artificial slopes have been formed on the working strip or other areas used during construction and, with the approval of the Engineer, are permitted to be so left.

Payment will be made for the construction of cross-embankments in accordance with Sub-Clause 8.3.4(c), provided construction thereof has been either ordered or approved by the Engineer prior to the commencement of such construction.

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PSDB 5.1.2.4 Cross Walls in Trenches

Add new Sub-Clause:

The Engineer may order the Contractor to construct cross walls in trenches to minimise the danger of flooding. Such cross walls shall be constructed to details given by the Engineer. Measurement and payment for construction of cross walls ordered will be on a rate basis where so scheduled or alternatively on a day work basis.

PSDB 5.1.5 Maximum Length of Open Trenching

Add new Sub-Clause:

The Contractor shall plan his operations in such a manner that the length of trench excavation remaining open shall be restricted to the absolute minimum. No excavation for prefabricated culverts may be commenced until the pipes or culverts to be installed are on site, and the excavations shall be backfilled within seven days of the pipes or culverts being installed. Unless otherwise permitted by the Engineer in writing the total length of open trench shall not exceed 300 m in the case of the Total Project or 100 m in the case of individual portions of the contract. Regardless of any approval or permission granted by the Engineer, the Contractor shall comply with any restrictions on length of trench contained in his insurance policy. All manholes, catch pits, kerb inlets, etc., shall be completed and backfilled at the same time as the installation of the prefabricated culverts.

PSDB 5.2 Minimum Base Widths Specified

Add to the Sub-Clause:

Trench sides shall be as near vertical as possible in order to minimise the quantity of backfill material required and to avoid possible difficulties where pipelines have to be installed parallel to existing services, fences, hedges, etc.

The base width for trenches for cables, ducts and unbended flexible continuous piping of external diameter less than 125 mm laid at a depth not exceeding 1,5 m, shall be equal to the external diameter of the cable, duct or pipe, plus a side allowance of 200 mm on either side.

PSDB 5.5 Trench Bottom

Add to the Sub-Clause:

a) On completion of excavation, before the bottom is trimmed or bedding is placed, the bottom of the trench in suitable material shall be so compacted that the density of the upper 100 mm thick layer of material is 93% of modified AASHTO density

b) Should the nature of the material be such that the specified density cannot be achieved the bottom of the trench shall be over-excavated, the bottom of the over-excavation compacted, and the excavated material replaced and compacted; the depths of the over-excavation, which shall be agreed with the Engineer shall be such that the specified density is attained at the bottom of

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the trench.

In waterlogged conditions and/or where so instructed by the Engineer a 150 mm thick layer (See PSLB 3.2.3) of imported 20 mm to 6 mm graded stone shall be laid under pipes.

PSDB 5.6.1 Backfilling - General

Add to Sub-Clause 5.6.1:

Notwithstanding the requirements of Sub-Clauses 5.6.1 and 5.6.6, no pipe joint or pipe fitting shall be covered by either blanket or backfill material prior to the successful completion of the visual inspection and pressure testing of the relevant section of the pipeline.

PSDB 5.6.2 Material for Backfilling

Delete fourth, fifth and sixth lines and substitute the following:

Hard rock material shall not be used for, or incorporated into, the backfill above the bedding layers without the Engineer's approval.

PSDB 5.6.3 Disposal of Soft Excavation Material

Add to the Sub-Clause:

Surplus material or unsuitable material which is not disposed of within the trench servitude shall be disposed of at designated areas within the free haul distance from the source of such material or some other distance where so scheduled.

PSDB 5.6.4 Disposal of Intermediate and Hard Rock Material

Add to the Sub-Clause:

Surplus intermediate material (where applicable) and hard rock material from trench excavations shall be disposed of to the designated spoil areas situated within the free haul distance from the source of such material except where shown otherwise on the Drawings.

PSDB 7 TESTING

Insert "and trench bottom" after "backfilling" in the first line.

Insert "5.5 and "before 5.7" in the fourth line.

PSG : CONCRETE STRUCTURAL
(Applicable to SANS 1200 G - 1982)

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PSG 2 EXPLANATION OF TERMS

PSG 2.4.3 Joints

Delete the fourth sentence and substitute:

The Engineer may order further joints prior to the commencement of casting the relevant concrete wherein they are to be situated. Such joints will become "designated joints" and will be paid for in terms of Sub-Clause 8.5, or as may be otherwise agreed. However, should the Contractor require further joints to suit his own purposes he shall first obtain the approval of the Engineer. Such further joints may then be constructed but these will neither be "designated joints" nor will they be paid for.

PSG 3 MATERIALS

PSG 3.2 Cement

PSG 3.2.1 Applicable Specifications

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

Subject to the provisions of 3.2.2, cement shall comply with the requirements of SABS EN 197-1 for CEM 1 42,5.

PSG 3.2.2 Alternative types of cement

REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:

All cement shall have a guaranteed alkali content (Na₂O equivalent) of less than 0,6% by mass of cement. For each consignment, the Contractor shall furnish a certificate stating that the cement has been tested and analysed by the manufacturer and complies with this requirement.

Alternatively Portland cement extenders, complying to SABS 1491 : 1989 may be used, subject to approval by the Engineer, to reduce the potential for alkali-aggregate reactivity and to enhance concrete durability.

Add to the Sub-Clause:

Portland cement (PC) and ground granulated blast furnace slag to SABS 1491 (slagment) shall be blended in a 50% PC and 50% slagment mix by mass for use under this contract.

PSG 3.2.3 Storage of Cement

Add to the Sub-Clause :

Cementations material shall not be kept in storage for longer than 4 weeks without the Engineer's permission.

PSG 5 CONSTRUCTION

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PSG 5.1.2 Fixing of Reinforcement

Add to the Sub-Clause:

Reinforcement shall not be welded.

Fixing blocks for the attachment of fixtures may be embedded in concrete provided that the strength or any other desirable feature (such as appearance of the member) is not, in the opinion of the Engineer, impaired thereby.

Where mortar blocks are used they shall be properly shaped so as not to slip out of position and shall be made of the same mix as the mortar of the concrete in which they are to be placed and they shall be cured in water for at least 7 days. The mortar shall be well compacted by approved means into the moulds to result in blocks with a density of at least 2 300 kg/m³ and which are free from honeycombing. Mortar blocks which have not been manufactured and cured strictly in accordance with these requirements or which are in any other way considered unsatisfactory by the Engineer, shall be rejected and shall be removed from the Site.

PSG 5.2.1(c) Special

Add to the Sub-Clause 5.2.1(c):

The quality of the formwork shall be such that no after-treatment e.g. rubbing down, other than the sealing of holes (which themselves shall be placed with precision in a regular pattern) will be necessary. The formwork used shall be unblemished and erected in a regular pattern so that the joints shall be a feature of the finished surface which shall be to Degree of Accuracy I tolerances.

PSG 5.3 Holes, Chases and Fixing Blocks

Add to the Sub-Clause :

Fixing blocks for the attachment of fixtures may be embedded in concrete provided that the strength or any other desirable feature (such as appearance) is not, in the opinion of the Engineer, impaired thereby.

PSG 5.4 Pipes and Conduits

Add to the Sub-Clause :

Pipes, specials and other items to be set in concrete as shown on the drawings, shall have all surfaces in contact with the concrete freed of all bituminous or other coatings and thoroughly scraped and cleaned except where directed otherwise by the Engineer. They shall be set firmly in position with shuttering fixed around them.

The clear space between any pipes and/or specials and the reinforcement shall be 40 mm.

Concrete shall be poured and worked into intimate contact with the surfaces of all cast in items. Holding down bolts to be cast into concrete shall be provided according to the dimensions and shapes shown on the drawings and shall be approved by the Engineer prior to concreting.

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The bolts shall be fixed securely in position before concreting begins in such a manner that displacement during the concreting operation does not occur. The projections above concrete, and threads shall be well protected against any damage which may result from placing of concrete.

PSG 5.5.1.1 Quality : General

Add to the Sub-Clause :

All concrete other than above ground concrete in non-water retaining structures shall be regarded as watertight, i.e. water retaining concrete, notwithstanding that a test for water tightness may not be called for.

PSG 5.5.1.5 Durability

Add to the Sub-Clause:

The minimum content of cementations material in concrete for water retaining structures shall be as specified in Sub-Clause 5.5.1.7

The exposed conditions at the site of the works are to be considered as severe.

PSG 5.5.1.6 Prescribed Mix Concrete

Delete the contents of this Sub-Clause and substitute the following:

Prescribed mix concrete will not be used under this Contract.

PSG 5.5.1.7 Strength Concrete

Add to the Sub-Clause :

The concrete mixes for the various grades of strength concrete shall be designed by a laboratory, approved by the engineer.

At least six weeks before placing any concrete on the Works the Contractor shall supply and deliver to the approved laboratory, at his own cost, samples of the aggregates he proposes to use in the concrete mixes. The approved laboratory shall prepare a batch of each grade of the designed mix and manufacture six cubes for compression testing in accordance with SABS Method 863, three of which will be crushed at 7 days and three at 28 days.

A provisional sum has been included in the Schedule of Quantities to cover the fees and charges levied to the Contractor by the approved laboratory in designing and testing the laboratory cubes of this concrete mix.

Strength concrete for water retaining structures

This concrete is designated as grade 35 MPa concrete with the desired durability in accordance with the provisions outlined below:

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The minimum cementations mixture contents of concrete shall be 325 kg/m³. The nominal stone size is 19 mm. The maximum water content shall be 175 litres/m³. The ratio of the combined cementations mixture : water shall be 1,86:1 unless that ratio gives rise to lower cementations mixture contents than that allowed, in which case a higher ratio will be required.

The characteristic cube strength at 28 days shall be not less than 35 MPa.

PSG 5.5.2.3 Aggregates

Add to the Sub-Clause:

Batching for strength concrete is to be by mass using an approved type of weigh-batching plant.

PSG 5.5.3.2 Ready-mixed Concrete

Delete the first sentence and substitute the following:

Ready mixed concrete is permitted provided the concrete is placed within 1 hour from the time it is discharged from the mixer at the central concrete production facility. The results of quality control tests from such a production facility will not be acceptable for evaluation in terms of Clause 7.3 of SANS 1200 G.

The method of controlling deliveries shall be subject to the approval of the Engineer.

PSG 5.5.5.10 Placing (Continuous walls)

Add new Sub-Clause :

In the case of continuous walls, these are to be cast in lifts of such height that each lift can be poured uninterruptedly in one continuous operation over the entire perimeter of the wall. No vertical or inclined construction joints of any kind will be permitted in continuous walls unless they have been specifically ordered or authorised by the Engineer. The placing of concrete shall commence at a convenient point on the perimeter of the wall and shall proceed both ways simultaneously so that fresh concrete meets fresh concrete. The Contractor may be required to work shifts to make the operation continuous.

PSG 5.5.5.11 Blinding Layer

Add new Sub-Clause :

Beneath all structural grades of concrete, or elsewhere if so ordered by the Engineer, or shown on drawings, the bottom of the excavation is to be covered by a blinding layer (screed) in Grade 15/19 concrete to a depth of 75 mm to prevent disturbance of the ground and to serve as an even and accurately positioned working floor for setting reinforcement and placing foundation concrete. This blinding layer shall be laid immediately after excavations have been taken out, trimmed to the required depths and have been inspected and approved by the Engineer.

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PSG 5.5.7 Construction Joints

PSG 5.5.7.3 Surface Preparation of Joints

Delete Sub-Sub-Clauses (a), (b), (c) and (d) and substitute:

(a) All horizontal and vertical construction joints shall be cleaned of all dirt and loose particles and shall be prepared to the satisfaction of the Engineer. All intersections of construction joints with concrete surfaces which will be exposed to view shall be made straight and level or plumb and shall be constructed to the details shown on the drawings.

(b) The Contractor is to provide a compressor on site for the whole period during which concreting is in progress, and this must be available for cleaning concrete faces prior to placing fresh concrete or pouring joints.

(c) "Blowing off" may generally be carried out on horizontal surfaces but under special circumstances approved by the Engineer it may also be carried out on vertical surfaces. The surface concrete to be prepared shall be between 4h and 8h old after completion of placing and shall be blown off using a mixture of air and water under a pressure of at least 500 kPa or by using a high pressure water jet until all dirt, laitance, etc is removed and particles of clean coarse aggregate are exposed sufficiently to produce a rough surface. Any loose particles of coarse aggregate shall also be removed. The success of this method of preparation depends on selecting the correct time (dependent on the type of cement) so that the concrete has set to just the necessary degree of hardness. The operation may therefore require to be undertaken outside normal working hours and at night. When the surfaces are at least 12h old any remaining loose fine aggregate particles shall be washed off.

(d) "Scrabbling", which refers to removal of all surface laitance plus roughening the concrete surface with pneumatic picks in order to expose the coarse aggregate in a uniform pattern, may be carried out on both horizontal and vertical surfaces. The surfaces to be prepared in this manner shall be at least 12h old after mixing the concrete. At least 35% of the roughened surface area shall consist of exposed coarse aggregate.

(e) All surfaces prepared either by "blowing-off" or by "scrabbling" shall be kept continuously wet until the next lift of fresh concrete is to be placed against them; the minimum time being 12h.

(f) The use of approved wet-to-dry epoxy resin concrete adhesive, strictly in accordance with the manufacturer's instructions, will be permitted in the formation of concrete joints at surfaces where the concrete is older than 7 days.

Placing Fresh Concrete at Joints

(a) Vertical construction joint surfaces shall be, as instructed by the Engineer: Either, smooth, clean and kept damp for at least 24h before placing fresh concrete against them or, scabbled, clean and damp as specified above.

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(b) Horizontal construction joint surfaces shall have been "scrabbled" or "blown off", cleaned and kept continuously wet as specified above before fresh concrete is placed over them. Immediately before placing the fresh concrete, the damp surface of the set concrete shall be evenly coated (by brushing or brooming) with a layer of cement mortar between 10 mm and 15 mm thick. The water/cement ratio and the cement/sand ratio of this mortar shall be the same as that of the fresh concrete to be placed and the mortar shall be producing by leaving the coarse aggregate fraction out of a batch of the fresh concrete. Coating with mortar is to be done in stages immediately before areas of set concrete are covered with fresh concrete, so that no mortar is exposed for longer than one hour after mixing, or less if the mortar has become dry or has started to set before being covered with fresh concrete. Any dried out mortar shall be removed and, after cleaning the surface, shall be replaced with fresh mortar.

(d) No fresh concrete shall be placed on the top surface of concrete which is laterally restrained (e.g. by formwork or by in-situ earth) while the top layer of concrete is between 3 hours and 12 hours old after mixing. No fresh concrete shall be placed on top of the concrete with an unrestrained lateral surface while the top layer of concrete is between 2 hours and 12 hours old after mixing.

PSG 5.5.8 Curing and protection

Add to the Sub-Clause:

Any face of freshly placed concrete shall not be exposed to the sun or wind for more than 0,5 hours after being placed until it is fully cured.

Curing Compounds

The use of membrane curing compounds will be subject to the approval of the Engineer.

Before any membrane curing compound is used, each batch shall be tested on a trial surface to ensure that it forms a satisfactory membrane, and any compound which is unsatisfactory in the opinion of the Engineer, shall be rejected. Surfaces where curing membranes are used shall be treated in such a manner that the final concrete texture and colour blends in with the rest of the concrete work. Furthermore, the Engineer will, at his discretion, require the Contractor to immediately adopt an effective alternative means of curing of any area of the structure to which a membrane has been applied, which, in the opinion of the Engineer, is unsatisfactory.

PSG 5.5.9.2 Hot Weather Concreting

Delete the first two sentences and substitute :

When concreting operations are being carried out at ambient temperatures in excess of 32°C, the Contractor shall apply the relevant recommendations for hot weather concreting set out in American Concrete Institute publication ACI 305R-77 "Recommended practice for hot weather concreting".

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PSG 5.5.10.1 Unformed Concrete Surfaces

All exposed surfaces not finished against forms shall be given a wood-floated finish unless a steel floated (or steel trowel) finish is indicated on the drawings or in the documents.

PSG 5.5.10.2 Wood-floated Finish

The surface shall first be given a finish as specified in Sub-clause 5.5.10.1 and after the concrete has hardened sufficiently, it shall be floated to a uniform surface free of float marks. The screened surface shall be wood-floated, either by hand or machine, only sufficiently to produce a uniform surface free from screed marks.

PSG 5.5.10.3 Steel-floated finish

Where steel-floated (or steel trowel) finish is indicated, the surface shall be treated as specified in PSG 5.5.10.1 except that when the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance being worked to the surface, the screened surface shall be steel-trowelled under firm pressure to produce a dense, smooth, uniform surface free from trowel marks.

PSG 5.5.11 Watertight Concrete

Add to the Sub-Clause:

The following structures shall be subject to a water-tightness test:

Inlet Works

All pump sumps and division boxes

No vertical or inclined construction joints of any kind will be permitted in the perimeter walls of water-retaining structures unless these have been specially ordered or authorised by the Engineer.

PSG 5.5.11.1 Concrete for Water Retaining Structures

Add new Sub-Clause:

Grade 35 concrete shall be used for the construction of all water retaining structures.

PSG 5.5.12 Concrete in Wet Ground

Delete the Sub-Clause and substitute:

The Contractor shall be fully responsible for keeping excavation free from water whilst construction work is being carried out. The methods by which he proposes to achieve this shall be approved by the Engineer before being implemented. The cost of dewatering shall be included in the tendered rates for the construction work and no separate payment shall be made for such dewatering throughout the construction period.

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PSG 5.5.13.1 Grouting

Bedding of base plates shall not be carried out until the superstructure or item of plant mounted on it has been finally levelled and plumbed. The base plates shall be supported by steel wedges and the space beneath the base plates shall be thoroughly cleaned immediately before grouting.

The grout shall be a non-shrink cementations grout, "Fosroc Conbextra GP" or similar approved. This grout shall be placed in strict accordance with the manufacturer's specifications.

PSG 5.5.13.2 Grouting of Pipework Passing Through Concrete Members

Add new Sub-Clause :

Where entry holes for pipework have been provided in walls, etc, the Contractor shall be responsible for the grouting in of such pipework regardless of whether or not these have been supplied by himself.

Before commencing the positioning in holes of any pipework the Contractor shall;

- a) remove all shuttering and boxing remaining in the holes;
- b) make any alterations required to the position and shape of the holes to accommodate the pipework;
- c) thoroughly clean and scabble the sides of the holes so as to obtain satisfactory bond surface for the new concrete; and
- d) free all surfaces of the pipework of all coatings, and thoroughly scrape and clean the pipework.

After accurately positioning the pipework in the respective holes, the Contractor shall fix the pipework in a suitable manner to prevent movement.

Immediately prior to grouting being carried out by the placing of mortar and concrete around the pipes, the surface of the existing concrete shall be saturated with water. All surplus water shall be removed and the surface covered with a layer, approximately 12 mm thick, of mortar consisting of 3 parts concrete sand and 1 part cement.

The concrete ingredients shall be mixed and placed as dry as possible to obtain a dense, waterproof concrete. Where a watertight seal is required, the concrete shall be carefully worked around the pipework and puddle flange, if any, and shall be vibrated in layers so as to obviate any falling away from pipework surfaces of the concrete already placed. The whole shall, when set, form a dense, homogeneous, and waterproof mass.

A spare vibrator with an independent power source shall be kept in readiness to ensure continuity of placing in the event of the breakdown of the duty vibrator.

Smooth formwork that has been suitably strengthened for use with a vibrator shall be provided for facing the concrete around the pipework.

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SG 5.5.13.3 Dry-packed Grout

Add new Sub-Clause :

When dry-packed grout is specified, under baseplates etc, only sufficient water shall be added to make the mixture ball when squeezed in the hand. Before any grouting is done with dry caulking the surfaces between which the caulking is to be placed shall first be thoroughly cleaned and flushed with water. All surplus visible water shall be wiped or blown away and the dry caulking shall be forcefully rammed or hammered into place using suitable tools. Exposed surfaces shall be finished off neatly with a trowel and extensive exposed areas shall be covered with wet sacking and kept damp for at least 24 hours.

Where additives are required for grouting operations, these shall be brought on to site in the manufacturer's unopened containers and used strictly in accordance with the manufacturer's instructions which the Contractor shall not fail to obtain. If necessary, the Engineer may require the Contractor to undertake preliminary tests to check the behaviour of proprietary additives under the conditions pertaining on the site.

PSG 5.5.13.4 Epoxy Grout (Epoxy mortar type only)

Add new Sub-Clause :

The manufacturer's instructions shall be observed when an epoxy grout is used.

PSG 5.5.16 Expansion Joints in Water-containing Structures

PSG 5.5.16.1 Expansion joints shall be formed to the dimensions and shapes shown on the drawings and provided with water stops, fillers, bond breakers and sealants where detailed and installed strictly in accordance with the manufacturer's recommendations.

Before sealing the joint recesses, they shall be thoroughly cleaned and dried out. The surfaces of the joint are then to be primed and the sealing compound applied, all in accordance with the manufacturer's recommendations and in such a manner that perfectly watertight joints free from air pockets or blow holes are formed. After sealing, the joints are to be tested for air pockets and blow holes by caulking with a blunt tool.

PSG 5.5.16.2 Sealing expansion joints with polyurethane sealants

The polyurethane used for joint sealing on this contract shall be supplied by a company approved by the Engineer.

Material shall be stored and protected to avoid damage, degradation or contamination.

The Contractor shall construct the joints to the degree of accuracy required by the manufacturers of the various joint components specified or to Degree 1 accuracy as defined in terms of Clause 6 of SABS 1200G, whichever gives the higher degree of accuracy.

The preparation of joints and mixing and placing of the polyurethane shall be done strictly in accordance with the manufacturer's instructions and as outlined below:

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- a) The sealing slot surfaces shall be ground with an angle grinder to ensure that the polyurethane bonds onto sound concrete free of any traces of water, laitance, mould oil, sand or any material which may affect the bond.
- b) After grinding the joint shall be blown clean using clean dry compressed air.
- c) An approved bond breaker shall be placed at the bottom of the joint.
- d) The bonding faces shall be primed strictly in accordance with the manufacturer's instructions with special cognisance being taken of the working life of the primer.
- e) The base compound and the activator compound shall be thoroughly mixed with care being taken that all areas within the container are covered during the mixing process.
- f) When applying the sealant into the joints care shall be taken to ensure that the material is properly worked into the bottom corners of the slot and that all air is expelled. After application the material shall be tooled to a neat, smooth finish.
- g) After completion, the joint shall be allowed to cure for the period recommended by the manufacturer after which random test sections the Engineer may require to be cut out to test adhesion and consistency of the joint filling. The cut out samples shall be sent to the manufacturer for testing and analysis.
- h) After completion the joint shall be protected from physical damage until the structure is put into service.

PSG 6 TOLERANCES

PSG 6.2.3 Specified Permissible Deviations

Add the following to the Sub-Clause :

The following permissible deviations and degrees of accuracy shall apply unless otherwise specified or shown on the drawings.

ACCURACY III

- i) Buried foundations of buildings and structures.
- ii) Encasement to underground pipes.

ACCURACY II

All other parts of the work except tops of walls and tops of weir walls

ACCURACY I

- Tops of outer walls: ± 3 mm overall, but ± 1 mm over 3 m
- Tops of Weir walls: ± 2 mm overall
- Tops of SST walls for bridge rollers ± 3 mm overall

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PSG 7 TESTS

PSG 7.1.2 Frequency of Sampling

Add the following to this Sub-Clause :

At least three samples shall be taken from each concrete structure cast daily exceeding 10 m³ in volume. The samples shall be taken at the following intervals:

- i) At the start of concreting
- ii) Midway through concreting
- iii) At end of concreting

The Contractor shall take independent samples of each batch delivered to the Site of Works from central concrete production facilities and submit the test results for evaluation in terms of Sub clause 7.3.

PSG 7.2.3 Laboratory Testing

Add to the Sub-Clause :

The Contractor will be liable for all costs incurred in making structural concrete cubes and having these tested.

PSG 7.2.5 Watertightness Tests (Applicable to SST)

Add new Sub-Clause:

Unless otherwise ordered by the Engineer, all water containing structures shall be tested for water tightness. Backfilling around structures which are to be tested shall be delayed until after the testing unless otherwise authorised by the Engineer. Each structure shall be cleaned out, then filled with clean water in four equal stages up to normal top water level. While filling is in progress, the structure shall be examined for leaks and if it is obvious that some appreciable leak has developed the test shall be terminated, repairs carried out and testing resumed.

As soon as the water surface is steady after filling, the water level shall be established by means of a hook gauge to be provided by the Contractor and recorded, and thereafter, will be measured and recorded by the Engineer each successive 24 hours or less, in relation to a fixed bench mark. The results will be graphed so as to establish the progressive rate of absorption and leakage.

Concurrently with this test the Contractor shall carry out an evaporation loss test by providing a steel tank 600 mm x 600 mm x 450 mm deep, filled with 300 mm of water, and accurately measuring the drop in water level during 24 hours. This drop in water level shall be regarded as a measure of the evaporation loss, and shall be used to calculate the probable evaporation loss in the structure being tested.

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If the nett rate of loss of water at any stage exceeds 5 mm depth per 24 hours (plus an allowance for evaporation) at the end of three days in the case of the first three stages, and at the end of seven days in the case of the fourth stage, and there is no prospect, in the opinion of the Engineer, of the rate of water loss reducing to that required, he shall have the right to deem the water containing structure to be not watertight, and to notify the Contractor accordingly. The Contractor shall forthwith take such steps, at his own expense and to the approval of the Engineer, as may be considered necessary to achieve water tightness.

In the event of the steps taken by the Contractor proving ineffective in reducing the rate of drop in water level over a period of 7 days to less than 5 mm depth per 24 hours plus an allowance for evaporation the Engineer shall have the right to order the Contractor to carry out at his own expense, approved steps, on completion of which the Contractor shall again clean out and test in the manner specified also at his own expense.

Notwithstanding the fact that a structure may have passed the test described in the aforementioned paragraphs, it will not be acceptable for any leaks or damp spots to show on any exterior surface. Any such defects shall be sealed and repaired in a manner and to a standard acceptable to the Engineer.

Upon satisfactory completion of the test the structure shall be left full of water unless otherwise ordered by the Engineer.

In the event of leakage being evident at any time during the Defects Liability Period, the Engineer, before issuing his Final Certificate may call for further rectification and testing as already described, and will have the right to withhold this Certificate until he considers the work to be satisfactory.

PSG 8 MEASUREMENT AND PAYMENT

PSG 8.1.1 Formwork

ADD THE FOLLOWING SUB-CLAUSES:

PSG 8.1.1.7 For construction joints at kickers, all additional costs for formwork to edges up to 300 mm high will be deemed to be included in the rates tendered for vertical formwork to sides of walls and will not be measured separately in narrow widths.

PSG 8.1.1.8 No formwork will be measured to edges of blinding layers under structures and the cost thereof, (if needed), will be deemed to be included in the rates tendered for concrete in blinding layers.

PSG 8.1.1.9 Back-shuttering or formwork to top revealed surfaces of sloping - or conical formwork will only be measured to surfaces of over 40° and up to 85° to the horizontal.

PSG 8.1.1.10 Formwork to Edges of Mass Concrete

No separate payment will be made for formwork to the edge of mass infill concrete. The rates tendered for mass infill concrete shall cover the cost of such formwork.

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PSG 8.1.1.11 Formwork to Sides of Foundations

Formwork to the sides of foundations will not be measured for payment unless this formwork has been scheduled for the specific item concerned. Authorisation for the use of side formwork will be given by the Engineer only where, for reasons beyond the Contractor's control, it is not possible or practical to use the side of the excavation to retain the concrete. The Contractor will be expected to dig neat excavations for foundations with vertical sides. No over break will be measured or paid. The concrete shall be cast against the sides of the excavation. Payment for concrete shall be based on the nett volume of concrete as computed from the dimensions of concrete shown on the drawings.

PSG 8.1.2.2 Reinforcement

Clauses 8.1.2.2 a, 8.1.2.3 a and 8.1.2.3 b of SANS 1200 G shall not apply to this contract. Reinforcing will be measured for bar sizes up to and including 16 mm diameter and for bar sizes exceeding 16 mm diameter otherwise in accordance with SANS 1200 G. Mild and high tensile bars will be measured separately.

PSG 8.4.7 Watertightness Testing

Cleaning out and watertightness testing of (structure indicated) Unit : sum

The rate shall include for all labour, plant and materials to clean out and test the structure, including all necessary pipework and connections, in accordance with PSG 7.2.5. The water used for the testing shall be provided by the Contractor from available sources on or near the site of works.

PSG 8.4.8 Dowelling

Holes shall be drilled 1,5 times the diameter of the dowell to a depth as stated in the Schedule of Quantities and filled with epoxy grout.

The dowell diameter and length shall be scheduled Unit : No

The above rate shall include for all labour, plant and materials for drilling, providing and fixing the dowell.

PSH : STRUCTURAL STEELWORK

(Applicable to SANS 1200 H 1990)

PSH 3 MATERIALS

PSH 3.1 Structural Steel

Add to the Sub-Clause:

All structural steelwork which shall include ladders, safety cages and platforms, shall be manufactured from GRADE S355JR grade steel in conformity with EN 1005-2-S355JR, except where shown to the contrary on the Drawings or in the schedule of quantities.

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Stainless steel shall be ANSI grade 304 L or, where no welding is required grade 304, except where shown to the contrary on the Drawings or in the schedule of quantities.

Grade 3CR12 corrosion resistant steel shall be used where scheduled or shown on the Drawings. The chemical composition and properties of this steel shall be as set forth in the publication "Fabricating 3CR12 Corrosion Resisting Steel"

PSH 5 CONSTRUCTION

PSH 5.1.2 Shop Details

Add to the Sub-Clause:

The Contractor shall prepare his own shop details based on the dimensions and details given on the Drawings and will be required to submit his shop details to the Engineer.

He shall submit the shop details to the Engineer at least 14 days before commencement of fabrication.

PSH 5.7.5 Sluice Gates, Frames and Operating Gear

Add new Sub-Clause:

Sluice gates, frames, guides, operating spindles etc, provided under this contract shall be manufactured in 304 stainless steel and designed for a working pressure head for seating and unseating conditions as scheduled in the Bill of Quantities.

Where gates and frames are to be provided and installed by the Mechanical Contractor in compliance with the requirements shown on the Drawings. Frames will be set into position in previously prepared grooves and grouted up. Grouting up of frames will be carried out under the supervision of the Mechanical Contractor. Care is to be taken to maintain the correct alignment of the frame during concreting.

PSH 5.7.6 Pipe Clamps and Brackets

Add new Sub-Clause:

Clamps and brackets around pipes are to be constructed in 304SS to the details shown on the Drawings and are to be provided with all necessary bolts for fixing to concrete.

PSH 5.7.7 Headstocks, Spindles and Hand wheels

Add new Sub-Clause:

Headstocks are to be provided where indicated, assembled from 75 mm internal diameter 304SS piping and standard fittings. Each headstock shall be provided with the necessary operating spindle, of the required length (to suit the location of the headstock above the valve), any necessary support brackets and bearings for the spindle, all holding down bolts for fastening to concrete and a hand wheel. The spindle shall be capable of transmitting a torque

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of at least 150 Nm without damage and shall be corrosion resistant to suit the in-situ working environment.

PSH 6 TOLERANCES
PSH 6.2.2 Accuracy of Erection

Add to the Sub-Clause:

The accuracy of erection shall be the degree of accuracy II as tabulated but amended as follows:

In item e)2) of the table the Degree of Accuracy is given as "+ 5" shall be read as "+ 3".

PSH 6.2.3 Weir plates

Add new Sub-Clause:

Weir plates shall be installed and set to the relevant structures to within + 1 mm of the designated level in the vertical plane.

PSH 7 TESTING

PSH 7.1 Test Certificates

Delete the part sentence "in terms of the project specification" from the wording of the Sub-Clause and add the words "when so requested by the former" at the end of the sentence.

PSHC : CORROSION PROTECTION OF STRUCTURAL STEEL

(Applicable to SANS 1200 HC : 1988)

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PSHC 5.9 Application of Metal Coatings

Add to the Sub-Clause:

The grade of hot dip galvanising (HDG) required shall be that for ISO 1461-1999 heavy duty coatings carried out in accordance with that specification. This shall be applicable to all metalwork where HDG is called for either on the Drawings or in the Schedule of Quantities.

PSHC 8 MEASUREMENT AND PAYMENT

PSHC 8.1 Principles

PSHC 8.1.1 Units

Add the following to the Sub-Clause:

Separate payment for corrosion protection of structural steel shall only be made when so scheduled in the Schedule of Quantities.

When not so scheduled, the cost of the corrosion protection work shall be deemed to be included in the price tendered for the structural steelwork.

PSLC : CABLE DUCTS

(Applicable to SANS 1200 LC - 1981)

PSLC 2 INTERPRETATIONS

PSLC 2.4 Abbreviations

Delete the words "GPO : Department of Post and Telecommunications" and insert the words "Telkom : Telkom SA Limited".

PSLC 3 MATERIALS

PSLC 3.1 Ducts

Add the following:

The Contractor shall use the materials supplied to him by Telkom in the most economical manner. Materials lost or damaged through neglect on the part of the Contractor or his workmen shall be made good by the Contractor or the value thereof will be deducted from any monies due to him.

The Contractor shall cart all materials supplied by Telkom to the place of work and shall, on completion of the work, return all surplus material to Telkom.

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PSLC 3.1(e) Split UPVC Pipes

Add new Sub-Paragraph:

Split pipes shall only be used to provide ducts for existing services which cannot be severed or threaded through the ducts. The pipes shall be accurately cut in the middle and opposite halves shall be matched as sawn. Split pipes shall be placed around the service, firmly bound by stainless steel straps, and finally backfilled or encased in concrete as required by the drawings.

PSLC 3.2.1 Bedding for Electricity Supply Cable Ducts

Delete from the second line "PI not exceeding 6" and substitute "PI not exceeding 12".

PSLC 3.2.2 Bedding for Telephone Cable Ducts

Delete from the second line:

"or crusher run graded from 13,2 mm to dust."

PSLC 3.3 Backfill

Delete the wording of this Sub-Clause and substitute:

Material to be used for backfill shall be sub-base quality material complying with the requirements of Clause 3.2.1 of SANS 1200 ME, and shall be compacted to a minimum of 90% of modified AASHTO density. At road crossings the ducts shall be encased in concrete or in soilcrete as specified in PSLB 5.5 or as instructed by the Engineer.

PSLC 3.4 Cable Duct Markers

Notwithstanding the provisions of the Sub-Clause, telephone cable duct markers shall be as detailed on the drawings. The rates shall be held to cover for the supply, additional excavation, installation including tying to draw wires and backfilling.

PSLC 3.5 Materials Provided by Telkom

Add new Sub-Clause:

When material, such as 100 mm dia. pitch-fibre pipes, 2,50 mm dia. copper screening wire and 3,05 mm dia. galvanized iron draw wire is supplied and delivered, free of charge to site by Telkom it will be done so against a receipt signed by a responsible representative of the Contractor.

The Contractor shall inform the official of Telkom delegated to handle this matter at least two weeks prior to the date on which pipes are required.

The Contractor shall use materials supplied to him in the most economical manner possible. Materials lost or damaged through neglect or accident on the part of the Contractor or his workmen shall be replaced by the Contractor at his own expense.

All materials and equipment handed to the Contractor shall be insured against damage or loss

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as stipulated under Clause 35 of the General Conditions of Contract 2015.

The Contractor shall on completion of the work, deliver any surplus material which has been issued to him, to the nearest Telkom engineering yard.

PSLC 5 CONSTRUCTION
PSLC 5.1.1 Trench Widths and Depths

Delete Sub-Paragraph 5.1.1.2(a) and substitute:

a) "The trenches in which ducts are to be laid shall have a depth sufficient to provide a minimum cover of 600 mm between the top of the uppermost duct and the finished ground level. Where this depth cannot be maintained owing to the nature of the ground, the depth may be varied at the discretion of the Telkom Engineer. In all cases where a duct has less cover than 600 mm it shall be covered by means of precast concrete slabs having a minimum thickness of 50 mm and a width equal to 400 mm plus the diameter of the duct it protects, except where otherwise directed by the Telkom Engineer. The concrete slabs shall be provided by the Contractor."

PSLC 5.3.1 Straight Laying

Add to the Sub-Clause:

"The base of the trench shall slope in order that water may drain from the ducts. The longitudinal gradient of the bottom of the trench shall be at least 75 mm per 30 m of cable duct run."

PSLC 5.3.3 Draw Wire

Add to Sub-Clause:

"A length of 3,05 mm dia. galvanized iron wire (supplied by Telkom) shall be attached to the cleaning brush end and drawn into the duct and left in place for use as a draw wire. A surplus length of wire, at least 2 m neatly coiled, shall be left at each end of each length of ducting. All open pipe ends must be plugged to prevent the ingress of dirt."

PSLC 5.3.5 Jointing of Pitch-Fibre Pipes (Compulsory for Telkom Ducts)

Add new Sub-Clause:

Pitch-fibre pipes which have tapered ends shall be joined by the use of tapered socket couplings. The pipe end and the inner surface of the coupling shall be clean before the spigot is pushed into the socket.

The end of the first pipe to be placed in a trench shall be butted firmly against a solid object to ensure that hammer blows applied to subsequent couplings will drive sockets firmly onto tapered pipe ends without causing displacement of previously laid cable ducting. Joints will be made by using a 1,8 kg hammer and a wood block (230 mm x 175 mm x 50 mm) held flush against the open end of the coupling. The end of the next pipe length shall be inserted into the coupling and a further coupling placed over its leading end. This pipe and coupling shall then be tapped home and the process repeated throughout the length of the line. In general, the

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pipe shall not enter further into the socket than 6 mm beyond hand tightness.

The Contractor shall be responsible for any necessary cutting of pitch-fibre ducts to suit the requirements of the work. Pipes shall be cut to length using a sharp coarse-toothed saw. The Contractor shall re-machine and taper the cut ends of pitch-fibre pipes with an approved hand turning machine.

PSLC 5.3.6 Screening

Add new Sub-Clause

Pipe runs shall be screened against electrical interference by copper wires with all joints made by soldering. The screen shall consist of two strands of 2,50 mm diameter copper wire, bound together by two turns of similar copper wire every 5 m. The binding shall be undertaken by the Contractor. The screen shall be placed approximately 200 mm above the duct, or the uppermost duct where there is more than one.

PSLC 5.6 Laying Of Cables with Other Services

Add to the Sub-Clause:

"For telephone cables the following will apply:

The trench shall be excavated in such a position that pipes can be laid at least 300 mm from any adjacent power cables. Where this is not possible, pipes shall be separated from power cables by concrete slabs or paving slabs placed vertically."

PSLC 5.7 Crossing of Telephone and Electricity Cable Ducts

Delete the second sentence of Sub-Clause and substitute:

"Where a duct will cross an existing service such as an electricity supply cable, a water supply pipe or a sewer, the telecommunication duct shall be laid with not less than 25 mm clearance above the other service. Where the depth of the existing service is insufficient for this to be done, the telecommunication cable pipe shall be laid to pass with not less than 25 mm clearance below the other service.

PSLC 5.10 Positions to be marked

Delete from the third line the words:

"... painted by means of an approved stencil with red paint"

and replace with:

"engraved by an approved method".

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PSLC 7 TESTING
PSLC 7.1 Access for Engineer

Add the following to the Sub-Clause:

"The Telkom Engineer shall have free access to the site at all times. He shall have the power to inspect work under the Contract at any stage and may reject any part which has not been executed in an approved, substantial, workmanlike manner and in accordance with the specifications.

No ducts shall be covered before inspection and approval by the Telkom Engineer. Arrangements shall be made by telephoning the designated official at least 24 hours prior to the required inspection.

PSLC 7.4 Final Inspection

Add new Sub-Clause:

On completion of the work a final inspection will be undertaken. The Contractor shall at his own cost expose all ends of duct runs prior to final inspection of the ducts, after which the exposed ends shall be finally closed up.

PSLC 8 MEASUREMENT AND PAYMENT

PSLC 8.2.5 Supply, Lay, Bed and Prove Duct

Delete paragraphs a) and b) in their entirety and substitute:

a) For Telkom ducts, the cost of collecting all materials provided by the Telkom, the provision of any other necessary material, laying the ducts and screening wire, inserting the draw wire, jointing, bedding and proving, all as specified

and

b) for all other ducts, as for a) above but including the cost of provision of all materials by the Contractor".

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PART A3: PARTICULAR SPECIFICATIONS

In addition to the standardised and project specifications, the following particular specifications shall apply to this contract and are bound in hereafter.

PH REPAIR AND PROTECTION OF REINFORCED CONCRETE STRUCTURES
PO OCCUPATIONAL HEALTH AND SAFETY SPECIFICATIONS

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PARTICULAR SPECIFICATION PH: REPAIR AND PROTECTION OF REINFORCED CONCRETE STRUCTURES

- PH 1 SCOPE
- PH 1.1 STRUCTURAL AND DIAGNOSTIC SURVEYS
- PH 2 REPAIR PLAN
- PH 3 CONCRETE WORKS
- PH 3.1 CONCRETE WITH INHERENT CHLORIDE
- PH 3.2 CONCRETE AFFECTED BY CARBONATION
- PH 3.3 PREPARATION OF STEEL REINFORCEMENT
- PH 3.4 REPAIRS WITH FORMULATED PRE-BAGGED MORTARS / SITE BATCH MORTARS REPAIR AREAS
- PH 3.5 CONCRETE REPAIR USING DURAREP FR OR SIMILAR APPROVED REPAIR MATERIAL
- PH 3.6 CONCRETE REPAIR USING DURAREP GT OR SIMILAR APPROVED REPAIR MATERIAL
- PH 3.7 REPAIRS WITH FLUID MICRO-CONCRETE - DURAREP FMC OR SIMILAR APPROVED FLUID MICRO-CONCRETE
- PH 3.8 CONCRETE FAIRING - DURAREP FC OR SIMILAR APPROVED
- PH 3.9 SURFACE COATING - DURACOTE SB OR SIMILAR APPROVED SURFACE COATING
- PH 3.10 SURFACE COATING - DURACOTE WB OR SIMILAR APPROVED SURFACE COATING
- PH 3.11 SURFACE COATING FOR IMMERSED CONDITIONS
- PH 3.12 SPALLING REPAIR
- PH 3.13 CRACK REPAIR
- PH 3.14 CONCRETE REPAIR

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PH 1 Scope

This specification is for the repairs of any structural concrete works associated with the secondary sedimentation tanks and any other associated structural concrete.

PH 1.1 STRUCTURAL AND DIAGNOSTIC SURVEYS

The essential elements for satisfactory concrete repair work are the correct diagnosis of the cause of damage and the correct choice and application of materials by specialists to meet the particular requirements.

A structural survey shall first be carried out by the structural specialist to assess structural integrity and to evaluate reparability. This shall be followed by a diagnostic survey to determine the exact cause and extent of deterioration together with its chances of increasing or recurrence.

The diagnostic survey shall be carried out by a qualified specialist and an assessment made of the types, causes, numbers and extent of defects. (Note: The indications resulting from this survey will depend upon the degree of the examination; also, due to the nature of concrete, will normally allow for variable extent of repairs). The findings shall be presented in the form of a detailed report describing the physical, chemical and other tests carried out in-situ and in the laboratory, giving test results and conclusions.

PH 2 REPAIR PLAN

The repair plan shall be based on findings of the diagnostic survey and other known factors such as the prevailing conditions or limitations under which the repairs are carried out.

Before the work commences the Contract Administrator, specialist contractor and product supplier representative approved by the Engineer, should meet to discuss recommendations for the application of the repair materials and technical advice and information will be offered by product supplier representative. The repair plan will be subject to the approval of the building owner's structural specialist. Unless the approved repair plan recommends otherwise the repairs shall be carried out using only the materials specified and skilled workmen under qualified supervision.

PH 3 CONCRETE WORKS

PH 3.1 CONCRETE WITH INHERENT CHLORIDE

The agreed area shall be broken out to remove all contaminated concrete. Where the depth corresponds to the depth of concrete cover and thereby exposes reinforcement, breaking out shall continue to expose the full circumference of the steel and to a further depth of 25 mm or as directed by the Contract Administrator. Breaking out shall continue along the reinforcement until non-corroded steel is reached and shall continue 50 mm beyond this point or as directed by the Contract Administrator. Special care shall be exercised to ensure that any reinforcement exposed is not cut or damaged.

It is essential that no chloride contaminated concrete substrate shall be in contact with, or within 10 mm of, the reinforcing bars. In cases where chloride ingress has reached within 10 mm of the reinforcing bars, the concrete shall be broken out to expose the full circumference of the steel and a further depth of 20-30 mm or as directed by the Contract Administrator.

Where desalination by electro-chemical means is specified, breaking out chloride contaminated concrete will be limited to areas subject to delamination and/or spalling. All concrete surfaces to receive repair mortar shall be of a rough scabbled nature. Saw/disc cut edges shall be grit blasted to lightly roughen. This preparation shall be such as to leave a sound exposed concrete substrate free from dust, loose particles and any deleterious matter.

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The following shall apply only to areas to be repaired conventionally:

To form a barrier between the chloride contaminated concrete and the repair mortar, the prepared concrete shall be primed with epidermix 345 or similar approved and allowed to cure for 8 - 24 hours. This coating is to be impermeable and should any unfilled voids (blowholes) be apparent, they shall be filled with epidermix 505 or similar approved before proceeding. A second coat of epidermix 345 or similar approved shall be applied, blended with dry, dust free, sharp sand and allowed to harden.

PH 3.2 CONCRETE AFFECTED BY CARBONATION

The agreed area shall be broken out to remove all contaminated concrete. Where the depth corresponds to the depth of concrete cover and thereby exposes reinforcement, breaking out shall continue to expose the full circumference of the steel and to a further depth of 25 mm or as directed by the Contract Administrator. Breaking out shall continue along the reinforcement until non-corroded steel is reached and shall continue 50 mm beyond this point or as directed by the Contract Administrator.

Special care shall be exercised to ensure that any reinforcement exposed is not cut or damaged.

After breaking out as specified the exposed surface of concrete shall be tested for carbonation by the use of a semi-aqueous solution of phenolphthalein. The test shall be carried out on the freshly exposed concrete or at least within 30 minutes of being exposed. The test shall be carried out on sound, dry and clean air-blown dust free surfaces. If the concrete substrate still exhibits carbonation in the vicinity of the steel reinforcement, breaking out to remove a further 20 mm shall be carried out and the test repeated. If carbonation is still present the Contract Administrator shall be notified before proceeding further. It is essential that no carbonated concrete substrate shall be in contact with, or within 5 mm of, the reinforcing bars. In cases where carbonation has reached within 5 mm of the reinforcing bars, the concrete shall be broken out to expose the full circumference of the steel and a further depth of 20-30 mm or as directed by the Contract Administrator.

Where desalination by electro-chemical means is specified, breaking out carbonated concrete will be limited to areas subject to delaminations and/or spalling.

All concrete surfaces to receive repair mortar shall be of a rough scabbled nature. Saw/disc cut edges shall be grit blasted to lightly roughen. This preparation shall be such as to leave a sound exposed concrete substrate free from dust, loose particles and any deleterious matter.

PH 3.3 PREPARATION OF STEEL REINFORCEMENT

All exposed reinforcement shall be cleaned of corrosion products by wet grit blasting or other approved means to achieve a surface finish to comply with a standard of steel cleanliness such as SA2½ (BS7079:Part A1 / ISO8501) or as directed by the Contract Administrator. Special care shall be taken to clean out properly any pitting which may have occurred in the steel bar. Exposed reinforcement in areas to be treated electrochemically shall be cleaned to SA2½ standard.

When the corrosion products have been removed and if directed by the Contract Administrator, the diameter of the reinforcing bar(s) shall be measured. If considered necessary by the Contract Administrator the existing reinforcement shall be cut out and replaced and/or additional bars added in accordance with instructions. Any deep pitting of the reinforcing bars shall be brought to the attention of the Contract Administrator.

Reinforcement damaged during the removal of concrete or the preparation process shall be brought to the attention of the Contract Administrator and if required, shall be repaired or replaced.

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Where the presence of chloride is determined, it is essential that the cleaning process is completed by pressure washing with clean water the total exposed areas of reinforcing steel to ensure the removal of all residual contamination from the pitted surface of steel.

Reinforcement Priming

The following shall apply only to areas to be repaired conventionally:

Immediately following preparation and cleaning, the reinforcing steel shall be primed with durarep ZR primer or similar approved single component epoxy primer complying with the relevant parts of BS4652, 1971 (1979) Specification For Metallic Zinc Rich Priming Paint Type 2.

The durarep ZR primer or similar approved shall be brush applied to the cleaned reinforcement ensuring that all exposed steel is fully coated. Special attention shall be paid to the backs of the steel bars and where steel bars are tied together. It is essential that this coat is continuous with that of any adjacent repaired area where zinc-rich primer has been used. Avoid excessive overpainting onto the concrete and allow to dry.

PH 3.4 REPAIRS WITH FORMULATED PRE-BAGGED MORTARS / SITE BATCH MORTARS

Repair Areas

The areas to be repaired are to be as shown on the drawings or as indicated by the Contract Administrator. The areas are to be clearly marked out on site and agreed with the Contract Administrator before proceeding.

The areas may be adjusted by the Contract Administrator as work proceeds according to the conditions found.

Propping shall be provided as noted on the drawings or as agreed by the Contract Administrator.

The surfaces adjacent to and of areas for repair shall be cleaned to remove any dust, unsound material, plaster, oil, paint, grease, corrosion deposits, organic growth, etc.

Within the repair area, the concrete cover to reinforcement links or main bars shall be determined by cover meter. A small area shall be chiselled out and the concrete cover and the depth of deteriorated concrete confirmed by measurement.

PH 3.5 CONCRETE REPAIR USING DURAREP FR OR SIMILAR APPROVED REPAIR MATERIAL

Durarep FR or similar approved mortar with durabond or similar approved primer shall be used for vertical or overhead concrete surfaces to be repaired in one or more layers, each layer 10-80 mm thick vertically, 10 - 50 mm thick overhead, where 22-25 N/mm² compressive strength and resistance to carbon dioxide and chlorides is required. The minimum depth for repair shall be 10 mm.

PRIMING CONCRETE

The prepared substrate shall be thoroughly wetted with clean water to totally satisfy absorption and any standing or excess water shall be removed.

The concrete primer shall be durabond or similar approved acrylic emulsion which shall be worked firmly into the damp substrate with a short-bristle brush to achieve a film intimate with the contact area for immediate repair.

Single repair areas larger than 0.5 m² shall be part primed to commence and thereafter progressively in maximum 0.5 m² adjacent bays as application of the repair mortar proceeds.

The repair mortar shall be applied whilst the durabond or similar approved is tacky.

Repairs to concrete subject to permanent immersion shall be primed with epidermix 345 or similar approved 'Slow- set' which shall be worked firmly into the damp substrate with a short-bristle brush to achieve a film intimate with the contact area for immediate repair.

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If the primer dries before the mortar is applied, the area shall be re-primed once.

MIXING REPAIR MORTAR

Before mixing the repair mortar the contractor shall ensure that sufficient and correct areas for reinstatement are prepared and ready to receive repair mortar.

Only mixes using complete bags of durarep FR or similar approved shall be allowed and part bag mixes not permitted.

The mixing shall be carried out strictly in accordance with current product instructions for use and only with appropriate mixing equipment.

The mixing water shall be potable quality and the carefully measured quantity of water for the required mix shall be placed into the mixing container before the durarep FR or similar approved.

The durarep FR or similar approved shall be added to the mixing water and in no circumstances shall more water be added than the maximum volume stated for each bag.

Mixing Warning

As with other 'one pack' repair mortars durarep FR or similar approved may exhibit satisfactory handling characteristics even though inadequately mixed. This will result in a significantly lower level of performance or possible failure. It is therefore essential that mixing instructions are strictly adhered to with particular emphasis on the quantity of water used and the time of the mixing operation.

APPLICATION OF REPAIR MORTAR

Only fully integrated mixes of durarep FR or similar approved at the required consistency and workability shall be used.

Immediately following mixing the repair mortar shall be applied by gloved hand or trowel to the prepared and primed surface of the substrate paying particular attention to packing behind and between the reinforcement and thorough compaction overall.

Durarep FR or similar approved shall be applied in accordance with current instructions for use. It may be applied in one operation by building up to the required profile in wet-on-wet layers between 10-80 mm vertically and 10- 50 mm overhead. Thicker sections may be achieved by building up in wet- on-dry layers, where each layer shall be wavy-line scratch keyed with a comb, cured with durabond or similar approved, allowed to dry throughout and re-primed at the time of application of subsequent layers.

In hot, humid, coastal situations and in heavy industrial areas ensure that the interval between successive layers is kept to a minimum. This is to prevent possible contamination of the surface of the preceding layer with air-borne contaminants, resulting in possible inter-coat adhesion failure and reduced product performance. In the event that delays are unavoidable, wash down the surface thoroughly with clean water before proceeding with the following coating.

Sagging of the repair mortar is not acceptable and if occurring all the material of the affected repair shall be completely removed prior to re-priming and refilling in two or more applications of mortar supported by formwork if required.

If formwork is used it shall be pre-treated with a varnish to prevent moisture absorption from the repair mortar. Special care shall be taken to ensure that the positioning of the formwork allows for compaction of and does not result in voids within the repair mortar.

After applying sufficient mortar to achieve a level flush with or slightly proud of the surrounding surface the durarep FR or similar approved shall be finished by striking off with a straight edge and trowelled/floated depending upon circumstances.

Repair mortar shall not be applied when the ambient or substrate temperature is below 50C or above 350C nor at an ambient temperature of 50C on a falling thermometer. The applied repair mortar shall always be protected from freezing whilst drying.

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CURING

Details of the methods of curing shall be submitted to the Contract Administrator for approval. Curing techniques shall be instigated immediately following application of repair mortar to any given area. Large areas (0.5 m² at a time) shall be cured as trowelling progresses without waiting for completion of the whole area.

Durabond or similar approved may be low pressure spray applied as a curing membrane. In fast drying conditions it will be necessary to supplement this with polyethylene sheet taped around its edges. Note: durabond or similar approved is compatible with the duracote or similar approved range of surface coatings and does not require removal prior to application of a duracote or similar approved material. Other curing membranes will require removal prior to further surface treatment.

During application and curing all work shall be protected against direct strong sunlight.

PH 3.6 CONCRETE REPAIR USING DURAREP GT OR SIMILAR APPROVED REPAIR MATERIAL

Durarep GT or similar approved mortar with durabond / epidermix 345 or similar approved 'Slow-set' primer shall be used for concrete surfaces to be repaired in 10-30 mm section, small pockets 10-100 mm, overhead repairs 10-20 mm section, each per layer, where 27-34 N/mm² compressive strength and resistance to carbon dioxide and chlorides is required. The minimum depth for repair shall be 10 mm.

CONCRETE PRIMING

The prepared substrate shall be thoroughly wetted with clean water to totally satisfy absorption and any standing or excess water shall be removed.

Conventional Concrete Repair:

The concrete primer shall be durabond or similar approved which shall be worked firmly into the damp substrate with a short-bristle brush to achieve a film intimate with the contact area for immediate repair.

Single repair areas larger than 0.5 m² shall be part primed to commence and thereafter progressively in maximum 0.5 m² adjacent bays as application of the repair mortar proceeds.

The repair mortar shall be applied whilst the durabond or similar approved is tacky.

Repairs to concrete subject to permanent immersion shall be primed with epidermix 345 or similar approved 'Slow-set' which shall be worked firmly into the damp substrate with a short-bristle brush to achieve a film intimate with the contact area for immediate repair.

If the primer dries before the mortar is applied, the area shall be re-primed once.

MIXING REPAIR MORTAR

Before mixing the repair mortar the contractor shall ensure that sufficient and correct areas for reinstatement are prepared and ready to receive repair mortar. Only mixes using complete bags of durarep GT or similar approved shall be allowed and part bag mixes not permitted. The mixing shall be carried out strictly in accordance with current product instructions for use and only with appropriate mixing equipment. The mixing water shall be potable quality and the carefully measured quantity of water for the required mix shall be placed into the mixing container before the durarep GT or similar approved. The durarep GT or similar approved shall be added to the mixing water and in no circumstances shall more water be added than the maximum volume stated for each bag.

Mixing Warning

As with other 'one pack' repair mortars durarep GT or similar approved may exhibit satisfactory

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handling characteristics even though inadequately mixed. This will result in a significantly lower level of performance or possible failure. It is therefore essential that mixing instructions are strictly adhered to with particular emphasis on the quantity of water used and the time of the mixing operation.

APPLICATION OF REPAIR MORTAR

Only fully integrated mixes of durarep GT or similar approved at the required consistency and workability shall be used. Immediately following mixing the repair mortar shall be applied by gloved hand or trowel to the prepared and primed surface of the substrate paying particular attention to packing behind and between the reinforcement and thorough compaction overall. durarep GT or similar approved shall be applied in accordance with current instructions for use. Apply in one operation, minimum total thickness is 10 mm, and well compact into repair voids, paying particular attention to compaction around reinforcing steel.

Where the depth of the void is in excess of 30 mm vertically (except for small pockets) or 20 mm overhead, the repair mortar shall be built up in wet-on-dry layers. The repair shall be temporarily finished off at the maximum single application thickness, wavy-line scratch keyed with a comb, cured with durabond or similar approved and allowed to harden. It shall then be re-primed at the time of application of the next layer.

In hot, humid, coastal situations and in heavy industrial areas ensure that the interval between successive layers is kept to a minimum. This is to prevent possible contamination of the surface of the preceding layer with air-borne contaminants, resulting in possible inter-coat adhesion failure and reduced product performance. In the event that delays are unavoidable, wash down the surface thoroughly with clean water before proceeding with the following coating.

Sagging of the repair mortar is not acceptable and if occurring all the material of the affected repair shall be completely removed prior to re-priming and refilling in two or more applications of mortar supported by formwork if required.

If formwork is used it shall be pre-treated with a varnish to prevent moisture absorption from the repair mortar. Special care shall be taken to ensure that the positioning of the formwork allows for compaction of and does not result in voids within the repair mortar.

After applying sufficient mortar to achieve a level flush with or slightly proud of the surrounding surface the durarep GT or similar approved shall be finished by striking off with a straight edge and trowelled/floated depending upon circumstances.

Repair mortar shall not be applied when the ambient or substrate temperature is below 5 0C or above 35 0C nor at ambient temperatures of 5 0C on a falling thermometer. The applied repair mortar shall always be protected from freezing whilst drying.

CURING

Details of the methods of curing shall be submitted to the Client's Representative for approval. Curing techniques shall be instigated immediately following application of repair mortar to any given area. Large areas (0.5 m² at a time) shall be cured as trowelling progresses without waiting for completion of the whole area.

durabond or similar approved may be low pressure spray applied as a curing membrane. In fast drying conditions it will be necessary to supplement this with polyethylene sheet taped around its edges. Note: durabond or similar approved is compatible with the duracote or similar approved range of surface coatings and does not require removal prior to application of a duracote or similar approved material. Other curing membranes will require removal prior to further surface treatment.

During application and curing all work shall be protected against direct strong sunlight.

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PH 3.7 REPAIRS WITH FLUID MICRO-CONCRETE - DURAREP FMC OR SIMILAR APPROVED FLUID MICRO-CONCRETE

Durarep FMC or similar approved high performance, shrinkage compensated micro-concrete suitable for large volume concrete repairs at nominal thicknesses in excess of 50 mm. Supplied as a premix requiring only mixing with water to produce a free flowing material, for placing by hand or pump. The low water requirement ensures fast strength gain and long-term durability.

FORMWORK

Adequate formwork shall be provided in accordance with the relevant codes of practice. It shall be constructed from appropriate materials as agreed with the Contract Administrator and shall be watertight at all joints between panels, and between formwork and the existing concrete. The formwork shall be securely fixed to withstand the hydraulic pressures of the fluid micro-concrete without distortion or movement during and subsequent to placement. It may be necessary to divide into suitably sized sections.

Formwork surfaces that are to be in contact with the fluid micro-concrete shall receive two coats of polyurethane shutter paint and be treated with a suitable release agent such as dura-strip or similar approved in accordance with current instructions for use.

The formwork shall include bottom drainage outlets for pre-soaking water, provision for introduction of the micro-concrete and air venting as required. The introduction and venting points shall be located so as to avoid any possibility of entrapment of air, etc. Where necessary provision shall be made for controllable venting points to prevent air entrapment and enable the extent of flow of the fluid micro-concrete to be assessed.

In hot, humid, coastal situations and in heavy industrial areas ensure that the interval between priming the reinforcement and erecting the shutter is kept to a minimum. This is to prevent possible contamination of the bond line with air-borne contaminants, resulting in possible bond failure with the substrate. In the event that delays are unavoidable, wash down the surface thoroughly with clean water before erecting the formwork.

PRE-SOAKING (unless priming with epidermix 345 or similar approved)

The formwork shall be inspected by the Contract Administrator and if approved, the void filled with clean water and kept full. This shall remain for a minimum of 2 hours, then the formwork shall be completely drained and resealed immediately prior to introducing the fluid micro-concrete.

PRIMING CONCRETE HAVING INHERENT CHLORIDE

The following shall apply only to areas to be repaired conventionally:

To form a barrier between the chloride contaminated concrete and the new concrete, the prepared concrete surface shall be primed with epidermix 345 or similar approved and allowed to cure for 8-24 hours. This coating is to be impermeable and should any unfilled voids (blowholes) be apparent, they shall be filled with epidermix 505 or similar approved.

A second coat of epidermix 345 or similar approved shall be applied, which, depending upon requirements may be (A) immediately followed by the shuttering and pouring of the micro-concrete, or (B) blinded with dry, dust free, sharp sand and allowed to harden before pouring the micro-concrete.

Pre-soaking with water is unnecessary in this case and shall not be permitted.

MIXING MICRO-CONCRETE

Only mixes using complete bags of durarep FMC or similar approved shall be allowed and part bag mixes shall not be permitted.

The mixing shall be carried out strictly in accordance with current product instructions for use

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and only appropriate mixing equipment will satisfy.

The mixing water shall be potable quality and the carefully measured quantity of water shall be placed into the mixing container before the durarep FMC or similar approved.

The durarep FMC or similar approved shall be added to the mixing water and in no circumstances shall more water be added than the maximum volume specified for each bag.

Mixing Warning

As with other 'one pack' repair mortars durarep FMC or similar approved products may exhibit satisfactory handling characteristics even though inadequately mixed. This will result in a significantly lower level of performance or possible failure. It is therefore essential that mixing instructions are strictly adhered to with particular emphasis on the quantity of water used and the time of the mixing operation.

CONCRETING

When assessed in accordance with the flow measurement requirements of DTp BD27/86 the durarep FMC or similar approved shall flow 750 mm along the test trough within 30 seconds, without segregation or bleeding.

Test cubes may be made at intervals if required by the Contract Administrator. They shall be made in 100 mm metal mould to BS1881:Part 108. The mould shall be carefully filled to avoid air entrapment. There shall be no compaction and the top of each cube shall be covered by a metal plate with a weight not less than 0.5 kg. The cubes shall then be cured and tested in accordance with the relevant parts of BS 1881.

Poured material shall be introduced slowly into the formwork. It may be introduced via a funnel, or hopper, at the top of the formwork, unless the configuration of the repair necessitates the use of external pipe-work to reach remote parts of the void. The entry point(s) shall be designed to provide sufficient head of material to ensure total displacement of air.

The placing of the durarep FMC or similar approved shall be, as far as possible, continuous.

The requirements of DTp BD 27/86 permit a maximum 20 minutes between completion of mixing and placing. Mixing shall be timed so that there is minimal interruption to material placing. If, however, placing is interrupted, this shall be brought immediately to the attention of the Contract Administrator. The operation may continue while the durarep FMC or similar approved retains its flow characteristics. Where fluid durarep FMC or similar approved is poured in sections, the previously cast edge at the stop end face shall be suitably roughened and cleaned.

durarep FMC or similar approved shall not be placed when the ambient or substrate temperature is below 5°C or above 35°C nor at ambient temperatures of 5°C on a falling thermometer. In cold conditions down to 5°C the use of warm water, up to 30°C shall be permitted for pre-soaking and mixing.

FORMWORK REMOVAL

The formwork shall not be removed until the durarep FMC or similar approved has achieved a compressive strength of at least 10 N/mm² or as directed by the Contract Administrator.

CURING

Details of the methods of curing shall be submitted to the Contract Administrator for approval.

Curing techniques shall be instigated immediately following application of repair mortar to any given area. Large areas (0.5 m² at a time) shall be cured as trowelling progresses without waiting for completion of the whole area. durabond or similar approved may be low pressure spray applied as a curing membrane. In fast drying conditions it will be necessary to supplement this with polyethylene sheet taped around its edges. Note: durabond or similar approved is

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compatible with the duracote or similar approved range of surface coatings and does not require removal prior to application of a duracote or similar approved material. Other curing membranes will require removal prior to further surface treatment. Curing shall be instigated immediately after removal of the formwork and continued for at least 3 days. During application and curing all work shall be protected against direct strong sunlight.

PH 3.8 CONCRETE FAIRING - DURAREP FC OR SIMILAR APPROVED

Durarep FC or similar approved single component polymer modified fairing coat shall be used. It is designed for application to a maximum thickness in one coat of 3 mm. durarep FC or similar approved may be feather edged.

USE

For fairing following concrete repair; filling blow-holes and similar imperfections; providing an ideal background for subsequent surface coatings overall. durarep FC or similar approved is not designed as a surface finish in its own right.

SURFACE PREPARATION

All surfaces shall be sound , clean and free from dust, plaster, oil, paint, grease, corrosion deposits, laitance, organic growth and any other deleterious substance.

Surfaces shall be cleaned by mechanical means, steam, pressure washing with clean water, grit blasting, or a combination to satisfy. Any remaining dust or loose material should be removed by blowing with oil-free clean compressed air.

MIXING

The mixing shall be carried out strictly in accordance with current product instructions for use and only with appropriate mixing equipment.

Mixing Warning

As with other 'one pack' repair mortars durarep FC or similar approved may exhibit satisfactory handling characteristics even though inadequately mixed. This will result in a significantly lower level of performance or possible failure. It is therefore essential that mixing instructions are strictly adhered to with particular emphasis on the quantity of water used and the time of the mixing operation.

APPLICATION

The prepared concrete shall be thoroughly saturated with clean water and maintained in this condition for minimum 30 minutes prior to application of durarep FC or similar approved.

Using a steel trowel and a scrape-on scrape-off technique, blow-holes, imperfections and the like, shall be filled flush to the surrounding surface.

Where the overall surface, or areas thereof, require fairing to produce a smooth, regular surface, further apply the fairing as a render to a maximum thickness of 3 mm. This shall be a separate operation after blow-hole filler has completely dried. Finish with a steel trowel or sponge float to blend to adjacent areas, or according to instructions of the Client's Representative.

durarep FC or similar approved shall not be applied when ambient temperature is below 5°C or 5°C and falling. Protect durarep FC or similar approved from rain and from freezing for at least 48 hours after application. In hot, humid, coastal situations and in heavy industrial areas ensure that the substrate is washed down thoroughly with clean water prior to the application of durarep FC or similar approved. This is to prevent possible adhesion failure as a result of contamination with air-borne contaminants.

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CURING

Provision for curing need only be made where durarep FC or similar approved is exposed in conditions of very rapid drying. Where curing is necessary, durabond or similar approved shall be applied by low pressure spray to the surface as finishing proceeds.

PH 3.9 SURFACE COATING - DURACOTE SB OR SIMILAR APPROVED SURFACE COATING

The surface coating shall be duracote SB or similar approved high performance solvent based pigmented methacrylate topcoat available in abe or similar approved range of colours. Use in conjunction with durasil S or similar approved penetrating hydrophobic silane-siloxane solution.

Use

For application to prepared backgrounds of atmospherically exposed reinforced and precast concrete and masonry where it is required to minimise ingress of carbon dioxide, chlorides and water, whilst permitting moisture vapour transmission from the structure.

Survey

Areas recently prepared overall with durarep FC or similar approved in accordance with abe or similar approved specification will present a surface suitable to directly receive a coating. Areas where the previous works have not taken account of the need to prepare the overall surface to receive a coating (small patch repairs with little or no fairing eg.) shall be the subject of an inspection identifying the background character, nature and surface presentation. Information shall be provided to the Contract Administrator detailing the areas for surface coating and the degree of preparation proposed together with techniques to be employed. The technical approval of the Contract Administrator shall be obtained prior to commencement. Where required by the Contract Administrator trial areas not exposed in the finished work shall first be treated using selected materials. These trial areas shall be noted on the drawings and shall be carried out using the type of materials, mixing procedures and application techniques that will be used in the contract and shall be approved by the Contract Administrator before the contractor commences the general work. Each colour and finish is to be agreed by the Contract Administrator.

Surface Preparation

All surfaces shall be sound, clean and free from dust, plaster, oil, paint, grease, corrosion deposits, laitance, organic growth and any other deleterious substance. Surfaces shall be cleaned by mechanical means, steam, pressure washing with clean water, grit blasting, or a combination to satisfy. Any remaining dust or loose material should be removed by blowing with oil-free clean compressed air.

Blowholes, cracks, imperfections and areas of pitting shall be made good with durarep FC or similar approved in accordance with current product information for use.

Only the specified areas shall be coated; where protection/masking is required, dependent upon the nature of the coating and its method of application, it shall be provided and installed to the approval of the Contract Administrator. During application, walkways, plants, joint sealants, asphalt and bitumen painted areas and glass shall be masked and shielding shall be provided to prevent animal contact and to prevent airborne coating materials leaving the immediate area of application.

In hot, humid, coastal situations and in heavy industrial areas ensure that the interval between successive coatings is kept to a minimum.

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This is to prevent possible contamination of the surface of the preceding coating with air-borne contaminants, resulting in possible inter-coat adhesion failure and reduced coating performance. In the event that delays are unavoidable, wash down the surface thoroughly with clean water before proceeding with the following coating.

Application

Thoroughly mix all materials in their original containers and progressively intermix containers of the same colours as the job proceeds. Surface coating materials shall not be applied in rain or when rain is likely within 6 hours of application, or when ambient and/or background temperatures are below 5 °C or 5 °C and falling. Protect all surface coatings materials from frost whilst drying.

Primer

Special care shall be taken to ensure that the recommended application rate of 0.4 l/m² is achieved and two or more applications may be necessary until the dried surface presents a uniform sheen. The primer shall be allowed to dry for not less than 2 hours at 20 °C, longer when cooler.

Topcoat

Two coats of duracote SB or similar approved topcoat shall be applied. Each coat shall be uniform and be applied at a minimum wet film thickness of 175 microns. The drying time between coats shall be minimum 6 hours at 20 °C and overcoating shall not take place until this period has elapsed and the first coat is dry. Under poor drying conditions at low temperature it is permissible to apply three coats each of 120 microns wet film thickness.

The finished coating shall be continuous, pin-hole free and have a minimum dry film thickness of 150 microns.

Colour & finish to be agreed with the Contract Administrator.

PH 3.10 SURFACE COATING - DURACOTE WB OR SIMILAR APPROVED SURFACE COATING

The surface coating shall be duracote WB or similar approved water based pigmented elastomeric acrylic topcoat having excellent crack-accommodation available in the above or similar approved range of colours. Use in conjunction with duracote WB primer or similar approved penetrating, hydrophobic, silane-siloxane/acrylic primer.

Use

For application to prepared backgrounds of atmospherically exposed reinforced and precast concrete and masonry where it is required to minimise ingress of carbon dioxide, chlorides and water, whilst permitting moisture vapour transmission from the structure.

Survey

Areas recently prepared overall with durarep FC or similar approved in accordance with above or similar approved specification will present a surface suitable to directly receive a coating system.

Areas where the previous works have not taken account of the need to prepare the overall surface to receive a coating (small patch repairs with little or no fairing eg.) shall be the subject of an inspection identifying the background character, nature and surface presentation. Information shall be provided to the Contract Administrator detailing the areas for surface coating and the degree of preparation proposed together with techniques to be employed. The technical approval of the Contract Administrator shall be obtained prior to commencement.

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Where required by the Contract Administrator trial areas not exposed in the finished work shall first be treated using selected materials.

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These trial areas shall be noted on the drawings and shall be carried out using the type of materials, mixing procedures and application techniques that will be used in the contract and shall be approved before the contractor commences the general work. Colour and finish to be agreed by the Contract Administrator.

Surface Preparation

All surfaces shall be sound, clean and free from dust, plaster, oil, paint, grease, corrosion deposits, laitance, organic growth and any other deleterious substance.

Surfaces shall be cleaned by mechanical means, steam, pressure washing with clean water, grit blasting, or a combination to satisfy. Any remaining dust or loose material should be removed by blowing with oil-free clean compressed air.

Blowholes, cracks, imperfections and areas of pitting shall be made good with durarep FC or similar approved in accordance with current product information for use.

In hot, humid, coastal situations and in heavy industrial areas ensure that the interval between successive coatings is kept to a minimum. This is to prevent possible contamination of the surface of the preceding coating with air-borne contaminants, resulting in possible inter-coat adhesion failure and reduced coating performance. In the event that delays are unavoidable, wash down the surface thoroughly with clean water before proceeding with the following coating.

Application

Only the specified areas shall be coated; where protection/masking is required, dependent upon the nature of the coating and its method of application, it shall be provided and installed to the approval of the Contract Administrator. During application, walkways, plants, joint sealants, asphalt and bitumen painted areas and glass shall be masked and shielding shall be provided to prevent animal contact and to prevent airborne coating materials leaving the immediate area of application.

Thoroughly mix all materials in their original containers and progressively intermix containers of the same colours as the job proceeds. Surface coating materials shall not be applied in rain or when rain is likely within 6 hours of application. The primer shall not be applied when ambient and/or background temperatures are below 5 0C or 5 0C and falling. The topcoat shall not be applied when the ambient and/or background temperatures are below 5 0C or 5 0C and falling. Protect all surface coatings materials from frost whilst drying.

Primer

Special care shall be taken to ensure that the recommended application rate of 0.4 l/m² is achieved and two or more applications may be necessary until the dried surface presents a uniform sheen. The primer shall be allowed to dry for not less than 2 hours at 20 0C, longer when cooler.

Topcoat

Two coats of duracote WB or similar approved shall be applied. Each coat shall be applied at a minimum wet film thickness of 400 microns. The drying time between coats shall be minimum 16 hours at 20 0C and overcoating shall not take place until this period has elapsed and the prior coat is dry. Under poor drying conditions at low temperature it is permissible to apply three coats each of 270 microns wet film thickness.

The finished coating shall be continuous, pin-hole free and have a minimum dry film thickness of 400 microns.

The colour and finish is to be as agreed with the Contract Administrator.

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PH 3.11 SURFACE COATING FOR IMMERSED CONDITIONS

duracote AR or similar approved Surface Coating duracote AR or similar approved is a two-component polymer modified cementitious coating, developed for use as an internal coating for potable water retaining structures such as water storage reservoirs and water towers. The total dry film thickness (dft) shall be not less than 1.8 mm and shall be capable of providing CO₂ diffusion resistance equivalent to not less than 125 mm of 30 MPa concrete cover (Taywood method using Klopfer's criteria). It shall provide protection against chloride ingress showing no measurable ingress after 400 days immersion under accelerated testing conditions (Taywood Method).

Use

For application to prepared backgrounds of reinforced and precast concrete and masonry where it is required to minimise ingress of chlorides, CO₂ and water, whilst permitting moisture vapour transmission from the structure.

Survey

Areas recently prepared overall with durarep or similar approved repair mortars in accordance with the specification will present a surface suitable to directly receive a coating.

Areas where the previous works have not taken account of the need to prepare the overall surface to receive a coating (small patch repairs) shall be the subject of an inspection identifying the background character, nature and surface presentation.

Information shall be provided to the Contract Administrator detailing the areas for surface coating and the degree of preparation proposed together with techniques to be employed. The technical approval of the Contract Administrator shall be obtained prior to commencement.

Surface Preparation

All surfaces which are to receive the coating must be free from oil, grease, wax, dirt or any other form of foreign matter that might affect adhesion. Good quality concrete surfaces can be cleaned using a high pressure water jet. Poor quality, friable, or contaminated concrete may require grit blasting.

Spalled surfaces or those containing large blow holes, cracks and other such defects should be repaired using a suitable durarep or similar approved repair mortar. If the surface contains small blow holes, typically less than 3 mm wide, or cracks no wider than 300 µm, the coating can be applied directly on to the substrate without the need for a repair mortar.

Only the specified areas shall be coated; where protection/masking is required, dependent upon the method of application, it shall be provided and installed to the approval of the Contract Administrator.

Mixing

Pour the liquid component (5 Litres) from the plastic container into a plastic or metal drum having a volume of at least 20 litres. Gradually add the powder component (20 Kg) to the liquid whilst mixing with a propeller agitator attachment on a slow speed drill (400-600 rpm unloaded). Continue mixing, constantly moving the agitator around the drum, until a lump free consistency is achieved. Mixing is continued for a minimum of 3 minutes, stopping at least once to scrape any unmixed powder from the side of the drum into the mixture.

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Application

The prepared substrate shall be thoroughly wetted with clean water to totally satisfy absorption and any standing or excess water shall be removed. In very porous substrates, particularly in hotter climates, saturate the surface, leave for 1 - 2 hours, then saturate again. Ensure excess water is removed before proceeding. The material shall not be applied when the ambient or substrate temperature is below 5 0C or 5 0C on a falling thermometer. The applied coating shall always be protected from rain and frost whilst drying.

The coating can be applied by soft bristled brush, medium haired roller or steel trowel. A special spray unit has been developed by abe or similar approved for large contracts. Consult your local abe or similar approved representative. The first coat should be applied at a minimum wet film thickness of 1 mm. Monitor the coating thickness during application at regular intervals using a wet film comb gauge. Care must be taken to check that all blow holes and other imperfections are filled during application. If not, this can be done while the coating is still wet by using a dry sponge. If the coating has dried before these imperfections are found they can be filled using fresh material.

Allow to cure for a minimum of 4 hours @ 20'C/50 % RH. This time can be reduced substantially in hotter climates.

All the mixed material should be used within 45 minutes of mixing. In hot, humid, coastal situations and in heavy industrial areas ensure that the interval between successive coatings is kept to a minimum. This is to prevent possible contamination of the surface of the preceding coating with air-borne contaminants, resulting in possible inter-coat adhesion failure and reduced coating performance. In the event that delays are unavoidable , wash down the surface thoroughly with clean water before proceeding with the following coating.

The second coat should also be applied at a minimum wet film thickness of 1 mm. Monitor the coating thickness during application at regular intervals using a wet film comb gauge. Pre-dampening of the surface is not necessary when applying the second coat.

Finishing

To produce a smooth finish or to repair film defects use either a steel trowel, caulking tool or hard sponge. This should be done immediately after application, otherwise the coating may drag or tear. When using a hard sponge it should be dry or very slightly damp. A wet sponge should not be used as this will cause polymer to come to the surface of the coating that causes an unsightly white streaky effect.

Curing

Under normal conditions of application, no curing is required.

PH 3.12 SPALLING REPAIR

Preparation of surfaces:

Remove all laitance and degraded surface from the concrete. Sand blasting, wet or dry, could be used. Investigate all areas by tapping to find any loose concrete, spalling and cracking. Hack out all loose and spalling material to expose entirely any corroded steel, i.e. All round the bar. Chase a further 25mm into sound concrete at each end of the bar. The exposed clean steel is to be coated with Durarep zr primer or similar approved before flash corrosion takes place.

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Abrade all corroded steel to remove the rust, either by sand blasting or needle descaling. All the corrosion products must be removed down to bright steel. If the steel is too badly corroded refer to a structural Engineer for advice on replacement. See data sheet "preparation of surfaces". In all cases never featheredge repair products, a minimum cut of 10 mm perpendicular to the surface of repair must be provided followed by the required depth of breakout for repair.

Void filling

Immediately after abrasion overall to remove rust, apply to top, bottom and sides of steelwork, coat the steel with durarep zr primer or similar approved. Where structural repairs are required the surface is to be primed with epidermix 344 or similar approved, a wet to dry structural epoxy adhesive. The repair mortar must be placed into the still tacky surface of the epidermix 344 or similar approved, study the data sheet for window period, pot life, mixing instructions etc.

After 12 hours from coating the steel, for structural repairs, plastering / plastic consistency applications, apply durarep or similar approved or durarep fr or similar approved into the tacky epidermix 344 or similar approved surface in layers not exceeding 30mm in depth (or as can be worked with the products without slumping). In multi application layers scratch the surface for bond improvement and allow to set before applying a second layer. Continue until the void has been filled.

The final surface can be smoothed with a wood float. Alternatively, a shutter can be formed and durarep fmc or similar approved flowable micro concrete, poured into the box. After 12 hours from coating the steel, for non-structural repairs, apply durarep fs or similar approved to a predampened surface in layers not exceeding 30mm in depth. Scratch the surface for bond improvement and allow to set before applying a second layer. Continue till the void has been filled. The final surface can be smoothed with a wood float, depending on surface finish required. Protect the repair from too rapid evaporation of contained moisture by covering with damp cloths or constant spraying with water.

Curing

Curing is of vital importance for a successful repair, the type of curing compound to be used will depend on the surface finishes to be applied, i.e. Paint work etc., in this case do not use wax base curing membranes rather seek advice from your abe representative for the curing method to be employed. Generally use Duracure sbc or similar approved, if water is used for curing then the surface must not be allowed to dry out and must remain moist for at least three days, 7 days ideal.

Skimming to obtain a smooth surface:

Skim with durarep fc or similar approved onto a predampened surface to a maximum thickness of 5mm per layer, with no areas thicker than 15mm. Protect the durarep fc or similar approved from too rapid evaporation of contained moisture by spraying with water.

PH 3.13 CRACK REPAIR

Description

The repair of cracks in concrete by injecting them with epidermix or similar approved pumped in under pressure is a well tried and tested process. A properly executed crack injection will restore strength to the concrete and will seal it against entry of moisture and chemicals. Cores taken from injection repaired concrete will often be found to have a higher crushing strength than the parent concrete. This is due to the reinforcing effect of the resin.

Crushing fracture should not occur on the plane of the injected crack. Often it will occur at right angles to the cracked plane.

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Important: Before attempting a crack repair the cause of cracking must be found. If the crack is working the amount of movement must be determined. There is no point in repairing a crack if the structure is still subject to the stresses that caused the crack. The structure will simply crack again at the next weakest point. If it is proved that the crack is moving it should be cut out and sealed with a fully flexible sealant. This will exclude moisture but will give no strength. (See data sheet on durakol or similar approved in the sealants section).

EPIDERMIX COMPOUNDS USED IN THE CRACK INJECTION SYSTEM

Epidermix 365 or similar approved – if crack width exceeds 0,10 mm

Epidermix 389 or similar approved – if crack width lies between 0,10 and 0,05 mm or similar approved

Epidemix 314/372 or similar approved – for surface sealing prior to the injection process.

Equipment needed to carry out crack injection system

Long shanked grease nipples (\pm 30mm long).

Manually operated pump type grease gun.

Power drill with 6mm masonry bit.

Wire brush.

Fine stiff wire.

Cold chisel and hammer.

Rubber or plastic tubing – 6mm I.D.

Flat paddles for mixing injection resins.

Putty knives for mixing epidermix 314/372 or similar approved.

Method of carrying out crack injection system

1. The surface over the entire length of the crack should be wire brushed to remove laitance from the concrete.
2. If the surface of the concrete is unsound chase a vee cut at least 10mm deep and 20mm wide into the crack.
3. Remove all debris.
4. Drill into the crack using the 6mm bit. Drill at least 50mm deep. Ensure that the crack lies within the sides of the hole. Using fine stiff wire scratch out dust that may block the crack in the sides of the hole. Holes should be between 250 and 300 mm centres, the finer the crack the less the centres.
5. Seal the grease nipples into the holes with a collar of epidermix 314 or similar approved. Cover the head of the nipple with a short length of rubber or plastic tubing to ensure the inlet is kept free of epoxy. Also ensure that the outlet is kept free of epoxy.
6. Having sealed the nipples into the crack, seal the entire face of the crack with epidermix 314 or similar approved applied about 3mm thick and approximately 50mm wide. Where the crack is chased out the chase should be filled with epidermix 314 or similar approved and finished flush with the concrete surface.
7. Allow to cure overnight.
8. Next day, open the non-return ball valves of the nipples by forcing in pins.
9. Fill the injection gun with correctly mixed epidermix or similar approved liquid.
10. Starting at the lowest point of the crack or at one end, if the crack runs horizontally, pump in liquid resin. Continue pumping until resin exudes from the next nipple. Remove pin and carry on pumping for a few more strokes of the gun.
11. Disconnect gun from inlet and attach it to the nipple from which resin exuded.
12. Continue this sequence working either up or along the crack. After about 30 minutes return to the first nipple that was filled. Reopen the ball valves with pins and try to pump in further resin. This can usually be done as the resin may have seeped away into finer cracks or pockets

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of honeycomb. If foamy resin extrudes continue filling until clear resin is in evidence.
13. Once injection of crack has been started, work must continue until the crack has been filled. Before injection work starts, a rough calculation should have been made as to the amount of resin that will be needed to fill the crack.

The calculation :

Length of crack x Depth of crack x Width of crack (all in cm) divided by 1000 = litres of resin required.

If usage exceeds this figure by more than 4 times, the matter should be referred to the Engineer as

excessive internal honeycomb may be present. If the crack is in a contact slab or in the wing wall of an abutment it is likely that the resin is going straight through the member into the ground.

Twenty four hours after injection, the surface seal and protruding nipples may be cut off with a grinding wheel.

Repair of honeycomb concrete

Essentially the process is the same as outlined with the following exceptions.

- a) Holes must be drilled right through the member and not merely 50mm deep. They should be spaced not more than 150mm vertically and horizontally apart.
- b) The entire honeycomb area must be surface sealed with epidermix 314 or similar approved.
- c) On the day after the injection process has been done, a second set of holes should be drilled moving the matrix 50% horizontally and vertically and repeating the entire nipping and injection process.

PH3.14 CONCRETE REPAIR

Repair Material

ERpidermix 510 or similar approved epoxy mortar with epidermix 365 or similar approved shall be used for vertical or overhead concrete surfaces to be repaired in one or more layers, each layer 10-50 mm thick, though up to 75 mm thick for small individual repairs, where early strength development, impermeability, chemical resistance, or 40 N/ mm² compressive strength is required. The minimum application thickness shall be 10 mm.

Work Area

Avoid inhalation of vapours and ensure adequate ventilation. In confined areas suitable breathing apparatus shall be worn.

Repair Areas

The areas to be repaired are to be shown on the drawings or as indicated by the Client's Representative.

The areas are to be clearly marked out on site and agreed with the Client's Representative before

proceeding. The areas may be adjusted by the Client's Representative as work proceeds according to the conditions found. The surfaces adjacent to and of areas for repair shall be cleaned to remove any dust, unsound material, plaster, oil, paint, grease, corrosion deposits, organic growth, etc.

Within the repair area, the concrete cover to reinforcement links or main bars shall be determined by cover meter. A small area shall be chiselled out and the concrete cover and the depth of deteriorated concrete confirmed by measurement.

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Concrete Preparation

Break out unsound concrete as defined within the repair zone. Using a saw, disc cutter, or other suitable tool, the perimeter of the area to be repaired shall be incised to a depth of at least 10 mm causing good arrises to be formed at the outer edges all to preclude feather edging of the repair mortar. Where the depth of breaking out corresponds to the depth of concrete cover and thereby exposes reinforcement, breaking out shall continue to expose the full circumference of the steel and to a further depth of 25 mm or as directed by the Client’s Representative. Breaking out shall continue along the reinforcement until non-corroded steel is reached and shall continue 50 mm beyond this point or as directed by the Client’s Representative. Special care shall be exercised to ensure that any reinforcement exposed is not cut or damaged.

After breaking out as specified the exposed surface of concrete shall be tested for carbonation by the use of a semi-aqueous solution of phenolphthalein. The test shall be carried out on the freshly exposed concrete or at least within 30 minutes of being exposed. The test shall be carried out on sound, dry and clean air-blown dust free surfaces. If the concrete substrate still exhibits carbonation in the vicinity of the steel einforcement, breaking out to remove a further 20 mm shall be carried out and the test repeated. If carbonation is still present the Client’s Representative shall be notified before proceeding further. Single repair/render areas larger than 0.5 m2 shall be part primed to commence and there after in bays to suit chequerboard application of the epidermix 510 or similar approved. epidermix 510 or similar approved shall be applied when the primer has started to gel, but the surface is tacky - 1/2 to 4 hours, depending upon temperature. If the primer dries before the mortar is applied, the area shall be reprimed.

Mixing Epoxy Mortar

Before mixing the epoxy mortar the contractor shall ensure that sufficient and correct areas for reinstatement are prepared and ready to receive epoxy mortar. Only mixes using complete packs of epidermix 510 or similar approved shall be allowed and part pack mixes not permitted. The mixing shall be carried out strictly in accordance with current product instructions for use and only

with appropriate mixing equipment. epidermix 510 or similar approved shall be mixed by hand if “Standard Pack” or mechanically mixed if “Industrial Pack”.

The complete contents of the Base and Hardener shall be emptied into the mixing container and mixed

thoroughly. The aggregate shall then be added and the three components blended together, ensuring

that the aggregate is thoroughly wetted out with resin.

Application of Epoxy Mortar

Only fully integrated mixes of epidermix 510 or similar approved shall be used and within the mixed-state life of approx. 45 minutes. Apply epidermix 510 or similar approved to the primed surface with a wood float, or by gloved hand, pressing firmly into place to ensure positive adhesion and paying particular attention to packing behind and between any reinforcement and even compaction overall.

Any areas for treatmentwhich are more akin to rendering, such as large shallow indentations, or surfaces being treated for chemical resistance, shall be treated chequerboard fashion, approx 0.5 m2 at a time. These areas shall be treated so that 8-24 hours is allowed between abutting epoxy mortar edges and all edges shall be primed together with the concrete. epidermix 510 or similar approved shall be applied in accordance with current instructions for use. It may be applied in one operation by building up to the required profile in wet-on-wet layers between 5-50 mm. For small repairs the maximum thickness may be increased to 75 mm.

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Thicker sections may be achieved by building up in wet-on-dry layers, where each layer shall be wavy-line scratch keyed with a comb, primed at the time of application of subsequent layers and be completed between 8-24 hours of the previous layer. Sagging of the repair mortar is not acceptable and if occurring all the material of the affected repair shall be completely removed prior to repriming and refilling in two or more applications of mortar supported by formwork if required. If formwork is used it shall be pretreated with a varnish, wax polished and coated with a silicone based release agent. Special care shall be taken to ensure that the positioning of the formwork allows for even placing and does not result in voids within the repair mortar. The surface of the formwork shall not be coated with primer. The formwork shall be removed by knocking sideways when the epidermix 510 or similar approved has hardened, e.g. the next day. After applying sufficient mortar to achieve a level flush with the surrounding surface the epidermix 510 shall be finished by closing with a steel trowel.

Temperature

At 20 °C the initial hardness of epidermix 510 or similar approved occurs approaching 24 hours and the full cure is at 7 days. Below 20 °C the curing time increases and the minimum application temperature is 5 °C. In cold weather the epidermix 510 or similar approved and epidermix 365 or similar approved should be stored in warm conditions. Dependent upon conditions it can be helpful to tent the work area, also to warm the workpiece immediately prior to priming and application of the mortar. New work shall be protected against frost until hard and resistant.

Particular Specification PO: Occupational Health and Safety Specifications

All the definitions as described in the Contract will also have the same meaning in this Report, or any later report produced by the Consultant during the Project.

Introduction

Provisions of this Specification typically only refer to the Contractor, compliance herewith is also required from Subcontractors. The Contractor remains responsible for compliance with the requirements of this Specification by Subcontractors and shall ensure that each Subcontractor complies with the requirements hereof at all times and as applicable. Without derogating from his obligations and responsibilities, the Contractor shall ensure that the requirement to comply with the provisions of this Specification is included in all Subcontracts involving activities at the Project Site.

Failure by the Employer, Engineer or Agent to enforce compliance with the requirements of this Schedule shall not relieve the Contractor from any responsibility or obligation under applicable Law.

The Employer requires that the management of health and safety issues shall be to a standard of excellence aligned with world class best practices. The Contractor carries prime accountability and responsibility for the health, safety and welfare of the Contractor's Personnel and for any works that may expose any other person other than their personnel. No health, safety and welfare requirements specified by or imposed on the Employer (whether under the Contract or under applicable Law) shall be construed to reduce the Contractor's accountability and responsibility for the health, safety and welfare of the Contractor's Personnel.

The Contractor is responsible for adequately informing the Contractor's Personnel of all relevant information of this health and safety Specification.

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The requirements of this Specification should not be considered to be exhaustive and the Employer reserves the right to add, delete or modify conditions where it is considered to be appropriate in this Specification.

Where additions, deletions or modifications are made to this Specification, the Agent shall advise the Contractor of the change. The Contractor shall be solely responsible for informing the Contractor's personnel and its subcontractors of these changes. The Employer, Engineer or Agent shall not be responsible for any failure caused by a Subcontractor not receiving a notification or failing to act upon such notification.

Any matter dealt with in this specification is also dealt with under applicable Laws, the two are intended to be mutually explanatory and supplementary, the one to the other. In case of conflict or difference between this Schedule and the applicable Laws, the more onerous provision shall prevail unless otherwise instructed by the Agent.

There shall be zero tolerance for failure to comply with the Project Health and Safety Requirements at the Project Site. Any person who is, or appears to the Employer, Engineer or Agent, to transgress the Project Health and Safety Requirements may be required to leave and/or be refused access to the Project Site. If such person is a Contractor's Personnel, the Contractor shall take necessary steps against such person (including disciplinary action, where appropriate, and the possible removal of the person from the Project Site)

The Contractor shall comply with the Occupational Health and Safety Act 85 of 1993 ("OH&S Act") and all applicable regulations promulgated under the OH&S Act and in particular the Construction Regulations ("2014 Construction Regulations") as amended from time to time. The Contractor shall furthermore comply with applicable South African National Standards or International Standards.

It is the duty of the Contractor and his Subcontractors to ensure that they are familiar with all applicable Law, SANS standards and Regulations. The Contractor shall compile and maintain an up to date Health and Safety file.

All contractors are required to execute their works in accordance with this document

Applicability

This document shall apply to all contractors executing construction activities

Process for monitoring

Conformance to this document shall be via regular safety inspections and by monthly audits

Contractor's Health and Safety Policy and Plan

The Contractor and each Subcontractor shall each have a Health and Safety Policy that shall be duly signed by authorised signatory concerning the protection of the health and safety of Contractor's Personnel and others in and about the execution of the Works, and the arrangements for carrying out and reviewing such policy. Copies of the Subcontractors Health and Safety Policies shall be provided as and when Subcontractors are appointed. The Contractor shall prominently display a copy of the policy in the workplace where the Contractor's Personnel normally report for service. The Contractor shall develop a suitable and sufficient Health and Safety Plan for the execution of the Works. This shall be submitted to the Agent for approval.

Upon approval by the Agent, the Contractor shall implement the Health and Safety Plan. The approval of the Health and Safety Plan shall not, however, relieve the Contractor of any responsibility under law

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**PART B1: DETAILED MECHANICAL SPECIFICATION
(INCLUDING GENERAL WORKS)**

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PART B1: DETAILED MECHANICAL SPECIFICATION (INCLUDING GENERAL WORKS)

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DETAILED MECHANICAL SPECIFICATION (INCLUDING GENERAL WORKS)

B1.1 INTRODUCTION

The Nkomazi Local Municipality is responsible operation, maintenance and upgrade of the waste water treatmentwork which includes the Civil, Mechanical, Electrical and Electronic aspects under a single tender.

There are four existing WWTW and four WTW which are operated by NLM.

This specification deals with the Mechanical aspects of the Contract.

Purpose of the contract

For effective treatment of waste water and improvement of the water quality produced at of all the WWTW operated by NLM.

Refurbishment, supply and replacement of the equipment which are no longer functional and repairable, old equipments which irrelevant to the current technology where the spare parts are not available in the market.

Upgrade of equipments which are not meeting required demand performance.

B1.2 SCOPE OF SUPPLY AND SERVICES

In summary, the scope of supply and services for this contract encompasses the following:

The refurbishment, replacement (supply and replace) and upgrade of the following:

- Dry priming centrifugal solids handling pumps with valves and interconnecting pipework
- Electrical motors
- Submersible pumps, pipework and valves.
- Aerator units: motor, gearbox and turbine
- channel mounted grinder.
- Mechanical screen
- Clarifier Bridge (or design and construct)
- New motor control centre with VSDs and new ultrasonic level sensors
- Supply and installation of LV cabling and wiring to the new pump sets
- Standby generator (250KvA with acoustic hood),
- General site lighting upgrade

B1.4 DESCRIPTION OF EQUIPMENT AT THE WWTW

Depends on equipment and location. **See Attached ANNEXURE A**

Design / Engineering

All required basic and detail engineering and design of plant and equipment, based on the Engineer's criteria as laid down in this document and the manufacture drawings, to achieve a complete and integrated working system.

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Where adaptations of the Engineer's design are necessary to meet the Contractor's specific requirements, approval shall be obtained from the Engineer.

"Design/ Engineering" includes all documents required to be incorporated into the Operating and Maintenance Manuals.

- (a) Installation of new equipment
- (b) New motor control centres (MCC), interface connections, etc.
- (c) Associated work for Mechanical and Electrical equipment

Delivery, offloading, transport, double handling (if required), storage, erection, installation, commissioning, testing, adjustment, handing over, as a complete working installation, in complete working order and operating for the Trial Operation Period as specified and upholding during the Defects Notification Period of all equipment and services under this contract.

Details are found in the respective sections of this document.

NOTE

The final details for all the Civil and Builder's Scope of Works required for the all of the above Plant and Equipment shall be fully defined by the Contractor to suit his equipment offered.

SPECIFICATION OF EXISTING EQUIPMENTS AT THE PLANTS

1.1. T- Series Model GORMAN RUPP CENTRAFUGAL

Specifications Pump Size: 3" (75 mm), 4" (100 mm), 6" (150 mm), 8" (200 mm), 10" (250 mm)

Max. Capacity: 3400 GPM (214.5 lps)

Max. Solids: 3" (76.2 mm)

Max. Head: 175' (53.3 m)

Materials of Construction: Cast Iron, 316 Stainless Steel Fitted, CD4MCu, G-R Hard Iron Fitted, G-R Hard Iron with Hard Iron VoluteShaft

Features:

Suction Check Valve 03 , O-Ring Seal, Replaceable Wearplate, Balanced impeller, Oversized Seal Oil Chamber , Seal Oil Monitor.Removable Rotating Assembly. Bearing Oil Monitor, Pusher Bolt Capability ; Optional Casing heater, Double lip Seals, Atmospheric Bearing isolation, Cartridge Mechanical Seal. Easy-Off Coverplate nuts, Removable Coverplate' Easy-Grip handle. Pressure Relief Valve, Pusher Bolt Capability, Shimless Coverplate Adjustment Eradicator™ Solids Management System. Aggressive Self-Cleaning Wearplate incorporates grooves, notches and tooth to shred stringy materials to further reduce clogging

1.2. V- Series Gorman Rupp Pump CENTRAFUGAL

Pump Size: 3" (75 mm), 4" (100 mm), 6" (150 mm)

Max. Capacity: 1900 GPM (119.9 lps) Max. Solids: 3" (76.2 mm)

Max. head: 325' (99.1 m)

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Materials of Construction: Cast iron, 316 Stainless Steel fitted, Cd4MCu, G-R hard iron fitted

Features:

Removable Suction Check Valve, Easy-Off Cover nuts, Pusher Bolt holes,
Removable Back Coverplate, Pressure Release Valve, Shimless Coverplate
Adjustment

Self-Cleaning Replaceable Wearplate

heavy-duty impeller

Cartridge Mechanical Seal

Atmospheric Bearing isolation

Two double lip Seals

heavy-duty Bearings

Oversized Seal Oil Chamber

Removable Rotating Assembly

Bearing Oil Sight Gauge

Seal Oil Sight Gauge

Removable Rotating Assembly

Removable Back Coverplate

Smart Scroll®

Transition Chamber

Scope of supply depending on the model, the following items are included in the scope of Supply

- Pump
- Baseplate
- Coupling
- Coupling guard
- Drive

1.3 KSB PUMPS ETANORM MODEL CENTRIFUGAL

Pump type : ETN- Etanorm or ETN-F Etanorm Feuerlöschpumpe

Pump Sizes

040-025-160	DN 40
050-032-125.1 to 050-032-250	DN 50
065-040-125 to 065-050-315	DN 65
080-065-125 to 080-065-315	DN 80
100-080-160 to 100-080-400	DN 100
125-100-160 to 125-100-400	DN125
150-125-200 to 150-125-315	DN 150
200-150-20 to 200-150-400	DN 200

Design details

Design

- Volute casing pump
- Horizontal installation
- Back pull-out design
- Single-stage
- Dimensions and ratings to EN 733

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Pump casing

- Radially split volute casing
- Volute casing with integrally cast pump feet
- Replaceable casing wear rings (optional for casing material C)
 - B Bronze CC480K-GS / B30 C90700
 - C Stainless steel 1.4408 / A743CF8M
 - G Cast iron EN-GJL-250 / A48CL35
 - S Nodular cast iron EN-GJS-400-1

Impeller type

- Closed radial impeller with multiply curved vanes

Bearings

- Standard bearings – Floating bearings: deep groove ball bearings
- Reinforced bearings – Floating bearings: deep groove ball bearings
- Bearings with bearing pedestal – Floating bearings: deep groove ball bearings Shaft seal ▪

Gland packing

- Single mechanical seals and double mechanical seals to EN 12756
- Shaft equipped with replaceable shaft sleeve in the shaft seal area

Impeller material

- B Bronze CC480K-GS / B30 C90700
- C Stainless steel 1.4408 / A743CF8M
- G Cast iron EN-GJL-250 / A48CL35 I Bronze2) IS318 LTB
- O Cast steel 1.4008 / A743CF8M
- S Nodular cast iron EN-GJS-400-1

Casing cover:

- A Conical cover for version with single mechanical seal
- C Cylindrical cover for version with gland packing or double mechanical seal

Shaft seal type

- A Conical cover without internal circulation
- D Double mechanical seal in back-to-back arrangement
- E External circulation
- F External flushing I Internal circulation (only for version with conical cover)
- P Gland packing
- S Internal circulation, discharge cover with anti-swirl baffles (only for version with conical cover)
- T Double mechanical seal in tandem arrangement with internal circulation

Temperature class to EN 13463-1 or ISO 80079-36

Product Information as per Regulation No. 547/2012 (for water pumps with a maximum shaft power of 150 kW) implementing "Ecodesign" Directive 2009/125/EC

Scope of supply Depending on the model, the following items are included in the scope of Suply

- Pump
- Baseplate
- Coupling
- Coupling guard
- Drive

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Example pump in Boskrans

KSB ETANORM 080-065-250 OR EQUIVALENT

Brand	KSB Etanorm or Equivalent
Model	ETN-080-065-250
Type	Centrifugall Pump
Max Pressure bar	< 16
Flow l/min	< 2517
Flow m3/h	< 150
rpm	2900
Power kW	0.75
Temp max °C	-30 > + 140
Impeller Diameter	255 mm

- Motor
- Kw : 132
- Mounting : Footmount
- Volts : 400
- Amps : 244
- Efficiency : 95.9%
- Rpm : 1485

1.3 N- Series Flygt Pump- Submersible

Ratings from 2.2 hp to 870 hp
 Discharges diameter up to 500 mm
 Flows up to 1,000 l/s
 Pump Heads up to 120m
 Suitable for Submersible and dry installations
 Cast iron impeller with hardened edges and insert ring for typical pumping applications.
 N- series Range: Large capacity pumps, Medium capacity pumps and Low capacity pumps

Medium capacity pumps :

Model	3153	3171	3202	3301	331
rating, hp	12–23	25–35	35–75	60–105	85–160
discharge, in 3" (80 mm)	4" (100 mm)	4" (100 mm)	4" (100 mm)	6" (150 mm)	6" (150 mm)
	4" (100 mm)	6" (150 mm)	6" (150 mm)	10" (250 mm)	10" (250 mm)
	6" (150 mm)	10" (250 mm)	8" (200 mm)	12" (300 mm)	12" (300 mm)
	8" (200 mm)		14" (350 mm)	14" (350 mm)	
	10" (250 mm)				

Other pump at the WWTW

SUBMERSIBLE PUMP

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• Type	HT V180F Pump or Equivalent
• Model	V180F
• Power	0.18 kW
• Voltage	220V
• Operating depth	5m
• Max. Flow	6 m ³ /h
• Max.Head	7m

1.6 AERATORS

Siemens Aerator

Description

An aerator is an impeller in the biological part of a sewage treatment plant. It swirls the surface of the water so that it is enriched with oxygen. This activates the bacteria, so that the biodegradable constituents are removed from the sludge.

The impeller is fixed to the gear unit output shaft, which is extended vertically downward, a certain distance from the gear unit. To prevent the clarified water from becoming contaminated with gear oil, gear units are designed with an output shaft featuring an oil retaining tube and a non-contacting, non-wearing shaft seal.

The axial and lateral loads resulting from the process are absorbed by extra-heavy-duty output shafts and output bearings.

Technical data

Types	Helical and bevel helical gear units
Sizes	16
Gear stages	2- and 3-stage
Power ratings	up to 3,600 kW
Transmission ratios	$i = 6.3$ to 112
Nominal torques	10.5 to 173 kNm
Mounting positions	vertical

Advantages

- Oil pressure lubrication with flanged-on pump
- Reinforced bearings
- Dry well design (shaft seal is absolutely oil-tight)
- Coupling flange for mounting the aerator
- High operational reliability
- Low noise level
- High efficiencies

Applications

- Wastewater treatment

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Aerator at the Boskrans Waste water treatment works
GEARBOX

- Model Flender K168-K4-225 or Equivalent
- Power (KW) 45
- Poles 4
- Voltage 400
- Mounting B7-A-3C
- Service Factor 1.3
- Output Torque 6319 Nm
- Shaft Diameter 100 mm
- Output Speed 68 rpm
- Ratio 21.90:1

Other Equipments at the WWTW:

WEG Drive motor or Equivalent

Model	Motor suitable for VSD drive
Power	0.18Kw
Voltage	400 volt or 525 volts
Poles	4 Pole
Class	H
Type	IP66
Efficiency	IE3
Flange	B5 Flanged

15 kW WEG Motor

Type	Flange Mount
Power	15kW
Voltage	380
Efficiency	IE1 (88.2%)

90 kW WEG Motor

Type	Flange Mount
Power	90kw
Voltage	380
Rpm	1480
Efficiency	IE1 (93.8%)

Cornel pumps or Equivalent

Model	3STX-F45
Type	SMN688A-A03
Head	GPM FT

Inlet Screen Gearbox

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Type SK5282AF-100.19-100 L A/4
Power 3kW
Rpm 14.37 RPM
Ratio 100:19

Inlet Screen Motor

Power 1.1 kW
Voltage 380 V
Type SK 90S4
Flange mount

Anaerobic zone motors

Flange mount
Power 7.5 kW
Voltage 380 V
Poles 4 pole
Rpm 1440 RPM

STRUCTURE OF THE CONTRACT

The equipment is to be incorporated into the required civil works to be constructed under the civil component of this contract.

SITE FACILITIES AVAILABLE / REQUIRED

Source of Water Supply

Potable water supply is available on site, The Contractor is also responsible for sourcing and storage of water of suitable quality for potable and construction purposes, for the duration of the contract should there be no water available on site for a period of time. All costs related thereto will be for the Contractor's account.

The Contractor will be responsible, for the construction of all temporary pipelines, pipework, storage facilities (to balance supply with demand), controls and appurtenant work necessary to convey water to his camp/depot and to other areas of the site where water is required for construction and other purposes.

On completion of the Contract, the Contractor shall remove all temporary facilities and reinstate all surfaces to their original standard.

Source of Power Supply

Power supply is available for use on site.

The Contractor may use this facility but shall be responsible for checking the suitability and adequacy thereof, all negotiations with Eskom / Nkomazi Local Municipality Electricity Department and all costs to provide the required electricity supply for construction purposes to Site.

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This shall not relieve the Contractor of his responsibility for provision of power for construction purposes, for the duration of the contract should there be no power available on site for a period of time. All costs related thereto will be for the Contractor's account.

The Contractor will be responsible for all costs entailed in providing the necessary cabling from the supply point. The installation shall be made by a certified electrician, and, on completion of the Contract, the Contractor will be responsible for removal of the installation and reinstatement of all surfaces, etc.

Location of Camp and Depot

Not applicable, contractors are expected to have their own workshop close to NLM area.

Contractor's Site Facilities

Not applicable, contractors are required to have a workshop around the area.
During construction or installation.

The Contractor shall, at his own expense, provide, maintain, and remove on completion, proper latrine facilities on site for his staff, to the satisfaction of the Engineer.

Housing facilities for the Contractor's staff are not available on site.

The Contractor shall be responsible for all necessary security and watching requirements for his site establishment.

The Contractor shall at all times maintain his site establishment in a neat and orderly manner to the satisfaction of the Engineer

Note 1:

Project team organogram, showing names and positions of key personnel, including their CVs. Contact details of project manager and responsible director.

Note 2:

Fully dimensioned drawings of the plant, the necessary data concerning the geometry of structures housing the plant, the position and sizes of all foundations, bolt holes, openings in walls or floors and all other special features affecting the design and construction of the Works for his approval, so that the Employer can arrange for the necessary concrete work, foundations, bolt holes, openings for pipes, cable ducts, etc., for the proper erection and installation of the plant.

The Contractor shall be responsible for any errors or omissions in the Contractor's Drawings unless they are due to incorrect Employer's Drawings or other written information supplied by the Employer or the Engineer. Approval by the Engineer of the Contractor's Drawings shall not relieve the Contractor from any responsibility under this Sub-Clause.

Within the following 14 days the Contractor shall deal with any amendments to the drawings required by the Engineer, and submit the final version to the Engineer.

Any cutting or alteration of structural work arising from inadequate or incorrect dimensions and

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particulars afforded by the Contractor, or through late receipt of such particulars, may be arranged by the Engineer to be carried out as he thinks fit at the expense of the Contractor concerned under this Contract. In any event, the Contractor shall bear any costs he may incur as a result of delay in providing Contractor's Drawings and other information or as a result of errors or omissions therein, for which the Contractor is responsible.

The Contractor shall at his own cost carry out any alterations or remedial work necessitated by such errors or omissions for which he is responsible and modify the Contractor's Drawings and such other information accordingly.

Contractor's Drawings will be used by the Employer for no other purpose than completing, operating, maintaining, adjusting and repairing the Works.

Note 3:

Including, but not limited to

strength and durability calculations of all gearboxes in accordance with AGMA 218.01
calculations of relay settings, including graphs where applicable

Note 4:

Including all technical information or documentation appended to or included with the order.

Note 5:

The Programme shall identify all major activities, principal items of plant and equipment and their components. The following activities and their duration shall, in addition to requirements of the Conditions of Contract, form the minimum basis for the preparation of the Programme:-

- Insurance Bond and general obligations
- Design
- Plant equipment and arrangement drawings
- Project Quality Plan
- Schedules
- HAZOPS
- Procurement
- Inspection and works testing
- Delivery
- Installation
- Adjustment
- Testing
- Commissioning
- Defects Notification Period

Note 6:

The Contractor shall provide a Piping and Instrumentation Diagram (P&ID) which will cover all equipment provided under this contract. The Control Philosophy shall also be provided within 6 weeks.

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Note 7:

The Contractor shall provide a monthly progress report to the Engineer. The report shall cover at least the following aspects:

- progress of various activities in comparison to original program
- attainment of key milestones
- list of purchase orders placed
- names and positions of key personnel working on the project
- staffing levels on site (when site work commences)
- identification of any aspects needing to be addressed by the Employer or the Engineer

CONTRACTOR'S RESPONSIBILITIES IN TERMS OF THE O.H.S. ACT

the Contractor is responsible for ensuring that:

- (a) all equipment supplied, and
- (b) the complete installation,

comply with the requirements of the Occupational Health and Safety Act, Act 85 of 1993, and the regulations promulgated thereunder.

The Contractor shall conform to the Health and Safety Specifications from the Employer appended to the Contract Documents. These specifications are for the whole project and are not specific to this contract only. The Health and Safety Officer appointed shall liaise directly with the Contractor on safety matters but shall be required to channel safety matters affecting the construction works through the Engineer's Representative.

The Contractor's safety plan and method statements shall be approved by the Engineer and a safety officer shall be appointed prior to the commencement of any construction activities.

ENVIRONMENTAL MANAGEMENT

General

The Contractor shall comply with the Environmental Management Specifications.

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WASTE WATER TREATMENT WORKS AND WASTE WATER PUMP STATION

Scope of Supply and Service

This section of the Contract covers the design, supply, delivery, offloading, transport, double handling (if required), storage, erection, installation, commissioning, testing, adjustment, handing over in complete working order and upholding during the Trial Operation Period and Defects Notification Period of:

The equipment supplied shall be suitable for integration with and efficient operation in combination with equipment to be supplied under other sections of this contract as described elsewhere in this document.

General Description and Duties

TRAINING AND OPERATIONS SUPERVISION

The Contractor shall be responsible for the training of the Employer's maintenance and operating staff which shall be completed prior to Taking-Over of the Works by the Employer. As a minimum it shall include:

Theoretical training, including lectures on the theory of sewage treatment, sewage pump station design theory and its operation, odour control treatment operational theory and monitoring, etc.

Safety training, covering all aspects of the plant which need to be treated with particular care (chemicals, gas, manholes, firefighting, potable and non-potable water, etc.);

Practical training, by regularly involving the Employer's staff during installation, inspections and commissioning. It shall include step-by-step instruction of the Employer's staff in the operation and maintenance of specific mechanical, electrical and instrumentation equipment. It shall also include the systematic training of the operating staff during the 2 week test run period.

DEFECTS NOTIFICATION PERIOD

During the Defects Notification Period the Contractor's engineers responsible for the project shall visit the Site at least three times, say 1, 6 and 12 months respectively after the Commissioning Date. The purpose is to inspect and check all the plant supplied and installed for proper operation and to adjust where necessary, and for the Contractor to satisfy himself that the regular maintenance of the plant is being carried out correctly and in accordance with the written instructions supplied by him. The personnel undertaking these visits shall explicitly not be the staff working under the maintenance contract.

An item has been provided for these visits in the Schedule of Quantities.

QUALITY MANAGEMENT

Quality System

The Contractor shall, for the purposes and duration of the Contract, operate and maintain a

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quality management system complying with the requirements of the ISO 9000-9004 series (as applicable). The Quality System shall take the form of a coordinated and formally documented statement and shall include quality management objectives, policies, organisation, procedures, and work instructions that demonstrate the Contractor's implementation of the requirements of ISO 9001 - 1994 Code for Quality Management Systems.

Quality Plan

The Contractor's Project Quality Plan for the Contract shall indicate how the Contractor's Quality System shall apply to the specific requirements of the Contract. It shall clearly indicate, by way of written description, schedules, flow diagrams and procedures, compliance with ISO 9001 - 1994 and compliance by Sub-Contractors to ensure compliance with ISO 9001, 9002 or 9003 - 1994, as appropriate to the classification of the product or service.

The Project Quality Plan shall identify all documentation concerning implementation of the procedures and will form part of the demonstration of conformance to requirements for the plant materials and equipment to be supplied under this Contract.

The project Quality Plan shall be subject to the Engineer's approval.

The vocabulary used shall comply with the requirements of ISO 8402-1994.

Component Quality Plans

Component Quality Plans shall be prepared by the Contractor or his Sub-contractor/Supplier for each component or group of components, or item of equipment, or service in accordance with an approved schedule of all plant and equipment and services to be provided under the contract according to the designated category.

Component Quality Plans shall be submitted to the Engineer for approval and insertion of his surveillance requirements before construction, manufacturing or installation may take place. The following surveillance requirements shall generally be provided for and affirmed:

Record (R) : Documentary evidence of the activity scheduled and statistical data in the Quality Plan is to be retained and included in the data book.

Verification (V) : The Engineer or his representative will not necessarily be present during the activity but documentary evidence is to be produced to demonstrate that the requirements of the Component Quality Plan were met. A copy will be required by the Engineer and shall be included in the Data Book.

Witness (W) : The Engineer or his representative requires notification to permit witnessing of that particular stage of manufacture. The Contractor shall notify the Engineer timeously (at least 48 hours notice in writing) with a copy of his surveillance report attached.

Hold (H) : The Contractor and/or his Sub-contractor/Supplier may not proceed to the following operation until the Engineer or his representative has cleared the preceding activities and the initial hold point.

Random (R) : Surveillance by random inspection.

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Categorisation

The following categories shall apply in determining the preparation of Component Quality Plans:

Category	Classification	Component Quality Plan
Critical	A component or permanent assembly, the failure of which is likely to significantly affect the performance of the plant of which it is a part, and/or will cause a detrimental environment impact, and/or is likely to result in hazardous or unsafe conditions for individuals operating, maintaining or being in the vicinity of such component or assembly, and/or requires 24 hours or more to replace assuming immediate availability.	Required on all components or assemblies
Major	A component or permanent assembly, other than critical, the failure of which is likely to materially reduce the ability of the plant, of which it is part, to perform.	As determined by the Engineer
Minor	All items other than those designated critical and major.	Not required

Quality Management Audit and Meetings

The Engineer shall carry out periodic assessments of the adherence to the Quality Plan and inspection and surveillance during design, manufacture and supply and may elect to appoint an independent quality assurance representative to act in this capacity. A formal quality assurance meeting will be held at least once a month.

Corrective Action

Failure to conform to the documented requirements will result in the issue by the Engineer of a CORRECTIVE ACTION REQUEST. Failure to rectify the deficiencies covered by a corrective action request within the period stated will be considered to be default by the Contractor in terms of the General Conditions of Contract.

Drawings

The Contractor and/or his Sub-contractor/Supplier may not proceed to the following operation until the Engineer has approved drawings as follows:

General Arrangement Drawings

General Arrangement drawings require an approved or approved with comments release from the Engineer.

Design Calculations

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Design calculations require an approved or approved with comments release from the Engineer.

Detail Drawings

Detail drawings require a reviewed status from the Engineer.

As-Built Drawings

As-Built drawings require a reviewed status from the Engineer.

Equipment Data Sheets

A data sheet shall be prepared and submitted for approval by the Engineer on each item of plant and equipment and components therefore and all electrical components, and instrumentation, in accordance with a programme approved by the Engineer.

The data sheets shall be referenced by a unique code or tag number as utilised on and identified from the process flow and instrumentation diagram. The submission shall be in a form approved by the Engineer as appropriate to each item and component.

The data sheet shall be in the format as contained in this document and shall provide detailed information on each item and component which shall include but not be limited to the following:

General: Contract reference number
(Heading) Client reference
 Plant reference
 Date
 Sheet reference

(Item) Supplier
Manufacturer
Type and Size

Model Number
Drawing or Catalogue reference

Process Data: Full details of process and duty requirements for each item and medium processed or utilised.

Construction

Details: Full details of materials of construction for each item and component, as well as pertinent physical details such as mass and key dimensions.

Operational Data: Ranges and operation limits.

Control: Power and signal control (input and output), pneumatic, hydraulic, and other service requirements.

The approved data sheets shall be modified where necessary during commissioning of the plant and a printed copy with approved type face shall be incorporated into the Operating and Maintenance Manuals.

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Data Book

A data book shall be prepared and submitted on completion of manufacture, installation, testing and commissioning. The master version of the book shall include originals of all product brochures, material certificates, certificates of testing, analyses, laboratory reports, commissioning reports, works test sheets, Q.C.P's and copies of orders generated during the execution of the Contract, as approved by the Engineer.

Copies of the data book shall form part of the Operating and Maintenance Manuals.

Inspections during Manufacture and Construction

The Engineer shall inspect and approve those stages of manufacture of all equipment necessary to ensure the correct quality of the equipment as prescribed in the approved Project Quality Plan.

The Contractor shall provide facilities for inspection of all items of equipment at the place of manufacture and this requirement shall extend to all Sub-Contractors and suppliers. The equipment may be examined by an Engineer's Representative who will have the right to examine and test and satisfy himself regarding the suitability of all materials, components, and fabricating methods and processes, and to test (including radiographic or ultrasonic inspection of welding), whether for strength, pressure or performance, all components and finished equipment. The Contractor shall provide all facilities for such testing and the contract price shall include for this.

When Plant has passed the tests referred to in this Clause, the Engineer will furnish to the Contractor a certificate or endorse the Contractor's test certificate to that effect.

Examination by an Engineer's Representative shall not relieve the Contractor from the responsibility of carrying out himself all tests which may be necessary to ensure the required standard of manufacture or from any of his obligations in terms of the Contract. Copies of the results of all tests carried out by the Contractor in accordance with an approved Quality Plan shall be forwarded in triplicate to the Engineer.

The tests referred to above shall be carried out at the Contractor's expense.

The achievement of adequate standards during tests at the place of manufacture, if performed, is only a first requirement. The final criterion will be performance on Site, and any of the equipment which proves defective due to bad workmanship or material shall be replaced forthwith by the Contractor at his own cost on the instruction of the Engineer.

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MAINTENANCE OF EQUIPMENT

General

The purpose of this section is to provide a practical arrangement in terms of which the Contractor will undertake all service, maintenance and repair functions on the equipment installed in terms of this Contract during the defects notification period in order to uphold the equipment in good working order and prevent long term deterioration.

The base assumption of the work involved in this section is that the service, maintenance and repair will eventually be taken over by the Nkomazi Local Municipality (NLM).

This Specification shall in no way reduce any claim that NLM may have in terms of latent defects in design, materials, etc, or invalidate any of the NLM's rights in terms of common law.

The NLM's staff will operate the equipment and carry out the necessary daily checks. The Contractor shall provide a detailed check list of the operations, checks, tests, etc. that have to be carried out by operational staff on a daily, weekly and monthly basis.

Scope

The Contractor shall be responsible for:

- 1) All routine work described in Clause 0.
- 2) Unscheduled repairs to all Plant or equipment, including the maintenance of corrosion protection systems and procurement of paint coatings, procurement of replacement parts, etc.

NLM responsibilities

The NLM shall:

Make all payments, which have been approved by the Engineer.
Provide a representative to attend inspections and tests.

Performance requirements

The Contractor shall be responsible for maintaining all equipment, including controls associated with the equipment in a manner which will ensure that the equipment is ready for operation at all times.

Whilst it is understood that breakdowns may occur, sufficient standby facility has been specified at the MRF to allow uninterrupted operation of the equipment. The limiting criterion for performance will be that the process can operate but, in addition to this, all reasonable attempts shall be made to ensure that the standby equipment is available.

Planned Maintenance

Schedule of Work

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The detailed schedule of tasks to be performed during the one year defects notification period and which shall form the basis of the Planned Maintenance Program shall be drawn up by the Contractor for the Engineer's approval 3 months prior to the start of the defects notification period.

Planned Maintenance Program

The Contractor shall be responsible for providing and upholding, during the defects notification period, a PC based planned maintenance program.

The Contractor shall be responsible for setting up the program on suitable computer equipment and ancillaries, constructing the database of all items of equipment and the corresponding service and maintenance activities required, and entering all occurrences by week's end for submission to the Engineer. This system shall be fully integrated with future SCADA monitoring system and shall extract relevant monitored parameters.

All computer equipment, software, databases, etc, shall be provided by the Contractor but will remain the property of the NLM.

Routine Maintenance

Routine maintenance shall include but not be limited to the following:

All servicing and maintenance to ensure the good and proper functioning of the equipment.

This shall include but not be limited to the following:

Mechanical Maintenance

- Checking and recording of all operating parameters such as hours run, power drawn etc.
- Measuring and recording of wear plate wear. This shall then be plotted against hours run.
- Checking and recording of any other wearing parts etc.
- Check and record vibration.
- Lubrication of bearings.
- Checking and tightening of bolts subject to vibration.
- Replacement of oil filters.
- Checking and tightening of drive belts.
- All work resulting from wear and tear of equipment.
- Prevention of corrosion and touching up of corrosion protection systems.
- Cleaning of strainers / filters as required.
- Check overall cleanliness.
- Check noise levels.
- Start and stop machine to ensure correct procedure and timing.
- Check operators are performing operations correctly as well as recording information.

Allow 2 hrs. per month to retrain operators and answer queries.

Electrical Maintenance

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- Checking all connections and terminations at terminals and busbars after 6 months. Thereafter, check every 12 months.
- Checking all overload relays and protection devices for operation.
- Visually inspecting panels for signs of overheating, corrosion or deterioration.
- Checking earthing integrity, performing loop impedance tests and recording all readings.
- Visually inspecting and maintaining the complete electrical installation.

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General Maintenance

- a) Provision and regular updates
- b) Maintaining cleanliness in all areas in which work is carried out in terms of this Agreement.
- c) Procurement of all lubricating materials and other consumables, including all activities ancillary to procurement such as transport, off-loading, storage, etc.
- d) Reporting to the Engineer as required by Clause 0.
- e) Co-operation and co-ordination with the Engineer as required.
- f) Provision, setting up (including provision of databases) and upholding (during this Agreement of Maintenance) of the PC based planned maintenance system.
- g) Co-operation and co-ordination with 3rd parties as required.
- h) Maintenance of workshop facilities, tools and spares supplied in terms of the Contract as well as any other facilities required for the correct execution of the Maintenance.
- i) All inspections, tests and checks to fulfill statutory requirements (in particular the Occupational Health and Safety Act).
- j) All inspections, tests and checks to fulfill technical requirements.

Personnel and Logistics

All offices workshop facilities, tool stores, etc, provided in terms of the Contract shall be used, maintained and secured by the Contractor.

Inspection and Testing

The Contractor shall be responsible for arranging all inspections, tests and checks to fulfill statutory requirements (in particular the Occupational Health and Safety Act) and technical requirements.

The Contractor shall give the Engineer a one week warning prior to all inspections and shall make all arrangements and keep the required records in connection with such inspections. Where the Services of third parties are required, the Contractor shall make all necessary arrangements in connection therewith.

Workmanship

A high standard of workmanship is required at all times

Reporting

A written description of all planned work shall be forwarded to the Engineer prior to the work being started. An exemption will apply when the work has to be begun with urgency or when the nature of the required work cannot be ascertained prior to its initiation.

A description of all completed repair work shall be given to the Engineer not later than the day following the execution of the work. This report may be handwritten and will be retained by Council.

A comprehensive typed monthly report on all aspects of servicing, maintenance and repair shall

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be submitted within ten days of the end of each calendar month. Space shall be allowed for the Engineer's comments. This report shall form the official record of the Maintenance Program and will be kept on site by NLM.

The Contractor shall inform the Engineer in writing of any matter, which he considers affects his work deleteriously and which he considers to be the responsibility of NLM to rectify.

Statutory regulations

All work carried out on-site shall be in strict compliance with all statutory requirements. In particular, work and operations shall comply with all provisions of SABS 0108 and the Occupational Health and Safety Act of 1993.

Tools and Spares

All specified and recommended tools and spares to be supplied in terms of the Contract will be available for use by the Contractor and shall be secured by him. In the case of spares, the Contractor shall replace used stock immediately. The Contractor shall, in addition, maintain a stock of tools or spares in addition to these, which he considers, based on experience, to be necessary to perform his tasks effectively.

All tools required for repairs shall be provided by the Contractor.

Where the purchase price of any items exceeds R5 000,00, the Contractor shall seek the Engineer's approval prior to purchase.

Manuals

The Contractor shall maintain copies of all operating and maintenance manuals (in addition to the Manual specified in terms of Section 0 which are to be handed to the Engineer).

Remunerations

Contractors Monthly Charge- Routine Maintenance

The Contractor shall be remunerated for all routine maintenance work at the monthly charge tendered for routine maintenance (see Schedule 16, item 1.12). The sum tendered for routine maintenance shall be deemed to include for everything necessary for the routine maintenance and shall include but not be limited to all costs and expenses in connection with the following:

- (a) All of the Contractor's responsibilities for routine maintenance as set out in Clause 0.
- (b) Maintain a system of standby personnel.
- (c) Keeping the Council indemnified against all penalties and liability of every kind for any breach of the Law.
- (d) Maintenance of insurance and surety.
- (e) Training of NLM Staff.
- (f) All administration, management, transport, salaries, wages, allowances, risks, liabilities, incidentals, overhead, profit, etc, in connection with the maintenance of the equipment.

Repair and Replacement Work

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The Contractor shall be remunerated for repair and replacement work which, in the opinion of the Engineer, is not routine maintenance work covered by the Contractor's monthly charge in 0above and shall be paid the cost to the Contractor of the labour, parts and materials used and other related incidental costs, plus the percentage mark-up tendered in the Summary of Tender to cover all overheads, supervision and profit.

All claims for the labour expended in repair and replacement work shall be based on the labour rates for artisans, handymen and labourers tendered in the Summary of Tender.

Replacement of Spares

The Contractor shall be remunerated for the replacement of the spares held in stock on a "cost plus" basis which shall be limited to the actual invoiced cost to the Contractor plus the percentage mark-up tendered in the Summary of Tender to cover all overheads, supervision and profit.

The Contractor shall note that if a part, which is held as a spare in the store is installed, payment will be made only when a new replacement part has been obtained and placed in the spares store.

Payment of Third Parties

Where it is necessary in the opinion of the Engineer to use the services of an expert third party, the Contractor shall be remunerated on a "cost plus" basis which shall be limited to the actual invoiced cost to the Contractor plus the percentage mark-up tendered in the Summary of Tender to cover all overheads, supervision and profit.

Extra or Additional Work

The Contractor shall be remunerated for any extra or additional work ordered or sanctioned by the Engineer and not included in the categories described in Clause 0.

Limit to Contractor's Expenditure

The Contractor shall have the authority to purchase any single item or specialist service required not exceeding R5 000,00 without first having to obtain written approval from the Engineer. In the case of any purchase, replacement or repair exceeding this amount, the Contractor shall require the prior written approval of the Engineer.

Adjustment of Tendered Rates and Prices

No adjustment for rates and prices will be payable.

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**PART B2: STANDARD SPECIFICATION FOR
MECHANICAL WORKS
(INCLUDING GENERAL WORKS)**

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PART B2: STANDARD SPECIFICATION FOR MECHANICAL WORKS
(INCLUDING GENERAL WORKS)

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M01: MECHANICAL SCREENS PARTICULAR SPECIFICATION

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ENVIRONMENT

The General Mechanical Specification shall apply wherever it is relevant to the Contract unless it is superseded in accordance with the precedence stated and, in particular, by the Detailed Specification.

GENERALLY

General

Sites, with the exception of Wastewater Treatment Works, shall be considered as coastal with some industrial pollution.

Wastewater Treatment Works

For the purposes of this Specification all Wastewater Treatment Works shall be regarded as severe marine environments with some industrial pollution.

This environment is very corrosive to ferrous metals and, where the use of such metals cannot be avoided, the metals must be adequately protected, such protection systems being designed for a life of at least 15 years.

Sewage gas is also present throughout the treatment works and this may contain hydrogen sulphide which, in addition to being corrosive to ferrous metal, is also corrosive to most non-ferrous metals. The effect on copper alloys can be particularly severe, often with disastrous effects on the reliability and life of switchgear, control systems, slip-rings, etc. Such equipment must therefore be adequately sealed and protected.

DESIGN

General

This Specification lays down the performance, quality and overall system requirements of the Works. Deviation from the Specification will only be considered if the Engineer considers such deviation an improvement.

Safety

Safety shall be an all-important and overriding consideration and proper attention shall be paid to this aspect at the design stage. The regulations of the Occupational Safety and Health Act 2005, as amended, shall be strictly observed.

Equipment which is potentially dangerous shall be designed in accordance with a relevant South African or international Standard.

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The following must be noted:

- (a) Hazards must be avoided or guarded. Nip points shall be guarded; sharp corners shall be rounded off; operating handles, supports and protrusions shall be kept clear of access ways; and so forth.
- (b) The Contractor's Drawings and specifications shall clearly specify the structural requirements of the Works and the Contractor shall be responsible for covering all unsafe gaps and openings left in structures after installation.
- (c) Moving parts shall be properly guarded to the satisfaction of the Engineer.
- (d) An emergency stop button shall be installed in a convenient position next to each machine. The installation shall be designed to provide immediate access without the danger of accidental operation. In addition, trip wires which will stop the driving motor when pulled shall be provided along the accessible side/s of moving conveyor belts, chains and the like irrespective of operating speed and irrespective of guards provided.

Where, in the opinion of the Engineer, an installation is not safe, the Contractor shall remedy such defect at his own cost to the satisfaction of the Engineer.

Design Factors

A high quality standard is demanded and reliability, long life, trouble free operation, efficiency, ease of maintenance and operation, and neatness are essential.

All plant and equipment shall be of robust construction and the design shall, as applicable, be based on:

- (a) the full range of duties which can be reasonably anticipated;
- (b) the power and torque transmitted by the driver system under full load and stalled conditions;
- (c) the maximum pressure or vacuum which can be produced by pumps, blowers and compressors under all conditions including blocked or closed inlet and outlet circuits;
- (d) conservative service and safety factors based on approved standards or laid down in the printed specifications of reputable and approved manufacturers;
- (e) a safety margin of at least 20% in addition to any service or safety factors which apply;
- (f) twenty four hour per day operation;
- (g) a minimum life of 100 000 hours before repair or major part replacement;
- (h) prevention of serious damage from normal operational problems such as blockages, blinding, jamming, seizure, malfunction and, as far as is practical, maloperation; if these occurrences cannot be avoided by good design.

Machines with non-overloading characteristics shall be selected wherever possible; eg: motors shall be sized so that they cannot be overloaded by the driven machine.

Fail-Safe Operation and Protections

Where damage can occur from normal operational or other foreseeable problems, plant, equipment

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and systems must be designed to be fail safe; i.e. must have built-in redundant elements, or be fail-to-safe; i.e. must return to a safe condition where no further damage can be done in the event of a failure, malfunction, maloperation, and overload and, as far as practical, misuse.

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All reasonable and economically justifiable protections to prevent or limit damage to plant and equipment, particularly in high risk situations, must be incorporated. Protections shall: be directed at the source of the problem, limit forces to safe levels and act quickly enough to prevent damage (electrical thermal type overloads are inadequate); stop or prevent from starting all equipment at risk; activate an alarm with a labelled indicator on the control panel whenever a protection operates; not permit unauthorised tampering; operate reliably after long inactive periods exposed to corrosive and dirty conditions.

Tenderers shall highlight equipment limitations which can be exceeded during operation and cannot be guarded against.

Moving Parts

The following general requirements apply not only to machines but to all equipment with moving parts such as headstocks, extension spindles, swivelling davits, heavy duty hinges, pivots and the like:

- (a) All rotating or swivelling shafts, pins and the like, shall be adequately supported, guided and restrained by lubricated or self-lubricating bearings, collars and/or bushes.
- (b) Swivelling joints on linkages and the like shall be of the "universal" or fork and rod type with bearings or bushes fitted to the eyes or forks.
- (c) On abrasive applications abrasion resistant materials and slow speed operation shall be utilised. Raw sewage and sludge shall be regarded as very abrasive.
- (d) All applications associated with wastewater shall be regarded as corrosive and materials of construction shall be selected to suit.
- (e) Susceptibility to fatigue failure shall be minimised by proper design and manufacturing procedures. In particular, changes in section shall be radiused and care must be taken to avoid the use of welded components in areas of fluctuating stress.
- (f) The locking of nuts and pins in position shall be done to the approval of the Engineer.
- (g) Wearing parts shall be designed for interchangeability and ease of removal and replacement.

Arrangement and Mounting

The arrangement and general design shall take the following requirements into consideration:

- (a) Lifting eyes, lugs, hooks, etc., shall be provided on heavy or large items to facilitate handling.
- (b) Castings or fabrications shall have machined pads for seating and be mounted on either soleplates or baseplates as appropriate.
- (c) Where accurate alignment is required, positioning pins and/or jacking screws shall be provided.
- (d) The needs of operation and maintenance including neatness, access, working space, safety, cleaning, adjustment, handling, assembly, alignment, disassembly, removal, etc.
- (e) With plant and equipment to be mounted on or against concrete or brick structures built by others, provision shall be made for adjustment in the mechanical design. Any special accuracy requirements must be specified on the Contractor's Drawings.

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INSTALLATION

General

The Works shall comply with the following:

- (a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.
- (b) The requirements of Sub-clause "Arrangement and Mounting" (see Clause "Design") must be noted. The Contractor shall provide all foundation bolts, supports, hangers, brackets, etc. required for the support and fixing of his equipment.
- (c) The Contractor is responsible for grouting puddle pipes which pass through liquid retaining walls or slabs and for all other grouting necessary for all plant and equipment.
- (e) The use of more than three shims in the alignment of equipment will not be permitted. Machined spacers shall be prepared where necessary. Shims and spacers shall be of a corrosion resistant material such as stainless steel.
- (f) Corrosion protection requirements shall be carefully attended to and the relevant paragraphs of Sub-clause "Paint Application" (see Clause "Corrosion Protection : Paint Coatings") must be noted. All mating faces must be coated before and sealed after assembly.
- (g) Fastener threads must be coated with a nickel-based, anti-seize compound before assembly.
- (h) Crevices which are formed between two surfaces shall be filled, prior to final fastening, with a suitable formable packing, Denso tape or equivalent. This applies particularly to stainless steel.

Alignment of Shafts

Shafts for drives, such as motors, with an output above 150 kW shall be aligned to the driven shaft as follows:

- (a) Final alignment shall be done after installation and before commissioning, shall be checked in the presence of the Engineer and shall be to his approval. Alignment shall be sufficiently accurate to ensure that no initial pre-load is placed on the shaft coupling.
- (b) Each motor shall be aligned to its pump using laser aligning equipment with real time computer display.
- (c) The use of pourable epoxy resin chocks (Epocast 36, Chockfast or equivalent) shall be acceptable. If pourable chocks are used, the baseplate feet do not have to be machined but each machine foot shall be provided with a screw for vertical alignment. The chock thickness shall not be less than 20 mm.

MATERIALS

Materials - Generally

All materials used in the manufacture and construction of plant and equipment shall be new, unused and shall be the best of their respective kinds. The Contractor shall ensure that the materials are

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selected in accordance with the best engineering practice to suit the working conditions and the extremely corrosive environment.

Steel

All structural steel shall comply with the requirements of SABS 1431 grade S 355 JR and shall be legibly marked with the maker's name or trade mark and identification marks.

Stainless steel

The AISI grade of stainless steel to be used will normally be specified in the Detailed Specification. Unless otherwise specified, rolled material shall be supplied with a matt, annealed and pickled or otherwise de-scaled surface finish. For wrought steels, the equivalent BS 970 grade may in each case be used. The common applications are as follows:

APPLICATION	AISI	BS 970
Wastewater Treatment Works (all applications):		
welded	316L	316S12
not welded	316	316S16
Low corrosion interior:		
welded	304L	304S12
not welded	304	304S15
Exterior and corrosive interior:		
welded	316L	316S12
not welded	316	316S16

A manufacturer's test certificate shall be provided for each batch of stainless steel giving details of the material analysis and any mechanical tests carried out on the material. Each stainless steel item supplied shall be clearly and permanently marked with the grade of stainless steel and cross-referenced to the applicable test certificate.

Where grades 316 and 304 are mentioned in the Tender Documents, these shall be taken synonymously with grades 316L and grade 304L, respectively.

3CR12

This is the titanium stabilised, 12% chrome steel as produced by Columbus Stainless, South Africa.

3CR12 shall always be supplied with an annealed and pickled finish. 3CR12, in cases where it is to be coated, shall be suitably abrasive blasted to ensure adherence of the prime coat.

Plastics

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Thermoplastics and fibre reinforced polymers shall be UV resistant, have adequate tensile strength and high impact strength and generally suit the application.

PVC is regarded as too brittle and shall not be used unless called for in this Specification or approved in writing by the Engineer before supply.

CASTINGS

Castings shall comply with the relevant South African or British Standard for the material used, including the following:

Grey Cast Iron Castings	-	SABS 1034	BS 1452
S.G. Iron Castings	-	SABS 936/7	BS 2789
Steel Castings (General Purpose)	-	SABS 1465	BS 3100
Aluminium Castings	-	SABS 989/992	BS 1490
Copper and Copper Alloy Castings	-	SABS 200	BS 1400

Particular attention shall be paid to cleanliness, soundness and neat fettling and dressing of castings. Surfaces shall be smooth and irregularities caused by mould washaways, and the presence of porosity and sand and slag inclusions will not be tolerated. Areas under bolt heads, nuts and washers, shall be machined or spot faced to ensure a flat and smooth pressure bearing area, and sufficient space shall be provided for the use of ring or socket spanners.

All pressure retaining castings shall be hydrostatically tested to not less than 1,5 times the maximum working pressure after machining and shall be pressure tight.

No repairs shall be undertaken to castings without the written permission of the Engineer and welding will not be permitted on cast iron castings.

Castings shall be heat treated to provide optimum corrosion resistance and toughness combined with reasonable machinability. In particular stainless steel castings shall be heat treated so as to ensure that all carbides are in solution, to ensure optimum grain size, and to provide maximum corrosion resistance.

The Contractor shall provide a test certificate for each casting or batch of castings, except for those made of grey cast iron, giving details of the material analysis, the heat treatment and any mechanical tests carried out.

FABRICATION OF CARBON STEELS

Standards

Steelwork shall be constructed fabricated and erected in accordance with SABS Standard Building Regulations, Chapter 6, "Structural Steelwork", and with SABS 1200H where applicable.

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Finish

Weld spatter and other protrusions shall be removed. Sharp edges shall be rounded to a radius of at least 2 mm.

Requirements for Corrosion Protection

In addition to finishing requirements, the requirements of corrosion protection application shall be taken into consideration. All surfaces must be accessible for surface preparation and coating. Inaccessible pockets, open hollow sections or the like shall not be permitted except where hot-dip galvanizing (without painting) is called for.

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Surfaces which cannot be properly prepared after fabrication must be abrasive blasted and coated with a two-pack epoxy pre-weld primer before fabrication.

Drawings

General and detailed fabrication drawings shall be submitted by the Contractor for approval by the Engineer. Full details of the welding procedures and standards which he proposes to use shall be shown on these drawings.

Inspections

The Contractor shall arrange for the Engineer to inspect fabrications, including fabricated pipework, in the fabrication workshop and prior to corrosion protection.

FABRICATION OF STAINLESS STEELS

The requirements regarding the fabrication of carbon steels apply to the fabrication of stainless steels as well. In addition, the following requirements apply to the fabrication of stainless steels:

(a) Fabrication of stainless steels and 3CR12 shall follow the recommendations in "The Stainless Steel User Manual" and "The 3CR12 Fabrication Guide" issued by Columbus Stainless. Only fabricators experienced with stainless steel will be considered acceptable. Such fabricators shall use permanently dedicated storage and fabrication areas and shall use machines, tools and handling equipment suited and permanently dedicated to this type of material.

(b) Surfaces which become contaminated with steel or otherwise stained or otherwise marked so as to be of uneven colour, shall be cleaned by pickling or electro-cleaning rather than by grinding.

The Contractor shall arrange for the Engineer to inspect fabrications, including fabricated pipework, in the fabrication workshop.

WELDING

General Welding Requirements

(a) STANDARDS: Standards complying with good modern practice, and acceptable to the Engineer, shall be adopted. These include the following:

BS 5135 - Arc welding carbon and carbon manganese steelwork.

BS 4677 - Arc welding austenitic stainless steel pipework.

BS 2633 - Class 1 Arc welding of steel pipework.

BS 2971 - Class II Arc welding of steel pipework.

BS 806 - Design and construction of ferrous piping in connection with land boilers (used for arc welding specification of all pipe flanges).

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Welders shall be experienced competent artisans approved in accordance with BS 4872.

(b) **WELDING TO BE CONTINUOUS:** All welding shall be continuous on all sides of any joint unless otherwise approved in writing by the Engineer. No crevices will be permitted and where stitch welding has been approved by the Engineer, the crevices so left shall be sealed with an approved filling compound after priming but before further painting.

(c) **WELD APPEARANCE:** Welding shall be free of blowholes and all welding flux shall be removed. All weld spatter and other sharp imperfections shall be removed prior to abrasive blasting. Prior to painting, weld beads with a surface irregularity exceeding 3 mm or with sharp crests having a radius under 2 mm shall be ground. Weld grinding must not be performed on 304L or 316L stainless steel, however, unless unavoidable.

(d) **ITE WELDING:** Site welding shall be kept to a minimum and shall only be undertaken with the approval of the Engineer.

Welding of Stainless Steel and 3CR12

(a) **WELDING STAINLESS STEEL:** Stainless steels shall be welded strictly as recommended in "The Stainless Steel User Manual" issued by Columbus Stainless.

(b) **WELDING 3CR12:** 3CR12 shall be welded strictly as recommended in "The 3CR12 Fabrication Guide" issued by Columbus Stainless.

(c) **TYPE OF STAINLESS STEEL:** Austenitic stainless steels to be welded shall be of the low carbon grade (i.e.: 304L, 316L, etc.).

(d) **WELDING RODS:** The welding rods used shall be the most suitable for the metal and purpose. Type 309 stainless steel welding rods shall be used for welding 3CR12 unless otherwise approved in writing.

(e) **WELDERS:** Only welders experienced with welding stainless materials shall be used.

(f) **GENERAL:** All possible steps shall be taken to ensure maximum corrosion resistance and strength of the welds and welded material. Special care shall be taken to avoid prolonged heating. Welds shall be passivated. Discolouration and steel contamination must be removed by pickling or electro-cleaning as approved by the Engineer but should rather be avoided by taking the appropriate measures.

CORROSION PROTECTION : APPLICATION AND CONTROL

Painting Contractor

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Surface preparation and coating application shall be carried out by experienced industrial painting contractors who are fully equipped and staffed to do such work in their own covered premises strictly in accordance with the paint manufacturer's recommendations.

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Before proceeding with the corrosion protection coatings, the Contractor shall submit the name of the painting sub-contractor for approval by the Engineer.

Site Work

Surface preparation and coating application shall not be done on Site except for minor repairs, for application of the final aesthetic coat, where specifically called for in the Detailed Specification or where permitted by the Engineer in writing.

Systems to be used

(a) SYSTEMS: The corrosion protection systems to be used on the plant and equipment will usually be specified in the Detailed Specification, but if not, the Contractor shall recommend a suitable system for approval by the Engineer. If doubt exists as to the system or colour to be used, the Engineer's requirements must be ascertained.

(b) ALTERNATIVE SYSTEMS: Alternative systems superior to those specified may be used if approved in writing by the Engineer.

(c) ALL ITEMS TO BE PAINTED: Except where otherwise specified, all metal surfaces shall be painted. This includes hot-dip galvanized items and metal-sprayed coatings. In the latter case the paint shall be in the form of a sealer. Details of approved painting systems to be used are given below.

(d) COATING APPEARANCE: After installation on Site the finished paintwork must be neat, smooth, of uniform colour and to the approval of the Engineer.

(e) 316 STAINLESS STEEL: It is not usually necessary to paint 316 stainless steel. If corrosion of 316 stainless steel does occur, and depending on the appearance or extent of the problem, the Engineer may call for pickling, electrocleaning, painting or replacement of the item at no additional cost. Painting may however be required if contaminated or stained surfaces cannot be properly cleaned or where stitch welding has been approved.

Quality Control of Coating Application

(a) INSPECTION: The Contractor shall arrange for the coating application on fabricated steelwork to be inspected throughout by the Engineer. The Engineer may approve inspections by an independent competent person (hereinafter called the Inspector) appointed by and at the cost of the Contractor. Inspections shall be adequate to ensure compliance with the Specification and shall be done at the following stages as a minimum:

Coating (Metal-Spray, Paint, etc.)

After fabrication but before surface preparation.

After surface preparation but before application of the first coat.

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After application of the final sprayed metal coating or after application of the paint primer or first coat (as applicable).

After the final factory applied paint or sealing coat.

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Hot-dip Galvanizing

After fabrication but before hot-dip galvanizing.

After hot-dip galvanizing.

Duplex Protection (Hot-dip Galvanizing and Coating)

After fabrication but before hot-dip galvanizing.

After hot-dip galvanizing but before application of the first coat.

After application of the primer.

After the final factory applied paint coat.

(b) WITNESSING OF INSPECTION: If the coating is to be done in by an inspector other than the Engineer, the Contractor shall, nevertheless, arrange for the Engineer to witness the inspections at his discretion.

(c) INSPECTION REPORT: A written report of the inspections, prepared by the Inspector and by both the Inspector and the Contractor, shall be submitted for appraisal by the Engineer before delivery of the equipment to Site.

(d) INSPECTOR QUALIFICATIONS: Inspectors appointed by the Contractor shall hold an appropriate qualification from either the CISA, the SAIW or the SAQCC.

(e) IDENTIFICATION OF ITEMS: Every item to be coated shall be identified by a welded or hard-stamped code. Records shall be maintained for each item.

CORROSION PROTECTION: SURFACE PREPARATION

Imperfections

Welding shall be free of blowholes and all welding flux removed. All weld spatter, sharp edges and other imperfections shall be removed prior to abrasive blasting. Prior to painting, weld beads with a surface irregularity exceeding 3 mm or with sharp crests having a radius under 2 mm shall be ground. (Weld grinding must not, however, be performed on stainless steel). Areas to be painted shall be free of crevices. If the Engineer has permitted stitch welding in terms of Clause "Welding", crevices shall be filled with a compatible sealing compound after the priming coat has been applied.

Abrasive Blasting

Before coating all surfaces shall be properly degreased and abrasive blast cleaned to an SA3 finish with a 40-65 µm surface profile to Swedish Standard SIS 055900 of 1967. The abrasive shall comply with paragraph 4.3.3 of SABS 064 and shall be free from all traces of oil, grease, foreign matter and corrosive contaminants such as chlorides, etc. The prepared surface shall be given the first coat of the painting system within 4 hours after cleaning.

In instances where stainless steel and 3CR12 are to be painted, the surface shall be suitably abrasive blasted prior to primer application.

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Between Coats

Between coats or with previously painted surfaces in good condition, all traces of oils, greases, soluble salts and corrosive air borne contaminants shall be thoroughly washed from the surface to be painted using a detergent type cleaning agent, rinsed and dried. The previous coat shall then immediately be lightly sanded or otherwise prepared as recommended by the paint manufacturer, wiped clean, dried and painted. Solvents are not acceptable as a surface cleaning agent.

Hot-Dip Galvanized Surfaces

Hot-dip galvanized surfaces to be painted shall be free from white rust and shall be cleaned with an approved water based galvanizing cleaner using non-metallic abrasive pads until a "water break free" surface is obtained. The surface shall then be thoroughly rinsed with clean potable water to remove all residues and dried immediately prior to painting. Where necessary to obtain adhesion a sweep blast of the surface shall be done after cleaning.

CORROSION PROTECTION: METAL COATINGS

General

Fabrication of items to be protected by metal coatings shall be in accordance with SABS ISO 14713.

Hot-Dip Galvanizing

(a) STANDARD: Hot-dip galvanizing shall be done in accordance with SABS ISO 1461:1999 Hot-dip Galvanized Coatings on Fabricated Iron and Steel Articles.

(b) THICKNESS: Coatings shall be to the thicknesses detailed in the Standard.

(d) PASSIVATION: Hot-dip galvanized material which is to remain unpainted shall be passivated as specified in SABS 763. Items to be painted after hot-dip galvanizing shall be air dried and not passivated.

(e) WHITE RUST: Hot-dip galvanized material shall be substantially free from white rust when it is erected on site. Stacking and storing shall at all times be done in a manner to prevent white rust forming.

(f) REPAIR: Damage to hot-dip galvanizing caused by welding, grinding, etc. is not acceptable. The repair to hot-dip galvanizing damaged by handling or transport shall be done by cleaning the area and applying 3 coats of a zinc rich primer giving a dry film thickness of at least 100 µm and containing at least 94 % zinc in the dried film. If the opinion of the Engineer is that damage is excessive, such items will be rejected by the Engineer and shall be replaced by the Contractor at his own expense.

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(g) WELDING: Welding after hot-dip galvanizing is not acceptable.

(h) TEST CERTIFICATE: The Contractor shall supply a galvanizer's guarantee or test certificate prior to installation.

Sprayed Metal Coatings

(i) STANDARD: Sprayed metal coatings shall be done in accordance with SABS 1391: Standard Specification for Thermally Sprayed Metal Coatings as amended below. The statements below apply to Part 1 of SABS 1391.

(j) SYMBOLS: The type symbol described in Table 1 of the Standard shall be used to specify material and thickness requirements in the Detailed Specification; i.e. AL for aluminium, Zn for zinc, followed by the minimum average thickness in microns.

(k) THICKNESS: The minimum coating thickness for both Aluminium and Zinc shall be 150 μm . Greater thicknesses may be specified in the detail specifications.

(l) THICKNESS TESTING PROCEDURE: The procedure laid down in Clauses 4.2.1.3 a(1) or b(1) of SABS 1391: Part 1 for the determination of the coating thickness shall not be regarded as sufficient. The thickness shall be checked on every surface plane at points not more than 300 mm apart for small articles and 500 mm for large articles, e.g. angles shall be checked along all 4 surfaces, channels along all 6 surfaces, pipes in 4 planes etc. The minus tolerance on thickness in isolated areas shall also not exceed -10% and such low areas shall not be larger than 50 mm in diameter.

(m) PERIOD BETWEEN PREPARATION AND COATING : For the purpose of Clause 3.3 of SABS 1391: Part 1, the time between preparation and coating shall be shortened from 4 hours to 2 hours at any application area closer than 10 km from the coast.

(n) SEALING: Unless otherwise specified, all metal coatings shall be sealed immediately after metal-spraying using a suitable pre-treatment wash primer followed by coats of low viscosity sealant until absorption is complete. This shall be followed by a suitable top coat system to give a smooth final finish. The various coatings used shall be as specified or, if not specified, shall be selected by the Contractor to suit the duty and submitted to the Engineer for approval. The final coat shall normally be applied on site after installation. Colours shall be as specified or as agreed with the Engineer. Depending on the particular application, the following systems are acceptable:

System 1

Application of micaceous oxide pigmented polyamide cured epoxy to achieve a dry film thickness of 60-80 μm ; (Sigmarite Sealer, or equivalent).

One coat of solvent borne modified acrylic coating to achieve a dry film thickness of 70 μm ; (Sigma Topacryl coating, or equivalent).

One coat of solvent borne modified acrylic finish to a dry film thickness of 30-45 μm ; (Sigma Topacryl finish, or equivalent).

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System 2

Application of one coat of two component epoxy primer to a dry film thickness of 40 µm; (Intergard 269, Chemrite Carboline Rustbond Penetrating Sealer, or equivalent).

Application of one intermediate coat chemical resistant vinyl copolymer to a minimum dry film thickness of 70 µm.

Application of one coat of vinyl copolymer chemical resistant enamel to a minimum dry film thickness of 40 µm.

System 3

Application of one coat of two component epoxy primer to a dry film thickness of 40 µm; (Chemrite Carboline Rustbond Penetrating Sealer, Intergard 269, or equivalent).

Application of two coats of polyurethane enamel (twin pack) to a minimum combined dry film thickness of 70 µm.

CORROSION PROTECTION: PAINT COATINGS

Paint Selection

(a) **PAINT QUALITY:** Paint shall be of best quality, of approved manufacture and brand and comply with the requirements of the relevant SABS or BS specifications.

(b) **COMPATIBILITY:** To avoid incompatibility between paint coats due to variations in formulation, the different coats in any one paint system shall be provided by the same manufacturer.

(c) **CONFIRMATION OF SUITABILITY:** Contractors shall obtain confirmation from their paint suppliers that, when using their paints, the systems specified are technically correct and suitable for the application and the material being coated.

Paint Application

(a) **SURFACE PREPARATION:** All surfaces shall be properly prepared as specified in Clause "Corrosion Protection: Surface Preparation".

(b) **PAINTING:** Paints shall be applied strictly in accordance with the manufacturer's instructions by tradesmen skilled in this class of work. Thinning of paint shall only be allowed for spray application and the manufacturer's recommended thinners shall be used.

(c) **COATING OF HIDDEN AREAS:** Areas which will be inaccessible after erection and surfaces resting on floors shall receive the full paint system prior to erection. Mating or contact surfaces shall be prepared and primed and be brought together while the paint is still wet.

(d) **ITEMS ENCASED IN CONCRETE:** Metal to be encased in concrete shall be painted externally up to 30 mm inside the concrete section, leaving the remainder bare so as to facilitate bonding with the concrete.

(e) **CREVICES:** Crevices will not be permitted. Where unavoidable crevices are accepted by the

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Engineer, such crevices shall be filled with compatible filler after application of the priming coat.

(f) PROTECTION OF MACHINED SURFACES: Where painting of machined surfaces is not possible or advisable, these surfaces shall be coated with an approved proprietary anti-corrosion compound giving 12 months protection under operating conditions. Shaft ends and machined mating or mounting surfaces or pads shall be so coated and shall not be painted.

(g) COATING THICKNESS: The dry film thickness shall be measured using a non-destructive thickness gauge such as the "Mikrotest" or equivalent and shall comply with the Specification.

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(h) REPAIR: Painted areas damaged during transportation, erection or any means whatever shall be repaired as follows - Rusted spots shall be removed and cleaned by means of a wire brush or emery paper to a bright metal finish and the surrounding paint which is still intact shall be feathered for a distance of 50 mm beyond the damaged area. Spot priming and repair shall consist of all the coats previously applied and shall overlap the undamaged area.

(j) PROTECTION ON SITE : Proper and adequate use of cover sheets and other means shall be made to protect the existing paintwork from damage and from metal dust and sparks when welding, grinding, and wire brushing on site. Similarly effective steps shall be taken to prevent spillage or splashing or other damage to floors, walls and equipment when painting on site and any damage or mess caused shall be corrected at the Contractor's cost.

(k) FINAL COAT: The final external coat/s shall always be applied on site after installation except for System A/1, where all coats shall be applied by a specialist applicator at his premises. A professional, smooth finish with a uniform colour is required.

Final Colour Code - General

The final colour code, with the exception of projects for wastewater treatment works, shall be as follows:

PIPEWORK				
CONTENTS OF PIPE	BASIC COLOUR	COLOUR OF INDICATOR		
		1 BAND	2 BANDS	3 BANDS
AIR				
Compressed, Power	Arctic Blue (F28)		-	-
Aeration	Arctic Blue (F28)	Canary Yellow (C61)	-	-
Instrument	Arctic Blue (F28)	Salmon Pink (A40)	-	-
Vacuum	Arctic Blue (F28)	Primrose (C67)	-	-
Lime Transfer	Arctic Blue (F28)	Crimson (A03)	-	-
Backwash	Arctic Blue (F28)	Verdigris Green (E22)	-	-
CHEMICALS				
Aluminium Sulphate	Jacaranda (F18)	Verdigris Green (E22)	-	-
Sodium Aluminate	Jacaranda (F18)	Crimson (A03)	-	-
Ferric Sulphate	Jacaranda	Canary Yellow	-	-

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	(F18)	(C61)		
Lime (dry powder)	Jacaranda (F18)	Salmon Pink (A40)	-	-
Activated Carbon	Jacaranda (F18)	Light Stone (C37)	-	-
Polyelectrolyte	Jacaranda (F18)	Cloud White (G80)	-	-
GASSES (other than air); liquefied or gaseous				
Butane, Propane	Light Stone (C37)	-	-	-
Ammonia	Light Stone (C37)	Ultramarine (F09)	-	-
Blast furnace	Light Stone (C37)	Crimson (A03)	-	-
Carbon Dioxide	Light Stone (C37)	Light Brunswick Green (H07)	-	-
Coke Oven	Light Stone (C37)	Light Grey (G29)	-	-
Producer	Light Stone (C37)	Verdigris Green (E22)	-	-
Chlorine, Hypoclorite	Light Stone (C37)	Canary Yellow (C61)	-	-

WATER				
Cold Drinkable	Brilliant Green (H10)	Cornflower (F29)	-	-
Hot Drinkable	Brilliant Green (H10)	Crimson (A03)	Cornflower (F29)	-
Boiler Feed (Distilled)	Brilliant Green (H10)	Crimson (A03)	Cloud White (G80)	Crimson (A03)
Boiler Feed (De-mineralised)	Brilliant Green (H10)	Cloud White (G80)	-	-
Industrial, Raw	Brilliant Green (H10)	Golden Yellow (B49)	-	-
Reclaimed	Brilliant Green (H10)	Jacaranda (F18)	-	-
Backwash	Brilliant Green (H10)	Light Stone (C37)	-	-
De-sludge	Brilliant Green (H10)	Canary Yellow (C61)	-	-

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Stove Circulating	Brilliant Green (H10)	Salmon Pink (A40)	-	-
Hydraulic Power	Brilliant Green (H10)	Terra Cotta (A10)	-	-
Final Treated Effluent	Aquamarine (E67)	-	-	-
Interchange, Stage	Drakensberg Green (H36)	-	-	-
Raw Sewage	Olive Green (H05)	-	-	-
Sea Water	Light Brunswick Green (H07)	-	-	-
Primary Sludge	Dark Brown (B03)	-	-	-
Waste Activated Sludge	Light Brown (B15)	-	-	-
Digested Sludge	Light Brown (B15)	Light Olive Green (H21)	-	-
Pasteurised Sludge	Light Brown (B15)	Cloud White (G80)	-	-
OIL				
Diesel Fuel	Golden Brown (B13)	Cloud White (G80)	-	-
Hydraulic Power	Golden Brown (B13)	Salmon Pink (A40)	-	-
Lubricating	Golden Brown (B13)	Verdigris Green (E22)	-	-
Transformer	Golden Brown (B13)	Crimson (A03)	-	-
Paraffin	Golden Brown (B13)	Arctic Blue (F28)	-	-

PLANT AND EQUIPMENT

EQUIPMENT

COLOUR CODE

FIRE FIGHTING

Equipment and Pipework

Signal Red (A11)

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ELECTRICAL	
Distribution Boards, Switch-Gear, Terminal Boxes and Conduits	Light Orange (B26)
Emergency Stop	Signal Red (A11)
MACHINE GUARDS	
Inside	Light Orange (B26)
Outside	Colour of Machine
Protruding Shafts, Exposed Gear Wheels and Rotating Parts	Light Orange (B26)
HANDRAILS	
Horizontal Rails and Chains	Golden Yellow (B49)
Stanchions	Black
Protrusion, Sides of Ramps	Black and Yellow Diagonal Stripes
GENERAL	
Scour Pipes	Deep Buff (B24)
Valves	Basic colour of pipeline
WORKSHOP FLOOR DEMARCATION	
Demarcation Lines	Golden Yellow (B49)
Working Areas	Pastel Grey (G54)
No Parking, No Storage	Golden Yellow (B49)
Aisles and Walkways	Brilliant Green (H10)
Storage Area	Terracotta (A10)
Urethane based paint is to be used for concrete surfaces Traffic paint is to be used for tarred surfaces	

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Final Colour Code - Wastewater Treatment Works

NO	APPLICATIONS	COLOUR	SABS 1091
A	WATER APPLICATIONS		
A1	Fresh water	Cornflower	F29
A2	Sea water	Light Brunswick Green	H07
A3	Cooling water	Aquamarine	E67
A4	Final treated effluent	Aquamarine	E67
A5	Fire fighting	Signal Red	A11
B	SLUDGES		
B1	Interchange	Drakensburg Green	H36
B2	Raw sewage	Light Olive Green	H21
B3	Primary sludge	Dark Brown	B03
B4	Waste activated sludge	Light Brown	B15
B5	Digested sludge	Light Brown with bands of Light Olive Green *	B15/ H21
B6	Pasteurised sludge	Light Brown with bands of Cloud White *	B15/ G80
C	OTHER LIQUIDS		
C1	Drainage	Black	-
C2	Hydraulic oil	Salmon Pink	A40
C3	Lubricating oil	Verdigris Green	E22
C4	Polyelectrolyte	Aquamarine/bands of Dark	E67/F06
C5	Diesel Fuel	Violet * Golden Brown	B13
D	GASES		
D1	Chlorine, Hypochlorite	Canary yellow	C61
D2	Digester gas	Smoke Grey	F20
D3	Air	Arctic Blue	F28
D4	Oxygen	Cloud White	G80
D5	Ventilation air	Pale Grey	G62
D6	Steam	Silver (Aluminium)	-
D7	Hydrogen	Poppy Red	A14

* Bands shall be 250 mm wide, 4m apart.

Hot liquid lines shall have a 50 mm wide band of Crimson (A03) every 4 metres.

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Final Colour Code (continued)

NO	APPLICATION	COLOUR	SABS 1091
E	ELECTRICAL EQUIPMENT		
E1	Motors : External	Light Grey	G29
E2	Motors : Cowls; external and internal surfaces	Light Orange	B26
E3	Terminal boxes, Conduits	Light Orange	B26
E4	Emergency stop	Signal Red	A11
F	MECHANICAL EQUIPMENT		
F1	Pumps	To suit liquid being pumped	-
F2	Blowers, compressors, including ancillary equipment	Strong Blue	F11
F3	Turning shafts, couplings, pulleys, etc.	Light Orange	B26
F4		Black	-
F5	Baseplates	Black on white, white on other colours	-
F6	Direction arrows, Unit number, etc.	To suit liquid being handled	-
F7		Black	-
F8	Valves	Light Admiralty Grey, or	E46
	Handwheels	Arctic Blue	F28
F9	Bridges for settling tanks	Light Grey	G29
F10	Bulk mechanical equipment, gearboxes, general fabrications, brackets, supports, etc. Cranes and crawl beams	Golden Yellow	B49
G	DANGER AREAS		
G1	Guards : External and internal surfaces	Light Orange	B26
G2	Turning shafts, couplings, pulleys, fans, etc.	Light Orange	B26
G3	Fire fighting	Signal Red	A11
G4	Protrusions, Low beams, etc.	Black/Golden Yellow Stripes	---/B49
G5	Handrails :		
	Top horizontal and chains	Golden Yellow	B49
	Bottom horizontal	Black	-
	Stanchions	Black	-

EXCEPTION:

Items made of 316 or 316L stainless steel may be left unpainted provided the surface is of uniform self-colour without blemishes, rust, marks or stains. If blemished the surfaces must either be painted or cleaned by pickling and/or electro-cleaning (not grinding or other mechanical means).

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Painting Systems

DEFINITION OF TERMS

The abbreviation "d.f.t." used in this Specification shall mean dry film thickness given in microns and, except where otherwise specified is the minimum (not average) thickness permissible.

SYSTEM A/1

Three coats of a low solvent, high solids, polyamine/amide cured, epoxy (twin pack) to a minimum thickness of 350 µm.

Notes:

The coating shall undergo holiday detection over the full surface in accordance with SABS 1217. This test shall be done by an inspector holding an appropriate qualification from either CISA, the SAIW or the SAQCC.

When applied to hot-dip galvanized surfaces, a suitable epoxy primer shall be used after careful surface preparation before applying this system.

This system shall be applied by a specialist applicator prior to delivery to site with particular attention to the required interval between coats.

The first and third coats shall be a different colour to the second coat.

Applied to:

Items subject to immersion and/or wet abrasion; e.g. screw pumps, clarifier rotating arms, scum boxes and weirs, pipework, chutes, tanks, etc.

SYSTEM A/2

System A/1, plus

1 Coat polyurethane enamel (twin-pack)

d.f.t = 350 µm

d.f.t = 40 µm

Total d.f.t = 390 µm

SYSTEM A/3

3 Coats of a micaceous iron oxide pigmented polyamine/amide cured epoxy sealer/coating (twin pack) with d.f.t = 60 µm per coat.

Total d.f.t = 180 µm.

Notes:

Use Sigmarite Sealer, or equivalent.

Applied to:

Hot dry applications up to 200 °C.

SYSTEM A/4

3 coats of a micaceous iron oxide pigmented polyamine/amide cured epoxy sealer/coating (twin pack) with a d.f.t = 80 µm per coat.

Total d.f.t = 240 µm.

Notes:

Use Sigmarite Sealer, or equivalent.

Applied to:

Immersed applications in potable water up to 100 °C.

SYSTEM A/5

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2 or 3 Coats polyamine/amide cured coaltar epoxy.

Total d.f.t. = 400 µm.

Notes:

Where paints are available in different colours, each coat shall be a different colour.

SYSTEM B/1

- | | | |
|---|---|-----------------------|
| 1 | Coat aluminium filled epoxy (twin pack) | d.f.t. = 125 µm |
| 1 | Coat polyurethane enamel (twin pack) | d.f.t. = 40 µm |
| | | Total d.f.t. = 165 µm |

Application:

A maintenance coat over weathered coatings on steel.

Notes:

Surface preparation shall include, as a minimum, removal of all loose mill scale, non-adherent rust and loose paint prior to wire brushing and de-greasing and shall be in accordance with an appropriate internationally accepted standard such as the Steel Structures Painting Council of the USA or that of the Swedish Standards Institute's St standards.

SYSTEM B/2

- | | | |
|---|---------------------------------------|-----------------------|
| 1 | Coat HB epoxy primer | d.f.t. = 100 µm |
| 2 | Coats polyurethane enamel (twin pack) | d.f.t. = 60 µm |
| | | Total d.f.t. = 160 µm |

Applied to:

Motors, gearboxes, cast iron components, steel fabrications, etc.

SYSTEM C/1

- | | | |
|---|---|-----------------------|
| 1 | Coat inorganic zinc silicate | d.f.t. = 75 µm |
| 1 | Coat high build modified acrylic coating | d.f.t. = 75 µm |
| 1 | Coat modified acrylic finish to approved colour | d.f.t. = 30 µm |
| | | Total d.f.t. = 180 µm |

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Notes:

The primer must be factory applied. The intermediate and final coats may be applied on Site. Particular care shall be taken to obtain the recommended anchor pattern during abrasive blasting and to achieve the required primer thickness on all surfaces in one coat. The primer shall be tested for full cure before applying the subsequent coats. This system shall not be used for items subject to immersion. Intermediate coat shall be Sigma Topacryl, or equivalent. Top coat shall be Sigma Topacryl Finish, or equivalent.

Applied to:

Heavy fabricated steel items requiring a primer which travels well and/or can be left for an extended period before overcoating.

SYSTEM C/2 ("West Coast Specification")

1	Coat inorganic zinc silicate	d.f.t. = 75 µm
1	Coat epoxy tie coat	d.f.t. = 75 µm
1	Coat polyurethane enamel (twin pack)	d.f.t. = 40 µm
		Total d.f.t. = 190 µm

Notes:

The complete system must be factory applied and touch ups will be required on Site. The primer shall be tested for full cure before applying the subsequent coats. This system shall not be used for items subject to immersion.

Applied to:

Heavy fabricated steel items requiring a hard, high gloss colour finish - eg. bridges, tanks, non-immersed piping, structural steel, etc.

SYSTEM C/3

1	Coat inorganic zinc silicate	d.f.t = 75 µm
1	Coat modified silicone heat resisting coating suitable for 200 °C	d.f.t = 75 µm
		Total d.f.t = 150 µm

Notes:

Particular care shall be taken to obtain the recommended anchor pattern during abrasive blasting and to achieve the required primer thickness on all surfaces in one coat. The primer must be factory applied. The primer shall be tested for full cure before applying the subsequent coat. A tie coat suitable for 200 °C shall be included between the primer and top coat if so recommended by the paint manufacturer. The top coat must cure at ambient temperatures.

Applied to:

Steel and cast iron items on dry heat applications with temperatures up to 200 °C continuous.

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SYSTEM C/4

3 Coats modified silicon Total d.f.t = 120 µm

Notes:

Steel and cast iron items on dry heat applications with temperatures up to 540 °C continuous.

SYSTEM D

1 Coat epoxy primer (twin pack, for HDG surfaces) d.f.t = 75 µm
1 Coat polyurethane enamel (twin pack) d.f.t = 50 µm
Total d.f.t. = 125 µm

Applied to:

Hot-dip galvanized steel pipes, handrails and stanchions, guards, steelwork, etc.

SYSTEM E/1

1 Coat wash primer to SABS 723 d.f.t = 10 µm
1 Coat zinc chromate primer to SABS 679 Type 1 d.f.t = 40 µm
1 Coat universal undercoat to SABS 681 d.f.t = 35 µm
2 Coats silicone urethane gloss enamel top coat to colour code d.f.t = 70 µm
Total d.f.t = 155 µm

Notes:

If the specified dry film thickness of the zinc chromate primer of 40 µm is not achieved with one coat, an additional coat shall be applied.

The paints used shall be suitable for internal and external use.

An alternative priming and undercoat system of superior corrosion resistance may be used.

SYSTEM E/2

1 Coat phenolic based primer d.f.t = 20 µm
1 Coat universal undercoat to SABS 681 d.f.t = 35 µm
2 Coats machinery enamel d.f.t = 50 µm
Total d.f.t = 105 µm

Notes:

The paints shall be suitable for internal and external use.

The paints selected shall not be damaged by oil spillage or grease and shall be reasonably chemical resistant.

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SYSTEM E/3

- | | | |
|---|---|----------------------|
| 1 | Coat zinc chromate self-etching wash primer to SABS 723 | max. d.f.t = 10 µm |
| 1 | Coat zinc chromate primer to SABS 679 Type 1 | d.f.t = 40 µm |
| 1 | Coat universal undercoat to SABS 681 | d.f.t = 35 µm |
| 2 | Coats single pack urethane gloss enamel | d.f.t = 60 µm |
| | | Total d.f.t = 145 µm |

Notes:

All paints shall be suitable for internal and external use.

If the specified dry film thickness of the zinc chromate primer of 40 µm is not achieved with one coat, an additional coat shall be applied.

SYSTEM E/4

- | | | |
|---|--|----------------------|
| 1 | Coat water borne vinyl based primer; Dulux Corrocote 3 or equiv. | d.f.t = 40 µm |
| 2 | Coats Acrylic Semi Gloss top coats; Ameron 234 or equivalent | d.f.t = 100 µm |
| | | Total d.f.t = 140 µm |

Applied to:

General use on hot-dip galvanized surfaces.

SYSTEM E/5

- | | | |
|---|--|----------------------|
| 1 | Coat twin pack epoxy zinc chromate primer | d.f.t = 30 µm |
| 2 | Coats acrylic semi gloss coats; Amercoat 234 or equal approved | d.f.t = 100 µm |
| | | Total d.f.t = 130 µm |

SYSTEM E/6

- | | | |
|---|--------------------------------------|---------------------|
| 1 | Coat epoxy strontium chromate primer | d.f.t = 25 µm |
| 2 | Coats Dulux Silthane Gloss enamel | d.f.t = 60 µm |
| | | Total d.f.t = 85 µm |

Note:

The paints used for this system must be suitable for a continuous operating temperature of 120°C or higher.

SYSTEM F

- | | | |
|---|--------------------------------|----------------------|
| 1 | Coat vinyl copolymer polyester | Total d.f.t = 100 µm |
|---|--------------------------------|----------------------|

Applied to:

Steel floor grating.

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SYSTEM - FUSION BONDED EPOXY

This is a water resistant, non-toxic and non-tainting, fusion bonded epoxy pipe coating in accordance with SABS 1217. The material used shall be of Type 2; i.e. a thermosetting powder-coating material. The finished coating shall have a thickness of 300 µm and no reading shall be less than 200 µm.

Note:

The Contractor shall execute holiday detection over the full surface in accordance with SABS 1217. The items to be coated shall be prepared in accordance with Clause 4.1.1 of the SABS 1217 and, in particular, shall have edges ground to a radius of curvature of at least 3 mm.

The surfaces to be coated shall be prepared in accordance with Clause 4.1.2 of SABS 1217 and, in particular, shall be blasted to a preparation grade of Sa 3.

Pre-heating is needed to achieve the required coating thickness.

Applied to:

Immersed objects, cast iron valve bodies, pipework, etc.

SYSTEM – HOT-APPLIED THERMOPLASTIC

This is a synthetic thermoplastic polyamide, Rilsan or equivalent, which shall be applied by dipping the hot object into a fluidised bed of the polymer. The coating shall be executed in accordance with the supplier's recommendations. The finished coating shall have a thickness of 300 µm and no reading shall be less than 200 µm.

Acceptable Materials and Suppliers

The table below lists acceptable materials and suppliers. In all cases, equivalent materials and suppliers are acceptable.

GENERIC	MATERIAL/SUPPLIER
Hot-dip galvanizing	Hot dip galvanisers shall hold the SABS certification mark for SABS 763.
Powder Coating	Plascon epoxy/polyester powder : CEP series, Dulux Sigmalining FBE 27.
Universal Undercoat	Dulux Sigmarine Undercoat, Chemrite Carboline GP-64 Undercoat, Plascon Plasconamel 189 Undercoat.
High-Gloss Alkyd Enamel	Chemrite Carboline AD-51 Finish, Plasconamel 1000 Finish, Dulux Sigmarine BTB Enamel.
HB Epoxy Primer : Twin Pack	Plascon Plascotuff HB Epoxy MLE series, Dulux Sigmacover CM Miocoat, Chemrite Carboline 888.
Epoxy Primer : Twin Pack (for hot-dip galvanized surfaces)	International Interguard 269, Dulux Sigmacover Primer, Carboline 193 Primer.
Polyamine/amide Cured Epoxy sealer/coating : Twin Pack	Chemrite Carboline Rustbond Penetrating Sealer, Plascon Plascoguard Copon EA3 Primer, Dulux Sigmarite Sealer.
Epoxy Tie Coat	Dulux Sigmarite Sealer (used soon after primer application), Dulux Sigmacover CM Miocoat (where there is a delay after primer application), Chemrite Carboline 193, Plascon Plascosafe 18 Primer.
Low solvent, high solids, Polyamine/amide Cured Epoxy : Twin Pack	Plascon Plascoguard Copon KSIR88, Dulux SigmaGuard EHB, Ameron Amercoat 385, Chemrite Carboline 891.
Polyamine/amide Cured	Dulux Sigma TCN 300, Chemrite Carbomastic 200,

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GENERIC	MATERIAL/SUPPLIER
Coal Tar Epoxy : Twin Pack	Ameron Amercoat 78HBB.
Solvent Free Epoxy repair coating	Plascon Plascoguard Copon Hycote 151, Dulux Sigmaguard CSF 75.
Aluminium Filled Epoxy : Twin Pack	Ameron Amerlock 400 AL, Carbomastic 15, Sigmacover Aluprimer.
Zinc Phosphate Primer	Chemrite Carboline GP-18 Primer, Plascon Plascoprime 183 HB, Dulux Bildphos M10 Primer.
Inorganic Zinc Silicate	Plascon Plascozinc 233, Dulux Sigma Tornusil MC60, Chemrite Carbozinc 11, Ameron Dimetcote 11.
Modified Silicon	Chemrite Carboline 4631, Plascon Plascotherm Silicone 540 – Aluminium, Dulux Sigmatherm Silicate.
Silicone Acrylic	Plascon Plascotherm Silicon – Acrylic 200 T, Chemrite Carboline 1248.
Polyurethane Enamel : Twin Pack	Dulux Sigmadur Gloss, Chemrite Carboline 134 over polyamine/mide coatings, Chemrite Carboline 133 HB over zinc coatings, International Interthane 990, Plascon Plascothane Recoatable Enamel CPC Series, for two-coat systems, Plascon Plascothane Recoatable Enamel CPQ Series, for single coat systems.

FASTENERS

Standards

Bolts and nuts shall be hexagon head type complying with SABS 135 with threads of the coarse pitch series. Allen head screws of any type shall not be used without the Engineer's written consent.

Fasteners M12 and Smaller

All fasteners M12 and smaller shall be manufactured of grade 316 stainless steel.

Fasteners Larger than M12 - in Corrosive Areas

All fasteners in corrosive areas shall be manufactured of 316 SS. Corrosive areas shall be taken to include any moist or wet area such as in and above settling tanks, in or in the vicinity of open channels, where a continuous spray can be expected and all internal and external areas in the vicinity of the inlet works of a wastewater treatment works. All fasteners embedded in brick, concrete or soil shall also be of 316 SS.

Fasteners Larger than M12 - Non-Corrosive Areas

Fasteners larger than M12 which are in non-corrosive areas shall, except when specified otherwise, be hot-dip galvanized.

High Tensile Bolts

Where high tensile bolts are required by the design, they shall be hot-dip galvanized and painted. The bolt holes and crevices shall be filled and sealed prior to painting.

Material Compatibility

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Fastener material shall always be of equal or better corrosion resistance than the items being fastened, e.g. 316 stainless steel bolts must be used to fasten together 316 stainless steel fabrications or flanges.

Washers

Washers of similar material to the bolts shall be provided under each nut and setscrew head. Multiple washers or shims shall not be used. Spring washers or other approved locking arrangement shall be used on all fasteners subject to vibration.

Anti-Seize Compound

Before assembly, threads shall be treated with a nickel based, anti-seize/corrosion protection compound; Chesterton 725 : Nickel Anti-Seize Compound, or equivalent. The thread shall be treated in the area under the final position of the nut. Compound on the exposed thread shall be cleaned off after installation. If it is found during inspection that compound has not been applied, the Contractor shall disassemble all fasteners and comply with this requirement.

Thread Projection

Bolt threads shall project between 1 and 6 mm from the head of the nuts when fixed. Longer projections will only be allowed if the Contractor can show that bolts of a more suitable length are not manufactured.

Corrosion Protection

After installation the exposed surfaces of bolts not made of 316 stainless steel shall be coated as for the items being fastened. If the use of Allen head or similar fasteners has been approved by the Engineer, the recessed heads shall be filled with a suitable non-hardening sealing compound.

ANCHOR FASTENERS

Type and Material

All anchor fasteners shall be of grade 316 stainless steel.

Anchor fasteners for water retaining structures and for brickwork shall be of the chemical anchor fastening type. Anchor fasteners for other applications may be of the expanding type or chemical anchor type.

Hook Bolts

Grade 316 stainless steel hook bolts shall be supplied and grouted by the Contractor into pockets which will be provided in the concrete structure in accordance with the information to be supplied by the Contractor. The grouting products shall be used strictly in accordance with the manufacturer's instructions.

Alternative Anchor Bolts

The use of 316 stainless steel "Hilti Kwik Bolt" stud bolts or similar may be used as an alternative where approved by the Engineer. If steel reinforcing bars are encountered while the holes are being drilled, the Contractor shall knock a hole in the concrete around the steel and grout in a stainless steel hook bolt as described above.

Through-Bolt Anchors

Where machinery is anchored by studs or bolts which extend through the supporting structure and is

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therefore fastened down with the use of nuts from both sides, these, together with associated washers and brackets, shall also be of grade 316 stainless steel.

Anti-Seize Compound

All threads shall be coated with an approved nickel-based, anti-seize/corrosion protection compound before assembly.

GRID FLOORING

All grid flooring shall be Mentis type RS40 or equal approved with bearer bars across the shorter span. The depth of bearer bars shall not be less than 30 mm with a bearer bar pitch of not greater than 40 mm. Panels are to be set level and fixed down in angle frames so as to prevent rocking. All cut-outs in grid flooring for pipes, valve spindles and the like are to be banded and made before any corrosion protection is done. The edges of removable grid access covers must also be banded.

Grid flooring and frames shall be hot-dip galvanized after fabrication. Painting is not required unless called for in the Detailed Specification.

Where grid flooring bears onto painted surfaces, strips of rubber insertion material shall be secured under the grid flooring to protect the paint.

The fixing clip set (saddle clamp and locking plate) shall be of hot-dip galvanised steel but all fasteners shall be of grade 316 stainless steel.

GUARD RAILING

Guard railing shall be provided in accordance with legislated requirements and shall be provided generally in positions where the vertical change in level is 1 000 mm or greater.

Guard Railing for Equipment Installations

Guard railing shall comply with SABS 0104.

The following specific requirements shall be complied with:

- (a) All guard railing shall be of grade 316 stainless steel and shall comprise hand and knee rails not less than 32 mm diameter and stanchions spaced at not more than 1,8 m except where specifically directed otherwise in writing by the Engineer.
- (b) On platforms, walkways, landings or around dangerous areas the vertical height, measured from the top of the hand rail to the floor or surface, shall be at least 1 000 mm.
- (c) On stairways and fixed ladders the rails shall be parallel to the strings, and the vertical height, measured from the top of the hand rail to the nosing of the tread, shall be at least 900 mm.
- (d) For applications covered by this Specification, the rails and stanchion shall withstand, without permanent deflection, a proof force of 890 N and 1780 N respectively, applied at any point and in any direction. Contractors shall provide proof that their guard railing has been tested and withstands these loads.
- (e) Stanchions and rails shall be smoothly finished and free from sharp corners, edges and projections which may injure persons or damage clothing. Stanchion bases shall have the corners rounded or sheared off.

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(f) Railing, if tubular, shall be joined using the slip-jointing method with separate and neatly fitting tubular inserts fitted into the railing bore. If used, pins shall have their ends peened over and smoothed or, if taper pins are used, shall be filed off flush with the rail. The joint shall withstand the loads specified above when situated in any position including centrally between two stanchions. Joints shall preferably be located inside the stanchion balls. All joints shall be sealed.

(g) Railings shall be ended off with positively fixed (pinned) closure bends. At corners, short radius bends with stanchions on both ends shall be employed or, alternatively, stanchions specifically designed for such a position shall be employed. No sharp endings will be permitted.

(h) Stanchions shall generally be base-mounted to suit the arrangement requirements and shall be of solid or welded construction. Welding shall be compatible with the material, shall not impair the strength or corrosion resistance of the material, shall be continuous and shall be smoothly finished and then passivated.

(i) Stanchions shall be self-draining to suit the mounting arrangement.

(j) Holes for the rails to go through the stanchions shall have a diametral clearance not exceeding 1 mm but preferably 0,5 mm. On stairways with stanchions vertically mounted, the hole shall be angled to suit and shall accurately fit the angled rail with the abovementioned clearances. The crevices caused by rails passing through the stanchions shall be sealed.

(k) Stanchion feet which are attached to metallic surfaces shall have minimum dimensions of 150 mm X 60 mm. Two fasteners, of minimum size M16, shall be used to attach the foot. Foot material thickness shall be not less than 8 mm. Neatly fitting packing, Denso tape or equivalent, shall be fitted under stanchion feet to prevent the formation of crevices.

(l) Stanchion feet which are attached to non-metallic surfaces shall have minimum dimensions of 150 mm X 150 mm. In instances where the horizontal surface to which the foot is to be fastened is less than 150 mm wide, the foot shall be designed to be seated on at least two surfaces. Four fasteners, of minimum size M16, shall be used to attach the foot to the concrete. Foot material thickness shall be not less than 10 mm. Non-shrink, cementitious grout shall be applied under the foot just prior to final tightening of nuts.

(m) Stanchion feet shall be epoxy-coated.

(n) A nickel-based, anti-seize compound shall be applied to all threads before fastening.

(o) All components shall be supplied in the pickled and passivated condition which may also be polished. All surfaces must be uncontaminated and unmarked to ensure maximum corrosion resistance. A manufacturer's test certificate shall be provided for each batch of stainless steel giving the chemical analysis of the material.

(p) Inserts for internal slip joints may be of non-corrosive material using steel reinforcing provided the steel is completely enclosed.

(q) Where kickplates are required by legislation, these shall extend to 150 mm above the walkway level.

Guard Railing in Public Places

The requirements for guard railing at equipment installations shall also apply for guard railing for public places. The following specific requirements must also be complied with:

(a) The structural design shall be done in accordance with the requirements of SABS 0104.

(b) No opening in guard railing installed in public places shall allow the passage of a ball of 100 mm

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diameter.

PERMANENT LADDERS AND STAIRS

General

Permanent ladders shall comply, primarily, with the requirements of the Occupational Safety and Health Act and, secondarily, with BS 5395. Stairs shall comply with BS 5395, Part 3.

Unless other materials are specified, ladders and stairs shall be of carbon steel and hot-dip galvanized after all fabrication has been completed.

Permanent Ladders

Ladders shall comply with the following detail design aspects:

- (a) Access points to the head of ladders from platforms and walkways shall be protected by self-closing gates or by chains.
- (b) No part of the ladders shall project into the passageway.
- (c) The width between strings shall be between 380 mm and 450 mm.
- (d) A minimum clear space of 230 mm must be allowed behind the rungs.
- (e) The diameter of the rungs shall be between 20 mm and 50 mm.
- (f) Additional rungs shall be provided in the same horizontal plane as the top rung in order to close the gap between the platform and the ladder. Sufficient rungs shall be provided to ensure a maximum gap of 75 mm. These top rungs shall be at the same level as the floor or platform to which access is being provided.
- (g) Strings shall be formed from flat bar.
- (h) The vertical distance between the ladder support brackets shall not exceed 1 800 mm.
- (i) The strings shall extend to 1 100 mm above the floor or platform and shall be matched with any guard rail protections at this level. Connections between hot-dip galvanized steel ladders and stainless steel guard railing shall be bolted. Unless laterally supported by the guard rails, these strings shall be supported by vertical structural sections (not flat bar) whose footings shall comply with this Specification for guard rail stanchion feet.
- (j) All rises in a flight shall be uniform and the surface of the top rung shall be level with the top platform or landing. The height chosen for the rise shall be between 225 mm and 255 mm.
- (k) Except on chimneys, the height of a ladder should not exceed 6 000 mm. Greater heights shall be provided with intermediate landings between each 6 000 mm ladder section.
- (l) If the height between start and end levels is over 4 000 mm, the ladder shall be fitted with a safety cage. The safety cage shall extend at least 1 000 mm above the higher landing. The cage shall be no more than 700 mm away from the plane of the rungs. The cage shall comprise no fewer than seven vertical elements.
- (m) Anchor bolts shall be of grade 316 stainless steel and shall be no smaller than M16.
- (n) Strings, rungs and anchor brackets shall be of solid structural sections (e.g. flat bar, round bar, square bar, angles, etc.) and no hollow sections will be accepted for any part of the ladder.

Stairs

Stairs shall comply with BS 5395.

PIPEWORK

Pipes and Fittings

- (a) **STEEL PIPE - GENERAL DUTIES** : Steel pipes for general non-corrosive, non-abrasive duties for liquid, air and gas shall be as follows:

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Up to DN 150 - SABS 62 medium class
Over DN 150 - SABS 719

Unless otherwise specified, steel pipework and fittings shall be hot-dip galvanised and painted.

(b) **STEEL PIPEWORK – DESIGN:** Pipework up to DN 600 shall be in accordance with SABS 1476. Pipework for the conveyance of water shall, in addition, comply with CCT-WS 11 Standard Specification for Steel Pipe, Fittings and Specials.

(c) **STAINLESS STEEL PIPEWORK:** Stainless steel pipework shall be to ASTM 312. Schedule 10 pipes and fittings shall be used except where otherwise specified.

(d) **STEAM PIPEWORK:** Steam pipework smaller than DN 50 shall be of 316 stainless steel to ASTM A-312 Schedule 40 or approved equal. Steam pipework DN 50 and larger shall be manufactured to SABS 62 heavy class, ANSI B36.10 STD/Schedule 40 or to BS 1600 Schedule 40. Steel pipework shall be supplied with a suitable temporary corrosion protection both internally and externally in order to prevent corrosion during the storage, installation and pre-commissioning period. A primer similar to Plascon SNK 2, phenolic modified polyvinyl butyral self-etch primer, would be suitable.

(e) **HYDRAULIC & OIL PIPEWORK:** Hydraulic pipework shall be to BS 778 or equal. All hydraulic and oil pipes and fittings shall be thoroughly degreased, descaled and cleaned internally and externally after fabrication by abrasive blasting or pickling, thoroughly cleaned and rinsed, dipped in a hot iron phosphate solution and coated internally with a corrosion inhibiting, oil soluble preservative. After treatment and drying all openings shall be sealed until the pipes are installed.

(f) **BUTT WELD FITTINGS :** Steel butt welding pipe fittings shall be to ANSI B 16.9, BS 1965 or BS 1640 of the same schedule as the pipework or heavier. Butt weld fittings in stainless steel shall be to ASA B 36.19 for schedule 5S and 10S and ASA B 16.9 for schedule 40S and 80S. Alternatively, fittings may be to BS 1640.

(g) **MALLEABLE CAST IRON:** Malleable cast iron fittings shall be to SABS 509.

(h) **CAST IRON:** Cast iron pipes and fittings shall comply with BS 2035 (Class D) and shall be pressure tested in accordance with Clause 12 of that Standard. The requirements of the Standard's Clause 6 regarding freedom from defects and casting appearance and Clauses 8, 9 and 10 regarding casting accuracy will be strictly applied. The requirements of the Standard with regard to protection and flanges shall be modified to comply with this Specification. Also refer to Clause "Castings" of this Specification.

(i) **COPPER PIPES:** Copper pipes shall be to BS 2871 or approved equal.

(j) **PLASTIC PIPEWORK:** Polyethylene or Polypropylene pipes shall comply with SABS 533 and SABS 1315 respectively and shall carry the SABS mark. The contractor manufacturing and installing the pipework shall satisfy the requirements of SABS ISO 9002. PVC pipework is not acceptable except where specified.

An operating life of 50 years shall be designed for and appropriate derating factors shall be applied to suit the application. The rated maximum working pressure at operating conditions of the class of pipe selected shall be not less than 1,5 times the actual maximum operating pressure. If the material used has insufficient resistance to solar radiation (U.V. light) for the application, suitable protection must be provided to achieve the required life.

Note that nominal bores and pipe diameters specified must be regarded as the minimum inside diameter.

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Pipework Design

(a) **PIPE TYPE AND MATERIAL:** The type and material of pipe to be used will be given in the Detailed Specification.

(b) **PIPE DIAMETERS:** Unless otherwise specified in the Detailed Specification, pipe diameters shall be based on the following velocities. The velocities shall be based on the compressed volume at the operating pressure in the case of steam, air and other gases. Valves and other ancillaries shall generally be of the same nominal diameter as the pipe. Non-standard sizes shall not be used.

FLUID	FLUID FLOW [ℓ/s]			
	0-2,5	2,5-15	15-100	100-500
	ALLOWANCE FLOW VELOCITY [m/s]			
LIQUID				
GRIT FREE:	0.75 max	1,25 max	1,5 max	2 max
HIGH SOLIDS OR GRIT:		0,8 min	1 min	1 min
		1,5 max	1,75 max	2 max
STEAM	10 max	15 max	20 max	25 max
AIR AND GAS				
above 10 kPa	5 max	8 max	10 max	12 max
below 10 kPa	2,5 max	3 max	4 max	5 max

* Grit free liquids include potable water, final effluent, centrate, supernatant, etc. Liquids considered having high solids content will include raw sewage, sludge and grit slurry.

If anomalies occur within the same system using the above table, the larger pipe diameter shall generally be used.

(c) **COUPLING ARRANGEMENT:** Screwed fittings may be used on DN 50 and smaller provided that sufficient unions or flanges are provided for disassembly and removal of equipment. Reducing sockets and not reducing bushes shall be used where required.

All steel pipes larger than DN 50 shall be flanged or fitted with pipe couplings as applicable.

Suitable flexible couplings shall be incorporated wherever necessary to facilitate maintenance or isolate vibration. A flexible pipe coupling shall be provided on each pump suction. Flexible couplings shall be adequately restrained by harnesses as specified in the Clause "Flexible Pipe Couplings".

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(d) **DRAINING, VENTING AND PURGING:** On liquid lines provision shall be made for draining and venting where necessary. Vents shall be provided at all vertical down bends on gravity lines. On gas lines provision shall be made for purging.

(e) **CONDENSATE DRAINS:** Automatic condensate traps with isolating valves and valved by-passes shall be provided at all necessary points including ahead of any globe type valve, orifice plate or concentric reducer in a horizontal line, at each change of level and immediately ahead of the user equipment.

A suitable well of a diameter equal to the pipe diameter with a bottom drain shall be provided at each condensate removal point. Condensate traps and valves shall be accessible and condensate shall be piped to the nearest drain. Pipework shall be sloped in the direction of flow towards a drain point with a slope of 1 in 150 and care shall be taken to avoid sagging at any point.

(f) **BY-PASSES:** Isolating valves and valved by-passes shall be provided around condensate traps, pressure reducing valves and valves with solenoid or other actuation which do not have provision for manual operation.

(g) **ENCASED PIPES:** Pipework to be permanently encased in concrete, cement or similar shall be of cast iron or 316 stainless steel for steel and stainless steel pipework respectively. The encased portion must be a separate section flanged both ends with adequate clearance between the wall surface and the flanges. Victaulic type couplings may in some instances be permitted instead of flanges.

Pipe sections through walls below ground or water level shall be provided with a puddle flange the same diameter as a standard flange. The encased area shall in such cases be uncoated up to 30 mm inside the wall surface and coated to Specification from there on.

(h) **ISOLATION:** The layout design shall make provision for isolation and easy removal of mechanical equipment.

(i) **NOZZLES FOR FITTINGS GAUGES, ETC.:** Nozzles on pipework (for installation of gauges, transmitters, drain pipes, cooling water take-offs, air valves, etc.) shall be designed so that the pipework corrosion prevention system is not affected.

Nozzles shall consist of a flanged, welded tee-off of at least 100 mm in diameter, painted internally and provided with a non-corrosive blank flange, e.g. grade 316 stainless steel. The blank flange shall be provided with tapped holes suitable for the equipment installation.

A nozzle on cement-lined, carbon steel pipework shall consist of a flanged, cement lined tee-off (of at least 100 mm diameter) and a non-corrosive blank flange.

Internally painted, small diameter carbon steel nozzles and screwed carbon steel tee-offs are both unacceptable as nozzles. Carbon steel pipework may be provided with small diameter, grade 316 stainless steel nozzles which are welded into the pipework if the Engineer considers this acceptable in the application.

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Pipework Installation

- (a) **APPEARANCE** : Pipes and fittings shall be conservatively selected to suit the application, neatly installed, straight to line and level, adequately supported and shall operate without vibration.
- (b) **VALVE ORIENTATION**: On sludge or raw sewage pipelines, check valves shall, wherever possible, be mounted horizontally and isolating valves with spindles vertical. Valve handwheels shall be arranged so that they are accessible to the operators.
- (c) **SUPPORTS**: No external loads shall be placed on items of mechanical equipment such as pumps, compressors, etc. Adequate provision shall be made for expansion and contraction due to variations in temperature or pressure.

A drawing or sample of proposed pipe supports shall be submitted to the Engineer for approval prior to manufacture.

Pipe supports shall be so located that when an item of mechanical equipment is removed, the associated valves and pipework are still adequately supported. Supports shall be provided close to heavy items such as valves.

3 mm thick neoprene strips shall be placed between pipes and supports or clamps to protect the paintwork and limit corrosion. Where roller or sliding supports are used to accommodate movement, suitable wear blocks shall be fixed to the pipe to prevent damage.

Where the Engineer approves the use of concrete pipe supports to be built by a civil contractor under a separate contract, these shall be constructed after installation of the pipework and temporary supports shall be provided by the Contractor in positions which will not interfere with the construction of the concrete supports.

- (e) **PRESSURE TESTING** : All pipelines shall be pressure tested to 1,5 times maximum working pressure. This shall be done before covering up the pipeline in any way where applicable and shall be witnessed by the Engineer.

FLANGES

- (a) **STANDARDS**: All standard flanges shall comply with SABS 1123. For flange sizes not included in the SABS, BS 4504 shall be used. Cast iron flanges and their mating flanges shall have flat faces. The flange table shall be as specified or, if not specified, selected to suit the maximum possible operating pressure but not less than Table 1000. Drilling and installation of flanges shall be "off-centre".
- (b) **FLANGE FIXING**: Flanges DN 50 and smaller may be of the screwed on type. Metal flanges above DN 50 shall be welded on in accordance with BS 806 Type 6 unless otherwise agreed or specified.
- (c) **MACHINING OF FLANGES**: All flanges shall be machined on the sealing face. Flanges cut from plate shall also be machined on the bore and outside diameter. Cast iron flanges shall also be machined or spot faced on the back of the flange to ensure a flat bearing surface for the fastener's head or nut and washer. All edges, including bolt-holes, shall be chamfered or rounded to a 2 mm radius.
- (d) **BUTT FLANGES**: If the use of a loose hot-dip galvanized butt flange arrangement with stainless steel pipework is specified or approved by the Engineer, such arrangement and design shall comply with BS 4504 Table 6/6 or 10/6 as appropriate. The butt welded shouldered end for the pipe may be rolled from hot rolled stainless steel angle section. The hot-dip galvanized butt flange must be electrically insulated from the stainless steel pipework.

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(e) **RECTANGULAR FLANGES:** The use of square or rectangular flanges shall be avoided and will not be accepted for pressures above 100 kPa. The thickness of flanges designed for positive or negative pressures between 20 and 100 kPa shall be not less than 75 % that of a circular flange of equivalent nominal opening area manufactured to Table 600 of SABS 1123. For pressures 20 kPa and below the flange thickness shall be to the Engineer's approval. Bolting shall in all cases be to the Engineer's approval.

(f) **GASKETS:** The jointing material used on flange joints shall be of rubber or compressed asbestos fibre at least 3 mm thick complying respectively with BS 2494 or BS 1832, as applicable. Full face gaskets shall be used for full face flanges. Inner bolt circle gaskets shall be used on raised face flanges and when clamping items such as wafer type valves between flanges inside the bolt circle. Properly designed O-ring seals are also acceptable.

FLEXIBLE PIPE COUPLINGS

Coupling Types

Where movement or misalignment must be allowed for, or if necessary for any other reason, rubber expansion joints may be used if approved by the Engineer. The flexible material used for rubber expansion joints shall be chosen specifically for maximum resistance to bursting.

Viking Johnson couplings and flange adaptors, or equivalent, may also be used if approved by the Engineer and these shall be supplied without centre register unless otherwise specified.

Flexible couplings for cast iron pipes and, where specified, for asbestos cement pipes, shall be of the cast iron short or long collar type. Flexible couplings for steel or stainless steel pipework may be of the "Victaulic" type or approved equal for grooved or shouldered end pipes.

Couplings for plastic pipes shall be of the clamp type employing buttressed pipe ends.

Pipe Ends

Pipe ends shall be prepared strictly in accordance with the coupling manufacturer's recommendations. Where machining is required, as in the case of cast iron pipes, the length of machining on each pipe shall be approximately equal to the total length of the coupling to ensure that the coupling can be separated for pipe removal.

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Supports and Anchors

Pipework using flexible couplings shall be supported and anchored strictly in accordance with the coupling manufacturer's recommendations. Harnesses against separating forces shall be provided where appropriate to the approval of the Engineer. Where this restraint is not provided by the layout, other neat and positive means of harnessing shall be provided. A system incorporating additional flanges or lugs cast on in the case of cast iron, or welded on for steel, and connected by tie bars or positively fixed to anchors, will be accepted. Systems relying purely on friction will not be acceptable.

Corrosion Protection

Cast iron couplings shall be painted. Steel couplings for gas applications shall be hot-dip galvanized. Steel couplings for fluid applications shall be coated in accordance with System – Hot Applied Thermoplastic or System - Fusion Bonded Epoxy.

Metal backing flanges for rubber expansion joints shall be of stainless steel or hot-dip galvanized steel.

Fasteners

Fasteners for Viking-Johnson type couplings shall be of grade 316 stainless steel. This includes coupling studs, stub studs (i.e. studs welded to the flanges of flange adaptors), washers and nuts.

Fasteners for other couplings shall be of stainless steel or hot-dip galvanized steel.

Underground Protection

When couplings are part of a buried pipeline the couplings shall be enclosed with "Denso mastic" to a smooth finish, wrapped with "Denso tape" and then wrapped with a polythene sheet which is strapped in place. If the operating temperature is likely to exceed 70°C the Denso paste and tape shall be replaced with a suitable grease or a suitable sealer.

CONDENSATE TRAPS FOR SEWAGE GAS

Not used

FLAME ARRESTERS

Not used

PRESSURE RELIEF AND VACUUM BREAKER VALVE WITH FLAME ARRESTER UNIT

Not used

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VALVES FOR LIQUIDS OR GASES

General

The valves to be used on the more common applications are specified below. Where special valves are necessary for special applications, these may be specified in the Detailed Specification but, if not, the Tenderer must select suitable valves and provide details with his tender.

Requirements for All Valves

(a) **CONSTRUCTION AND DESIGN:** Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.

Valves shall be double-flanged unless unavailable or otherwise specified.

Valves and their method of actuation shall be designed to provide operation under the full pressure rating of the valve.

(b) **OPERATING DIRECTION :** The handwheel, lever, etc. on valves, valve actuators and valve gearboxes to be supplied and installed for the Water Department of the Water and Waste Directorate of the NKOMAZI LOCAL MUNICIPALITY shall be configured to be anti-clockwise closing unless unobtainable.

All valves supplied and installed for Nkomazi Local Municipality other than the Water Department shall be clockwise closing.

(c) **POSITION INDICATION:** All valves, including valves with gearboxes and valves with actuators, shall be provided with indication of current position as well as indication of closing and/or opening direction. Valves with configurations which makes this information apparent will be acceptable.

(d) **CORROSION PROTECTION:** The specific application shall be taken into account in the corrosion protection of valves.

Cast iron valve components, including valve bodies, shall be protected with System - Fusion Bonded Epoxy.

(e) **FASTENERS:** Valve and valve gearbox fasteners shall be of grade 316 stainless steel.

Cast Iron Gate Valves with Resilient Seals

(a) Resilient seal gate valves may be used on raw sewage, raw water, effluent and general duties where some solids may be present but must not be used on high solid applications such as sludge and grit duties.

(b) The valves shall comply with SABS 664 or SABS 665, Class 10 or higher as required.

(c) The valves shall be double flanged.

(d) Valves shall have rising spindles unless otherwise specified or necessary because of space restrictions. Non-rising spindle valves shall be fitted with indicators showing the valve opening position.

(e) Handwheels shall be of cast-iron.

(f) Fixing lugs for end of travel limit switches shall be provided

(g) Handwheel size and construction shall permit easy opening of the gate when subjected to a differential pressure equal to the maximum operating pressure anticipated. Suitable gearboxes shall be fitted to provide easy opening when necessary. These gearboxes shall be grease filled.

(h) Valves larger than DN 150 shall be provided with bypass arrangements.

Cast Iron Gate Valves (Wedge Gate)

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Wedge gate valves shall be used on raw water and treated water duties but shall not be used on raw sewage, raw water, effluent, sludge and general duties where some solids may be present. The valves shall comply with the following:

- (a) The valves shall comply with SABS 664 or SABS 665, Class 10 or higher as required.
- (b) The valves shall be double flanged.
- (c) The material of the body seat and the material of the gate trim shall be of copper alloy or stainless steel.
- (d) The body shall be provided with channel guides and the gate shall be provided with shoes. Guides and shoes shall be of copper alloy or stainless steel and shall guide the gate along the complete travel distance.
- (e) Fixing lugs for end of travel limit switches shall be provided.
- (f) Valves shall have rising spindles unless otherwise specified or necessary because of space restrictions. Non-rising spindle valves shall be fitted with indicators showing the valve opening position.
- (g) Handwheels shall be of cast-iron. Handwheel size and construction shall permit easy opening of the gate when subjected to a differential pressure equal to the maximum operating pressure anticipated. Suitable gearboxes shall be fitted to provide easy opening when necessary. These gearboxes shall be grease filled.
- (h) Valves larger than DN 150 shall be provided with bypass arrangements.
- (i) Valves larger than DN 250 shall be provided with doors for inspection and cleaning.

The valves shall comply with the additional requirements of CMC-WS15:1993 where applicable.

Knife-Gate Valves

- (a) Knife-gate valves must be used on water sludges as well as on primary, waste activated and digested sludge duties. They shall also be used on other high solids application and may be used for duties specified under Clause "Cast Iron Gate Valves with Resilient Seals".
- (b) Valves shall be Insamcor HDH CI STD, or equivalent, with cast iron bodies, stainless steel blades, cast handwheels, and no carbon steel parts.
- (c) Valves for water sludges shall be anti-clockwise closing. Valves for primary, waste activated and digested sludges shall be clockwise closing.
- (d) Valves shall have chamfered blade edges and resilient body seals, and may have either rising or non-rising spindles. Gate position indication shall be provided if the overall design does not make this apparent. The blade shall be loaded through its central plane during opening and closing and this shall be achieved by the use of a clevis link or similar.
Blade scrapers shall be incorporated to protect the body seal and valve chest. As the valve is opened, the scrapers shall clean the blade surfaces before these contact the body seal. The scrapers shall be of a non-elastomeric, non-metallic material and shall be designed to cause minimal damage to the blade.
- (e) Valves shall be droptight in either flow direction. Suitable sealing shall be provided to prevent leakage from the valve and it shall be possible to adjust these seals while the valve is in line under pressure.
- (f) Internal and external surfaces of the valve body shall be protected with a water resistant, non-toxic and non-tainting, fusion bonded epoxy pipe coating in accordance with System - Fusion Bonded Epoxy.
- (g) Valves shall be double-flanged and shall suit the standard flange rating but may incorporate drilled and tapped fastener holes (the type of valve which is clamped between two flanges will be considered for acceptance only in positions where it is very likely that the pipe or flanged item on either side will never have to be removed or if isolation will not be necessary if it is removed). Fasteners may be studs or setscrews manufactured to suit the tapping depth.

Waterworks Type Butterfly Valve

For use on raw and potable water duties.
These shall comply with SANS 1849

Resilient Seal Butterfly Valves

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- (a) For use on air, gas and clean liquid duties.
- (b) Butterfly valves shall be of the resilient seal type with suitably lined cast iron body and a lined or 316 stainless steel blade.
- (c) Shafts and fittings shall be of stainless steel and bearing bushes of Teflon or similar. Seals shall be selected to suit the application. No carbon steel components shall be permitted internally and externally such components shall be properly protected.
- (d) Valves shall be air, gas and water tight when closed.
- (e) Hand lever valve actuation with a locking system for incremental valve setting from fully shut to fully open shall be provided for valves up to and including DN 200. Valves larger than DN 200 shall be equipped with robust, weatherproof grease-filled gearboxes with an indicator to show the degree of valve opening.
- (f) For normal usage, the valves may be of the type which is clamped between two flanges. Where it is necessary to remove equipment on either side for maintenance purposes, suitable spacer pipes must be provided or the valves shall be flanged and provided with drilled and tapped holes.
- (g) The valves shall be installed with horizontal disc shafts.

Bronze Isolating Valves

May be used for isolating duties on clean air and liquid duties up to DN 50. Bronze gate valves shall be to SABS 776. Ball or plug valves of appropriate construction may also be used where preferred.

Rubber Diaphragm Valves

To be used on sewage, sludge and other dirty or corrosive liquid duties requiring valves up to DN 80. May also be used on clean liquid duties. Rubber diaphragm valves shall preferably be of the straight through type. This type of valve shall not be used on the suction side of pumps or on any line subject to vacuum.

Needle Valves (above DN 150)

Needle valves, VAG Plunger Valve or equivalent, shall be used for the regulation of flow and/or pressure in pipelines containing water where the size is DN 150 or greater unless this is overridden by the requirements of the Detailed Specification. The configuration shall be double-flanged with co-axial flanges unless otherwise specified.

The seal seat and associated downstream parts shall be selected to prevent any cavitation for the application. Such parts shall be of stainless steel or copper based alloy.

Telescopic Overflow Valves

Telescopic overflow valves, (Fulton, or equivalent), shall be vertically mounted and shall be specifically designed for the purpose intended.

Operation shall be by handwheel mounted on an independently mounted headstock. Rising spindles are preferred. The outer tube shall be flanged and bolted to a similarly flanged vertical pipe. The inner tube shall incorporate a conical bellmouth. The bridge connecting the inner tube to the valve's spindle shall be attached to the outside of the bellmouth in order to limit the effect of fouling rags, etc. The spindle shall be of grade 316 stainless steel or better. The outer tube and inner tube shall be of 3CR12. The headstock and handwheel shall be of painted cast iron or painted 3CR12.

CHECK VALVES

General

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A shut-off valve shall be installed downstream of each check valve.

The check valve installation shall ensure that flaps are able to open fully without being impeded by, for example, a shut-off valve, bend or pipework internal lining. Where a check valve is located close to another valve, an intervening spool piece with a minimum flange-to-flange length of 1,5 times the valve diameter shall be provided.

Bronze swing type check valves may be used for pipework up to DN 50.

Check Valves for Water

Check valves for treated water and raw water duty shall be of the double-flap, positive-closing type (Stockham Duo-Chek II, or equivalent).

Bodies shall be of cast-iron or cast-steel. Flaps shall be of the light, leaf type, shall be of bronze or stainless steel with machined sealing faces, shall be specifically designed to be non-sticking, and shall have teflon bearing washers. Seals shall be of resilient material. The axis of rotation of the flaps shall be vertical, pins shall be of 316 stainless steel and closure shall be initiated by stainless steel springs, suitably rated for the duty so that closing is initiated prior to the onset of reverse flow.

Positive, external indication of the position of both plates shall be provided.

Swing Check Valves

Swing check valves shall be used on all sewage, sludge or similar applications.

Swing check valves shall be flanged, shall be of all iron construction suitable for a working pressure of at least 1 000 KPa, and shall be fitted with a side lever and adjustable weight.

Orientation of the valve installation shall comply with the manufacturer's recommendation.

AIR VALVES

General

Air valves for water shall be of the non-slamming type, Vent-O-Mat or equivalent.

Air valves for sewage and similar duties shall be specifically designed for the application.

Arrangement and Installation

Air valves shall be installed above pockets designed to collect air. The pockets shall be designed in accordance with the requirements for nozzles in the Clause "Pipework". The diameter of the nozzle shall be at least half the diameter of the parent pipework.

Air valves shall preferably be flanged and shall be provided with isolating cocks.

PENSTOCKS

General

Penstocks shall be of the rising stem configuration if feasible. If this is not feasible, non-rising stems are acceptable.

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Design

Penstocks shall be designed to be operated under full design pressure for both manual and power actuated operation. The headstock beam shall be designed to accommodate the door opening and closing forces with no visible deflection.

A system of adjustment shall be provided for ensuring that the penstock door is held against the seal correctly. Side wedge door adjusters shall be provided. Top and bottom wedge door adjusters shall be provided where required by the installation.

The door shall slide between polymer, elastomer or non-ferrous alloy materials. Direct contact between the door and the frame is not acceptable.

Wedges, guides, seals, door nuts and drive sleeves shall be replaceable.

Stem guides shall be provided along the length of the stem. The spacing between them shall not exceed the height of the door.

Power actuated penstocks shall also be provided with manual operation by handwheel.

Materials

The penstock door and frame shall be of cast iron or grade 316 stainless steel.

The door guides, seals, door nut and drive sleeve shall be of polymer, elastomer or non-ferrous alloy materials.

All fasteners, muff couplings and stem adaptors shall be of grade 316 stainless steel. Universal joints shall be of stainless steel and shall be provided with rubber gaiters for protection.

Copper alloy seals shall not be used on sewage applications.

Fabrication

Fabrication of stainless steel shall comply with the fabrication requirements specified elsewhere in this document. In particular, welding shall be continuous and crevices shall be avoided.

Stainless steel shall be pickled and passivated prior to installation and again before commissioning.

Installation

Penstocks shall be installed by the Contractor using personnel skilled in such installations.

Suitable gaps shall be left for the application of grout. Grout shall be of the non-shrink type and shall be applied strictly in accordance with the manufacturer's instructions. The first penstock to be installed shall be grouted under the supervision of the supplier and in the presence of the Engineer.

Leakage Testing

Leakage testing shall be done under maximum expected pressure and after all installation work has been completed. No leakage between the penstock frame and the structure shall be acceptable.

The acceptable leakage rate shall be:

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0,015 l/s/m of seating perimeter/3 m pressure head (for off-seating penstocks);
0,008 l/s/m of seating perimeter/3 m pressure head (for on-seating penstocks).

VALVE ACTUATORS

General

Valve actuators shall be electric unless otherwise specified.

The direction of operation of the handwheel shall comply with Clause "Valves for Liquids or Gases".

Electric Actuators

Electric actuators shall incorporate three phase motors and shall be specifically matched to the design duty; Rotork IQ, or equivalent, for normal duties and Rotork IQM, or equivalent, for modulating duties.

Manual operation at the unit is required unless otherwise specified.

The actuator motor and gearbox shall form one integrated unit. Motors shall be for three phase, 400 Volt, 50 Hz supply, shall be Class F insulated (or better) and shall have an embedded thermostat for overload protection. The complete unit, including installation work, glands and controls shall be ingress protected to IP 68 unless otherwise specified.

In instances in which the opening or closing period is specified (e.g. to avoid water hammer) this period shall be achieved, without pulsing, by incorporating a suitable gear ratio to allow the motor to operate from fully open to fully closed without stop/starts. If it is not possible to achieve the specified duty without pulsing, the actuator/gearbox/valve arrangement shall be designed to minimise frequency of motor switching and all design parameters shall be submitted to the Engineer for approval.

For open/shut duties, actuator torque rating shall be at least 200% of the start-opening or shut-off torque, whichever is higher, specified by the valve manufacturer for this application (after the gearbox mechanical advantage has been taken into account).

For modulation duties, actuator torque rating shall be at least 400% of the start-opening or shut-off torque, whichever is higher, specified by the valve manufacturer for this application (after the gearbox mechanical advantage has been taken into account).

All components of the drive shall be designed to prevent backlash.

The actuators shall incorporate the following features:

hand operated gearwheel override operation incorporating open/close direction indication.

visual position indication at the unit.

the actuator shall initiate a trip if:-

it does not succeed in moving the valve within a suitable period.

the motor windings overheat.

the actuator shall provide an impact effect to overcome:-

tightly seated valves.

an unintended loss of movement.

the following information shall be fed back to the control panel or, if applicable, the SCADA system:-

valve position.

torque on output shaft.

it shall be possible to configure the control instructions and interrogate the actuator status without

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removing covers.

the terminal compartment shall be separately sealed from the actuator internals.

Pneumatic Actuators

Actuators shall be designed to match their valves' operating requirements.

Actuators shall be fabricated of non-corrosive materials and shall be mounted using stainless steel mounts and couplings. Fasteners shall be of stainless steel.

Unless the system configuration clearly does not require it, automatic spring-closing shall be provided to ensure that the valve closes (if open) or remains closed (if closed) upon power failure or failure of the air supply. The spring shall be of stainless steel.

Linear actuators shall be provided with stainless steel cylinder piston, cylinder rod and attachments. For open/shut duties, actuator force rating shall be at least 200 % of the start-opening or shut-off force, whichever is higher, specified by the valve manufacturer for this application (after any mechanical advantage has been taken into account). Manual operation, by lever or equivalent, shall be provided in addition to pneumatic operation.

For open/shut duties of rotational actuators, torque rating shall be at least 200 % of the start-opening or shut-off torque, whichever is higher, specified by the valve manufacturer for this application (after any mechanical advantage has been taken into account). Manual operation, by handwheel or equivalent, shall be provided in addition to pneumatic operation.

The air supply to each actuator shall be fitted with a filter-regulator unit with an automatically operating water drain trap.

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BASEPLATES

Common Baseplates

Both direct-coupled and belt-driven machines shall be mounted with their drivers on common cast iron or fabricated steel baseplates of rigid construction.

Corrosion Protection

Steel baseplates shall be hot-dip galvanized unless specified otherwise in the Detailed Specification.

Machined Mounting Pads

The baseplate shall incorporate machined mounting pads at the support and fixing positions of each item of plant and equipment to be mounted on the baseplate. On fabricated baseplates this machining shall be done after fabrication, stress relieving (if applicable) and hot-dip galvanizing are complete. The thickness of the solid pads shall be not less than 1,25 times the diameter of the holding down bolts. The pads shall not be provided with threaded holes for machine screws but shall be drilled for inserting through-bolts and adequate provision shall be made for reaching the nut with a suitable spanner. In the period between machining and installation of the equipment, the machined surface shall be protected against corrosion by a removable coating. After installation, a non-hardening compound, Tectyl or equivalent, shall be applied to exposed machined surfaces and to the crevice formed at the foot of the equipment.

The above design may be suitably modified if the Contractor uses a pourable resin based chocking system. Such chocks shall be at least 15 mm thick.

Fasteners

Anchor fasteners shall be of grade 316 stainless steel with threads coated with a nickel-based, anti-seize compound before assembly.

Alignment

Preliminary alignment shall be done at the factory to ensure that the baseplate has been correctly manufactured, but final alignment shall always be done on site after installation and grouting has been completed. Alignment shall be accurate and to the approval of the Engineer and a final alignment check witnessed by the Engineer must be carried out by the Contractor prior to start up.

Shimming

Not more than three shims may be used at any point and these must be made of a corrosion resistant material.

Jacking Screws

At least two diagonally opposed jacking screws shall be provided for belt tensioning in the case of belt-driven units. Direct-coupled motors above 10 kW shall be provided with jacking screws for horizontal alignment and direct-coupled motors above 150 kW shall be provided with jacking screws for vertical alignment as well.

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Jacking screws shall be of grade 316 stainless steel.

Grouting

Baseplates shall be so designed and grouted as to eliminate collection points for water or dirt. Except where otherwise approved in writing by the Engineer, all baseplates on concrete plinths shall be fully grouted in. Grouting holes must be provided on baseplates having a continuous top plate. Tapped holes and fixing setscrew protrusions shall be suitably protected.

The material used for grouting shall be a non-shrink, cementitious grout (ABE Duragrout 1000, or equivalent). ABE Epidermix 324, or equivalent, is acceptable if the Contractor's design requires an epoxy grout to be used.

The initial grouting shall be overseen by the supplier's technical representative.

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Soleplates

In applications where baseplates are not practical, machined soleplates, suitably fixed and grouted to the concrete plinths, shall be provided. No machine may be mounted directly onto a concrete base without the use of either a baseplate or soleplate.

GUARDS

Guards shall comply in all respects with the Occupational Safety and Health Act 2005 as amended and the following points shall also be noted:-

- a.) Guards are required to cover all moving or revolving components of machinery. Guards which do not adequately cover moving protrusions such as keys, lock-nuts, lockwashers, setscrews, etc., or irregularities such as keyways, will under no circumstances be accepted.
- b.) Guards shall be neatly and rigidly constructed and fixed and shall not vibrate or cause noise during operation.
- c.) Where expanded metal or similar mesh is used, the mesh opening shall not permit a circular object 10 mm or larger to penetrate.
- d.) Mesh shall not be used for chain guards but on belt drives the side of the guard most conveniently sited for inspection shall be constructed of expanded metal or similar. Mesh should similarly be used in other situations where inspection or ventilation is required.
- e.) Guards shall completely enclose drives and shall entirely prevent a person from touching any moving protrusion.
- f.) Allowance must be made for adjustment on belt guards or where adjustment will be required.
 - g.) It shall be possible to remove the guard easily for maintenance purposes.
- h.) Guards shall preferably be fabricated of 316 stainless steel (uncoated) but may also be hot-dip galvanized, zinc-sprayed or aluminium-sprayed carbon steel, coated to Specification in all these cases. Fasteners shall be M10 or larger and shall be of 316 stainless steel.

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ELECTRIC MOTORS

Rating

All electric motors shall be rated for operation on a 3-phase, 4-wire, 400/230 volt, 50 Hz, AC supply at sea level, with an ambient temperature of up to 40°C. Full load speed shall not be in excess of 1500 rpm. The rated power of the motor shall be not less than 20% in excess of the maximum power requirement of the associated plant, except where the size of the motor is specified or as otherwise specifically approved by the Engineer. In addition the motor shall be rated so that, with the method of starting and drive arrangement used, the maximum period for the motor to reach full operating speed shall not exceed 10 seconds.

Specifications

Except as otherwise specified, motors shall be standard squirrel cage or slip-ring motors complying with SABS 948 as amended, with IP55 enclosure and IC0141 cooling, and suitable for a damp environment. Motors shall be suitable for both "continuous running duty", Duty Class S1, and "intermittent periodic duty", Duty Class S3. Windings shall be copper conductors insulated with Class F material with Class B temperature rise. The motors shall be suitable for 6 starts per hour, two of which shall be consecutive.

Type

The type of motor (and starter if applicable) to be supplied is determined by the requirements of the application specified in the Detailed Specification and by the starting limitations specified in the Electrical Specification. In the absence of such specifications, a standard squirrel cage motor complying with this Clause shall be offered.

Construction

Motor frames shall be of the totally enclosed fan cooled type with cast iron yoke frames and cast iron end covers. The end covers and yoke shall be properly machined and each cover shall locate on a spigoted register to ensure concentricity and parallelism. Bearings shall be of grease lubricated roller and/or ball type, provided with grease nipples (with extension tubes where access is restricted) and sealed to suit external use. Motors required for external use shall be fully weatherproofed.

Terminal Boxes

Terminal boxes shall be top mounted wherever possible and arranged for cable entry from either side. The two ends of each stator winding shall be "brought out" to the terminal box. Squirrel cage motors shall be wired to permit both direct-on-line and star-delta starting.

Thermistors

Motors between 55 kW and 150 kW (the latter not inclusive) as well as motors for variable speed drives shall be provided with thermistors embedded in the windings of each phase. The thermistor tails shall be "brought out" to separate terminals mounted near the motor winding terminal block.

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RTDs

Motors rated at 150 kW and above, both fixed and variable speed, shall be provided with PT 100 type RTDs. Two RTDs shall be provided per phase winding. All six shall be incorporated into the control system, three to provide monitoring and three to provide high temperature trip.

Heaters

Motors of size 75 kW and above shall be fitted with "pocket" heaters. The heater shall be mounted at the bottom of the motor frame and shall be replaceable without dismantling the motor.

Slip-Ring Motors

Slip-ring (wound rotor) motors shall be of the totally enclosed fan cooled type with stainless steel slip-rings. The slip-rings shall be mounted inboard of the non-drive end bearing and be fitted and keyed to the shaft as a single unit. The terminal box shall be common to both stator and rotor connections.

The brush holders shall be manufactured from fibreglass and be removable from the terminal box as a complete unit. Where the current density in a single brush at the full operating load approaches or is above 80% of the capability of the brush then an additional brush shall be provided in a separate brush box.

Variable Speed Applications

In applications where the motor speed is controlled by supply frequency variation, the motors shall be cooled by a separate, 50 Hz motor driven "piggy-back" fan. This requirement will be waived if the Contractor can provide test results to confirm that the drive and motor design with shaft mounted fan can operate in the application without overheating. This requirement does not apply to submerged motor applications.

Hazardous Locations

When required to suit a hazardous location in terms of SABS 0108 or in terms of this Specification, suitable motors complying with SABS 969 or SABS 970, as appropriate, shall be supplied. The relevant SABS certificates, clearly indicating the location classification in which the machine may be operated, shall be submitted to the Engineer before delivery of the motors. Each motor shall be clearly and permanently marked with the applicable certificate number.

Special Motors

Should the Tenderer wish to offer a different type of motor to those specified so as to obtain special starting characteristics and/or variable speed, a full technical specification of the motor must be supplied and such specification shall be for the equipment to a standard at least equal to that of the motors specified above. In particular, no item of electrical protection shall be omitted.

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Warning

Motor manufacturers must be warned that the motors are to be installed in an extremely corrosive and often damp environment. All motors shall therefore be adequately protected.

POWER TRANSMISSION

Shaft Couplings

Shaft couplings shall, wherever practical, be of the rubber-tyre or rubber compression type with taperlock bushes which shall be keyed to the shafts. After installation the alignment of all couplings shall be checked by the Contractor in the presence of the Engineer or a person delegated by him. Alignment shall be accurate and to the approval of the Engineer.

Spacer couplings shall be used in all cases where this will assist maintenance.

Vee Belt Drives

Vee drives shall be designed to suit the power rating of the motor using service factors appropriate to the driving and driven machinery. Drives shall be designed, manufactured and installed in accordance with BS 3790 and ISO 4184, utilizing taperlock pulleys with taperlocks keyed to the shaft.

Where alternative pulley diameters can be selected, preference must be given to the larger pulley diameters to minimize the belt loading on bearings.

Tenderers shall ensure that the bearing arrangements of driving and driven machinery are designed to cope with the loads imposed by vee-belt drives and shall incorporate lay shafts between plummer blocks where necessary. With lay shaft arrangements, Tenderers shall submit their design calculations and drawings for approval by the Engineer. Bearings shall be designed for an L10 life exceeding 100 000 hours. Plummer blocks shall be adequately sealed and shall be fitted with grease nipples. Bearing units incorporating open, shielded bearings are not acceptable.

Motor Driven Gearboxes

Gearboxes shall, unless otherwise specified, be supplied with environmental protection to IP 55.

Gearboxes shall be selected using a service factor of 1,75 based on the drive rating and shall have an efficiency of not less than 96% on two stage reduction and 95% on three stage reduction.

Gears shall be case hardened, profile ground and lapped, helical and spiral bevel gears.

Roller bearings shall be used throughout. Bearings shall be designed for an L10 life in excess of 100 000 hours.

The gearbox housing shall be of rigid cast iron construction preferably split in the horizontal plane.

A breather designed to prevent moisture from entering shall be fitted.

Oil-bath gearboxes shall have suitable oil level indicators or dipsticks. Unless otherwise decided by the Engineer, the drain from the gearbox shall be extended beyond the base so that the oil can be easily collected. The drain line shall be of grade 316 stainless steel and shall be fitted with a ball valve and square-head plug.

Each gearbox shall be mounted on machined sole plates fitted with jacking screws to assist with alignment.

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MACHINE VIBRATION LEVELS

The mechanical vibration of machines measured at all important points such as bearings shall be lower than that specified as "good" for that class of machine in BS 7854 (ISO 10816).

NOISE CONTROL

Noise Levels

The sound power of any equipment shall not exceed 89 dB(A) (referred to 10-12 Watts) unless specifically approved by the Engineer. This is approximately equivalent to a sound pressure level of 81 dB(A) at a radius of one metre from the acoustical centre assuming uniform hemispherical propagation in a free field on a hard floor. In certain instances, a lower noise level may be called for in the Detailed Specification.

Where the Contractor is unable to restrict the noise level of the machines to the maximum specified by the appropriate selection of suitable equipment; e.g. by selecting slow speed or silent type machines, quiet type cooling fans, suitable silencers, etc.; this shall be clearly pointed out by the Tenderer in his Tender so that appropriate steps can be taken at the design stage to counteract the effects of noise.

Acoustic Treatment

Acoustic enclosures are not acceptable unless permitted in this Specification. Acoustic treatment of high noise sources where this can be done without greatly interfering with operation or maintenance must, however, be included where applicable.

When acoustic lagging is called for in the Detailed Specification this shall consist of a 100 mm thick layer of rockwool having a density of 60 kg/m³, suitably fixed in place and reinforced to prevent collapse, and covered with 25 mm thick asbestos free plaster having a density of 1 000 kg/m³ (I.P. Insultex AF720, or approved equal). The outer surface shall be finished off with scrim cloth before being painted.

It is not necessary to lag flow meters and cast iron valves on acoustically lagged pipelines.

Components which can move, such as those associated with expansion bellows or flexible couplings, shall be enclosed by an effective acoustic enclosure designed to prevent sound transmission but able to cope with movement without damage.

THERMAL LAGGING

Not used

BEARINGS

Bearing systems shall be designed to provide safe shut down without damage under normal stoppages as well as electrical supply failure.

LUBRICATION

Grease Lubrication

Grease lubrication is preferred and all greasing points must be easily accessible.

Equipment with multiple greasing points shall be provided with grease lines which are piped, separately, to

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a single easily accessible position.

In cases in which motorised lubrication is provided to more than one destination, a distributor shall be provided. The distributor shall be a positive displacement device which ensures equal, successive lubrication to all destinations.

Pipework for grease distribution shall be of stainless steel or non-ferrous metal.

Oil Lubrication

When oil lubrication is necessary, the Tender Prices shall include for the initial oil fill and the first oil change, including flushing, draining and filling, after an initial run-in period not exceeding 3 months.

Oil level indicators shall be fitted for visual checking. Drain cocks, including 316 SS fittings where necessary to permit convenient draining, and plugged at the end, shall be provided for oil reservoirs exceeding 1,5 litre capacity. Drains shall be from the lowest point and syphon type drains are unacceptable.

Lubrication systems shall be designed to exclude dirt and moisture. Air vents on the oil reservoir shall contain an air filter.

SCREW PUMPS

Not used

CENTRIFUGAL PUMPS

Pump Duty

Details of pump duties are given in the Detailed Specification and the type of pump and materials of construction shall at all times be selected to suit the duty.

Type

Centrifugal pumps shall, wherever feasible, be of the single stage, end suction, back pull out type, direct coupled to the motor using spacer type couplings and complete with common baseplate and coupling guard. Close coupled pumps may be used on clear water applications for motor sizes up to 2,2 kW.

Pump Speed

Pump speeds shall not exceed 1 500 rpm.

Pump Motor Speed

Pump motor speeds shall not exceed 1 500 rpm with the following exceptions:

- a.) On small (5,5 kW and smaller), high head, low capacity duties, tenderers may submit two-pole speed installations as an alternative offer.
- b.) Where the use of speeds above 1 500 rpm avoids the need for of a multi-stage pump, tenderers may submit two-pole speeds as an alternative offer.

Performance Parameters

Performance characteristics shall be suitable for parallel operation with pump head increasing continuously to shut off. The pump shall be selected to operate as close as possible to best efficiency at duty point and shall be adequately sized to safely permit an increase in capacity of at least 25 % should

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the head be lower than estimated. The impeller diameter fitted to direct coupled pumps fitted shall not exceed 95 % of maximum impeller diameter for the volute/diffuser provided.

Margin of Power

A non-overloading absorbed power characteristic, preferably with maximum power absorbed at best efficiency, is strongly preferred. The motor's continuously rated power shall exceed the greater of the following:

- a.) 10 % above the maximum power demand under any condition of operation for the pump, including open discharge.
- b.) 20 % above the pump's maximum power demand over the full range of flow and pressure conditions anticipated in the pump installation.

Life

Pumps and motors shall be designed for long life under continuous operation. Bearings shall be designed for an L10 life of not less than 50 000 hours.

Lubrication

Unless otherwise specified in the Detailed Specification, bearings shall be grease lubricated and adequately sealed against the ingress of moisture or dirt.

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Vibration

Rotating elements shall be balanced and vibration severity of the unit during operation shall not exceed $V_{rms} = 1 \text{ mm/s}$ at the pump and motor bearings.

Pump Glands

Pump glands shall be arranged as follows:

- a.) For clear, non-aggressive liquids up to 200 kPa discharge pressure - shaft sleeve with packed gland or mechanical seal.
- b.) For clear non-aggressive liquids at pressures above 200 kPa and for clear corrosive liquids at any pressure - 316 stainless steel shaft sleeve with mechanical seal.
- c.) For liquids with solids in suspension at any pressure - packed gland with hardened stainless steel shaft sleeve and grease seal. If a mechanical seal is specified, the pump gland shall be arranged to suit a clean water flush. A throttle bushing made of a suitable non-corrosive, self-lubricating material shall restrict the flushing water flow into the pump. Mechanical seals for such applications shall have silicon or tungsten carbide sealing faces.

Venting

A vent cock shall be fitted to the highest part of the casing.

Connections

Suction and discharge connections shall be flanged except on 40 mm connections and smaller which may be screwed. In the latter case, unions shall be incorporated in the pipework close to the suction and discharge connections. As a general rule, flexible couplings shall be fitted close to the suction connection of all pumps.

Isolating and Check Valves

Isolating valves shall be provided close to the suction and discharge connections of all pumps. A check valve shall also be fitted between the discharge isolating valve and the pump except where reverse flow through the pump when stationary cannot occur. Valves shall be sized to suit the pipe sizes and not the pump connection sizes. Any reducing necessary shall be done immediately next to pump connections.

Pressure Tapping Points and Gauges

Pressure tapping points shall be provided near the suction and discharge connections of each pump located, wherever possible, on a straight length of pipework where readings will be as steady and accurate as possible. Suction and discharge pressure (or suction, as applicable) gauges shall be fitted at these tapping points.

Strainers

A centrifugal pump which draws from a tank or sump shall be protected by a strainer, suitably designed for the installation. The strainer shall be installed between a shut-off valve and the pump.

SUBMERSIBLE AND IMMERSIBLE PUMPS

General

Details of the duty and performance requirements of submersible and immersible pumps to be supplied are specified in the Detailed Specification.

Submersible sewage pumps shall be provided with a facility to prevent crusts as well as debris and sludge

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collection on the floor. This shall operate automatically whenever a pump is started.

Submersible Pumps

The motor shall be close-coupled to the pump and separated from the pump casing by an oil chamber. A mechanical seal shall isolate the motor from the chamber and a mechanical seal with tungsten or silicon carbide faces shall seal the oil chamber from the liquid to be pumped. The rated output of the motor shall be 15 % in excess of the maximum power which can be absorbed by the impeller fitted to the pump at any duty; i.e. the unit shall be non-overloading. Pump speed shall not exceed 1 500 rpm.

The motor shall be shut down automatically in the event of leakage through either seal or as a result of overheating of stator windings.

Pumps handling raw sewage, primary sludge, activated sludge or similar shall be of a non-chokeable type with open impellers, and shall be capable of handling a solid size of 100 mm diameter or greater. Impellers designed specifically for the application are preferred. These duties must be regarded as abrasive.

Pumps required for abrasive duties shall be designed for low wear. Low operating speeds shall be used. The suction cover shall incorporate a replaceable liner of a suitable abrasion resistant material such as high chrome iron. The design shall permit easy adjustment of the clearance between the impeller and suction cover.

All sewage duties shall be considered to be corrosive.

The shaft, all fasteners and all steel components in contact with the pumped liquid shall be of grade 316 stainless steel or better. The pump and motor casing shall be of high-quality, close-grained cast iron. A suitable, heavy duty epoxy or polyurethane coating system with a minimum thickness of 400 µm shall protect the pump unit internally and externally.

Immersible Pumps

Immersible pumps shall incorporate all features specified in Sub-clause "Submersible Pumps" above.

The motor for an immersible pump shall be provided with an integral jacket cooling system designed for non-immersed operation at full power. The cooling fluid shall inhibit corrosion, shall not be the pumped fluid itself and shall be self-contained; i.e. shall not rely on an external flow system. Positive circulation of the cooling fluid within the jacket is preferred.

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The Tenderer shall clearly indicate the external ventilation cooling requirements.

DRAINAGE PUMPS

General

This Clause applies to drainage pumps to be provided for applications involving seepage, slow leakage, etc. Drainage pumps which are to prevent accidental flooding or other large inflows of water shall be specifically designed for the application by a pump engineer.

Pump

Pumps shall be of the free-standing, submersible sewage, heavy construction, cast-iron type (Zenit Draga or equivalent). Drive motors shall be three-phase units with oil bath and shall have protection to IP 68. The shaft shall be of stainless steel. Switching shall be done in accordance with liquid level by a float switch on cable (rotating arms will not be acceptable).

Installation

Drainage pump installations shall comply with the following:

- a.) The discharge pipework shall be rigidly supported at a distance not exceeding 1 000 mm. The discharge point shall be indicated by the Engineer.
- b.) The discharge pipework shall incorporate a check valve on the initial upward run of pipework.
- c.) The pump's discharge shall be connected to the discharge pipework via a clear flexible hose. It shall be possible to remove the pump and check valve without damaging the pipework.
 - d.) Discharge pipework shall be of uPVC, Class 12 or higher.
 - e.) The area of the outlet pipework shall not exceed 200 % of the area of the pump outlet.
- f.) Discharge pipework shall be sloped up away from the pump at all points apart from a single final straight run to the drain which may slope downwards at any angle.

POSITIVE DISPLACEMENT PUMPS

Type

"Positive displacement pump" refers to both progressing cavity pumps and peristaltic pumps.

Positive displacement pumps shall be suited to handle the fluids specified.

If the fluid to be pumped is sludge, it shall be noted that this contains solids, fibrous matter and grit. Construction materials shall be selected accordingly and the pump size shall be conservatively selected to ensure a very low operating speed. All universals, pins, bushes and so forth operating in the pumped liquid shall be properly lubricated and must be fully sealed.

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Duty

The pump duty will be specified in the Detailed Specification.

Drive Arrangement

Each pump shall be direct coupled to a motor/gearbox unit to suit the range of pump duties. The complete drive unit shall have an ingress protection rating of IP 55 or higher. The pump and drive unit shall be mounted on a common fabricated steel baseplate complete with all necessary guards.

All components shall be conservatively selected to suit the specified type of duty with continuous 24 hour per day operation. The continuously rated output of the motor shall exceed the power required at maximum duty and at the worst operating condition by not less than 30%. The gear unit shall be selected using a service factor of not less than 2, based on the installed motor power. If applicable, the unit must be prevented from reverse rotation.

Variable Speed Drive

Pumps in variable speed applications shall have their drive motors controlled by electronic variable frequency convertors which are suitably rated for the torque required by the application. The convertor shall be housed in a cubicle in the electrical control panel which is normally in a separate room. The motor and VFC shall be of suitable design and shall be adequately sized to provide the high torque requirements of the pumps under all operating conditions, particularly start up.

Drive Unit Protection

When pumping sludge, it is possible for the pumps to block or seize or have abnormally high starting torque requirements, particularly when operating on a duty/standby rotation basis. The complete installation shall be designed to cope with such operating conditions without damage to equipment.

The drive unit shall be rated to withstand such shock overloads at any torque produced by the motor between full speed and shock stall without any damage. If any part of the unit could be damaged under such conditions, suitable safeguards shall be incorporated. Thermal overloads on the motor shall not be regarded as adequate in such a case.

If an overload safeguard system is necessary to protect against overload damage, the system used shall disconnect the load immediately an overload occurs, switch off the unit, activate an alarm indication on the control system and initiate the shutdown of other equipment if this is necessary. A sealed, adjustable and resettable torque limiting coupling, such as "Bibbigard" or approved equal, between the pump and drive unit would be acceptable. The coupling must be set for the maximum torque which the drive unit can safely handle.

Full details of the drive system must be provided with the Tender.

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Pump Flushing System

A DN 50 connection shall be provided downstream of a check valve on the suction line of all pumps. A DN 50 flushing line from the domestic water supply, or the service effluent water system (if applicable), shall be connected to this. On each branch a solenoid valve, isolating valve, by-pass with isolating valve and check valve shall be fitted. This system shall automatically flush the pump before each start up and shut down. Manual flushing shall also be possible using the by-pass.

Where a system such as that described above is not possible on, for example, a direct feed hopper system, then an alternative flushing system such as a hopper flushing system shall be devised.

Pressure Switches

Where pressure switches are used to protect the pumps against closed or blocked lines by interrupting the supply to the motor, a pressure switch be mounted on the pump outlet and a vacuum switch shall be mounted on the pump inlet.

When used on sewage, sludge, chemical or other applications where blockage or corrosion of the switch is possible, the switches shall be protected by a diaphragm type, liquid filled chemical seal. The portion of the seal in contact with the process liquid shall be suitably corrosion resistant and, when solids are handled, shall have a large threaded socket connection not smaller than 1" BSP.

The switch and its seal shall be mounted on the top leg of a cross with two plugged connections. The cross shall be mounted on the side of the pipe and the bottom and second side connection of the cross shall be plugged, but arranged so that effective cleaning or flushing of connections can be done. An isolating valve shall be provided to permit isolation of the cross from the pipe (see drawing at end).

Pressure Gauges

A suitably rated pressure or combination pressure/suction gauge shall be installed on the suction and discharge of each pump.

General

The following shall be provided for each positive displacement pump:

- a.) A suitable check valve on the discharge pipework.
- b.) Protection against running against a closed discharge; i.e. discharge pressure switch or pressure relief valve.
- c.) Protection against running dry; i.e. suction pressure switch, pump stator temperature switch or low flow signal from related flow meter.

Progressing Cavity Pumps

Progressing cavity pumps shall be installed in compliance with all requirements of this Clause.

The layout of progressing cavity type pumps shall be such that the glands are under the lowest of suction or discharge pressure.

Peristaltic Pumps

Peristaltic pumps shall be installed in compliance with all requirements of this Clause.

Spares

For each progressing cavity pump provided in terms of this Contract, one spare rotor and one spare stator shall be provided as part of the Contract.

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For each peristaltic pump installed, one spare hose and ten complete lubricant fills as well as a complete set of tools for replacement of the hose shall be provided as part of the Contract.

METERING PUMPS

Pumps

Metering pumps shall comply with the applicable design and installation requirements for positive displacement pumps but shall, in addition, comply with the following:

Pumps which feature diaphragms shall be configured or protected so that diaphragm breakage will not lead damage to the internal part of the pump.

All pump fasteners shall be of stainless steel.

Pump Installation

The following requirements shall be provided for metering pump installations:

- a. Pumps shall either be mounted on a wall or other rigid vertical mounting surface or shall be mounted on plinths above ground level.
- b. Pumps shall be provided with an automatic pressure relief system in order to prevent overloading within the pump.
Pumps shall be provided with check valves downstream of their outlets.
- c. The pipework on the inlet and outlet of pumps shall be provided with isolating valves and couplers to allow removal of the pumps without dismantling of the surrounding pipework.
- d. Strainers shall be provided upstream of the pump inlet. The strainers shall be designed and installed in a manner which will allow cleaning of the strainer element without uncontrolled spillage. Strainers shall be provided with inlet and outlet isolating valves.
- e. A facility for connection of a flushing water pipe shall be provided. Permanently connected flushing water systems shall be provided where specifically called for.
- f. The piping in the vicinity of a metering pump shall be provided with a drain facility which shall be designed to minimise the amount of dosing fluid which would be lost during removal of the pump from the pipework.
- g. All mounting fasteners and mounting brackets shall be of grade 316 stainless steel.

PUMP SUCTION STRAINERS

General

Where specified, strainers shall be installed on the suction side of centrifugal and positive displacement pumps which draw from an open tank, channel, sump, reservoir, etc.

Type, Design and Arrangement

Strainers shall preferably be of a proprietary type, A.R.I Semi Globe Filter, Krombach y-type, or equivalent and shall be of the double-flanged configuration. The basket type of strainer element is preferred in order to facilitate removal of captured solids.

The strainer element opening diameter shall be decided in conjunction with the Engineer.

Suitably rated pressure gauges or combination pressure/negative pressure gauges shall be installed on both the inlet and outlet branch.

Strainers whose baskets exceed 25 litres in volume shall incorporate:

- a.) top pull-out configuration;

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- b.) a lifting device, such as a lifting beam with hoist or a davit arrangement, and the strainer basket shall be provided with a suitable lifting eye.
- c.) a hot-dip galvanized steel support or concrete support plinth.

The ratio of open area in the basket to inlet pipe area for non-proprietary units shall be designed to suit the application but shall exceed 7. Baskets shall be made of stainless steel perforated plate with an opening size to be decided in conjunction with the Engineer. If the Engineer approves the use of wire grid for baskets, the wire shall be of at least 2 mm diameter and shall be of stainless steel. Baskets shall be robustly constructed, shall be provided with adequate flow passages between the strainer element and body and shall withstand the differential pressure developed when a basket is partially blocked. Flat surfaces shall be adequately braced to prevent sag. Lids shall be located at the top of strainer housings, shall incorporate an O-ring type seal and shall be secured with grade 316 stainless steel fasteners. Handles shall be provided on baskets of 25 litres or smaller.

Corrosion Protection

Strainer housings and lids shall be either:

- coated cast iron;
- 316 stainless steel;
- glass reinforced plastic;
- plastic; or,
- Hot-dip galvanized carbon steel.

Coated carbon steel shall only be acceptable if the design is such that internal scraping of the surface is unlikely to occur. In such cases, System A/1 or System A/4 or System "Fusion Bonded Epoxy" will be acceptable.

Testing

Strainer bodies shall be pressure tested to a minimum of 500 kPa and vacuum tested to 70 kPa before delivery to Site.

VERTICAL SHAFT MIXERS

Mixing Performance Tests

The Contractor will be required to test the performance of the mixers when commissioning the plant. This test shall consist of taking a minimum of six samples at random points close to the surface and from the bottom of the compartment within 10 (TEN) minutes. Duplicate analysis of these samples for suspended solids concentration will then be carried out in a suitable laboratory and the average concentration calculated. The suspended solids concentration of any one sample shall not differ from this average by more than 200 mg/l.

If the equipment fails to pass this performance test, a second test may be carried out. If the mixers still fail the test, the Contractor shall increase the mixing capacity of the equipment and shall achieve compliance with the performance requirements at no additional cost to Council.

SUBMERSIBLE MIXERS

Details of the mixer application and performance requirements will be given in the Detailed Specification. In general the mixers are required to thoroughly mix the contents of the tank or chamber, to keep solids in suspension throughout the volume and to prevent a crust forming on the surface.

The mixers shall be submersible with a propeller integrally mounted on a submersible motor. The motor shall be separated from the propeller by an oil chamber. A suitable seal shall isolate the motor from the oil

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chamber and a mechanical seal with tungsten carbide faces shall seal the oil chamber from the mixed liquid. If the mixer incorporates a gearbox an additional seal shall be provided to isolate the gearbox oil system.

The mixers shall automatically shut off in the event of water contamination of the oil, loss of oil, excessive stator temperature, earth leakage or motor overload and suitable probes and switches shall be provided.

Each mixer shall be provided with one flexible cable to accommodate all the required connections within the machine. Cable lengths shall suit site requirements but a minimum length of 7 metres shall be allowed for.

Propellers shall be of a type suitable for handling stringy solids and thick sludges and shall preferably not require a shroud. The motor shall be of adequate size to perform the required duty with sewage sludges having a dry solids content of over 6% by weight.

The mixer shall be of rugged cast iron construction coated with a heavy duty epoxy corrosion protection system at least 400 µm thick. If a shroud is necessary this shall be ruggedly and rigidly fixed with the shroud and all brackets made of a non-corrosive material. Full details shall be given with the Tender.

Each mixer shall be mounted with a sliding bracket on a guide column which is located on the floor of the tank and fixed at the top of the tank with a suitable bearing or turntable. It shall be possible to rotate the mixer through an angle of 180° while the mixer is operating and to fix the direction and height in the position selected. The guide column shall extend above the walkway level, as required to suit the specified lifting arrangements.

The operating cross bars or handles, the locking arrangement and the fixing arrangement shall not intrude into any walkway and shall not present a hazard in any way. If necessary, operating levers shall be easily removable.

Tenderer's shall advise whether they consider it to be advisable to allow for variation in mixer inclination in the vertical plane and shall design accordingly.

Suitable lifting arrangements shall be provided for removing each mixer. The general design of the sliding bracket and lifting arrangement shall allow one man to lift the mixer without any jamming, wedging or sticking.

Each lifting arrangement shall incorporate a davit and winch generally complying with the General Specification except that the guide column and turntable may form part of the arrangement. The height of the davit shall be such as to permit the mixer to be swung over the handrails along the walkway. Should the Tenderer consider that the guide column height will be too high with the above arrangement, and then an alternative system with gates in the handrailing at each mixer will be considered. Removable handrail sections shall not be proposed as an alternative.

The guide columns and the entire mounting arrangement and lifting device shall be adequately supported and sufficiently rigid to prevent vibration or noisy operation.

Guide columns, support brackets, etc., shall be of hot-dip galvanized carbon steel (and painted as specified) or of 316L stainless steel. All fasteners, guide pins, turntables, bearings, fixing pins, chains, pivot pins, etc., shall be of 316L stainless steel or, where applicable on items such as bushes, of non-corrosive materials.

Where the mixers are required to operate in sumps or other containers in which the level varies, the mixers shall be designed and arranged to permit the lowest possible operating level and Tenderers shall state the minimum submergence required. Level controls shall be provided to stop the mixer at the lowest level and restart again at a suitable higher level (except as otherwise specified in the Detailed Specification).

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DISINTEGRATORS

Type of Solids

The solids which must be handled consists of the usual solid matter found in sewage primary sludge including grit, cotton waste, rags, stockings, plastic bags, paper, seeds, and so forth. The cutter screen must also be able to cope with hard and tough materials such as wood, leather, canvas, plastic and metal containers, metal bottle tops and so forth without serious damage to the unit or its cutters. The gap between cutters shall be 6 mm or less.

Design of Cutter Screen

The cutter screens shall be slow speed, high torque design suitable for the duty conditions. Two shafts carrying toothed cutting discs shall operate at different speeds.

Cutters shall be manufactured of high grade corrosion resisting hardened and ground steel having a surface hardness of not less than 50 HRC. Cutters shall preferably be of a design which can be reconditioned so as to minimise operating costs.

Casings shall be of cast iron and shafts of a corrosion resistant high quality alloy steel. Bearings shall be of the roller or ball type, grease lubricated and efficiently sealed from the liquid being handled by mechanical seals with tungsten carbide faces. Tenderers shall advise whether any seal flushing arrangement will be required. Plugged grease points shall be provided for the bearings, particularly the bottom bearings, so that these connections can be piped to a remote pressurised grease container. Greasing shall be possible whilst the unit is operational. The drives shall be vertically arranged through a close coupled gearbox with all components adequately rated for a stall condition.

Installation

In-pipeline cutter screens shall be mounted on a vertical length of pipework with the flow upwards.

Control System

The motor size shall be sufficient to permit cutting of any object which will not damage the cutters or machine. Once an excessive level of power is approached, however, the control system must try to clear the machine by reversing for a few seconds at least twice. If this is not successful in clearing the machine, both the cutter screen and any in line pump shall shut down, sound an alarm and activate an alarm on the control system.

Shut-down shall not prevent continued flow through the cutter screen.

Corrosion Protection

The corrosion protection system shall include a 400 µm thick epoxy tar or similar approved coating on all cast iron components. Non-corrosive materials shall be used wherever possible.

SCREW CONVEYORS

Screw Conveyors - General

Details of the duty, performance and any other special requirements for screw conveyors to be supplied will be given in the detailed specification. Conveyors shall comply with the following:

a.) The conveyor shall be conservatively sized and shall be suitable for handling at least 35 % in excess of the maximum duty specified in the detailed specification. The conveyor shall also be

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designed to operate well within the maximum design limits for the type of duty specified.

- b.) A receiving conveyor shall operate at a capacity of at least 5 % above that of its supply conveyor.
- c.) All units must be suitable for operating at any duty between no load and full load, either wet or dry, 24 hours per day.
- d.) The conveyor shall be of rigid construction and shall be designed for a life before major repair of not less than 10 000 hours. Each unit shall operate quietly and without spillage or leakage. Protection shall be provided against damage from blockage or jamming.
- e.) All radial and thrust loads shall be taken by the screw bearing and shall not be transmitted to the driver.
- f.) All greasing points shall be piped to a convenient accessible position but the system shall provide positive lubrication of each point; i.e. lines shall not be manifolded.
- g.) The conveyor shall be driven by direct coupled motor and gearbox. Couplings shall be "Fenaflex", or approved equal, tyre-type couplings with taperlock bushes keyed to the shaft. Guards shall totally enclose the drive.
- h.) Conveyors shall be designed for resistance to corrosion. All fabrications such as screws with centre tubes, troughs and covers, supports, guards, etc., shall be manufactured of coated 3CR12, coated 304L stainless steel or of 316L stainless steel. All shafts, pins, fasteners, hangers, sleeves, bushes, rollers, gland followers and other small items shall be made of grade 316 stainless steel or of another non-corrosive material.

On proprietary items such as motors, gearboxes, couplings, sprockets, etc., particular care shall be taken to apply suitable protective coatings. Welding shall be continuous all round to prevent any crevices and all bolted and other mating faces and mounting pads shall be sealed during assembly with a suitable non-hardening sealer.

- i.) Trough covers shall be light and easily removable but rigid and strong and shall be of a non-corrosive, UV-resistant material. Covers shall be hinged for inspection purposes and to serve as a relief in the event of blockage in the following positions:

at the discharge point and in line with the screw axis;
near the inlet.

- j.) Fixing, supporting and structural arrangements shall take into account the very high prevailing winds.
- k.) Special care shall be taken to prevent sharp edges on items fabricated from thin sheets. Such sharp edges shall preferably be eliminated by design.

Shafted Conveyors

Shafted screw conveyors shall, additionally, comply with the following:

- a.) The conveyor screw shall be kept clear of the trough and shall be supported at both ends by rolling element bearings. These bearings shall be totally enclosed in coated cast iron or stainless steel housings which shall be adequately sealed against the ingress of moisture and dirt and shall be mounted external to the trough.
- b.) With inclined conveyors, the upper bearing shall be the thrust bearing and the bottom bearing shall

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be mounted clear of the trough and cover. In this case the shaft through the bottom cover shall be sealed by means of a gland incorporating at least one throttle bush, a lantern ring, at least three rings of packing, a positively driven, "Stellited", 316 stainless steel, slip fit shaft sleeve with o-ring seal and 316 stainless steel gland follower. The gland shall be grease sealed or water flushed depending on the application.

c.) The centre tube shall preferably be rigid enough to avoid the use of intermediate bearings. Where the use of intermediate bearings cannot be avoided, they shall be supported by suitable slim hangers which will not interfere with the flow of the product being conveyed. The screw shall also be sized so that the bearing is not immersed in the product being conveyed. The bearings shall be very well sealed and grease lubricated.

d.) Provision shall be made in the conveyor design for easy replacement of items such as end bearings, intermediate bearings, throttle bushes, shaft sleeves, coupling tyres, chains, etc., without excessive disassembly and without removal of the complete unit. The general arrangement shall permit convenient access to all parts of the unit and shall permit easy installation or removal.

d.) Where appropriate, the screw conveyor shall be designed for abrasion resistance. All applications handling grit or sludge shall be regarded as highly abrasive. The conveyor shall be designed for slow speed and very low rubbing velocities. Outer edges of the conveyor screws shall be manufactured of, or lined with, an abrasion and corrosion resisting material. The trough shall be completely lined using conveniently replaceable 1 000 mm long sections made of a corrosion and abrasion resistant material. Alternatively the trough shall be lined to a minimum thickness of 6 mm with a suitable repairable material such as neoprene, polyurethane, ceramic lining compound, etc. Full details of the manufacturer's proposals shall be provided with the Tender.

The helical shall be fabricated from material with a thickness of not less than 6 mm.

Centreless Conveyors

Centreless screw conveyors shall, additionally, comply with the following:

- a. The material thickness of the helical outer surface shall be at least 20 mm.
- b. The liner on which the spiral rests shall consist of a polymer featuring a two-colour laminate designed to act as a wear check. Thickness of the liner shall be at least 10 mm.
- c. The complete body shall be of grade 316 stainless steel.
- d. The drive motor shall preferably be mounted at the high point of the conveyor.

BELT CONVEYORS

Design

The design, manufacture and application of the conveyor shall comply with Conveyor Equipment Manufacturer's Association (CEMA) Standard No. 402. Conveyor components shall comply with SABS 1313, SABS 1669 and SABS 1366, all as applicable.

The conveyor shall be of the troughed belt type running either on non-corrosive troughing idlers or on a stainless steel slider bed as recommended by the Contractor. It must also be noted that the loading on the belt could be relatively low and the conveyor would be operating in a very moist and corrosive environment. During operation all idlers shall rotate freely.

Conveyor Belt

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The belt width shall suit the duty but shall not be less than 450 mm with at least 2 plies, and with 1,5 mm minimum thickness of covering to both sides. The belt shall be of a neoprene or other material unaffected by moisture or substances normally expected on a sewage application. Alternatives may be offered. Vulcanised splicing shall be used. The use of clips will not be allowed. Belt speed shall not exceed 30 m/minute.

Guards

The conveyor shall be so enclosed that all moving parts and nip points are neatly and safely guarded. The head and tail pulley's shall be as safely guarded as possible without causing a hindrance to the operation of the conveyor. Where exposed, the sides and bottom of the conveyor must be covered with corrosion resistant and easily removable panels small enough to handle in a strong wind.

Splash Boards

On screenings duty, the Conveyor shall be provided with suitably protected 20 mm thick hard wood or 8 mm polypropylene, angled splash boards not less than 300 mm wide along both sides of the belt and firmly secured to the conveyor frame along its entire length. The bottom edge of the splash boards shall be provided with a rubber skirt which shall be adjustable and adjusted so that clearance between the skirt and conveyor belt is kept to a minimum. The splash boards shall be so designed and installed as to assist with clean and trouble free loading and discharge of material.

Emergency Trip Wire

An emergency trip wire and cut out switch must be provided. The trip wire must extend along the entire length of the conveyor on both sides.

Belt Scraper

A belt scraper, either reinforced neoprene or neoprene bladed shall be incorporated below the head pulley designed to remove screenings of a fibrous and sticky nature. The scraper shall be designed to be well clear of the discharge point and not provide collection points for screenings. Pressure between the belt and the scraper shall be maintained by suitable rubber filled torsion holders. The torsion holders shall be mounted on adjustable stainless steel screw type mountings positioned well clear of the discharge from the conveyor.

Idlers and Pulleys

Idlers shall be of a non-corrosive abrasion resistant material. All idlers shall have pre-lubricated sealed for life roller or ball bearings and details of the bearing sealing arrangement shall be provided with the tender. Head and tail pulleys shall be crowned and shall be fabricated of 316 stainless steel or shall be of cast iron or carbon steel and neoprene coated in both cases. Pulleys shall have a minimum diameter of 250 mm and be fitted with taperlock bushes. Shafts shall be of 316 stainless steel and adequately sized and bearings selected for an L10 life of 100 000 hours.

All idlers must be mounted in such a way as to facilitate easy removal and replacement.

The pulley shafts shall be supported by spherical roller bearings designed for an L10 life exceeding 100 000 hours. The bearings shall be mounted in cast iron plummer blocks which shall fully enclose the bearing. (Open type integral bearing units are not acceptable even if shielded bearings are used). All plummer blocks shall be sealed and fitted with grease points piped to a convenient easily accessible block on which nipples shall be fitted.

"Take ups" shall be of the protected screw type with a minimum adjustment range of 350 mm. The screws are to be of grade 316 stainless steel.

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Slider Beds

If used, slider beds shall be of 3CR12 or grade 316 stainless steel not less than 6 mm thick and painted with an approved 3 coat polyurethane paint system. Slider beds shall also be designed so as to be easily replaceable. The slider bed trough shall be open along the centre so as not to provide a collection area for liquids or dirt.

Framework

The supporting framework shall be of rigid welded or bolted construction. Tubular construction will not be accepted. All welding shall be continuous and no unwelded or unsealed crevices shall be permitted. All idlers must be mounted in such a way as to facilitate easy removal and replacement. The corrosive nature of the environment must be noted and all steel work shall be hot-dip galvanized (or zinc-sprayed or aluminium-sprayed) and painted.

Drive

The drive unit shall preferably be of the shaft mounted torque arm gearbox type with motor and gearbox being a combined unit, and mounted directly on the drive pulley shaft. The gearbox shall be selected for continuous operation with a power service factor of not less than 1.5. All bearings shall be designed for an L10 life of not less than 100 000 hours. A sight glass for observing the oil level shall be provided and shall be of a type which cannot be easily broken accidentally. Tenderers shall allow for initial fill of lubricants and for draining, flushing and refilling after an initial bedding in period of not longer than 3 months. Although a shaft mounted direct coupled arrangement is preferred, a chain or belt drive shall comply in all respects with the requirements of this Specification. Jacking screws must be provided for tensioning the drive and a movement of at least 50 mm in each direction must be possible. These screws shall be of grade 316 stainless steel.

The gearbox shall comply with the requirements of Sub-clause "Motor Driven Gearboxes" (see Clause "Power Transmission").

COMPRESSORS

General

When operating in parallel with other compressor/s, an isolating valve, check valve, and lockable pressure relief valve complete with bronze lock and keys shall be fitted to each unit. (The pressure relief valve is in addition to those fitted to the air receivers).

Silenced, Package Type Compressors

Compressors shall be of the air cooled rotary type complying with the noise limit of 70 dB(a) at one metre. In order to achieve this, the compressors shall be of the packaged type mounted in a soundproofed enclosure on anti-vibration mounts with the machine adequately silenced.

The volume of air delivered shall modulate to match the demand. Provision shall, however, be made for the compressor to shut down should there be no air demand for a predetermined period, and to restart when demand is re-established. During the period before the compressor stops, the compressor shall be arranged to operate in a low power demand idling mode.

All necessary controls and instruments shall be integrally mounted with the compressor enclosure and shall comply with the Electrical Specification.

The air intake shall be fitted with an efficient heavy duty dry type air filter incorporating a centrifugal pre-cleaner with automatic dust ejector and a renewable filter element or cartridge. A servicing indicator is

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to be fitted.

All relevant and necessary check valves, minimum pressure valve, air/oil filters, etc., shall be fitted to the unit.

A final automatic filter drain to remove any trace of oil and water is to be supplied.

When an oil separator vessel is needed in the compressor, this is classified as a pressure vessel and the requirements of the clause "Air Receivers" shall apply. A handholes will not, however, be required where the diameter of the separator precludes it.

Standard Compressors

a.) TYPE: Compressors shall be air cooled, rotary type, either directly coupled to, or vee-belt driven by an electric motor, and shall be mounted on a rigid fabricated steel base plate and fitted with suitable guards. Preference will be given to low speed units, and the size of unit shall therefore be conservatively selected.

b.) ANCILLARIES: The following ancillaries shall be provided:

Efficient air filters shall be fitted to the air intakes.

Silencers shall be fitted to the inlet and outlet of the compressors.

A discharge pressure gauge shall be fitted.

c.) NOISE LEVEL: The sound level at a distance of 1 metre from the compressor at any operating point, shall not exceed 80 db(A).

AIR RECEIVERS

Wherever possible, only South African manufactured construction materials shall be used for air receivers which shall be of heavy gauge steel with convex ends, shall be of welded construction and shall be manufactured to a code acceptable to the Department of Manpower Utilisation.

This Code of Manufacture shall allow for two elliptical handholes with oil resistant gaskets, one at each end of the cylindrical section, as per drawing No. ME A4/1519 (see end) and the handhole covers shall be spigotted to facilitate accurate positioning. Screwed inspection plugs will not be acceptable. A Government authorised inspection authority shall, in addition to the duties laid down in the relevant Code of Manufacture, inspect the design, construction and materials of all handhole covers and the clamping arrangement. These covers and clamps shall be stamped and certified and the maker's certificate shall be endorsed accordingly.

The vessels shall in all respects comply with the requirements of the applicable regulations of the Machinery and Occupational Safety Act of 1983 and each vessel shall include the following:

a.) A pressure gauge of not less than 150 mm diameter, calibrated in kPa and redlined at the maximum safe working pressure. The calibration scale shall not exceed twice the safe working pressure of the vessel or be less than the hydraulic test pressure of the vessel.

b.) Lockable safety valves complete with bronze padlocks and two keys.

c.) Automatic drain valve cock (the drain for condensate removal must be at the lowest point of the receiver, a syphon type drain is not acceptable). Particular attention must be paid to the contouring of the weld at the drain cock to ensure that no condensate can be trapped within the vessel. The draincock shall be piped to a drain.

d.) An isolating valve in each air supply line as close as possible to the air receiver which it controls.

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A maker's Test Certificate for the air receivers as required in terms of the Machinery and Occupational Safety Act, 1983 as amended, showing the hydraulic test pressure, must be supplied. This Test Certificate must be signed by a Government authorised inspection authority. The Contractor shall also arrange for the receivers to be tested and inspected in accordance with the above Act after installation and before being put into use for the first time. This test shall be witnessed by the Engineer or a competent person delegated by him.

All hot pipework which constitutes a hazard to operators shall be insulated.

The vessel shall be painted externally in accordance with System C/2 and unpainted internally.

PRESSURE VESSELS

All aspects of pressure vessels installations, including design, fabrication, installation, ancillary equipment, etc., shall comply in all respects with the appropriate parts of the Occupational Safety and Health Act. Pressure vessels shall be of welded construction and shall be manufactured to a code acceptable to the Client. Screwed inspection plugs will not be acceptable.

The vessels shall in all respects comply with the requirements of the applicable regulations and each vessel shall include the following:

(a) A pressure gauge of not less than 150 mm diameter, calibrated in kPa and redlined at the maximum safe working pressure. The calibration scale shall not exceed twice the safe working pressure of the vessel or be less than the hydraulic test pressure of the vessel.

(b) Lockable safety valves complete with bronze padlocks and two keys.

A maker's Test Certificate for the air receivers as required in terms of the Machinery and Occupational Safety Act, 1983 as amended, showing the hydraulic test pressure, must be supplied. This Test Certificate must be signed by a Government authorised inspection authority. The Contractor shall also arrange for the pressure vessel to be tested and inspected in accordance with the above Act after installation and before being put into use for the first time. This test shall be witnessed by the Engineer or a competent person delegated by him.

The required corrosion protection system shall be System C/2 unless specified otherwise in the Detailed Specification.

COOLING TOWERS

Cooling towers shall be rated to suit the cooling duty calculated from or specified in the Detailed Specification. Calculations shall be based on the maximum wet bulb temperature of 23°C.

Cooling towers shall be of the induced draught counter flow design. Construction shall be of corrosion free and UV resistant materials such as fibre glass, with all metal components including fasteners of 316 stainless steel.

The cooling towers will be exposed to the very strong winds common in this area and must be designed to eliminate spray drift.

A large water reservoir must be provided in the bottom of the tower which shall be provided with a float valve for make-up water, and connections for overflow, drains and take off.

DAVITS

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Davits shall be column mounted with swivelling booms and designed to suit the application. The arrangement shall permit easy and safe lifting of the load to a convenient height not less than 500 mm clear of ground level or high enough to permit the load to be swung clear of any obstruction through an angle of at least 180°.

The davit shall be designed for a maximum safe working load at least 50% above the calculated actual load requirements. The maximum stress permitted in any component at the design load shall be the lesser of:

- One quarter the ultimate tensile stress for the material.
- One half the yield stress or 0,2% proof stress of the material (as applicable).

The contractor's design calculations shall be submitted to the Engineer for inspection before manufacture may proceed.

Where a portable davit is specified the construction shall be as light as possible while still complying with the above, shall be collapsible to make it easy to carry, and be easily removed from or remounted on permanent fittings which shall be provided in the various positions where the davit is to be used.

Each davit shall be provided with a winch rigidly fixed to the davit at a convenient height and position. The winch rope shall be of 316 stainless steel with a safety factor of at least 6. With portable davits to be used for lifting submerged or otherwise inaccessible equipment the required length of rope shall be provided for each item of equipment, with the bottom end attached to the equipment (load) and, during normal operation, with the upper end detached from the winch, neatly coiled and tied in a convenient position. A protection system shall be provided which will prevent the rope from being dropped and lost when being attached to or detached from the winch.

Guide pulleys to suit the arrangement shall be provided. These pulleys shall be machined with a groove having a radius 5% to 7,5% greater than the rope radius and with a flare angle of 52°. The pulley sheaves shall have a diameter at the bottom of the groove of not less than 25 times the wire rope diameter. The groove depth shall be twice the rope diameter or greater.

The davit shall be manufactured of carbon steel, hot-dip galvanized and painted or of grade 316L stainless steel. All fasteners, pins, shafts, shackles, hooks, etc., shall be of 316L stainless steel. Guide pulleys and shafts shall be made of 316L stainless steel or other approved corrosion resistant material, and use suitable non-metallic bearings which do not need to be lubricated.

The swivelling arrangement shall be properly designed for easy operation, shall be accurately fitted and shall not be subject to corrosion problems. Bushes made of nylon, "Vesconite" or other suitable non-metallic material shall be used and any metallic rubbing mating face shall be of 316 stainless steel.

Operating cross bars, locking arrangements, fixing arrangements, etc., shall not represent a hazard to passers by in any way. If necessary operating levers shall be hinged so that they can be swung out of the way when not in use.

The safe working load shall be clearly and permanently marked on the davit jib, winches and shackles. Before being put into use each davit assembly shall be load tested in position by the Contractor to 1.1 times the maximum safe working load and the Contractor shall arrange for this test to be witnessed by the Engineer. The Contractor shall then supply a test certificate.

WINCHES

Hand cranked winches shall be rated for a safe working load at least 100 % in excess of the calculated load. All gears, clutches, etc., shall be enclosed in a robust cast iron or cast steel casing which shall be grease filled and sealed against ingress of dirt and moisture. The winch shall be designed to hold the load

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stationary when the hand crank is released during raising or lowering. In addition, a locking arrangement to lock the position of the load shall be provided.

The force required to operate the winch at its maximum rated load shall not exceed 100 N.

The radius at which the handle operates shall preferably be adjustable. A double handled crank or two opposing cranks shall be provided when necessary to ensure easy operation in all positions possible with the mounting arrangement provided.

The wire rope and all attachments shall be of 316 stainless steel with a safety factor of at least 6. The wire rope shall be long enough to reach the lowest required position with at least 3 turns left on the drum. The drum size shall easily store the full rope length. The inside diameter of the drum shall suit the rope diameter in accordance with good engineering practice approved by the wire rope manufacturer.

The maximum safe working load shall be clearly and permanently marked on the winch. The drum support brackets, all exposed fasteners, shafts, handles, pins, etc., shall be 316 stainless steel and the casing shall be hot-dip galvanized or zinc-sprayed (to a thickness of 150 µm) and then painted.

LIFTING EQUIPMENT

General

All lifting equipment shall comply with the following requirements:

- (a) All aspects of lifting equipment, including design, fabrication and installation work shall be full in accordance with the relevant aspects of the Occupational Safety and Health Act 2005.
- (b) Lifting equipment shall be designed and constructed in accordance with a generally accepted technical standard.
- (c) The safe working load (SWL) shall be marked clearly on all items.
- (d) The complete installation shall be inspected and shall be tested over its complete lifting range using a load which is at least 125 % of the safe working load.
- (e) High-tensile or alloy steel chains shall have a factor of safety of at least four.
- (f) Chains shall have a factor of safety of at least 10 (TEN).
- (g) Steel-wire ropes shall have a factor of safety of at least six.
- (h) Man made fibre ropes or woven webbing shall have a factor of safety of at least six.
- (i) Natural fibre ropes shall have a factor of safety of at least ten.

Hoists

Hoists shall be provided with a slipping clutch, or equivalent, which shall ensure that it is not possible to overload the hoist.

Powered hoists shall hold the load upon power failure; i.e. shall feature fail-to-safe braking.

Crawl Beams

Crawl beams shall be hot-dip galvanised after all fabrication. If the beam is drilled or welded or the zinc coating is damaged by any other fabrication technique, the complete beam shall have the zinc removed by abrasive blasting and it shall be returned to the galvanisers for hot-dip galvanising. Repair using cold-applied zinc products will not be acceptable.

Crawl beams shall be anchored to concrete using grade 316 anchor bolts. The anchor bolts shall, preferably, be through-bolted. If chemical anchor is used, every anchor shall be load-tested prior to installation of the beam. A nickel-based anti-seize compound shall be applied to bolt threads prior to fastening of the nut and galled fasteners shall be removed and replaced.

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Crawl beams shall be fastened to hot-dip galvanised steel support structures using hot-dip galvanised fasteners and it shall be noted that high-tensile, hot-dip galvanised fasteners are available in South Africa.

Overhead Travelling Cranes

The design, fabrication and installation of overhead travelling cranes shall comply with the following:

(a) The Tenderer shall inspect the drawings to determine what steps need to be taken for installation of the crane and shall plan work on Site accordingly. Design requirements for installation of the crane rails shall be provided by the Contractor.

(b) Construction of the crane shall be in accordance with BS 466 and BS 2573, as applicable. All welding of steelwork shall be carried out in accordance with BS 5135 by competent artisans meeting the requirements of BS 4872.

(c) The Contractor may use a crane during the installation of other equipment on condition that all testing and certification for the complete lifting installation, including supporting structure, has been successfully completed.

(d) The hoist shall be supported on and travel along a fabricated steel crane beam structure. The crane beam shall be supported on and travel along crane rails. The rails shall be supported along their full length, either on a concrete ring beam or on additional hot-dip galvanised steel beams.

(e) The Contractor's proposed method of fixing the crane rails shall be submitted to the Engineer for approval.

(f) The crane's safe working load rating shall be stated in the tender submission.

(g) The crane long travel, cross travel and hoist shall be electrically-powered or manually operated as stated in the Detailed Specification.

(h) The crane duty shall be stated in the Detailed Specification.

(i) Unless otherwise stated, the lowest hook level shall be room floor level and all operating chains shall fall to one metre above this level.

(j) All materials shall be new and unused and suited to the application. Structural steelwork shall comply with the requirements of SABS 1431 and the grade used for structural members shall be S 355JR.

(k) Site welding will not be acceptable. All welding shall be continuous unless otherwise approved in writing by the Engineer. No crevices will be permitted. All welding slag and weld spatter shall be removed and welds shall be ground smooth prior to coating. All welds shall be free of blowholes.

Sharp edges resulting from cutting operations shall be rounded to a radius of at least 3 mm and open pockets which are inaccessible for preparation and coating will not be permitted.

(l) The crane beam and end carriages shall be designed with suitable dimensions, wheel spacings and gusset plates or diagonal bracing to prevent cross-whipping.

(m) End stops with rubber buffers shall be fitted to prevent the hoist from moving off the travelling beam and to limit the long travel along the rails.

(n) Lubrication systems shall be designed to exclude dirt and moisture and all gear wheels shall be fully enclosed.

(o) Bearings shall be mounted in properly sealed plummer blocks or in totally enclosed and sealed

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housings, grease-lubricated and provided with grease nipples in both cases. The open type bearing units with exposed "lubricated for life" bearings will not be acceptable.

(p) The safe working load shall be permanently marked on the crane hook and on both sides of the girder.

(q) The hoist, if powered, shall comply in all applicable respects with the Occupational Safety and Health Act.

(r) An overload prevention device, such as a clutch which slips upon overloading, shall be incorporated.

(s) The bottom hook shall swivel on a ball or roller bearing through 360° and shall be fitted with a safety latch. The bearing shall have a protective skirt.

(t) Lifting chain is preferred, but corrosion-protected steel wire rope is acceptable for higher loads.

(u) A chain box for the unloaded length of lifting chain shall be provided.

(v) The crane rails shall be supported on and secured to the concrete or steel gantry beams and shall be installed true to span, level, aligned, and shall be straight to within the permissible deviations given in BS 466 over their entire length. The crane rails shall be made from standard rail sections. Rails manufactured from square section steel bar will not be acceptable. Rails shall be joined using fish-plates, with at least four fasteners, to provide a continuous path for the travel of the crane wheels. The rails shall be hot-dip galvanized after all fabrication work.

(w) The distance between rail supports shall not exceed 1 000 mm and supports shall be anchored using grade 316 stainless steel bolts.

(x) Where specified, a personnel platform for two people shall be provided on the crane structure. The platform shall be bolted to the crane beam structure and shall be removable. The steel sections which form the crane beam shall be provided with welded lugs to which the platform shall be bolted. The complete platform and all guard-railing shall be hot-dip galvanised after fabrication. The platform itself shall be designed so that a person standing on it will be able to replace the electric lamps. A hot-dip galvanised steel ladder shall be provided for accessing the platform. The platform floor shall have a minimum width of 500 mm. Guard rails shall comply with the clause "Guard Railing".

Crane rail anchor bolts shall be M16 or larger and shall be of grade 316 stainless steel. Fasteners smaller than 12 mm shall be of 316 stainless steel. All other fasteners, including high-tensile fasteners, shall be of stainless steel or shall be hot-dip galvanized.

Before assembly, the threads of all bolts and studs shall be coated with an approved nickel-based, anti-seize corrosion protection compound.

(y) The crane beam and end carriages shall be zinc-sprayed and sealed in accordance with the clause "Corrosion Protection : Metal Coatings. Smaller items, such as cable brackets and protective covers, shall be hot-dip galvanized.

Where the Tenderer prefers to offer corrosion protection systems other than those specified, these may be offered as an alternative with full details of such recommended systems. The Council reserves the right to reject such offers if considered inadequate by the Engineer.

The Contractor shall arrange for the crane to be inspected by the Engineer at the fabricator's premises prior to preparation for corrosion protection.

(z) The crane final colour shall be Golden Yellow, B49.

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(aa) The crane and rails, when erected and installed, shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.

(bb) In the alignment of equipment or structures, the use of multiple shims will not be permitted. All shimmed feet shall be neatly grouted to provide corrosion protection.

(cc) The full length of the rails shall be grouted in cases in which the rails rest on a concrete ring beam. A suitable gap between the rails and the beam shall be provided for application of the grout. The grout shall be applied strictly in accordance with the manufacturer's instructions. The grout shall be neatly finished with a 45° chamfer. The Engineer shall be notified prior to application of the grout.

Grouting shall be done using a non-shrink cementitious grout, ABE Duragrout 1000 or equivalent, to the approval of the Engineer and in accordance with the manufacturing instructions.

(dd) The inspection of corrosion protection systems shall be done in accordance with the clause "Corrosion Protection : Application and Control".

(ee) The Contractor shall supply to the Engineer a certificate from the manufacturer which:

certifies that the crane has been manufactured in accordance with the requirements of the Occupational Safety and Health Act 2005;
specifies the design standards used, and;
states the safe working load and the test load.

This certificate shall be provided to the Engineer prior to delivery of the crane to Site.

LINEAR SCREENS/BELT PRESSES

Refer to Detailed Mechanical Specification

AUTOMATIC POLYELECTROLYTE PREPARATION SYSTEM

The system shall be of proprietary, unit design which has been tested in practice.

The system shall be chosen for the application and shall have volume flow capacity and polyelectrolyte dosing capacity of at least 20 % above the design ranges for the application.

The polyelectrolyte make-up and stock tanks shall be of GRP or stainless steel.

The polyelectrolyte stock tank shall be sized to provide at least six hours of polyelectrolyte dosing before refilling.

Polyelectrolyte dosing pumps shall be selected to avoid high shear on the liquid being pumped. Prepared types of pumps include progressing cavity and peristaltic pumps.

CENTRIFUGES

General

The centrifuge shall be of the horizontal solid bowl type with fully variable differential speed control of the scroll. The centrifuge shall be of a type with proven performance on the specified duty.

Particular care shall be taken to minimise corrosion and abrasion and generally a part life exceeding 100 000 hours before major overhaul or repair is required and shall be achieved by the appropriate selection of materials and sizing of parts.

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Operational problems must be minimised. All openings, particularly in the sludge feed and cake discharge areas shall be of adequate size and design to prevent plugging or bridging. Sludge feed velocity into the centrifuge shall not exceed 2,5 m/s at design capacity.

The point of polymer addition shall be recommended by the Tenderer to suit the recommended type of polyelectrolyte but the option of polymer addition into the bowl of the centrifuge must be provided.

Provision shall be made for automatically flushing the centrifuge after operation. A manually operated flushing valve shall also be provided.

Casing

Casings shall be split and flanged down the centreline with adequate access covers for inspection of the dewatered solids discharge area and for easy access to the centrate discharge weirs for pool level adjustment. Sealing arrangements of all mating seal faces shall prevent any leakage. The casing shall be of rigid construction with baffles to ensure separation of the cake and centrate. Lifting lugs for the upper casing and handles for access covers shall be provided.

The casing, including all covers and fasteners, shall be manufactured of either grade 304 stainless steel painted or of grade 316 stainless steel. The internal surface areas at the centrate and sludge discharge points must be suitably protected against abrasion using a lining material or approved thick coating.

Bowl

The bowl assembly shall be of grade 316 stainless steel construction with replaceable corrosion and abrasion resistant liners in the cylindrical and dewatering beach section and sintered tungsten carbide replaceable liners at the cake discharge ports.

Provision shall be made for measurement of the scroll flight wear via sealed ports provided in the bowl.

All fasteners shall be of grade 316 stainless steel and so positioned as to avoid wear and shall be protected against plugging of clearances and holes for spanners and keys.

Scroll

Scrolls shall be of grade 316 stainless steel and protected against wear on the outer edges. This protection shall take the form of metal-backed, tungsten carbide components which are welded to the scroll and which can be replaced without causing structural damage to the scroll.

The feed sludge entry ports shall be fitted with replaceable abrasion resistant liners. The sludge feed pipe shall be easily replaceable and fabricated from an abrasion and corrosion resistant material or shall be suitably lined.

Bearings

The main centrifuge bearings and scroll bearings shall preferably be grease lubricated and shall be adequately sealed to prevent moisture or solids entering the bearings and to prevent lubricant entering the bowl. Details of the sealing arrangements shall be provided with the tender. Grease nipples which are easily accessible from outside the centrifuge shall be provided for all bearings.

Designs incorporating bearings which must be oil lubricated shall include for a system which will protect the bearings during the centrifuge run down period in the event of a power failure. Oil lubrication systems shall include all necessary ancillaries including oil pump, suction filter, discharge filter with blockage indicator, pressure relief valve, an adequate reservoir with drain, plugged drain valve, filler and breather cap, level indicator and temperature gauge, oil cooler with connecting pipework, protection switches, etc.

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Fabrications

Structural steelwork shall be protected by hot-dip galvanizing and the application of System A/1; or shall be zinc-sprayed and sealed.

Ducting shall be of grade 316 stainless steel.

Hoppers shall be of grade 316 stainless steel.

Screw Conveyors shall comply with Clause "Screw Conveyors".

Baseplates shall be protected against corrosion. Acceptable systems are hot-dip galvanizing and paint or zinc spray (Zn 150) and sealed. The final colour shall be black.

Coupling guards shall be of grade 316 stainless steel but, in hazardous areas, shall be of aluminium.

Small items such as brackets, etc., shall be hot-dip galvanized and coated or shall be of grade 316 stainless steel.

Fasteners - See Clause "Fasteners".

Pipework and Valves

Sludge pipework shall be of cast iron + System A/1 (internal and external) or shall be of grade 316 stainless steel or HDPE.

Centrate pipework shall be of HDPE.

Polyelectrolyte pipework shall be of grade 316 stainless steel.

Water pipework up to 25 mm diameter shall be of copper. Water pipework above 25 mm shall be HDPE, PP or of carbon steel and protected with System Fusion Bonded Epoxy.

Machines

Motors, pumps, gearbox, etc., shall be of cast iron and protected by System E/1, or approved equal.

Basket strainers - See Clause "Pump Suction Strainers".

Alternative Materials of Construction

Tenderers may, as an additional and separately priced alternative, offer alternative materials of construction to those specified provided that both the short and long term economics of such alternatives are detailed.

Centrifuge Drive Arrangement

The centrifuge shall be vee-belt driven by an electric motor through a fluid coupling or by a frequency controlled variable speed motor, as recommended by the centrifuge manufacturer.

The motor and drive arrangement shall be adequately rated for the maximum load which can apply at any operating condition. In particular, the torque characteristics of a motor, fluid coupling and load under starting conditions shall ensure that the motor reaches full speed within 10 seconds and that the centrifuge reaches full speed with a substantial margin before causing overheating of the fluid coupling. Similar

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requirements apply to variable speed drives and their motors.

Contractors shall provide full details of torque characteristics and starting times for approval before commencing with manufacture.

The motor shall be mounted on slide rails incorporating stainless steel jacking screws.

Fluid couplings shall be suitably protected. This shall include protection from high temperature due to operation at high slip for extended periods.

Centrifuge Mounting Arrangement

Each centrifuge and motor unit shall be mounted on a common fabricated steel baseplate generally complying with the Clause "Baseplates". A high mass, very rigid base arrangement is required with low deflection of the vibration isolation mounting system during operation.

Foundations will be constructed, usually by others under a separate building contract, in accordance with the details and requirements which shall be provided by the Contractor.

Vibration isolation mountings which will eliminate not less than 90% of the vibrations transmitted by the equipment shall be provided between the centrifuge baseplate and the concrete foundations. Full details shall be provided with the tender. When mounted on the vibration isolators, distortion of the baseplate shall be negligible in comparison with the permissible and acceptable misalignment of the equipment mounted thereon.

All cable, pipework and other connections to the machine shall be flexible and so fixed and mounted as to prevent wear and fatigue.

The baseplate and guards shall fully comply with the relevant clauses of this Specification.

Centrifuge Scroll Differential Speed Control

Variable speed scroll drive systems utilising electronic frequency variation, preferably, or air cooled electric braking systems may be used. Hydraulic drives will only be acceptable if electric/electronic systems are unavailable.

If used, hydraulic power packs shall be properly designed and shall include all necessary ancillaries including oil pump, suction filter, discharge filter with blockage indicator, pressure relief valves, an adequate reservoir with drain, plugged drain valve, filler and breather cap, level indicator and temperature gauge, an oil cooler where necessary with connecting pipework, protection switches, etc. All systems shall be so designed that no damage may result during the centrifuge run down period in the event of a power failure. Noise levels must also be kept low.

The scroll differential speed control shall be designed to provide a selectable option of either maintaining a selected differential speed or of maintaining a constant drive torque.

Provision must be made at the position of adjustment for indication of both differential speed and scroll torque.

The gearbox and differential speed control system shall be adequately rated for the duty using a service factor of at least 1,75. Gearboxes shall be oil lubricated and sealed.

Further requirements with regard to control and instrumentation are specified elsewhere in this Specification.

Centrifuge Discharge Diverter

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A means of diverting flushing water and thin sludge from the cake discharge opening shall be provided.

Sludge and Centrate Discharge Ducting

Ducting and pipework shall be provided to guide the thickened or dewatered sludge and centrate without hangup, bridging, leakage, overflow or blockage. Consideration must be given in the design to the stickiness of sludge and all duct surfaces must be vertical or very steep.

The arrangement shall be such that no spillage or other mess occurs during start-up, normal operation or shut-down. All sections of the discharge ducting shall be individually flanged for separate removal.

Sampling

Suitable sampling connections shall be provided for sludge, cake and centrate. These connections must be conveniently located and not less than DN 50.

Centrifuge Maintenance

Tenderers shall provide, with their Tender, the anticipated short and long term maintenance schedules for the centrifuge. This schedule shall list the estimated maintenance which will be required at various stated intervals including lists of parts which will need to be reconditioned or replaced at each service and the present cost of the reconditioning and parts.

Separate schedules shall be provided for alternative materials or designs which may be offered.

INSTRUMENTATION

Calibration of each instrument shall be done to the approval of the Engineer.

Instruments and their cabling shall be protected so that electromagnetic interference does not affect their operation and signal transmission.

Environmental protection shall be as follows:

Instrumentation, including associated displays and transmitters, located either outside and above ground level or inside shall have IP 55 or higher rating.

Instrumentation, including associated displays and transmitters, located in underground chambers shall have IP 68 environmental protection and shall be mounted in an enclosure.

Outside mounted instruments (in cases in which the mounting arrangement allows), and their displays and transmitters shall be mounted in enclosures. Enclosures shall be of polycarbonate construction with transparent front, Fibox EK or equivalent. The complete enclosure installation shall have an IP 55 rating or higher. The enclosure size shall be chosen to provide a clearance of 100 mm all-round the instrument.

MAGNETIC FLOW METERS

Meters

Magnetic flow meter sensors shall be full-bore, in-line, double-flanged units with remotely mounted transmitters. The transmitters shall provide local flow indication and 4-20 mA output. Sensors shall, unless otherwise specified, have IP 68 protection and transmitters shall have IP 67 protection.

Magnetic flow meters shall have polyurethane lined stainless steel tubes with either Titanium or Hastelloy C electrodes. Accuracy shall be + 1 % of flow or better. Rubber linings are acceptable for treated water applications.

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Calibration shall be in litres per second unless otherwise specified.

For applications other than for treated water, flow meters shall be provided with an electronically operated electrode cleaning device. Automatic, timed cleaning shall be provided.

Installation

The equipment shall be correctly installed, connected, adjusted and calibrated by competent persons. Calibration shall be done in the presence of the Engineer. The operation and signal transmission of meters against electromagnetic interference shall be provided.

The meter shall be installed with a straight pipe length of at least 10 pipe diameters upstream of the sensor and a straight pipe length of at least 5 pipe diameters downstream of the meter. If this is not possible, specific measures shall be taken to provide flow straightening. The complete meter installation shall comply with the manufacturer's instructions.

Grounding rings shall be supplied and installed if the application requires these.

Testing

A factory test calibration certificate shall be provided for each flow meter.

The flow meter shall be provided with a simulation test unit for field verification of the measuring system without removal of the sensor. If more than one identical model flow meter is installed, two simulation test units shall be provided.

GAUGES

Gauges – General

- (a) Gauges shall be of durable, industrial construction. Case and bezel shall be of stainless steel unless this material is unsuitable.
- (b) Scale markings shall be radial, plain, straight, black lines on a white background and shall be spaced so that one scale division represents approximately 1% - 1,5% of the maximum scale value in values of 1, 2 or 5 multiplied by any power of 10 to suit the maximum operating rating.
- (c) On circular gauges the scale shall be concentric and the maximum and minimum scale values shall be near the bottom of the gauge, with the scale symmetrically disposed about the vertical centre line of the gauge.
- (d) The tip of the pointer shall be of the knife edge type extending across the scale divisions and shall be as close as practical to the dial.
- (e) Wherever applicable, gauges shall be clearly, strip marked in green to indicate the normal operating range and in red to indicate the non-permissible range of values. Such markings shall always be on the inner scale face and not on the glass face.
- (f) The units of measurement shall be clearly marked on the dial. A printed label of approved non-corrosive material indicating the duty of the gauge shall be neatly fixed on or near the gauge.

Gauge Installation and Mounting

Gauges shall be installed and mounted in accordance with the following:

- (a) Gauges shall be mounted vertically and in such a position that they can be easily read from floor level. If this cannot be done, the Engineer's requirements shall be ascertained.
- (b) Nozzles shall be provided for gauge tappings. Nozzles shall comply with the requirements of the Clause "Pipework".
- (c) Gauges for rotational equipment, such as for centrifugal and reciprocating pumps, shall not be mounted directly on pipework but shall be mounted on walls or on pedestal stands mounted so as to avoid vibration.

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Gauge cocks shall be provided at each end of the connecting pipework.

- (d) Pressure gauges shall be fitted with an isolating and air bleed cock of the type which has handle in line with the bore of the cock when the cock is open.
- (e) Pressure gauges used on sewage, sludge, powder, chemical or other applications where blockage or corrosion of the gauge is possible, shall be fitted with a diaphragm type chemical seal, both being liquid filled. The portion of the seal in contact with the process liquid shall be of a suitable non-corroding material and, when solids are handled, shall have a large threaded socket connection not smaller than 1" BSP. With liquids containing solids, the gauge and seal shall be mounted on top of a side-mounted cross having one horizontal and one vertical connection plugged, so arranged to permit cleaning (see drawing).

Pressure Gauges

Pressure gauges shall comply with the following:

- (a) Pressure, vacuum or compound gauges shall comply with SABS 1062. Gauges shall be of Accuracy class 1.6 and Durability grade A unless otherwise specified. The gauges shall bear the SABS standardisation mark.
- (b) Gauges shall have a scale diameter of not less than 100 mm.
- (c) Calibration shall be in kiloPascals with the full scale reading between 1,5 and 2 times maximum actual operating pressure except where otherwise specified.
- (d) All gauges shall be suitable for continuous operation and shall be liquid filled on all pump applications and where fluctuations in pressure may cause damage.
- (e) Gauges shall not be mounted directly on equipment subject to vibration.
- (f) For dry locations indoors, the casing may be reinforced plastic or epoxy coated aluminium and the elastic element and shank of stainless steel. For damp indoor locations, particularly in any location where sewage is flowing, and for all locations outdoors, the gauges shall be weatherproof and have the cases and other metal components of grade 316 stainless steel.
- (g) When used on steam lines a siphon shall be fitted between the steam line and the gauge which shall be filled with water before putting the gauge into service.

Temperature Gauges

Temperature gauges shall comply with the following:

- (a) Temperature gauges shall have dials not less than 120 mm diameter. Accuracy shall be + 1% of reading or better.
- (b) The gauges shall be fitted vertically into removable 316 stainless steel wells and the gauges shall be removable without leakage from the pipe or vessel. Protrusion into a pipeline shall be kept to a minimum. When handling sludge, sewage or other abrasive liquids the protrusion shall not exceed 15 mm and in this case the wells shall also be of a heavy duty abrasion resistant type.

THERMOMETERS

Thermometers shall be of the liquid column type and the complete tube shall be protected by a sturdy pocket of stainless steel or brass.

CHLORINATION SYSTEMS

The design of plant installations for chlorination shall suit the application concerned but shall comply, as a minimum, with SABS 0298.

CONTROL SYSTEMS

General

General requirements for all control systems are as follows:

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(a) All control systems, instrumentation, indication, actuation and other equipment which is necessary to provide an efficient, safe, reliable and easy to operate system in accordance with the requirements of the detailed specifications shall be provided.

(b) Control shall function as an integrated, coherent system.

(c) Protection systems with interlocks to prevent maloperation, including incorrect sequencing, and to prevent or limit damage to equipment resulting from operating conditions or equipment failure shall be provided.

(d) Emergency stop stations shall be provided next to each motor driven unit.

(e) The failure to start, tripping or stopping of any item of equipment shall prevent the start-up or shall initiate the appropriate shut-down procedure of related equipment as and when necessary.

(f) Full details for control systems, sequences, logic charts, protections, control panel layout and design, etc., shall be submitted to the Engineer for approval before manufacture. These shall include drawings and circuit diagrams.

(g) Indication of measured parameters on digital indicators shall be given to three significant places (or more, but not fewer than three).

SCADA SYSTEMS

Control systems which utilise computer based SCADA shall incorporate the following:

(a) The control system shall be configured so that the equipment is PLC controlled to the extent that the installation can operate under SCADA failure.

(b) Functions and information relating to a single item of equipment shall normally be provided on the control panel, MCC or other electrical panel. Functions and information relating to overall control shall normally be provided on the SCADA system.

(c) Mimic screens provided for SCADA systems shall, where applicable, include at least the following:
Overview of scheme; including the process flow diagram and indicating all electronically monitored parameters if these are not included in a sub-system.

Overview of each separate installation.

Individual unit (Centrifuge, compressor, pumpset, etc.).

Equipment sequence selection.

Equipment start interlocks.

For each motor larger than 55 kW, motor status and, where applicable, motor protection relay diagnostic.

Electrical reticulation schematic.

Hardware diagnostic.

Alarms.

Set-points for alarm, trip and control loop functions (including password protected alteration facility).

Record of equipment and process parameters at instant of equipment trip and station trip.

Trending of all monitored system parameters, with separate screens for logical groupings from an operating point of view.

Communication status of control system hardware.

SCADA security system password current settings, including personnel names.

Ancillary equipment status; e.g. security, fire detection, UPS).

Printing.

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(d) Indication of measured parameters shall be provided to three significant places or more.

(e) All setpoints, such as temperature trip settings, flow trip settings, level settings for pump switch-on, etc., shall be indicated on mimic screens. It shall be possible, with password protection, to alter the set-points.

(f) All points of inflection of measured parameters shall be recorded.

(g) At least one colour printer (for graphs, mimics, etc.) and one line printer (for alarms) shall be provided.

(h) An alarm condition which leads to the control system executing an equipment trip shall be logged and all subsequent alarms which occur as a result of the tripping action shall be logged as subordinate alarms. The condition which caused the trip shall be fully described with respect to the:

Item of equipment.

Trip setpoint reached.

Description of parameter; i.e. flow, temperature, etc.

Time.

(i) Alarm conditions which lead to the control system executing an equipment trip shall be provided with a suitable time delay in order to limit the number of tripping actions caused by electrical disturbances or similar occurrences. The time delay for each trip shall be decided in conjunction with the Engineer.

CONTRACTOR'S DRAWINGS

The following requirements apply to the preparation of the drawings:

(a) Drawings shall be prepared in accordance with the latest issue of SABS 0111 (or superseding document). The equivalent BS code of engineering drawing practice will also be acceptable.

(b) Drawings shall be to A0 size.

(c) Drawings shall be to scale, with both the scale and the drawing being large enough to clearly show all relevant components of the plant and equipment without misunderstanding.

(d) Drawings shall be in black ink.

(e) In addition to the usual plan and two side elevations, sufficient additional sections shall be included to clearly show the arrangement of all plant and equipment.

(f) General arrangement and detail drawings shall be cross-referenced.

(g) Items and components shall be systematically and clearly numbered, with consistency (same item numbers) between layout and detail drawings for the same plant or equipment.

(h) Item lists shall be provided on the drawing or on a separate parts list.

(i) Item descriptions shall include the material of construction, quantity and full identification information, including, as applicable, brand name, manufacturer's reference number, model number, size, rating, source, duty, quantity, etc.

The Contractor shall prepare and correct drawings to satisfy the requirements of the Conditions of Contract and of this Specification to the satisfaction of the Engineer and shall incorporate reasonable

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changes required by the Engineer.

TUITION

General

The Tenderer shall price for tuition of operational and technical staff. Unless otherwise called for in the Detailed Specification, the Tenderer shall price for the on Site personal tuition of operational staff members and engineering staff members.

The Contractor shall also provide all WMA staff involved with printed copies of the tuition material. Printed copies shall preferably also be included in the Manual.

Operational Staff Tuition

The Contractor shall provide the following tuition as applicable to the Contract:

- (a) Start-up, shut-down and operating instruction for all operational modes for the Works shall be provided. This shall be comprehensive and shall include actions to be taken in the case of all alarm conditions and basic fault finding.
- (b) A layout drawing of the installation, a process flow diagram, and a P&ID shall be provided for each Operator. The instructions described in (a) above shall also be provided in printed form for each Operator.
- (c) If the specified control system is SCADA based, the tuition shall include instruction on the SCADA system.

Electrical Engineering Staff Tuition

The Contractor shall provide the following tuition as applicable to the Contract:

- (a) Control system software instruction.
- (b) Detailed overview of 11 kV protection and settings.
- (c) Tuition on setting of 11 kV protections.
- (d) Motor protection relay and settings.
- (e) Overview of PLC programming for the purposes of making changes and re-loading programs if PLCs are replaced.
- (f) Overview of SCADA system.

OPERATING INSTRUCTIONS

Wall mounted operating instructions, if specified in the Detailed Specification, shall comply with the following:

- (a) Start-up, Shut-down and Operating instructions shall be provided. These shall be comprehensive and shall indicate actions to be taken in the case of all alarm conditions. These shall be written from the point of view of the plant operator.
- (b) A layout drawing of the equipment installation, a process flow diagram, and a P&ID shall be provided.
- (c) Instructions shall be framed (wooden frame, glass front, hardboard backing) and shall be attached to the wall in the control room using brass screws.

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Miscellaneous

The Manual shall comply with the following:

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(a) A Manual for the complete Works is required.

(b) Two copies of the Manual shall be provided prior to commissioning of the Works. One copy is to be submitted for acceptance by the Engineer and will be returned to the Contractor. The second copy will be used by the operational staff on Site during commissioning. Unless otherwise specified, six copies of the final version of the Manual shall be provided prior to the end of the Trial Operation Period.

(c) The Manual shall be of a standard acceptable to the Engineer. At least one set shall contain original copies and this set shall be marked "Original". The other sets shall be marked "Copies 2 to 6".

(d) Binders shall have hard, plastic protected covers utilising four-ring, spring-clip holders. Sufficient binders shall be used to make each volume easy to use. One spare, empty binder shall be provided for every three used. A title label shall be affixed to the spine of all binders. This shall indicate contract number, title and location, Contractor's name and, where required, plant description, volume number and contents.

(e) Labelled separator sheets shall be provided between each section and sub-section and also wherever volume or complexity make this advisable.

(f) The Manual shall be in English, shall be easy to use, practically and neatly presented, clearly sectionalised and titled, provided with a Contents List and shall be specifically applicable to the system as installed.

(g) Where standard equipment manuals are used in any sections, these shall be marked up to be unambiguously applicable to the equipment installed and marking up shall be done in a manner which will be transmitted to photocopies.

(h) All sections and sub-sections shall be numbered. Numbering of the Contents List shall be sequenced so that section numbering is unique.

(i) Drawings shall be to a scale which makes all details clear. Large drawings shall be held in plastic envelopes in the Manual. A4 and A3 drawings shall be bound directly. Drawings shall also be provided on CD in AutoCAD format.

(j) Where practical, each section shall form a separate volume.

The Manual shall be divided into sections and shall include the information described below.

Section 1 – General

The following shall be provided:

(a) Contents List for the complete Manual. This shall consist of:

an overall contents list.

a detailed contents list in front of each section and/or sub-section.

a comprehensive list of all drawings.

The Contents Lists shall be structured so as not to be affected if volumes are added or subtracted from the Manual.

(b) Equipment List for all individual items of mechanical, electrical, instrumentation and control equipment. The Equipment List shall include the make, model, serial number, description, size, range, performance data, motor and drive details, supplier's name, address and phone numbers, all as applicable. The design duty, the position of each unit's installation and its purpose in the system shall be given. Additional

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information which shall be provided for instruments includes the tag number and setpoints. A schedule of corrosion protection systems used shall be provided for fabrications such as tanks, supporting structures, clarifier bridges, etc.

(c) Cable schedule for power and instrumentation cables. This shall include the cable construction, conductor material, insulation, protection, voltage rating, start and finish points, route length, duty, load, voltage drop, no. of cores, core area, no. of cores used and gland size. For cable voltages above 400 Volts, the schedule shall also include the purchase details, specification and date of manufacture.

(d) Cable routes.

(e) Drawing list of all Contractor's and Tender drawings.

(f) The detailed specification, Section D of the Specification, may be included in this section.

Section 2 – Process, Operation and Control

The following shall be provided:

(a) Description of plant and process design and including all design parameters.

(b) A description of each system supported by drawings, process flow or circuit diagrams and explanatory sketches to assist operating staff.

(c) Description of control system, including control panels and SCADA system, as applicable and including controls, instruments, settings, indications, alarms, trips, etc. Functional Specification. List of protections, including description, sensor, operating limits, settings, etc.

(d) Straight forward, step by step, initial start-up instructions for commissioning. These shall include operating steps, precautions, settings, adjustments, observations, etc.

(e) Training manual including normal start up, adjustment, operating and shut down procedures for the system as installed and including settings, adjustments, observations, etc. The procedures shall highlight any safety precautions to be observed.

(f) Functional description and operation instructions of all electrical panels.

(g) An Instrument List giving a description of the duty as well as the serial number, normal operating reading, maximum or minimum permissible readings, set-points (activation, warning and trip), etc.

(h) Trouble-shooting guide, including symptoms, causes and solutions.

(i) Documents:

as-built system, layout and GA drawings.

plant circuit or flow diagrams

P&IDs, indicating equipment, piping, valves, instrumentation and safety devices.

control panel layouts.

I/O list, program listing, loop and logic diagrams for each PLC, if applicable.

paper copies of SCADA mimics, if applicable.

system control diagram and logic sequence chart, as applicable.

Section 3 - Maintenance Schedules

The following shall be provided for all mechanical, electrical, instrumentation and control equipment:

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A comprehensive lubrication schedule of recommended and initial lubricants, capacity, lubrication periods, etc., for all items.

A comprehensive maintenance schedule of routine maintenance by time period for the new installation and including information for individual items.

It is not required that the detail information in supplier's standard manuals is repeated here and cross-references will be acceptable on condition that the position of the supplier's manual in the contents list is given.

Section 4 - Mechanical Equipment

The following shall be provided for each item of mechanical equipment:

A copy of the information applicable to the item and appearing in the Equipment List.

A separate table containing the unit's nameplate information; or, a photograph of the nameplate.

Technical and descriptive literature, including principle of operation and construction.

Installation instructions.

Detailed operating instructions.

Control and electrical details, including logic sequence, circuit diagrams and software, as applicable.

Full technical and maintenance information including instructions for assembly, disassembly, lubrication, adjustment, calibration, reconditioning, repair, etc.

A spares list giving the item number, part number, description, quantity and materials. A list of recommended spares.

Factory and Site test results.

Corrosion protection systems used, coating supplier's data sheets and coating repair procedures.

Drawings:

performance curves.

layout drawings.

large scale, dimensioned, cross sectional and arrangement drawings of the item for assembly and spares recognition purposes, cross-referenced to the spares list.

dimensioned drawings of fabricated equipment.

circuit layout of any auxiliary systems.

Section 5 - Electrical Equipment

The following shall be provided for each item of electrical equipment:

- (a) A copy of the information applicable to the item and appearing in the Equipment List.
- (b) A separate table containing the unit's nameplate information; or, a photograph of the nameplate.
- (c) Technical and descriptive literature, including principle of operation and construction.
- (d) Control and electrical details, including logic sequence, circuit diagrams and software, as applicable.
- (e) Installation instructions.
- (f) Detailed operating instructions.

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- (g) Full technical and maintenance information including instructions for assembly, disassembly, lubrication, adjustment, calibration, reconditioning, repair, etc.
- (h) A spares list giving the item number, part number, description, quantity and materials. A list of recommended spares.
 - (i) Factory and Site test results.
 - (j) Drawings:

electrical reticulation.
 equipment overall dimensions.
 wiring diagrams.
 switchboard layout drawings and SLDs.
 electrical panel construction drawings.

Section 6 - Instrumentation Equipment

The following information shall be provided for each item of instrumentation equipment:

- (a) A copy of the information applicable to the item and appearing in the Equipment List.
- (b) A copy of the relevant information in the table of instrumentation in the sub-clause "Operation Section" and including all settings.
 - (c) Installation instructions.
- (d) Descriptive and technical literature giving full details of performance, operation, calibration, setting, service, maintenance and spares including suitable assembly drawings.
 - (e) Technical and descriptive literature, including principle of operation and construction.
- (f) Control and electrical details, including logic sequence, circuit diagrams and software, as applicable.
 - (g) Factory test results.
- (h) Full technical and maintenance information including instructions for assembly, disassembly, lubrication, adjustment, calibration, reconditioning, repair, etc.
 - (i) Drawings:

circuit diagrams of both instrumentation systems and individual instruments.
 overall dimension and installation drawings.

Section 7 - Control Equipment, Network and Software

The following shall be provided, as applicable to the Works:

- (a) A copy of the information applicable to PLCs, transmitters, HMIs, computers, etc. which appear in the Equipment List.
 - (b) Cross-referenced listing of all I/O used.
 - (c) Prints of SCADA mimic screens (all copies to be provided in colour).
 - (d) An annotated program listing.
 - (e) Drawings:

copy of hardware diagnostic mimic.
 loop drawings showing field terminal numbers, marshalling terminal numbers and PLC rack/slot/terminal numbers.

Section 8 – Drawings

All drawings not filed elsewhere shall be filed in this section.

Contents List

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The contents of the Manual shall be generally as follows:

INSTALLATION, OPERATIONAL AND MAINTENANCE MANUAL

GENERAL

Contents List
Overall Description of Works
Equipment List
Drawing List
Cable Schedule

PROCESS, OPERATION AND CONTROL

Description of Plant and Process
Control System
Protection System
Commissioning
Normal Operation
Instrument List
Troubleshooting

MAINTENANCE SCHEDULES

Lubrication Schedule
Maintenance Schedule

MECHANICAL EQUIPMENT

(Item 1; e.g. "Chlorinators")
(Item 2; e.g. "Pump")
(etc.)

ELECTRICAL EQUIPMENT

(Item 1; e.g. "Transformer")
(Item 2; e.g. "MV Switchboard")
(etc.)

INSTRUMENTATION EQUIPMENT

(Item 1; e.g. "Turbidimeter")
(Item 2; e.g. "Pressure Transducer")
(etc.)

CONTROL EQUIPMENT, NETWORK AND SOFTWARE

(Item 1; e.g. "PLC")
(Item 2; e.g. "SCADA Software")
(etc.)

DRAWINGS

This contents list may be elaborated and/or repeated as required.

STARTING, SITE TESTING AND COMMISSINING OF PLANT

Before starting up any section of the Works, the Contractor shall make all necessary checks to ensure that the installation has been correctly carried out, that all ducts, pipework, tanks, etc., are clean, that all equipment is correctly aligned, lubricated and connected up, and is in all respects ready to start with safety. It shall be noted that all initial fill requirements such as lubricating oil shall be the responsibility and at the cost of the Contractor.

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The Contractor shall arrange for the Engineer to be present at initial start up and also, if applicable, for the electrical and control instrumentation sub-contractors to be present.

The Contractor shall start up and test each section of the Works. These tests will be carried out to certify that the Works is operating in accordance with the requirements specified and must be witnessed by the Engineer. All necessary modifications and rectifications shall be carried out during this period.

Three copies of reports in writing on all tests shall be submitted by the Contractor within two weeks after the tests have been carried out.

When all tests have been completed to the satisfaction of the Engineer or the Municipality, the Works shall be commissioned. Unless the Engineer states otherwise, the complete plant, including all control functions and control systems shall be commissioned as a unit and the process performance requirements shall be achieved during normal operation. The Contractor shall train the operational staff in the starting, operating and stopping of the Works, and shall train the maintenance staff on the routine maintenance requirements.

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PARTICULAR SPECIFICATION: M01: MECHANICAL SCREENS

CONTENTS

M01.1 INTERPRETATIONS

This specification covers detailed design parameters, manufacture, supply, installation, testing and commissioning of inclined mechanical front raked screens, screenings conveyor and screenings screw compactor for the screening of raw sewage. The Specification shall be read in conjunction with the Project Specification and other relevant Particular Specifications.

M01.1 INTERPRETATIONS

M01.2.1 Abbreviations

In this Specification the following abbreviations will apply:-

- ANSI : American National Standards Institute
- ASTM : American Society for Testing and Materials
- BS : British Standards Institution
- SANS : South African National Standards
- SIS : Swedish Institute of Standards
- DIN : Deutsch Industry Normen
- ISO : International Organisation for Standardization
- ASME : American Society of Mechanical Engineers
- SAECC : South African Electrolytic Corrosion Committee
- AGMA : American Gear Manufactures Association

M01.2.2 Standards

All design standards for the front raked screen equipment shall be subject to the latest amendments and editions of the following standard specifications:-

- SANS 10400 : National Building Regulations
- BS 5304 : Code of practice for safeguarding of machinery
- SANS 9096-1: 1994 : Testing of welders, where applicable to the type of welding required
- BS 292 Part 1: 1987 : Dimensions of ball bearings, cylindrical and Spherical roller bearings
- SANS 10162-4 : Structural use of Steel Part 4: The design of cold-formed stainless steel structural
- SANS 10044-3 : Welding Part 3: The fusion of steel (including stainless steel): Tests for the approval of welding procedures
- SANS 10044-4 : Welding Part 4: The fusion welding of steel (including austenitic stainless steel): Tests for the approval of welders working where weld procedure approval is not required.
- SANS 10064 : The preparation of steel surfaces for coating
- SANS 10102-4 : Selection of pipes for buried pipelines Part 1: General Provisions
- SANS 10104 : Hand railing and balustrading (safety aspects)
- SANS 10111-2-1 : Engineering Drawing Part 1: General principles Engineering Drawing Part 2: Geometric Tolerancing Section 1
- SANS 10341 : Installation and maintenance of bearings – General guidelines
- SANS 1700-5-9 : Fasteners Part 5: General requirements & material properties Section 8: Corrosion resistant stainless steel fasteners-Bolts, Screws & Studs
- SANS 1700-5-10 : Fasteners Part 5: General requirements & material properties Section 8: Corrosion resistant stainless steel fasteners-Nuts
- ISO 281 : Rolling bearings -- Dynamic load ratings and rating life
- BS 4999 : General requirements for rotating electrical machines. Specification for standard dimensions
- SIS 05 59 00 : Pictorial Surface Preparation Standards for Painting Steel Surface

M01.2.3 General Requirements

This specification must be read in conjunction with the following specifications:-

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M08: Particular Specification for Gearboxes
M16: Particular Specification for Conveyor Equipment
M17: Particular Specification for Actuator equipment
E01: Particular Specification for Electric Motors
E03: Particular Specification for Isolator Push Button
G01: Particular Specification for Colour Codes
G02: Particular Specification for Corrosion Protection
Volume 9: Automation and Control Design Standards Level Measurement

M01.2 DESIGN OF SCREENS

M01.3.1 General Design Parameters

Screens shall be designed such that the following requirements are met:-

- To facilitate manufacture, inspection, installation, maintenance, cleaning and repairs,
- Ensure safe and satisfactory operation for an acceptable life expectation of 12 years under the ambient conditions prevailing at the Site,
- Prevent undue stresses being produced by expansion due to temperature changes.
 - Keep maintenance costs to a minimum,
 - To comply with the legal requirements in respect of safety as well as the prevention of water and air pollution,
- To satisfy any specific requirement contained in the statutory codes and legislation, and
- Suitable for operation 365 days per year, 24 hours per day under specified design conditions.

M01.3.2 Specific Design Parameters

The screening equipment shall remove from the influent debris materials of raw sewage to minimise the subsequent damage to equipment or that may result in unsatisfactory operation of downstream unit processes. This shall be considered as a pre-treatment process.

The influent received at the head of works for the particular wastewater treatment works shall be given in the Project Specification.

M01.3.2.1 Head of Works Screens Design Parameters

The design loads of the screenings for the head of works screens shall be based on the influent sewage characteristics at the particular wastewater treatment works.

The average daily screening production rate is 0.025 m³ of dry screenings per Ml.

The peak screening load shall be equal to 5 times that of the average daily load.

The inflow channel shall not be divided into more than two channels at any division of a channel to maintain the minimum required inlet flow velocity. No fewer than two screens shall be in parallel.

The straight length of channel ahead of the screens shall not be less than 5 times the width of the approach channel unless site constraints prevent this arrangement.

M01.3.2.1.1 Head of Work (HOW) Screen Isolation

The head of works screens are to be supplied with electrically actuated sluice gates manufactured from stainless steel upstream and downstream of each screen.

M01.3.3 Types of Screens

Two Types of bar screens shall be covered under this particular specification namely:-

1. Hand Rake Screens

- Screen field bars having a clearance between the bars of 40 mm shall be installed at the head of works,
- Emergency bypass screens at the head of works shall have 50 mm bar spacing, and Manually hand raked screens shall be installed at an incline of 60

° from the horizontal. The complete screen shall be manufactured from 304 L stainless steel.

A suitable hot dipped galvanised rake shall be provided with the hand rake screen.

2. Head of Works Screens

- The screen field bars shall be accurately set and secured to give the maximum clearance between bars of 12 mm. The screen bars shall be manufactured from bars that have a tapered cross section.
- The maximum velocity through the screen opening shall be 1.2 m/s.

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- The minimum approach velocity shall be 0.6 m/s

The complete screening field shall be manufacture using 304 L stainless steel. The individual bars shall be clamped into position and shall extend from the sole plate and shall extend to at least 200 mm above the maximum flow depth within the channel as indicated on the drawings. The bars shall be fitted with laser cut spacer plates that shall allow for easy removal in the event of damage to the spacer plates. The screen shall be front raked and shall operate by means of a suitably designed lifting device, the entire driving device shall be installed above the channel coping level.

M01.3 INCLINED FRONT RAKE BAR SCREEN

The screen frame, superstructure and operating components above channel coping level shall be completely clad in 3CR12 panels which shall be removable for maintenance and repair purposes. Screenings conveyors shall be provided with sufficient wind deflection shielding to prevent light screening's (e.g. paper and plastic) from being blown off the screening conveyor.

Approach velocities shall be no more than 0.9 m/s at peak hourly flow rate and no less than 0.6 m/s at average dry weather flow. Should grit removal chambers follow the bar screens then the minimum velocity shall be greater than 0.6 m/s. These requirements shall be met in the design and detailing of the civil structures.

The Tenderer shall submit full details regarding the plant offered by him and shall submit full details of the requirements for fitting the units into the civil structure including all necessary illustrations, drawings and pamphlets, etc. The Tenderer shall submit with his tender complete references of clients who have installed screens identical to that offered by the Tenderer.

M01.4.1 Housing

The screen housing shall be manufactured from 3CR12, with a minimum thickness of 4.5 mm and shall be recessed to accommodate the scraping mechanism, chain guides and idler sprockets in order to maintain the screening of the full channel width and depth shall be provided. The screen housing shall be fitted with a rubber skirt and stainless steel diversion plates, to accommodate the total channel width not covered by the screen field. The screen shall be set in the channel at approximately 15° fr om the vertical.

M01.4.2 Access

The screens shall be provided with suitably designed 3CR12 hand railings and deck gratings which shall provide access to the screens for repair and maintenance. The screening channel shall be provided with electrically actuated channel gates manufactured from 304 L stainless steel on either side of the screen to facilitate the maintenance and the repair thereof.

M01.4.3 Sole Plate

The screening field shall be provided with a sole plate designed such and profiled as to induce the accumulation of debris material at the lower portion of the screen for effective removal. The leading edge of the sole plate shall be installed at the invert level of the receiving channel.

M01.4.4 Rake System

The screen shall be periodically raked by a mechanized rake system which shall be controlled by the differential water level and timing devices or by continuous operation.

A scraper cleaning mechanism at the top of the travelling rake shall remove the screenings collected by the rakes. The moving rakes shall be suspended between two side chains, which shall be driven through a head shaft and sprockets.

The rakes shall be bolted with counter sunk bolts to the main comb frame for ease of removal when necessary.

M01.4.5 Screen Blade

The scraper cleaning mechanism shall be positioned at the discharge chute area and shall comprise of a single UHDPE blade positioned above the upper edge of the screening retention plate which is activated as the rakes rotate. The blade shall be positioned so that it efficiently cleans the full width of each screen rake.

Scraper arms shall be attached to the side frame and designed to pivot so as to allow efficient cleaning of each rake as it passes. The bearing for the scraper arm shall be self-lubricating polypropylene. The

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discharge height of the rake mechanism shall be sufficient to allow free and unhindered discharge to the conveyor.

M01.4.6 Discharge Chute

Screenings shall be removed from the rakes and dropped onto the discharge chute.

The discharge chute shall be manufactured from 304 L SS, shall at least be the length of the screen and shall be positioned such that the screenings are deposited into the screenings conveyor without spillage of any of the screenings.

M01.4.7 Drive Units

Refer to Particular Specification M08: Mechanical Gearboxes for a detailed specification on gearboxes. Also refer to Particular Specification E01 for a detailed specification for the Electric Motors.

A torque arm shall be attached to the drive unit to accommodate vertical adjustment. A facility shall be incorporated within the drive mechanism, to enable the drive chains to be correctly tensioned, and the combs to be accurately positioned across the screen field face.

This adjustment shall be possible without the dismantling of any part of the screen frame and without the necessity for any special tools. The comb teeth shall make an approximate angle of 5° to the plane of the screen field when engaged.

The geared motor and moving comb system shall be protected from damage caused by jamming, by means of an Intelligent Motor Protection Relay type device with built in phase angle protection. As a backup device a torque overload coupling with a limit switch shall be provided. The limit switch must have at least one SPDT contact or one normally open and one normally closed contact capable of switching at least 500mA at 230 Volts AC. The motor and gears shall be correctly sized to avoid over stressing of parts. A facility for reversing the rake drive back to a stationery park position must be provided.

M01.4.8 Screen Rake Control

The operation of the screen raking mechanism shall be automatically controlled by the upstream water level and shall be timer controlled incorporating; variable time between activation and variable operation duration. An override for continuous operation based on a maximum water level within the inlet structure shall be included. The automatic controls of the raking mechanism shall be supported by a manual override. The timing devices shall be supplied and installed by others.

M01.4.9 Channel Parameters

The channel preceding and immediately following the screen shall be shaped and sloped to eliminate the deposition of solids and permit draining of the channel. The channel shall be constructed by the Civil Contractor.

The screen supplier shall be responsible for providing the Engineer and the Civil Contractor with information regarding the civil requirements of his screen on a timeous basis.

M01.4.10 Chains and Sprockets

The chains connecting the comb frames are to have vesconite rollers and 304L SS side plates and pins. The sprockets shall be suitably sized for the proposed chain, giving a 0.2 mm clearance between the roller and the seating curve.

Preference will be given to a chain turn about track arrangement instead of bottom sprockets below water level.

M01.4.11 Welds and fasteners

All stainless steel metals are to be welded together unless otherwise stipulated. All welds are to be in accordance with SANS 10044. All submerged fasteners shall be 316 SS.

M01.4.12 Control Process

The screens shall be automatically controlled, based on:

- Timer controlled operation of the screen raking mechanism with a variable time between activation of the raking mechanism and variable duration of operation of the raking mechanism
- Override for continuous operation of the raking mechanism based on a water level in the inlet channel

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- The activation of the raking mechanism shall be fitted with a manual override with "inching" facility in both the forward and reverse directions
- The screen control settings must be adjustable from the SCADA.

M01.4.13 Screenings Conveyor

The covered screw type conveyor shall be supplied in 3CR12. The covers shall be manufactured from clear plastic and hinged for easy inspection of the screw.

Any drainage, spillage and wash water from the conveyor must be returned to the influent sewer preferably upstream of the screens.

M01.5 SCREW COMPACTOR

M01.5.1 General

A screw compactor shall be included for if specified in the Project Specification to remove excess liquid from the screenings collected. The screenings removed from the screens shall be transported by a screw conveyor system to the compactor. After being washed and dewatered the screenings shall be discharge into receiving bin for the disposal thereof. The screw compactor and bin shall be located within a bunded area in which spillage from the equipment shall be collected and returned to the inlet channel.

Where specified in the project specification, the contractor is to supply the trolley and the hand winches for handling of the bin.

The compactor shall accommodate feed from a number of conveyed sources.

M01.5.2 Design Parameters

The screw compactor shall consist of a washing zone, drainage zone, an inlet zone, a conveying zone and a compacting zone.

The design of the screw compactor shall be such that the extruded product shall have a moisture reduction of 50% minimum, a weight reduction of at least 65% and a volume reduction of no less than 70%. The screw compactor shall be manufactured from 304 L stainless steel.

The screenings shall enter the inlet hopper where it is washed and then transported and compressed by the screw and discharged. As the screenings are compressed, the liquid drains out of the holes in the bottom of the pan and discharges back into the inlet channel.

Provision for bi-directional rotation of the screw compactor shall be made in order to remove any blockages that may occur. Access to the operation of this feature shall be by means of a key switch located locally in the field. A separate panel shall be provided to accommodate the relevant field control equipment. The materials used for the manufacturing of this field station shall conform to the requirements of the E03: Particular Specification for Isolator Push Button.

A spray system to wash the screenings shall be provided at the inlet Zone.

Inlet Zone

The inlet zone shall be designed to suit an inlet chute. The inlet chute shall have a minimum area of 0.4 m².

Drainage Zone

The drainage zone at the feed end of the compactor permits the drainage of free water. The drainage zone shall be a minimum length of 200 mm.

Conveying zone

As the screw rotates it conveys screenings along the length of the conveying zone up to the compacting zone. As the screw rotates the material, gravity and the surface friction react to force the water from the screenings. The conveying zone shall be a maximum length of 8000 mm.

Compacting Zone

The resulting compacted plug of screenings is forced out of the discharge. The compacting zone shall have a minimum length of 500 mm.

M01.5.3 Helical Shaft Screws

The screw shall have a helical flight and shall have a minimum of 6 flights per linear meter. The shaft screws shall be designed to withstand the subjected torsional forces imposed during the operation thereof. Lower bearings shall be enclosed in a watertight assembly suitable for submerged operation in grit service. The bearing shall have an L-10 rating life of 50 000 hours while operating at maximum load. Internal

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bearing parts shall be completely sealed from outside contamination

The helical screw flights shall have easily-replaceable bearing shoes on the leading edge which shall support the screw through the trough and keep drain holes clean. The bearings shall be designed to withstand the thrust forces imposed. The screw shall operate at a maximum of 10 rpm.

The spiral shall run on a lined trough.

M01.5.4 Trough

The trough shall be totally enclosed to prevent spillage and contain odours.

M01.5.5 Drive Unit

The compactor-drive unit shall be mounted at the bottom of the inclined screw trough and shall be enclosed. The compactor shall be directly driven by an electric motor coupled to a shaft mounted gearbox. Refer to Mechanical Specification for Gearboxes and refer to particular specification E01: for a detailed specification for Electric Motors.

M01.6 SPARES AND TOOLS

The Tenderer must submit on the appropriate schedule a priced list of spare parts which is recommended should be kept by the water treatment plant for maintenance of the plant. Spares which the Client decides to order must be manufactured simultaneously with the rest of the equipment and be subject to the same tests for dimensions, tolerances, strength, etc. All spares must be packed separately and the cases appropriately marked. All spares must be new and unused.

A full range of spares must be kept available locally for not less than 15 years.

Tenderers shall submit a provisional price (where applicable) for a complete set of spanners, keys and tools required for the operation, adjustment and overhaul of the plant supplied. All spanners, keys and tools shall be new and unused.

M01.7 PROOF OF MAINTENANCE

The period of maintenance will extend over a period of 12 months calculated from the Completion as defined in the Appendix. However, should a portion or all of the plant and equipment fail / or require rectification during this period, the Engineer reserves the right to extend the Period of Maintenance in respect of such portion or all of the plant and equipment for a further period of not more than 12 months calculated from the date of Commissioning of such plant and equipment after rectification

M01.8 METAL PREPARATION AND CORROSION PROTECTION

Refer to particular Specification Corrosion protection.

M01.9 COLOUR CODES

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01: Colour Codes.

M01.10 QUALITY MANAGEMENT (QM) AND QUALITY ASSURANCE

QM shall be categorised as 'critical and major' for this section of the Project.

M01.10.1 Manufacture

Tenderers shall submit with their tender a detailed Project Quality Plan, stating how they control the flow of paperwork from commencement of the Project through final handover to the Client, a sample of their Quality Control Plan, (QCP) and Project Quality Plan, (PQP) both during the course of the Project, manufacture and finally, installation.

The successful Tenderer shall submit a QCP covering all aspects of the manufacturing process, indicating held points to allow the Engineer opportunities to evaluate the equipment for compliance to this specification.

All items of equipment shall be subject to inspections by the Engineer during design and manufacture per these QCP's.

In general, it is anticipated that this Project shall be in accordance with the relevant ISO 9000 requirements.

M01.10.2 Installation

The successful Tenderer shall submit a QCP covering all aspects of the installation of each item of equipment to be installed under this Project. The Engineer shall be afforded every opportunity to certain stages of completion of the installation to ascertain compliance with the Specifications and to witness the

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Contractor's site activities at the Engineer's discretion.

M01.11 SYSTEM PERFORMANCE

M01.11.1 Works testing

Each item of equipment shall be subject to inspection and testing prior to despatch from the works. All performance test results shall be made available to the Engineer for verification or when the QCP's require intervention or hold points for inspection.

M01.11.2 Before commissioning

- Check for correct oil level in gearboxes and that motors are greased properly.
- Ensure all HD bolts are torque down correctly.
- The alignment and levelling of each assembly shall be checked and the results shall be available for inspection by the Engineer.
- The electrical functions and control shall be checked by a responsible inspector prior to attempting to start any motor on this Project.

M01.11.3 After initial commissioning

- Ensure all oil pumps and flow or pressure switches are functional
- Measure the volume of screenings in the raw sewage upstream of the screens
- Measure the screenings removed from by the screen • Measure the volume of screenings in the raw sewage downstream of the screens

M01.11.4 Before expiry of the Defects Liability Period

The Engineer requires the Contractor to visit the site every quarter to inspect for the correct operation of the installed equipment. A report after each visit shall be submitted in writing within 14 days after the inspection.

M01.12 MEASUREMENT AND PAYMENT

Payment under scheduled items shall be made per complete installation as specified, electrical connections, etc and grouting, etc. Measurement and payment will distinguish between supply / delivery and installation / commissioning of the equipment.

The Tenderer shall include in his rates for coupling plates and the grouting thereof, nuts, bolts, washers and painting for the Mechanical Screens to provide a complete working unit.

The tendered rates or sums shall cover the cost of design, drawings, manufacture, supply, testing at the manufacturers works, delivery to site, off loading, installation, site testing, setting into operation, the supply of O & M manuals, commissioning and maintenance during the warranty period of all equipment specified and also for anything not specifically mentioned but obviously required, (e.g. all ancillaries, including all bolts, fastenings and brackets, safety guards and any work or material required for the proper installation of such equipment) to enable the equipment to be installed and/or function safely and correctly as specified. No claims whatsoever for extras will be allowed on the grounds that a necessary piece of equipment or a part thereof is not specifically mentioned

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C1: STANDARD ELECTRICAL SPECIFICATIONS

PART C1.1

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C1: STANDARD ELECTRICAL SPECIFICATIONS

PART C1.1

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1 GENERAL

1.1 General Aspects

In this document the term "Contractor" shall mean the contractor appointed in terms of this document, irrespective of whether the contract is a direct contract with the client or a sub-contract with a Principal Contractor.

If, at any stage, the Contractor wishes to deviate from these specifications, he may do so only if permission has been obtained from the Engineer in writing.

Prices tendered for equipment specified by trade names or catalogue references must be for the type and manufacture specified. If it is desired to use substitutes, the onus will be on the Contractor to prove that such substitutes are similar and equivalent to the article specified and meet with the approval of the Engineer in writing. The decision whether the tendered articles are acceptable shall rest solely with the Engineer. The cost implications of such substitutes shall be allowed for in the tendered amount.

Tenderers are required to enter at the time of tendering in the Schedules of Equipment and Materials Offered, the manufacturers of the materials on which their tender is based, and the catalogue numbers and other information by which the materials may be identified. Technical brochures of the equipment offered shall be submitted with the tender so that the unit concerned to be identified without ambiguity.

Tenderers shall only offer equipment for which proven backup is available in South Africa.

The Project Specification shall take preference over this General Specification where any conflict exists.

Should the Tenderer become aware of any discrepancies or apparent discrepancies in these documents, he shall notify the Engineer thereof.

Only technicians and artisans with adequate and applicable training and experience shall be used to carry out the work on this contract.

All materials and equipment used shall be of new or recent manufacture.

If requested by the Engineer, the contractor shall submit samples of cables, terminals, labels, trunks and other construction materials which he proposes to use on the installation for the Engineer's approval.

All materials and equipment used shall be suitable for the environment and service for which it is to be used. This pertains, inter alia, to corrosion protection, UV stability etc.

If installation commences with any type of material or equipment, then the same type shall be used throughout the contract.

Equipment offered shall be small enough to be moved through the available doorways, passages, etc., to their final locations.

Dimensions scaled from drawings shall not be used to obtain lengths of trays, trunks, cables etc. The runs shall be measured on site.

The Contractor shall make due allowance for other contractors' operations in progress concurrent with his own activities.

Any damage to protective coatings, equipment, services or structures caused by the Contractor shall be made good at his own expense.

The Contractor shall prevent pollution caused by spillages of fuels and lubricants, etc.

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1.2 Scope of Works

The Scope of Works shall be as per the Detailed Electrical Specification.

1.3 Site Conditions

The Tenderer shall take cognisance of the fact that the plant is currently in operation and a minimum --- disruption to the operation is required.

Motor manufacturers, switchboard manufacturers, electrical equipment manufacturers, are all warned that the motor and associated control equipment are to be installed in an extremely corrosive and often damp environment. The motor and allied equipment shall therefore be adequately protected.

2 Statutory Regulations Pertaining to Electrical Work

Except where otherwise specified or implied the contract work and equipment supplied shall comply with the latest revisions of the standard specifications listed, including generally:

SANS 10142 – 1 “The Code of Practice for Wiring of Premises”

Local Fire Regulations

The Regulations of the Local Supply Authority

The Regulations of the Department of Posts and Telecommunications

Where an SANS Standard does not exist or if not applicable, the relevant IEC or BS Standard shall be applicable.

The equipment supplied and work carried out shall fully meet and comply with the requirements of the Occupational Health and Safety Act (Act 85 of 1993) and the Construction Regulations 2014 issued in terms of Section 43 of the Act, Standards South Africa (a Division of the South African Bureau of Standards {SABS}) and all other statutory regulations and laws insofar as they may apply to an electrical installation of the type contemplated.

In the event of discrepancy between any of the specifications, regulations and codes of practice, the SANS 10142 Code of Practice for Wiring of Premises shall take precedence.

All references to “SABS” specifications shall be read as “SANS” in light of the recent changes by the South African Bureau of Standards.

Additionally, the following specifications, whether specifically mentioned within the tender document or not, shall also apply:

SANS 10111 - Part 1 - 1990 Clause 4.2 - Engineering Drawing - General Principles

SANS 1091 - National colour standards for paint

SANS 156 & VC8036 Moulded case circuit breakers

SANS 172 - Cartridge type fuse-links for low voltage electric fuses

SANS IEC60269-4 - Fuse-link holders for cartridge type fuse-links

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SANS 950	-	Unplasticised polyvinyl chloride rigid conduit and fittings for use in electrical installations
SANS 1507	-	Electrical cables with extruded solid dielectric insulation for fixed installation
SANS 1195	-	Busbars
SANS 10157	-	Direct-acting indicating electrical measuring instruments and their accessories
SANS IEC 60439	-	1 & 2 Low voltage switchgear and control assemblies
SANS 1973-1		
SANS 1973-3		
BS 4070	-	Performance of A.C. control gear equipment rated up to 660 V for use on high prospective fault-current systems
BS 587	-	Motor starters and controllers
SANS 1195	-	Busbars
SANS IEC 60947/4/1	-	Performance of A.C. control gear equipment rated up to 660 V and 60947/4/2 for use on high prospective fault-current systems
VC8011	-	Lamp holders

Terms Definitions and Abbreviated Terms

Abbreviations used in the Contract Documents shall mean:

AC	Alternating Current
A/C	Air-conditioning
AFFL	Above Finished Floor Level
AGL	Above Ground Level
BCEW	Bare Copper Earth Wire
BGL	Below Ground Level
BSS	British Standard Specification
DB	Distribution Board
DC	Direct Current
DP	Double Pole
DSO	Dedicated Socket Outlet
CCT	Circuit
CSA	Cross Sectional Area
CT	Current Transformer
DALI	Digital Addressable Lighting Interface
E	Earth
ECC	Earth Continuity Conductor
ELCB	Earth Leakage Circuit Breaker
ELI	Earth Leakage Isolator
ELV	Extra Low Voltage (< 50 V)
EW	Earth Wire
GSM	Global System for Mobile Communication
HDGS	Hot Dipped Galvanized Steel

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HID	High Intensity Discharge
HPS	High Pressure Sodium
HV	High Voltage (>33 000 V)
IEC	International Electro technical Commission
LV	Low Voltage (50 ≤ 1 000 V)
MCB	Moulded Case Circuit Breaker
MCC	Motor Control Centre
MCI	Moulder Case Isolator
MSB	Main Switchboard
MV	Medium Voltage (>1 000≤33 000 V)
PEC	Photo Electric Cell
N	Neutral
PEC	Photo Electric Cell
PILC	Paper Insulated Lead Cable
PLC	Programmable Logic Controller
PVC	Poly Vinyl Chloride
PVCA	PVC/SWA/PVC/PVC Cable
RC	Reinforced Concrete
SANS	South African National Standards
SCADA	Supervisory Control and Data Acquisition
SO	Socket Outlet
SP	Single Pole
TP	Triple Pole
UPS	Uninterruptible Power Supply
VSD	Variable Speed Drive
XLPE	Cross Linked Polyethylene Cable

3 DRAWINGS, DOCUMENTATION & TUITION

3.1 The Engineer's drawings for this Project shall be as listed in the Project Specification.

3.2 Contractor's Drawings, Documentation and Tuition

3.2.1 The Engineer's drawings covering the various sections of the installation are listed in the schedule of drawings. The working drawings of the Contract shall, where applicable consist of:

The Engineer's drawings;

The Architect's drawings;

The Structural Engineer's drawings;

The Engineer's drawings of the other disciplines, as applicable.

The drawings of other services and installations that is relevant for co-ordination and installation.

The installation drawings of other contractors and subcontractors where applicable.

Unless otherwise specified, three sets of the Engineer's drawings will be issued to the Contractor for installation purposes. Any further copies may be purchased from the Engineer.

3.2.2 Workshop drawings of the Motor Control Centre, Field Control Stations, Local Distribution Board in the Proposed Motor Control Centre Room, as well as any other switchboards are required for approval by the Engineer prior to fabrication. The Contractor shall submit shop drawings to the Engineer for examination and to demonstrate compliance with the Contract. Shop drawings shall include drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are prepared by

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the Contractor, manufacturers, supplier or distributors and which illustrate some portion of the work.

3.2.3 The Engineer's examination of shop drawings or samples shall not relieve the Contractor of responsibility for any deviation from the requirements of this Contract. Unless the Contractor has informed the Engineer in writing of such deviations at the time of submission of shop drawings or samples and the Engineer has given written approval for the specific deviation. Nor shall the Engineer's examination relieve the Contractor of responsibility for errors or omissions in the shop drawings or samples or for responsibility for erection or installation fit.

3.2.4 The Contractor shall submit to the Engineer four copies of marked-up structural drawings, or other drawings, showing changes and/or additional requirements to be made in the structure in order to accommodate equipment installed under this Contract.

3.2.5 The Contractor will not be allowed to rely on the Engineer for as-installed information that he may have compiled, to produce record drawings.

Drawings to be entitled "Record" shall bear the signature of the Contractor, or his authorised representative, and the date.

3.2.6 The Contractor shall obtain from the Engineer, if available, the Engineers' drawings in electronic format, which have been drawn on a PC based CAD system for the preparation of record drawings to be provided by the Contractor. The Contractor shall provide one set of paper prints of the record drawings for verification by the Engineer.

The record drawings shall be provided in electronic format upon completion of the contract. In the case that drawings are not available in electronic format, the Engineer will issue a set of Engineer's drawings to the Contractor near completion of the installation upon request of the Contractor. The Contractor shall mark these drawing to indicate the record of the installation.

3.2.7 A set of final layout and schematic record drawings shall be mounted towards the end of the contract in a purpose made frame inside a door, or where no doors are fitted, to the front plate of the cabinet. The frame shall be adequately sized to receive the equivalent of one A0 size drawing folded to a nominal size of A4.

3.2.8 The Contractor shall submit to the Engineer, two sets of approved record drawings in electronic format on CD (AutoCAD 2013 or higher).

The Contractor shall submit to the Engineer three manuals bound between hard covers and two electronic copies including the following: -

Dimensioned drawings of the layout of the equipment and systems.

Wiring diagrams cross-referred to the drawings described above, and to the Engineer's layout and schematic drawings.

All Test Certificates for tests did at the factories and on the site.

Detailed system and equipment descriptions.

Operating instructions.

Maintenance, adjustment and calibration instructions with preventive maintenance schedule and fault-finding procedures.

Spare parts list with names and address of component suppliers and a list of recommended spare components to be kept in stock.

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Submit two preliminary copies of the manual to the Engineer for scrutiny.

3.2.9 The Contractor shall provide thorough tuition of the Employer's staff in the operating and maintenance of the contract works.

3.2.10 When specified in the Project Specification, the Contractor shall allow in his price for the provision of a set of digital photographs taken on a monthly basis, for the duration of the contract, of all the areas and equipment where the contractor is involved. The photographs shall be properly dated with comments e.g. access to substation not possible etc. A set of the photographs shall be handed each month to the Engineers' Representative at the site meetings. These photographs may be used for the evaluation of claims.

3.2.11 The installation shall not be accepted and will be deemed incomplete until the Engineer has approved the manuals and handed them over to the Client.

3.2.12 Electronic Scanning

The Contractor shall allow for:

Hand-typed maintenance and operation manuals and hand-drawn "record" drawings to be scanned and stored on CD in Acrobat format and handed over to the Engineer.

Drawings shall be scanned at a minimum of 1200 dpi with the proviso that when the drawing is enlarged to its original size then all dimensions and text must be legible.

Documents shall be scanned at a minimum of 600 dpi or as required by Acrobat to produce a printable document.

4 LOCKOUT PROCEDURES / PERMIT TO WORK FROM

The Council has implemented a system whereby any party entering and/or proposing to undertake any electrical works on any of its premises or sites, is to be issued with a permit to undertake work, which is available from the respective Plant Manager etc. Work MAY NOT be undertaken in any form or context if this permit is not issued and validated by the Authorised personnel onsite.

Any and all low voltage (below 1000 Volts) work onsite at any of this Council's premises requires a written Permit to Work to be issued by the council.

NO MEDIUM VOLTAGE ELECTRICAL SWITCH OPERATION shall be permitted at all by any non-Council personnel. Only Council personnel, as permitted in writing by the Engineer may perform Medium Voltage Switch Operation.

Any work onsite at any of this Council's premises requiring excavation (for example excavation of cable trenches) requires a wayleave to be issued by the relevant Electrical Supply Authority. This Wayleave shall be reviewed and endorsed by the Engineer or his duly appointed representa.

5 LOCKS

The Tenderer shall supply locks whilst completing the work at hand. This Council shall supply locks for all the equipment on completion of commissioning.

6 PERMISSIBLE VOLTAGE DROP

Unless otherwise stated, the permissible voltage drop within low voltage installations from the Point of Common Coupling (PCC) shall be calculated as follows:

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“1V plus 2% of the voltage at the end of the circuit when the entire circuit is fully loaded”.

The PCC on low voltage installations shall be the respective transformer low voltage terminals.

7 CONTROL VOLTAGES

Control Voltages within Switchboards shall be deemed to be 24V DC. Control voltages for remote field equipment, for example Start/Stop stations, shall be 220V AC. If an existing installation is to be expanded, the existing control voltage shall remain.

8 LV Switchboards

8.1 General

Specific switchboard requirements shall be as per the Standard and Detailed Electrical Specification.

8.2 Switchboard Standards

(MOTOR CONTROL CENTRES, DISTRIBUTION BOARDS, TRAYS, BOXES, ETC.)

8.2.1 General

The manufacture of LV Switchgear and Controlgear ASSEMBLIES also referred to as motor control centres (MCCs) and distribution boards (DBs) {both collectively referred to as in this specification as “ASSEMBLIES” or “switchboards”} shall strictly comply with the latest revisions of the following standards:

SANS 60439-1 ‘LV Switchgear and Controlgear ASSEMBLIES Part One: Type-tested, Partially Type-tested ASSEMBLIES’.

SANS 60439-2 ‘LV Switchgear and Controlgear Part Two: Busbar Trunking’

SANS 1973-1 ‘LV Switchgear and Controlgear ASSEMBLIES Part 1: Type-tested, ASSEMBLIES with stated deviations and rated short-circuit withstand strength above 10kA.

SANS 1973-3 ‘LV Switchgear and Controlgear Part 3: Safert of ASSEMBLIES with a rated prospective short-circuit current of up to and including 10kA.

For ASSEMBLIES equal to or greater than a 10kA rating, switchboard manufacturers shall be in possession of a minimum of the test reports required as defined in SANS 1973-1.

Only authorized holders of these test reports may design and construct the ASSEMBLIES.

Copies of relevant test reports shall be made available to the Engineer immediately upon request.

Should this information not be presented to the Engineer upon request, Engineer reserves the right to call for another manufacturer to supply equipment that complies with this requirement and no compensation in any form shall be granted to the non-compliant party.

Notwithstanding any requirements of SANS 1973-1, the manufacturer of the ASSEMBLY (including the

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busbar assembly and mounting), shall re-torque the busbars onsite once fully populated and connected-up, prior to switch-on, and shall issue a certificate to the Engineer detailing that the bus-bar arrangement is still to the same standards as at the time of initial construction and is safe for operation.

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Suppliers/Manufacturers of switchboards equal to or below 10kA shall be in possession of a Permit to Apply Certification Mark, issued by the South African Bureau of Standards, in terms of the Specific Permit Conditions of SANS 1973-3.

ASSEMBLIES shall be fitted with a metal label, clearly displayed, detailing the information required by SANS 1973-1 or SANS 1973-3 as applicable.

8.2.2 MCC Preferred Design Requirements

The following switchboard requirements shall be assumed as correct unless altered in the Project Specification:

Mounting: Floor standing

Access: Front and rear access

Sectioning: Multi-section, Form 3b or Form 4 to SANS IEC 60439

Manufacture: 2.0 mm and 1.6 mm 3CR12
(see Fabrication below)

Finish: Painted Electric Orange (SABS 1091) external, White arc-free internal
(see Painting and Finishing below)

Cable Entry: Incoming & Outgoing – bottom
MCC gland plates to be 3CR12 painted
(see Glanding Section below)

Base: Single 100x50x6mm thick channel iron base with mitred corners and cross bracing between every 2nd tier, hot-dipped galvanised.

Doors: Lockable (see Doors and Covers below)

Protection: IP44 (panels fixed); IP12 (panels removed)

Functional Units: Removable but not fully withdrawable

Electrical Details: 400V, 50Hz, 3 Phase with full Neutra(see Busbars and Wiring below).

Earthing Details: Full length, rear of switchboard(see Earthing below).

All earthing bars to be tinned and coated with “Gliptal”.

Electrical Ratings: MCC Fault level to be to Transformer Secondary Output Symmetrical fault level, 3 second rating, applicable to Main and Distribution bars.
(See Project Specification for specific values and electrical loading requirements)

Dimensions: Height: 2100mm (max)
Depth: 400mm/600mm (standard)/800mm
Cubicle Size: 600mm (width) x 400mm (height) (MINIMUM)
Or
800mm (width) x 400mm (height) (MINIMUM)
Cubicle/Door Panel Spacing: 40mm horizontal
20mm vertical

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Note that cubicle height may be 384mm provided that the width is greater than 600mm.

An 800mm wide cubicle may be divided into 2 x 400mm cubicles (minimum 600mm cubicle height).

(Cubicle sizes may vary but only subject to written approval by the Engineer)

Positioning and Clearances: Switchboards (free standing) are to be positioned within existing or proposed switchrooms such that the following Clearances are maintained:

At rear of switchboard = 1000mm

At each end of the switchboard = 1000mm

In front of switchboard = 2000mm

On top of switchboard = 700mm (bottom entry panels)

On top of switchboard = 900mm (top entry panels)

The Engineer shall be the sole arbitrator in disputes relating to adherence to these and the general technical specification standards.

8.2.3 Hold Points During Manufacture

The following hold points require action and shall be adhered to prior and during the manufacturing process. Each step shall be completed in turn, requiring an inspection of the switchboard at the manufacturer's premises and requiring the written acceptance of the Engineer for each step, prior to acceptance:

Distribution Board Design

After manufacture of metal work, prior to painting

After painting, prior to installation of equipment (switchgear etc.).

Prior to delivery to site (at the sole discretion of the Engineer who may call for on-load testing in the manufacturer's workshop)

Should these points not be followed and the item in question proves to be incorrect, it shall be for the manufacturer/tenderer/contractor to undertake to repair the situation at his own cost.

8.2.4 Switchboard Preferred Tier Arrangement/Layouts

Switchboards are to generally comply with the following, but these guidelines may be altered due to the specifics of the installation:

For switchboards with a single incomer, this cubicle and tier shall be positioned on the entrance side of the switchroom.

For switchboards with a single incomer and a generator incomer, these cubicles and tiers shall be positioned in the middle of the switchboard.

For switchboards with two incoming mains feeders as well as optional and generator supplies, these cubicles and tiers shall be position in the middle of the switchboard.

PLC and Instrumentation dedicated Tiers shall be positioned within the switchboard on the side furthest from the entrance.

Bus-section switches shall be position in the middle of the switchboard adjacent to incomer tiers and cubicles.

Redundant/duplicated equipment shall be positioned on either side of a bus-section where practical.

8.2.5 Grouping of Equipment

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Each motor circuit shall be individually protected by a circuit breaker dedicated to the respective motor circuit. A single circuit breaker protecting multiple motor circuits will not be permitted.

Only one motor drive per cubicle is required. Where motors operate as a single group, these shall be controlled as a single motor.

A motor drive cubicle which houses multiple motor drives shall only be permitted, when all the motor drives in the group are dedicated to a single item of equipment and all the motors operate as a group. When a single motor, within any one group of motors which has been selected for automatic operation, trips or is isolated, all the motors within the group shall stop and shall be prevented from being restarted by electrical interlocking.

8.2.6 Door Interlocking on Switchboards

A circuit breaker shall provide the means of isolation to each motor drive cubicle, or a cubicle housing a group of motor drives which forms part of the MCC. The operating lever, of the circuit breaker mounted within the cubicle, shall be coupled to an operating handle fitted to the cubicle door and interlocked such that the door may not be opened with the circuit breaker in the "on" position. The operating handle shall be padlockable in the "off" position. Auxiliary contacts shall be provided, on the circuit breaker, to isolate the control circuit.

Refer to OHS Act (Act 85 of 1993), Section 14 "Machinery Regulations, Electrical", Clause 6(2) "Electrical Control Gear", which states:

"The user shall, whenever reasonably practicable, provide switchgear with an interlocking device so arranged that the door or cover of the switch cannot be opened unless the switch is in the "off" position and cannot be switched on unless the door or cover is locked".

8.2.7 Interlocking

Further to Clause above entitled "Switchboard Preferred Tier Arrangement/Layouts", the following electrical interlocking example, with 2 x Incomers and 1 x Generator, depicts the preferred arrangement to avoid paralleling of equipment:

SWITCH	A	B	C	D
Incomer Transformer No 1	Closed	Closed	Open	Open
Bus-Section No 1	Open	Closed	Closed	Closed
Incomer Standby Generator	Open	Open	Open	Closed
Bus-Section No 2	Open	Closed	Closed	Closed
Incomer Transformer No 2	Closed	Open	Closed	Open

Note this arrangement shall preferably be electrically implemented via a PLC OR mechanically via the use of keys. However, should the electrical option be implemented, each circuit breaker shall be fitted with a separate lock out key. The preferred systems for key locking equipment shall be Keyguard, Ronis or Keymaster (Allen Bradley) or equivalent and approved Key Interlocking systems.

These combinations will provide the following, and only the following, arrangements:

- A Busbar 1 fed from Transformer No 1; Busbar 2 fed from Transformer No 2
- B All busbars fed from Transformer No 1
- C All busbars fed from Transformer No 2
- D All busbars fed from Standby Generator

Refer to project specification for specific details as to circuit breakers being motorized or not.

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8.2.8 Fabrication

8.2.8.1 All electrical motor control centres (MCCs), distribution boards (DBs), sub-distribution boards (SDBs), boxes, trays, covers or any other enclosure housing electrical apparatus supplied, shall be fabricated from AISI SX 3CR12 sheet metal only unless stated to the contrary.

The tenderer/contractor/manufacturer shall take cognisance that MCCs and DBs shall in their entirety be manufactured from 3CR12. This shall include all framework used to form the structure of the panel. Angle iron or tubular structures shall not be permissible.

1. Outer panels, doors, covers, rails, distribution board framework etc shall be manufactured from 2mm thick 3CR12 sheet metal and 1.6mm thick 3CR12 sheet metal for internal partitions. The sheet metal shall be suitably bent, braced and welded where necessary to form a rigid structure (this sheet metal shall be 3CR12 only). Holes, doors, covers, rails, framework, etc. shall be accurately formed to present a true to line and plumb structure when completed. Where welding is necessary the inevitable excess material shall be ground down to the parent surfaces to present a blemish free surface for painting.
2. All screws employed in the manufacture of the electrical cubicles shall be in AISI 316 material with machine threads. No self-threading screws or self-setting rivets (pop rivets) will be permitted. Where the thickness of material for screw tapping is less than 5 x screw pitch, an externally knurled, threaded insert shall be installed to accept the machine screw. The insert shall be fitted with an hydraulically operated tool, and properly clinched, to ensure it will not rotate in the sheet steel, even when subjected to a torque of 200% of the torque required to shear the fitted screw. The inserts shall also be manufactured from AISI 316 stainless steel. Alternative methods of providing suitable screw anchorages in sheet steel may be considered, such as captured or welded nuts, but the detailed alternatives shall be submitted for consideration at the time of tendering.

8.2.8.4 Each tier shall be divided into compartments to accommodate equipment for motor drives, instrumentation, switchgear for main and sub-main feeder switches.

Each compartment of MCCs or larger DBs shall be totally separated from adjacent compartments with 1.6mm sheet steel (3CR12) barriers welded or bolted into position and where wiring is required to pass through these barriers, brass brushed holed shall be provided.

Panel tiers to be bolted together and not welded.

8.2.8.5 Accessible PVC wireways shall be provided to afford routes for conductors between the various compartments of each switchboard/MCC. Internal wiring shall be kept separated from external wiring and as far as possible the internal serving of PVC/PVCSWAPVC cables entering the switchboard/MCC shall be left around the conductors until the cable enters the compartment to which it is to be connected.

Low current and instrumentation/signal cables shall be kept separate from other cables right up to the point where the conductors are connected to the required terminals on the apparatus. Accordingly, where required, separate sheetmetal (3CR12) wireways shall be provided in each board to ensure this separation.

All instrumentation and signal cabling shall be routed via galvanised conduit within the MCC.

8.2.9 Busbars and Busbar Chambers

8.2.9.1 Totally enclosed busbar chambers shall be provided though out the length of the MCC or DB. The busbar chamber shall have front, back, top and end covers.

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The front and back covers shall be secured with square hatch keys, with one catch per cover lockable by padlock. The top and end covers shall be bolted.

The busbar chambers shall be so positioned in the MCC or DB at the top that each and every connection is easily accessible and sufficient space is provided to easily operate a torque wrench on each and every bolt/nut.

8.2.9.2 Dielectric barriers shall be provided in the busbar chamber at 2 x tier module. The dielectric may not be split and offered into position as separate parts but shall instead be slotted to allow the busbars to pass through. The slotted holes shall be fitted with U-shaped rubber gasketing to ensure the busbar is snugly fitted to the dielectric. These dielectric barriers may not be employed to support the busbars. The dielectric shall be bolted to the sheet metal at the periphery of the busbar chamber.

8.2.9.3 The penetrations for circuit into or out of the busbar chamber shall also be provided with dielectric material at the point of penetration, as for the busbar chamber barriers.

8.2.9.4 Busbar supports shall comprise moulded epoxy insulators mounted on robust steel brackets arranged in stepped formation with the red-phase busbar at the top rear of the chamber and the neutral busbar at lower front position.

8.2.9.5 All busbars shall be tinned over the full length using only resin-based flux and fitted with phase colour co-ordinated heatshrink for the full length, or coated with "Gliptal". Copper for busbars, risers and droppers which is delivered uninsulated shall be fitted with heat shrink sleeving between bolted connections. Once bolted connections have been completed, (torque checked) PVC insulation tape shall be provided, in neat half lapped formation, over the connection. The tape shall overlap onto the sleeving at least 40mm.

8.2.9.6 Joints in busbars shall be avoided as far as possible, but where they are necessary the joint shall be formed by offsetting one of the bars, by an amount equal to its own thickness, to overlap the other. The length shall be equal to twice the width of the bar, and the joint shall be secured with a minimum of 4 Hexagon headed set screws nuts and washers (plain and spring).

All busbar joints shall be torque tightened before the switchboard (MCC or larger DB) is delivered, and torque checked (and tightened if necessary) just prior to commissioning.

Each joint or point of connection shall be properly tinned. Only resin based fluxes shall be employed during the tinning process.

The busbar riser sections, onto which cables terminate, shall be considered as part of busbar system as a whole and shall be equally subject to all the specifications detailed.

8.2.9.7 Busbars shall be capable of carrying the full rated current along their entire lengths. Reduced section busbars will not be permitted. Busbars shall be designed for a maximum temperature of 700C (i.e. a 400C temperature rise in an ambient of 300C). Where a transformer feeds directly to the busbar (via a main circuit breaker), the copper busbar shall be designed for 125% of the transformer output (in kVA) and shall be rated to withstand an internal or external fault for 3 seconds without incurring any damage.

The neutral busbar in the MCC or any DB shall be equal in size to the busbars and shall be considered as part of the busbar system.

8.2.9.8 Busbars shall be manufactured from 99% electrolytic copper that has been hard drawn to the finished sizes. The copper shall be rectangular in cross section, shall be solid, and the cross section shall be maintained throughout the busbar system. Where the copper is delivered with rounded corners the copper shall be suitably de-rated for thermal emissivity. The copper shall be supported on SANS approved insulators at centres which are commensurate with the fault level to which the busbar system has been designed, but in no instance shall they be greater than 500mm apart. Where it becomes

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necessary to employ more than 1 copper bar per phase the copper bars shall be of equal cross section and shall be properly spaced by an equal thickness spacer between the copper bars. Only copper having a cross section of 100mm x 6mm, or greater, may be employed in parallel, per phase. The spacers shall be bolted into position at points of attachment for lugged conductors or droppers.

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Where joints in the copper bar are inevitable they shall be made by offsetting one bar by the thickness of the copper such that the copper bars overlap one another, at the joint, by the width of the copper.

Joints shall be properly fastened together with hexagon headed bolts, full size nuts, spring and flat washers. At least 2 and not more than 3 threads shall be visible beyond the nut once the final torque has been applied to each fastener. Where copper is punched or drilled the inevitable burr shall be removed and the copper shall be lightly chamfered at each hole.

The busbars shall be provided with holes at either end of the switchboard to allow for an extension to the copper bar at some future time, together with centrally located holes in the copper bars, between the insulating supports to allow for future loads to be added where required.

At least two such sets of holes shall be provided, between consecutive supports along the busbar length. If more than one copper bar per phase is being employed, then a copper spacer shall be provided between the copper bars and a bolt shall be provided to secure the spacer at each of the "spare hole" positions.

All copper shall be tinned with S6 solder using resin based flux, after all the drilling, bending and cutting has been completed. The finished, tinned copper, shall be free of solder lumps and shall be as smooth as the copper under the solder.

After tinning, the copper shall be fitted with heat shrinkable, colour coded, insulating material before being fitted to the MCC.

All joints and points of connection, once completed, shall be torque checked on site and shall then be fitted with colour coded PVC insulation tape. The tape shall be neatly installed by half lapping and shall commence on the heat shrink material on one side of the joint and shall finish on the heat shrink material on the opposite side of the joint.

Non sticky PVC tape is the preferred material for this application.

8.2.10 Wiring, Cable Terminations and Glanding

All wiring within panels may be enclosed in PVC slotted ducting. The exception is signal and instrumentation cabling passing through power compartments or cubicles, which shall be in galvanised screwed conduit. Wiring outside of panels and switchboards shall be run within galvanised ducting or conduit.

Alternatively, signal and instrumentation wiring may be run in a channel at either the front or the rear of the busbar chamber, accessible from that respective side of the switchboard within the busbar chamber. The channel shall be manufactured of 3CR12 and shall be welded into position. The channel shall contain a cover that is screwed into position.

All wiring and terminations shall be labelled with identification tags corresponding to the wiring diagrams. Cable terminations shall be marked with an identification label externally to the switchboard indicating the source of supply as well as the equipment being fed for feeder cables. For example: "FED FROM MCC 1" and "SUPPLY TO SUMP PUMP".

All glands for cable shall be nickel-plated brass, and fitted with waterproof neoprene shrouds.

8.2.11 Earth Bars

The earth bar shall be mounted at the rear of the MCC or DB and shall be accessible along its length from

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all tiers (where applicable). The earth bar cross-section shall be as specified, or, where not specified, shall be installed as per the minimum specified in SANS 10142 or SANS IEC 60439. Notwithstanding these requirements, the earth bar shall be not less than 70mm x 8mm in cross-section.

A one-piece copper earthing bar shall be installed from one end of the board to the other and shall be provided with earthing studs (nuts, bolts and washers) in each tier

The copper bar shall be bolted to the framework of the board in at least 10 positions with 10mm bolts. The copper bar shall be mounted 100mm above the top edge of the channel iron base and approximately 100mm from the backplate. Holes shall be provided in the copper bar in each cubicle along the length, for the termination of the earthing conductors associated with the circuits deriving a supply from the respective cubicles. Spare studs amounting to 10% of the Contractors requirements, shall also be provided. Bunching of earthing conductors on a single stud will not be permitted.

8.2.12 MCC and DB Bases

The floor mounted MCC or DB, shall be mounted to a one-piece hot dipped galvanised channel iron base, located at the position indicated in the transformer room. The one-piece base shall be fabricated from 100 mm x 50 mm x 6 mm (10,57 kg/m) channel iron. The corners of the base shall be mitred and welded whilst cross bracing shall be provided on centres coincident with the cubicle modules along the length of the base.

Each cubicle shall be secured to the base with at least four 10 mm diameter bolts, washers and nuts whilst the base shall be anchored to the concrete with a bolt in each corner and two bolts at every even numbered cubicle module. (One at the front of the base and one at the rear). The anchor bolts shall be 12 mm diameter and shall be entered at least 80 mm into the concrete.

The widths shall be uniform throughout their heights and the plan view of the switchboard shall be uniformly rectangular in shape.

8.2.13 Paint and Finishing

All metalwork in excess of 5mm thick shall be sandblasted to a profile of 40-80 microns, prior to painting. This finish shall be carried out carefully to provide the necessary "key" for the paint coats.

Where the material is less than 5 mm thick, it shall be, lightly sanded, de-greased, washed and forced air dried prior to painting.

The paint coat shall be a high quality polyurethane based powder coat to the acceptance of the Engineer. The sprayed powder coat shall be baked in an oven at a temperature of approximately 200oC for a period of 10 min or as specified by the paint manufacturers.

The dry film coat shall be as uniform as possible but shall not be less than 40 microns nor more than 90 microns. The finish shall be high gloss with a minimum of surface defects.

Distribution boards, boxes, trays, covers, ducts, or any other enclosure housing electrical apparatus shall be coloured white internally, whilst externally the colour shall be Electric Orange to SANS 1091 or to the approval of the Engineer.

Switchboards or switchboard tiers connected to dedicated emergency supplies shall be coloured red externally.

8.2.14 Glanding Sections and Cable Gland Plates

Gland plates shall be fitted in cubicles for termination of cables and shall be mounted 400mm above the

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final floor level. The cables shall be fitted with glands anchored to the respective gland plates. The glands shall be adequately spaced to permit the locknuts to be tightened with normal tools. The gland plates shall be painted and at least 2mm thick 3CR12 and shall be bolted to robust brackets welded to the framework of the board.

At positions where single core cables are employed the cable gland shall be fabricated from non-ferrous material of adequate thickness to support the cables i.e. 15mm thick TUFNOL, 5mm 3CR12 painted or 8mm aluminium.

8.2.15 Doors and Covers

A door shall enclose the front of each compartment, unless stated otherwise in the project specification.

8.2.15.1 Enclosures for outdoor or moist environments shall be provided with a weatherlip angled at 45° to the face of the enclosure framework, together with a door enclosing the cubicle and enveloping the weatherlip. The top of the outdoor enclosure shall be fitted with a full width canopy projecting at least 100 mm from the enclosure face.

8.2.15.2 All doors shall be arranged to stand off from the face/rear of the board, cubicle, compartment or enclosure. Each door shall be properly stiffened and shall be twice returned at the periphery. The second return shall be gusseted in the corners to further brace the door.

Large doors (e.g. those fitted to the rear of individual switchboard/MCC tiers) shall be further stiffened with "top hat" section channels welded to the inside of the door.

8.2.15.3 Each door shall be mounted on pin type hinges and shall be secured by means of a lever operated tapered tongue catch or catches (Hinges and catches shall be Barker Nelson or equal to approval). The lever shall be provided with an external stop to prevent rotation in excess of 360° and to provide a padlocking facility. (A hole in the stop and a hole in the lever).

A minimum of two square hatch keys catches are required per door or rear panel, installed in conjunction with the tapered tongue catch at the top and bottom edges of the door on the opposite side of the hinges. For rear panels, one or both of these square hatch key catches shall be padlockable by having an extended section that encloses the latching mechanism and will allow a standard lock to prevent operation of the catch while in place.

For covers over busbar chambers, four square hatch key catches are required, with a minimum of one catch required to be lockable.

8.2.15.4 Where doors are mounted adjacent to one another the spacing shall be arranged to permit each door to open through at least 150°, without fouling the adjacent door. A stop shall be provided which shall prevent the door from opening further to obviate damage to paintwork.

8.2.15.5 Doors fitted with flush mounted equipment shall be properly braced and stiffened to support the equipment. The hinges shall be easily able to support the mass added to the door when the flush fitted equipment is installed.

8.2.15.6 The space between the back of the door and the face of the coverplate shall be nominally 80mm.

Where coverplates are provided behind the doors, the coverplates shall be adequately recessed into the cubicle to permit the spindle on the lever to drive the tapered tongue catch into a slot in the framework of the board without fouling the coverplate.

Coverplates shall be fabricated as for the doors and shall be further stiffened to compensate for the machine punches circuit breaker slots. The coverplates shall be secured at the top edge with at least two square key driven catches, whilst at the lower edge they shall be located with two 6mm diameter tapered

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dowel pins located in holes drilled in the architrave. Each pin shall be fitted with a 1.2mm thick spacer washer. Both the pins and the washers shall be welded to the cover.

The end, rear and top coverplates shall be removable to permit access to the equipment. The coverplates shall be lockable in the closed positions.

8.2.16 Space Requirements

In arranging the chassis layouts a minimum clearance of 80mm between equipment and framework, side panels or internal divisions is required. This minimum space is required on the top, bottom and sides of equipment.

A minimum of 50 mm is required between equipment and wire trunkings. The spacing between equipment shall be sufficient to allow for the installation of conductors (taking in account the minimum permitted bending radii of conductors and cables).

A minimum of 80mm is required between power equipment (circuit breakers, contactors, etc.) and any auxiliary control devices.

8.2.17 General Mounting Requirements

No special tools shall be required to remove and re-install any equipment.

8.2.18 Switchboard Standard Colours

The following colours shall be utilised for electrical switchboards:

11kV to 400V Mains Supply – EXTERNAL	:	Electric Orange to SANS 1091
400V Mains Supply – INTERNAL	:	White Arc-Free
Emergency Supply	:	A11 (Signal Red) to SANS 1091

8.2.19 Metering within Switchboards

A combined Maximum Demand and kWh meter shall be provided, with associated cabling, fuses, current transformer, calibration certificates etc. in the metering cubicle situated above the bus-section switch for the metering of the incomer supply from the Local Supply Authority and the incomer from the future Generator.

The meters shall be positioned behind a glass panel cut into the metering cubicle and shall only be accessible once the cubicle door has been opened. A small diameter hole shall be drilled through this glass to allow the meter function selector switch to be depressed without having to open the metering cubicle door.

This metering shall be independent of the metering to be supplied by the Local Supply Authority for billing purposes.

The meters shall be of the "Enermax" type or equal and approved.

8.2.20 Field Control Stations

These constitute local control stations mounted adjacent to equipment such as instrumentation, motors, etc., or emergency stop stations in proximity to rotating machinery.

Where required, these field control stations shall be installed in Glass Reinforced Polyester enclosures mounted on a hot dip galvanised stand. The stand shall be constructed of a minimum of 100 mm x 50 mm U-channel, 3 mm thick, welded to at least a 300 mm x 300 mm x 3 mm thick base, bolted to the floor at each of the four corners.

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A 3CR12 hood shall be fitted over the GRP enclosure.

8.2.21 Switchboard Construction Drawings – Standard Requirements

All Construction Drawings for switchboards (MCCs, DBs, Field Control Stations, Instrumentation Panels etc.) shall contain the following information:

Project Name and Contract Number
Manufacturer/Supplier
Consulting Engineer and contact person
Client details
Drawing Number and Revision
Drawing to be Signed
Source of Supply – MCC or transformer name etc.
Switchboard General Description
Fault level (kA and time rating)
Form factor/Sectioning
Busbar Details (cross-section, material type, tinned etc.)
Busbar Support Details – type, manufacturer
Earth bar details (cross-section, full-length, front or rear etc.)
Switchboard Material type, grade, thickness etc.
Gland Plate details – material type, thickness, mounting etc.
Colour – internal and external
Switchboard Dimensions
Base Dimensions and bolting arrangements
Front door details – hinge and padlock requirements
Rear door details – hinge and padlock requirements
End panel details – removable cover details
Door details - Stiffeners and restrainers installed etc.
Hinge Details
Locking Details
Handle Details
Cable Entry Details
All bolts, nuts, screws material type (i.e. 316 Stainless Steel)
Equipment details – CB ratings, fault levels, type, manufacturer etc.
Equipment Layout details – Cubicle name, function, equipment function etc.
Indication Light colours
Section to be provided through switchboard

8.2.22 Switchboard Schematics – Standard Requirements

All Schematic Drawings for switchboards (MCCs, DBs, Field Control Stations, Instrumentation Panels etc.) shall contain the following information:

Project Name and Contract Number
Manufacturer/Supplier
Consulting Engineer and contact person
Client details
Drawing Number and Revision
Revision details to be listed
Drawing Page Number
Drawing to be Signed
Reference Grid required on each schematic page
Source of Supply – MCC or transformer name etc.
Fault level (kA and time rating)

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Voltages for all circuit to be clearly indicated
All devices to have reference number i.e. relays
Equipment ratings to be given i.e. motor ratings
All indication lamps to be labelled including required lamp colour
Legend to be provided
Equipment Tag Numbers as per P&ID and Water Services Plant Numbering System to be provided

9. Switchgear and Control Equipment for Switchboards

9.1 General

All equipment shall be of sizes, ratings and specification as detailed and as shown on the Single Line Diagrams. Where feeders or cables have to be revised because of equipment selection by the Principal Mechanical Contractor, these shall be done subsequent to the award of the Tender.

All equipment shall be approved by the Engineer in writing before acceptance for use on the project, and shall bear the SANS mark.

9.2 Circuit Breakers

The circuit breakers shall comply with SANS 156 and VC 8036.

Cascading of circuit breakers is not permitted.

9.3 Metal clad Air Circuit Breakers (ACB's)

Metal clad air circuit breakers shall be of the withdrawable type and shall be suitable for use in power distribution systems up to 1000V 50Hz.

The circuit breakers shall comply with IEC 157 and shall have a P2 performance rating.

The ACB's shall be self-contained units of the dead front type with the necessary mechanical interlocks to prevent:

- Access to "Live" terminals when the circuit breaker is withdrawn.
- The withdrawal or insertion of the ACB when the circuit breaker is in the closed position.
- Closing of the circuit breaker without resetting after an automatic trip.

The circuit breaker shall be of the quick make and quick break type with a stored-energy spring assisted operating mechanism provided with:

- A trip free, mechanical, hand operated closing mechanism.
- A manually operated, mechanical, trip mechanism suitably protected to prevent inadvertent tripping.
- A positively driven mechanical device to provide ON – OFF. - TRIP indication.

All non-current carrying metal parts of the ACB shall be connected to the earthing contact on the truck of the switch, which shall engage with a mating contact on the cradle. The cradle itself shall be connected to the earthing bar in the switchboard. The contacts for the earthing shall be made in the "Racked In" position as well as in the "Test" position. The cradle shall be of robust construction and shall incorporate safety shutters.

The "RACKED IN", "TEST" and "RACKED OUT" positions shall be clearly marked and easily visible.

The ACB's shall be designed in such a way that the direction of the energy flow does not affect the operation or performance of the breaker.

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Adjustable thermal overload releases shall be provided to suit the required current range. In addition, a magnetic short circuit release shall be fitted. This release shall have an adjustable current release value as well as an adjustable time lag. A minimum of four, time lag settings shall be available.

Care shall be taken to ensure the magnetic release occurs at a sufficiently low value to afford full protection under the lowest fault current conditions (Where generators are encountered).

Each ACB shall be equipped with the following accessories:

- Two normally open auxiliary contacts.
- Two normally closed auxiliary contacts.
- One alarm contact.
- One shunt release.
- Padlocking facilities in the "OFF" and "TEST" positions.
- Key interlock.

Each ACB shall allow for the fitting of the following options:

- Motor drive for spring charge mechanism.
- Closing release complete with "Anti Pumping Circuit"
- Adjustable time delayed under-voltage release.
- Carriage switches for "RACKED IN" and "TEST" positions.
- Mechanical interlock facility of the Bowden type.

Minimum clearances and distances between the enclosure and the arc chutes shall be strictly observed.

Full technical information of the ACB's offered, shall be supplied with the Tender.

9.4 Moulded Case Circuit Breakers (MCB's)

Moulded case circuit breakers shall be suitable for use in 1000V distribution systems at 50Hz. The circuit breakers shall comply with SANS 156 and VC 8036.

MCCB's of the same frame size and the same fault level shall be from the same manufacturer.

Circuit breakers for feeders to lighting and small power sub-distribution boards and motors shall be equipped with an instantaneous magnetic release and a thermal release.

Discrimination shall be provided in the feeder circuit breaker arrangement. An adjustable release shall be provided where deemed necessary.

MCCB's employed for motor-starting circuits shall be rated in such a manner as to avoid 'nuisance tripping'.

Feeder breakers to motor control centres shall be equipped with a thermal release and a time and value adjustable release. These MCCB's shall be selective towards the upstream and downstream circuit breakers.

MCCB's of the same frame size, where in one application an instantaneous magnetic release is employed and in another application a time lagged release is used, shall have plug-in type trip units.

The operating handles of the MCCB's shall provide a positive "ON" "TRIP" "OFF" indication of the breaker status.

MCCB's shall be installed vertically. Horizontal mounting will not be accepted.

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Minimum clearances and distances between the enclosure and the arc chutes shall be strictly observed.

10 MOTOR STARTING AND DRIVE SYSTEMS

10.1 General

Direct-on-line motor starter contactors shall be equipped with three pole thermal overload relays according to the rating of the motor. This shall be a combination unit with the door-interlocked circuit breaker.

The thermal overload relay shall be provided for single-phase protection, it shall be equipped with an electrical/electronic reset facility.

Drives to high gear ratio motor (such as the screen drive, screw conveyor and compactor) shall be equipped with an electronic shear-pin device. This protection relay will disregard the motor starting current, but trip the drive, should the current rise above a set threshold during running.

Should a phase failure or imbalance relay be incorporated in the design, this trip mechanism shall be manually reset along with the thermal overload relay.

10.2 DOL Motor Starter Compartments

Motor starter compartment shall include for a minimum of:

Motor Protective Circuit-breaker (backplate mounted and arranged vertically).

Mechanical operating handle for circuit-breaker, including door interlock, self-aligning spindle and padlocking facility (door mounted).

Current transformer class 1,5 (backplate mounted).

Ammeter.

Run Hour meter.

Contactors for DOL starting or contactors for alternative methods of starting (backplate mounted).

Thermal overload device operating on single phase / three phases (usually mounted on contactor).

Electrical/electronic reset push button for thermal overload (via door mounted pushbutton)

Selector switches MAN, OFF, AUTO (door mounted).

Stop / emergency stop push buttons (door mounted).

Start push button (door mounted).

Relays for stop, start and other controls where required
(backplate mounted).

Pilot lights for:

motor stopped but power available (red)

motor running (green)

motor tripped (amber)

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Din rail mounted terminals.

Lamp Test (black push button)

Submersible motor application

10.3 Actuated Valve Starter Cubicles

The following equipment mounted behind the front door of the cubicle:

Moulded case circuit-breaker [for motor applications] (cradle mounted and arranged vertically behind the door at the second architrave level).

Mechanical operating handle for circuit-breaker, including door interlock, self-aligning spindle and padlocking facility (door mounted).

Hour meter

Electronic reset push button for overload (door mounted).

Selector switch MAN, OFF, AUTO (door mounted).

Door mounted pilot lights for:

motor stopped but power available (red)

motor running (green)

motor tripped (amber).

Siemens Logo Controller (or equal to approval by the Engineer)

Din rail mounted terminals.

Lamp Test (black push button)

Key Switch, back plane mounted, to enable/disable actuated valve controls (i.e. actuated valve controls must be in the "enable" position in order to control the actuated valve from the cubicle door)

10.4 VARIABLE SPEED DRIVES (VSDS)

10.4.1 GENERAL

VSDs shall be provided for drives as shown on the single-line diagrams and in accordance with the Electrical Specification.

10.4.2 SPECIFICATION

The drive method of the VSDs shall be Modified Sinusoidal Pulse-Width Modulation (PWM), suitable for driving motors coupled to centrifugal pumps.

The system parameters are as follows:

System voltage	400 V
Motor voltage	400 V
System fault level	15kA
Motor speed	1 475 rpm (max)
	730 rpm (min)

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Installation	Within the MCC with ventilation fans mounted on cubicle doors
Drive Type	6 Pulse, Transistor / Diode Converter, DC bus, Thyristor Inverter

The VSDs shall be selected to match their associated motors and loads with respect to voltage, speed range, power and load torque characteristic.

Newly supplied VSDs shall be equipped with RS485 / Modbus interfaces, which shall be linked via twisted pair cable to the associated PLC. This communications interface shall be utilized for speed control of the drives, as well as monitoring of the motor's load, speed, drive faults, phase voltage, current, frequency, etc.

VSDs in existing MCC's are not all equipped with RS485 / Modbus interfaces. Speed control and monitoring will therefore be implemented via analogue signals to and from the associated PLC (closed loop control).

Current monitoring of the drives will be achieved by means of installing of signal converters and ct's in the existing MCCs. The contractor shall provide the necessary equipment (e.g. converters, ct's, cabling, etc.) to ensure accurate monitoring thereof.

10.4.3 INSTALLATION

The VSD's shall be installed with the heatsink mounted through the rear of the panel to facilitate the circulation of cooling air over the heatsink without drawing air over the control components of the VSD. Where this is not practically possible with smaller VSD's, the heatsink and control components may share the ventilation air.

Where two VSDs are mounted one above the other in an MCC, a 45° deflector plate shall be mounted above the fan-cooled heatsink of the lower VSD to deflect hot air away from the upper VSD's heatsink. Where a VSD's heatsink is contained in a dedicated cubicle, a division shall be provided to separate the incoming and outgoing cooling air. Extractor fans shall be installed on the doors of the VSD cubicles to increase air circulation, where necessary. The appointed contractor shall provide proof of heat dissipation within a VSD cubicle, by means of submitting heat rise calculations to the Engineer, where extractor fans are not installed.

The doors of the MCC compartments housing VSDs shall be fitted with the same control and indication equipment as those for fixed speed drives (as shown on the typical door layout drawing), but with the addition of VSD fault indication lights.

All internal wiring shall be silicone insulated panel wiring with tinned stranded copper conductors and PC boards shall have conformal coatings to provide protection against the corrosive atmosphere at the works.

A Remote Graphic Display terminal shall be installed for each of the drives, mounted on the drive's enclosure cubicle doors.

INTELLIGENT MOTOR PROTECTION REPLAYS (IMPS)

10.5.1 GENERAL

For this installation, it is intended that intelligent motor protection relays be used for all non-electronic starters (i.e. Direct-on-Line; Forward-Reverse and Star –Delta.) This unit replaces the conventional thermal overload normally used, and will communicate on a Modbus Plus protocol with the PLC.

CONNECTIONS

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The general proposed wiring connections are shown on the Engineer's drawings. This shows a typical diagram only, and the contractor shall develop his own diagram, along these guidelines.

(a) Control

The cubicle door mounted pushbuttons, as well as the Hand / Off / Auto selector switch shall be wired directly into the IMPR. The emergency stop shall interrupt the normally closed stop circuit on the IMPR, and shall also disconnect the power supply to the contactor coil.

All indicator lights must be wired straight out of the IMPR via the control voltage. Where more indicator lights are required than outputs are available on the IMPR, the contractor shall provide additional relays for these lights.

(b) Power

The IMPR is intended for use by running the power conductors through the integral CT openings of the unit. Where the current of the drive is more than the rating of the integral CT's, the contractor shall provide secondary CT's to relay the current through the IMPR.

(c) Inputs / Outputs

The unit shall as a minimum, have 6 digital inputs and 3 digital outputs.

10.5.3 FUNCTIONS

The unit shall have the minimum of the following functions:

(a) Measurement:

Average line current
Phase imbalance
Thermal capacity level
Frequency

(b) Protection:

Thermal overload
Phase imbalance
Phase loss
Under / Over current
Earth fault

(c) Metering and Monitoring:

Current
Fault history

10.5.4 PROGRAMMING

The IMPR shall have a removable user-machine interface (HMI). The contractor shall provide a single HMI per MCC, as well as one spare.

It shall be possible to set up all the parameters via the keypad on this HMI, and to view the various monitoring and metering units on the HMI screen.

It shall also be possible to program the unit from the PLC.

10.5.5 COMMUNICATION

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The unit shall have an open communications system, connected directly via RS485 or similar plug-in connectors, via a Modbus Plus network.

10.5.6 PREFERRED SUPPLIERS

ABB – Universal motor controller (UMC)
 Moeller
 Rockwell
 Schneider – TeSys T
 Siemens – Simocode

11 Wiring, Cable Terminations and Glanding

All wiring within panels may be enclosed in PVC slotted ducting. The exception is signal and instrumentation cabling passing through power compartments or cubicles, which shall be in galvanised screwed conduit. Wiring outside of panels and switchboards shall be run within galvanised ducting or conduit.

All wiring and terminations shall be labelled with identification tags corresponding to the wiring diagrams. Cable terminations shall be marked with an identification label externally to the switchboard indicating the source of supply as well as the equipment being fed for feeder cables. For example: “FED FROM MCC 1” and “SUPPLY TO SUMP PUMP”.

12 STANDARD COLOURS – INDICATION LAMPS AND BUTTONS

The suitability of colours employed is generally based on IEC 60073.

Due to colour schemes on existing plant and user/operator familiarity, the application of certain colours differs from IEC 60073. For clarification, the lamp colours are a reflection of the status of the particular control system (front of panel towards equipment to be controlled).

The following colours shall in general be employed on switchboards for indication lamps, push buttons and selector switches:

COLOUR	Condition / Meaning / Application
RED	System stopped/not running or CLOSED
AMBER/YELLOW/ORANGE	Any warning/trip/abnormal condition
GREEN	System running/healthy/normal/ SAFE Condition or OPEN
BLUE	Step/Process change condition
WHITE	Mode indication or other indication (where doubt exists about applicability of Red, Yellow or Green)

Specifically, the application of colours shall be as follows:

INDICATION LAMP COLOURS			Examples/Specifics
Local/Auto/SCADA Mode	Indication Lamp	WHITE	
Bus Bar Alive	Indication Lamp	WHITE	
Capacitor Bank Discharged	Indication Lamp	GREEN	Power Factor Equipment
Closed	Indication Lamp	RED	Valves, penstocks

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Differential Pressure – HIGH	Indication Lamp	AMBER	
Differential Pressure – NORMAL	Indication Lamp	GREEN	
Earth Fault	Indication Lamp	AMBER	MV Equipment
Emergency Stop	Indication Lamp	AMBER	
Mechanical Seal Failure Warning	Indication Lamp	AMBER	Sub / Immersible Pumps
Moisture in Coolant	Indication Lamp	AMBER	Sub / Immersible Pumps
Moisture/Water Ingress	Indication Lamp	AMBER	
Motor Winding Over Temperature	Indication Lamp	AMBER	May be flashing AMBER
Open	Indication Lamp	GREEN	Valves
Overload	Indication Lamp	AMBER	
PFC Fault	Indication Lamp	AMBER	Power Factor Equipment
Running	Indication Lamp	GREEN	
Starter Alive (Circuit Healthy)	Indication Lamp	GREEN	
Stepped Function	Indication Lamp	BLUE	Power Factor Equipment
Stopped & Power Available	Indication Lamp	RED	
Tripped	Indication Lamp	AMBER	
PUSH BUTTON/SELECTOR SWITCH COLOURS			Examples/Specifics
Emergency Stop	Push Button	RED	With yellow backing
Lamp Test	Push Button	BLACK	
Reset	Push Button	BLUE	
Start	Push Button	GREEN	
Stop	Push Button	RED	
Up/Down/Left/Right/Forward/Reverse	Push Button	BLACK on WHITE	
Selector Switches/Knobs		BLACK	with Black back plates with white lettering

Note: AMBER=YELLOW=ORANGE

For existing plant, lamp/pushbutton colours to be matched accordingly

All indication lamps to be accompanied with engraved backing plates

The Engineer shall provide the final confirmation/approval of ALL colours to be employed on existing or new plant.

13 Switchboard Accessories

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13.1 General

Refer to the switchboard equipment schedule in the Project Specification as well as the proposed Motor Control Centre layout drawing in the project specification for additional details. All manufacturers / suppliers of switchboard accessories shall ensure that the equipment is SANS certified. All systems providing starting and control shall provide full protection from the effects of internal and external faults.

13.2 Instrumentation in General

Instruments shall generally be designed for an accuracy of 1% (Class 1) of the full-scale reading. (Assume the frequency remains constant at 50 Hz). Instrument faces shall be either 96mm x 96mm on large panels or 76mm x 76mm on smaller panels. The faceplates shall be painted white with black paint for the lettering and scale divisions. A thumbnail operated adjuster shall be provided to zero the pointer at any given time. A clear glass window that is positively located by the framework of the instrument shall enclose the pointer and faceplate. The glass shall be mounted on a gasket that will seal the space between the faceplate and the inside surface of the glass against the ingress of moisture and dust. Terminals shall comprise nuts on a moulded in stud at the rear of the instrument. The terminals shall be fitted with two washers and a colour coded rubber shroud. The shroud shall allow the wire, fitted with a lug, to approach the stud at 90° and shall be moulded accordingly.

Instruments shall be provided with a scale not less than 20% above the normal operating value of the function being measured, then rounded up to the nearest standard scale provided by the manufacturers.

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13.3 Voltmeters

Volt meters shall be of two sizes 96mm x 96mm on the large panels and 72mm x 72mm on the smaller panels. The meters shall be of the moving iron type and the movements shall be mounted on shockproof suspensions. The accuracy shall meet class 1.5 i.e. 1,5% of full scale value at each reading.

The main incoming section of the Switchboards (Motor Control Centres in particular) shall have a Voltmeter of 96 mm x 96 mm size, equipped with coloured surrounds representing each phase, i.e. Red, White and Blue and equipped with a phase selector switch. The switch shall permit the indication of all phase to phase and phase to neutral voltages on the voltmeter. The phases shall be noted as "R", "W" and "B".

Where a voltmeter is connected to the main busbar and a selector switch is provided for the operator to monitor the voltage between any two phases or between any phase and neutral, then two sets of HRC fuses shall be provided. One set mounted on the respective phase bars and the second set mounted adjacent to the voltmeter on the back of the door. The fuses mounted on the busbars shall each be provided with an element that affords protection for the conductors run between the two sets of fuses. The second set of fuses shall be fitted with elements that afford protection for the selector switch and instrument, besides being a convenient (and safer) point of disconnection for the maintenance staff. The minimum wire size for a voltmeter circuit shall be 2,5mm².

13.4 Ammeters

Ammeters shall be of two sizes 96mm x 96mm on the large panels and 72mm x 72mm on the smaller panels. The meters shall be of the moving iron type and the movements shall be mounted on shockproof suspensions. The accuracy shall meet class 1.5 i.e. 1,5% of full scale value at each reading.

The main incoming section of the Switchboards (Motor Control Centres in particular) shall be equipped with instantaneous and maximum demand ammeters of 96 mm x 96 mm size, equipped with coloured surrounds representing each phase, i.e. Red, White and Blue.

Each individual starter/drive cubicle shall be equipped with a 76 mm x 76 mm logarithmic scale instantaneous ammeter, with a label above the ammeter indicating the full load current for the respective drive.

Ammeters for ac applications shall be of the type suited to motor drives and shall provide a substantive over-range to allow for the motor starting current. The faceplate shall be marked, with a red line, at the point on the scale where the absorbed motor current occurs. Ammeters shall be arranged in circuit for direct reading or indirect reading (CT operated), as required. Direct reading devices shall be employed up to a maximum of 40 A. Where multiple CT's are installed to permit a single instrument to indicate the load on each phase, in sequence, a rotary selector switch shall be provided which will permit the operator to select the phase he wishes to monitor. The CT's shall be connected in a star configuration and the star point shall be directly connected to the main earthing bar in the MCC. The minimum wire size for a CT and Ammeter circuit shall be 2,5mm²

13.5 Run-Hour Meter (RMH)

Run-hour meters in general shall be 72mm x 72mm in size and shall be installed for all motor starting and controlling applications. Run-hour meters shall be mounted on access doors with the face of the meter visible from the front of the board.

Run-hour meters shall be suitable for 230V 50Hz applications and arranged to operate directly from the control voltage but shall be controlled by the motor starter. The dial shall be cyclic and shall count to 99999,9 before returning to 0. A reset facility is not required.

Hour meters shall however be the same physical size as the Ammeter on the same panel. Enlarged

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bezels that make the run-hour meter appear the same size as the Ammeter, will not be accepted.

13.6 Time Switches

The time switches shall be of the 24 hour type, operating on a 230 V 50 Hz supply with an electrically wound 9 hour spring reserve. The time switches shall be mounted behind the hinged access doors. Each time switch shall be fitted with fifteen "on" stops and fifteen "off" stops thereby providing 30 selective operations per 24 hours.

13.7 Timers

The timers shall be of the electronic plug-in type operating on a 230 V 50 Hz supply. The timers shall be adjustable by turning a knob. They shall be mounted facing the front of the board but behind the access door.

13.8 Fuses

The fuses shall comply with SANS 172 and shall be adequately rated for the circuit currents. All fuses shall be positioned so as to be accessible from the front of the board.

13.9 Fuse Holders

All fuse holders shall comply with SANS 173 and shall be adequately rated to cater for the load currents.

13.10 Selector switches

Selector switches shall be of the rotary pattern and shall be mounted on the cubicle doors or on the door to the panel above the circuit breaker. All selector switches shall have a minimum rating of 15 A.

These shall preferably be of the same manufacturer as the push buttons and indicators lamps.

Selector switches shall allow contacts arranged in wafer housings that permit stacking along, and positioning about, the centrally mounted spindle driven by the operating knob. The escutcheon plate mounted on the door of the motor drive, or other, cubicle shall be secured with screws secreted from view by the 'snap on' plastic cover which shall be engraved in accordance with the circuit requirements (i.e. ON - OFF . REMOTE - OFF - LOCAL .

MANUAL - OFF - AUTOMATIC) etc. The spindle shall be splined to allow the contacts within the wafer housings to be 'timed' for early or late, make and brake contacts, as required.

13.11 Relays

The relays shall be general purpose plug-in relays with octal or 11 pin bases. Soldered connections to bases will not be accepted. Each relay shall be tightly sealed with a clear plastic cover. All relays shall operate on a 230 V 50 Hz supply.

13.12 Overload Relays

The overload relays shall be of the thermal type with an element in each phase and shall conform to the characteristic curve held by the manufacturer with a tolerance of + 10% of the values as specified in the SANS IEC 60947-4-1.

13.13 Contactors

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The contactors shall be operated electro-magnetically. The control voltage shall be 230 V, except for the dc emergency lighting contactor, which shall be 110 V dc. Contacts shall be capable of carrying 125% of the full load circuit current continuously. The contactors shall be suitable for "Intermittent Duty" 15 operations per hour.

13.14 Control Pushbuttons

In conjunction with the Clause entitled "STANDARD COLOURS – INDICATION LAMPS AND BUTTONS", the Control Pushbuttons shall be of the round, flush, spring-loaded type, 22,5 mm in diameter, coloured in accordance with the duty as follows:

START	=	Green
STOP	=	Red
LAMP TEST	=	Black
RESET	=	Blue

For field mounting of Control Pushbuttons, these shall be mounted and positioned as indicated on drawing TSE2002-0036 depicting a general arrangement of a Field Control station.

13.15 Indicating Lamps

Indicating lamps shall comprise a cluster of four light emitting diodes arranged in a common housing. Each lens shall be coloured as required for stop, start, alarm, trip, etc. shall be at least 20 mm diameter and shall be clearly visible through an angle of 180° in a brightly lit room (500 - 600 Lux) and the contrast between an energized condition and a de-energized conditions shall be clearly visible from all sides as well as in front.

The indicators shall be suitable for use on either 230V AC / 24V DC supply as per project specification. If the LED is not able to operate direct from the control voltage called for then a separate controller shall be provided with each LED to ensure that all LED's are fully interchangeable with those adjacent or on a separate panel some distance away.

The housing shall be fitted through a hole in the door of the cubicle and shall be secured with a separate screwed ring or a bayonet plate that is tightened into position with grub screws. The housing body shall be provided with a key to locate in a groove in the door cut-out to prevent the housing from rotating.

In conjunction with the Clause entitled "STANDARD COLOURS – INDICATION LAMPS AND BUTTONS", the lens shall be coloured in accordance with the duty as follows:

Red	=	System stopped and power available.
Green	=	System running.
Amber	=	System tripped.
Amber	=	Water ingress detected (Submersible / Immersible machines).
White	=	OFF position – (upon a second level inspection, OFF as a result of either MCB OFF, or selector switch in the OFF position)

13.16 Stop Pushbuttons

Stop push buttons shall comprise two main components namely a front mounted operator and a rear mounted contact block. The front mounted operator shall be fitted with a cylindrical housing, which is attached and keyed to the mounting panel. The cylindrical component shall house a spring returned, flush mounted button. The rear mounted contact block shall be arranged with a bayonet feature that attaches to the front mounted component and is secured with grub screws or a locking ring. The push button shall actuate a silver alloy bar contact rated at not less than 15A. Conductors shall be fitted with a crimping ferrule to be secured by a screw adjusted clamping terminal mounted in the contact block. The complete assembly when mounted and connected shall provide protection against the ingress of dust or vapours to

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IP66. Once access is gained to the rear of the device the Technician shall still be protected from accidental contact to IP4x. The unit shall be maintenance free and shall provide at least 1 million operations before failure. The front mounted operator shall be coloured RED and shall be engraved with the word STOP. The contact block shall be provided with locators and screw anchors or clips, to accommodate an additional contact block mounted "piggy back" on the first contact block.

13.17 Start Pushbuttons

Start push buttons shall be arranged as for stop push buttons with the exceptions that the contacts in the contact block shall be normally open and the front mounted operator shall be coloured GREEN and engraved with the word START.

13.18 Reset Pushbuttons

Reset push buttons where required shall be spring loaded mechanical devices, mounted immediately in front of the electrical overload. The outer appearance of the housing for the reset push button shall be similar to the start or stop push buttons on the same panel. The rod attached to the push button shall be adjustable to suit the depth of the drive cubicle, as required. The push button housing shall be of sufficient depth to provide proper support for the extension rod. The front mounted operator shall be coloured BLACK and engraved with the word RESET. To achieve a pleasing layout of equipment on the door to the motor drive cubicle it may be necessary to adjust the position of the overload device within the cubicle.

13.19 Emergency Stop Pushbutton

Emergency stop push buttons shall be arranged in similar fashion to the stop buttons. The operating pushbutton however shall be at least 50mm in diameter and shall be knurled at the periphery. The mushroom head shall be mechanically latched when it is pressed, to prevent the contacts, within the contact block, from re-closing. To release the mechanical latch, and thus close the contacts, the operator shall be required to rotate the push button head through at least 600.

13.20 Name Plates and Labels

Each component of electrical apparatus installed under this Contract shall be properly and unambiguously labelled. Components on/in a distribution board shall be individually labelled, the compartments in which these components are mounted shall be labelled as an entity. The labels on the outside of each compartment shall be operator orientated, whilst the labels inside the various compartments shall be technician orientated and shall be worded/numbered as per the wiring diagram for the respective cubicle/compartment.

All labels shall be secured to the outside and inside of distribution boards with machine screws. Self-threading screws or glue will not be permitted. The exception is equipment labels within the switchboard, which may be glued only. All screw fixed labels shall be jig drilled to provide interchange ability between compartments.

All notices and labels for warning purposes or indicating dangerous conditions shall be in English, Afrikaans and IsiXhosa. General operating and identification notices and labels shall be in English only. Labels shall have black letters on a white background for standard labels or white letters on a red background for caution, warning or danger labels.

Each label shall comprise a high quality plastic tri-laminate and the wording shall be engraved through the outer layer to expose the colour of the centre layer. All engraving shall have sharp, clearly defined edges.

Labels and character sizes shall be commensurate with the size of article being labelled, with the proviso that where a range of label sizes would thus occur on a panel, the labels/character sizes shall be of a uniform average size.

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14 Earthing AND LIGHTNING PROTECTION

14.1 Earthing

The earthing installation shall comply with the requirements of the latest revision of the Wiring Code of Practice (SANS 10142-1) as well as the requirements of the Local Supply Authority.

Earthing shall be undertaken as detailed on in the Project Specification.

The Neutral shall not be bonded to the Earth in the Motor Control Centre, but at the source of supply, namely the transformer.

All metallic cable support systems, handrails, ladders and access platforms shall be connected to the earthing system.

The resistance measured between the consumers earth terminal and any exposed conductive part of the installation or any other conductive part that needs to be bonded to the earth continuity conductor shall not be more than 0,2 ohms.

14.2 Lighting protection

Lightning protection for this installation shall be limited to surge arrestors on the main board and suitable voltage protection on the instrumentation cables and equipment.

The surge arrestors shall be of an approval manufacture and shall bear the SABS/SANS mark of approval.

15 CABLE TRAYS

15.1 General

All proposed cable tray installations shall be neatly sketched and submitted to the Engineer for approval before any cable tray work is commenced. The sketch shall include principal dimensions and show the proposed cable tray routes.

Cable trays shall be wide enough to accommodate the cables required in terms of this contract plus 15% spare capacity for future additions.

15.2 Material and Manufacture

Cable tray shall be of the heavy-duty type manufactured from 2,0mm thick sheet steel and hot dipped galvanised after manufacture, designed for internal and external use.

Cable trays shall be plumb and true to line and shall be arranged either vertically or horizontally. Trays fixed to brickwork or concrete shall be mounted on 90° Z section spacer brackets, manufactured from 3 mm thick material, to space the back of the tray 30 mm from the structure. The brackets shall be full tray width and shall be provided along the cable tray route at approximately 500mm centres. Brackets shall be provided where cable trays terminate.

Each bracket shall be fixed to the wall with two 8mm anchor bolts entered at least 70mm into the wall whilst the tray shall be secured to each bracket with two 6mm galvanised steel set screws with nuts and washers.

A sample of the spacer brackets shall be submitted to the Engineer for approval, before proceeding with the manufacture of the remaining brackets.

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Joints in the tray shall be kept to a minimum and shall only occur coincident with a spacer bracket position or cross brace position.

Bends and tees in the cable tray shall be factory made by the same manufacturer as the cable tray. Joints in the cable tray shall be kept to a minimum and shall be arranged to occur coincident with a support bracket.

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Nylon washers may be employed to prevent galvanic reaction between galvanised steel and 3CR12 or 316 steel (for specialised installation), but careful consideration shall be given to ensure earthing continuity of all metallic items employed.

Should the environment be considered corrosive (for example Wastewater Treatment Plants or near the coast) the Engineer may call for all brackets, straps, cable tray, bolts, nuts, washers, etc. employed for the cable tray system to be manufactured from AISI 316 stainless steel.

15.3 Cable Positioning and Fastening

All cables shall be neatly fastened to the tray with PVC cable straps at 300mm centres.

Where cable trays are run Vertically, Power Cables shall be installed at the bottom of the cable tray and instrumentation and signal cables at the top.

Where cable trays are run horizontally, Power Cables shall be installed closest to the supporting surface i.e. wall, and instrumentation cable to the front.

All cables shall be run and cleated in accordance with the wiring regulations and shall be run in the ground or on cable trays secured to concrete, brick or steel structures.

16 Building Services Installation

16.1 General

All equipment supplied shall be suitably rated to the identified fault level in the project specification.

16.2 Lighting Fittings

The preferred lighting fittings for use in installations are specified in the Detailed Electrical Specification and / or the Luminaire Schedule.

16.3 Switches for use in this installation shall be as specified hereunder:

The preferred switches for use in installation are as follows:

Type Description

A	16 A – One lever one way rocker type flush mounted switch, with 100% polycarbonate construction, modular design, removable clip on surround which covers the fixing screws and plates complete with standard fixing screws. To Lumex Series 2000 Code S2031/1/2AWE, or equivalent and approved. Colour Black.
B	16 A – One lever two way rocker type flush mounted switch, with 100% polycarbonate construction, modular design, removable clip on surround which covers the fixing screws and plates complete with standard fixing screws. To Lumex Series 2000 Code ST2031/2/3AWE-ST2031IWE, or equivalent and approved. Colour Black.

16.4 Sockets Outlets

The preferred power outlets for use in installation are as follows:

Type Description

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A	16 Ampere, double, switched socket outlet, on yoke, to fit 100 mm x 100 mm wall box, with cover plate. To Lumex Series 2000 Code ST2025WE, or equivalent and approved. Colour Black.
B	3 phase neutral and earth, switched socket outlet, 32 A. To Clipsal Code 76252-6 complete with plug, or equal to approval, or equivalent and approved. Colour Black.

16.5 Power Sockets Outlets

All power socket outlets shall conform to the types set out in the Project Specification Annexures or Single Line Diagrams.

All power socket outlets shall be at a height of 500mm above finished floor level, or as otherwise specified in Project Specification or on Drawings.

Where the socket outlet position would interfere with dado lines or other finishes the final position shall be decided on site by the Engineer.

16.6 Power Socket Outlets Circuits

16.6.1 Single phase socket outlet circuits

Circuits to single phase power socket outlets shall comprise two conductors not less than 4,0mm² in cross sectional area drawn into 20mm or 25mm diameter conduit run between the switchboard and the socket outlet.

Circuits shall be arranged as detailed in the Project Specification.

16.6.2 Three phase socket outlet circuit

Three phase socket outlet circuits, rated up to 32 A, shall comprise 4 conductors not less than 6mm² in cross sectional area drawn into a 32mm diameter conduit run between the distribution board and the respective socket outlet position.

Circuits shall be arranged as detailed in the Project Specification.

16.7 Lighting Switches

Lighting switches shall conform to the types set out in the Project Specification Annexures or Single Line Diagrams and shall be mounted 1,45m above finished floor level.

The Contractor's electrical representative shall throughout the contract ascertain from the Engineer, the heights of dado lines in the various rooms, etc. and so place switches so that they do not interfere with the dado lines or door swings.

16.8 Lighting Circuits

Lighting circuits shall comprise two conductors not less than 2,5mm² in cross sectional area drawn into 20mm diameter conduit run from the distribution board to the various lighting points and their controlling switches.

Floodlighting circuits shall be wired with two 4mm² conductors and one 2,5mm² (earth) conductor.

Emergency dc lighting circuits shall be wired with two 2,5mm² conductors drawn into 20mm diameter conduit. The conductors shall be coloured differently to the conductors of the normal lighting circuits.

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16.9 Photocell

A photo electric light sensing cell, controlling the 230 V coil of the contactor shall be mounted external to the building in which the electrical installation is being undertaken at the same height as the lighting fittings it controls or as indicated in the specification.

A flush mounted conduit box shall be provided for the photo electric light sensing cell from where a 20mm diameter conduit shall be run to the distribution board, with 1.5mm² conductors drawn into the conduit for the control circuit.

A rotary type switch mounted within the distribution board, shall be wired in the control circuit, to bypass the photo electric light sensing cell for testing purposes. A single pole circuit breaker shall be provided for the control circuit and connected to the load side of the triple control circuit breaker protecting the contactor.

17 DUCTS, CONDUITS, CONDUIT RUNS AND DRAW WIRES

All conduits and conduit accessories shall be PVC, shall conform to SANS 950 and shall be concealed in walls, concrete floors or structures, and roof spaces, as far as possible. Conduit may be galvanised steel with screwed electric thread where specified.

Every effort shall be made to obviate chasing and the Contractor shall build conduits into walls and floors as the building work proceeds.

Where chasing is necessary the chases shall be as narrow as possible and shall be carried out by machine. Once the conduits have been installed they shall be secured to prevent springing whilst the brickwork is being made good. Chasing of concrete will not be permitted.

Where conduit is installed in concrete floor slabs the conduits shall not cross one another and shall be adequately spaced to permit the satisfactory consolidation of the concrete.

The conduits installed in the concrete slabs shall be kept well clear of the underside and top of the respective slabs. The conduits shall be installed so that any condensation that may form inside the conduit will gravitate to the nearest box.

An electrician shall be standing-by whilst the Contractor is casting concrete over any conduits.

Holes, slots and cable trenches will be formed in the structure as the building work proceeds. The Contractor shall ensure that his conduits are kept well clear (at least 300 mm) from these penetrations when placing conduits for casting or building into the structures.

are run in brickwork and are required to pass through a concrete column or beam, a conduit sleeve shall be cast into the column concrete. As the brickwork is raised the required conduit shall be installed through the sleeve.

Deep concrete boxes shall be employed in preference to shallow boxes fitted with extension rings.

All conduits shall be installed to permit the wiring to be "looped in".

Surface mounted conduit shall be subject to the approval of the Engineer.

All boxes shall be fitted with cover plates where they are not covered by lighting fittings or other devices. All conduits for surface mounted light fittings shall terminate with conduit boxes and shall be arranged to permit back entry to each lighting fitting. The conduit boxes shall be securely fixed, flush with the underside of the ceiling or wall.

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All ducts, spare conduits and conduits for other services shall be clear, water and moisture free and fitted with 2,0 mm diameter galvanised steel draw wire.

All PVC pipes installed as cable sleeves shall be provided with bends, where necessary, with a minimum radius of 600 mm.

18 POWER SKIRTING

In general, three-compartment power skirting manufactured from high impact PVC is preferred.

The compartments shall be utilised for the following services:

Top compartment (80mm high)	Power cabling and socket outlets
Centre compartment (40mm high)	Computer services
Bottom compartment (40mm high)	Telephone services

All compartments of the skirting shall be approximately 35mm deep. All coverplates, end covers, elbows, bends and other fittings for the skirtings shall be provided from the same manufacturers' range of equipment as the power skirting and shall match aesthetically and mechanically.

Flush mounted, round, conduit draw boxes shall be provided in the wall behind each compartment of the power skirting. A 50mm diameter hole shall be provided in the back of the top compartment and 40mm holes shall be provided in the back of the remaining compartments, at positions coincident with the flush mounted conduit boxes, to facilitate the drawing-in of cables and conductors.

Each compartment shall be provided with its own 25mm conduit and box. The conduit coupled to the power compartment shall be run to the respective distribution board (whilst the conduits coupled to each of the remaining two compartments shall be run in accordance with Schedule G.

19 WATER HEATERS & CIRCUITS

Three phase water heater circuits 1 shall comprise four 4mm² PVC insulated copper conductors drawn into a 25mm diameter conduit terminating in a surface mounting box containing a 30 A triple pole isolator. From the isolator a length of 25mm diameter flexible conduit (not exceeding 700mm in length) and fitted at each end with an approved adaptor shall be run to the water heater terminal box. The circuit phase conductors shall be interrupted by the isolator but the mandatory earth continuity conductor shall be run from the distribution board, through the isolator box, to the water heater earthing stud, in one continuous length without joints.

20 Low Voltage CONTROL and Signal Cables

20.1 General

All cables indicated on the drawings and schematics shall be designed and selected according to the loadings, generally as detailed in the Project Specification.

A maximum total volt drop of 2,5% is allowed across the cable from the MCC to the motor terminals under running conditions.

All conductors used in the electrical installation shall be high conductivity, annealed copper with PVC insulation and shall comply with SANS 1507.

No joints will be permitted in any low voltage cable run, except where cable lengths exceed the drum

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length, without prior written acceptance by the Engineer. Any damaged cable shall be replaced by the Contractor at his own cost.

All cables shall be suitably rated.

20.2 Cable Routes

Control and instrument cables for the project may be run on the same cable tray as the power cables but where electromagnetic interference may upset the control signals the necessary precautions regarding screening and physical separation shall be applied.

20.3 Cable Lengths

Cable lengths indicated in the Project Specification are employed for voltage drop calculations only and shall not be used as a basis for re-measurement. The onus is on the Electrical (Sub) contractor to adequately survey the site and measure and price the power and control cabling installation as an all-inclusive complete item. Should a deviation be required due to unforeseen site conditions, the Schedule of Rates for the Electrical Installation shall be applicable to calculate the difference in cost for the installation of power and control cables, but only with the approval by the Engineer.

20.4 Power and Indication Cables (1000/600 Volt)

All power and indication cables shall be of the multi-core stranded soft drawn copper wire PVC insulated PVC bedded, steel wire armoured type with an overall PVC sheath (preferably black) and shall be manufactured and tested in accordance with SANS 1507 for general purpose duty.

The colour of the cores shall be as follows:

Twin core : one red, and one black.
Three core : one red, one white and one blue.
Four core : one red, one white, one blue and one black.

20.5 Instrumentation Cables (24V / 220V)

Instrumentation cable shall be constructed of multiple twisted pairs of insulated stranded copper wire, PVC insulated with an overall aluminium shield, extruded PVC inner jacket, served with steel wire armour with an extruded PVC outer jacket.

The nominal conductor resistance shall not exceed 3,5 ohms per 100 m at 20°C.

The complete cable shall withstand a dielectric test conductor to conductor and conductor to shield of 1 000 V dc for one minute.

The insulation resistance of each conductor shall be not less than 8 800 meg ohms/km for 1 minute at 500 V and 20°C, measured with the remaining conductors in the cable connected to the armouring.
The minimum core size shall be 1,5 mm².

All instrumentation and signal cables (excluding optical fibre cables) shall be installed separate from power cables.

20.6 Panel Wiring (24v / 220V)

Further to the abovementioned Clause, all panel wiring shall be of the silicone-insulated type with stranded tinned copper conductors, with a minimum conductor size of 1mm².

The colour of the conductors shall be as follows:

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220V AC control Line => Brown
220V AC Neutral => Black
+24V DC => Orange
-24V DC => Violet or Purple

20.7 PLC Wiring

Further to the abovementioned Clause, all panel wiring shall be of the silicone-insulated type with stranded tinned copper conductors, with a minimum conductor size of 1mm².

The colour of the conductors shall be as follows for Digital Signals:

PLC DIGITAL Inputs => Grey

PLC DIGITAL Outputs => Pink

The colour of the conductors shall be as follows for Analogue Signals:

PLC ANALOGUE Inputs => twisted pair Red/black

PLC ANALOGUE Outputs => twisted pair White/black

20.8 Spare Cores in all Cables

All cables installed shall include for spare cores. The spare cores shall amount to 10% of the number of cores used, rounded up to the nearest whole core.

20.9 Cable Identification

A suitable tag, onto which the appropriate cable identification number in accordance with the Contractor's detailed cable schedule shall be stamped, shall be adequately secured just below the gland at the ends of each cable.

Where cables deviate from one route to another (e.g. at tee's, on cable trays or in trenches) additional identification tags with numbers shall be fitted to each cable, within 500 mm of the point of deviation.

20.10 Cable Schedules

The Contractor shall submit to the Engineer a detailed schedule of all cables together with drawings showing cable routes (both underground and on cable trays) for approval prior to the commencement of laying such cables.

21 MV CABLES

21.1 General

The contractor shall upon request by the Engineer present the qualifications of the cable jointer to be used, including copies of all relevant supporting documentation.

Note: The Tenderer shall have a complete toolbox with all the necessary equipment need to complete the work at hand as well as any other work that may arise due to site conditions.

Only artisans that can produce Certification to prove that the relevant Termination Manufacturer has accredited them will be accepted for the proposed work.

21.2 Terminations

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Cable end terminations shall be dry type, suitable for the proposed equipment that is to be used.

The Engineer shall, before any work commencement, approve the type of cable ends proposed to be used by the contractor.

Heat shrink terminations shall be manufactured for non-tracking and U.V. stabilised for long life.

Termination or joint kits shall be packed as a complete kit, clearly marked in respect to the suitability for cable type, construction, and voltage. Each kit shall be packed with a detailed set of manufacturer's instructions. All terminations, joints, and all associated work shall be executed with the correct tools as described by the manufacturer.

Soldered ferrules are to be used for cable joints and terminations.

Cable joints shall be of the moisture blocking type for the prevention of moisture ingress from one cable to the other through the joint box.

Paper-insulated cables that are to be made off into cable end boxes shall have the lead covering, armouring and a correctly sized earthing conductor, finished into and consolidated by a solder wipe.

The electrical continuity of all the conductors shall be ensured and shall not be degraded by any method of cable termination, by inferior workmanship or exposure to any form of corrosion.

The Contractor shall ensure that phase rotation of the cables installed, coincides with the supply phase rotation at all points in the installation.

Any cable ends that are to be left unattended shall have their ends capped to prevent any moisture ingress occurring.

In the event of inclement weather the Contractor shall ensure that all work on MV cables is undertaken under suitable cover.

21.3 Cable Glands

All cable glands shall be of the adjustable pattern to secure to the wire armouring of the cable and shall be manufactured from nickel-plated brass. All cable glands shall be fitted with waterproofing neoprene shrouds.

21.4 Power Cable Terminations

Power cable terminations, connections and joints shall be facilitated by means of the use of a portable hydraulic compression tool with pre-set automatic tamperproof hydraulic unloading bypass valve, the entire equipment being either bought from, hired, or approved by the Cable Manufacturer. Approved lugs or ferrules shall be crimped to the cable cores in all cases. No other method of termination or joint shall be allowed.

Where aluminium and copper or brass is in intimate contact and especially where the joint so formed is current carrying, "Densal" jointing paste or other approved paste or treatment shall be used.

22 Cable Trenches

The cable trenches shall be as per project specification to suit environment, but shall generally be a minimum of 450 mm wide x 750 mm deep. The trenches shall contain no stone or sharp objects and shall be inspected by the Engineer prior to backfilling.

For the purpose of this Subcontract, only three classes of material are considered and all excavated

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material shall be classified according to the following:

Type (as measured) in this document	General Description	Formal Classification to SANS 1200
Soft excavation	Excavation by pick and shovel in soft soil	Soft Excavation
Intermediate excavation	Possible by use of pneumatic tools and equipment	Intermediate excavation: Boulder excavation Class A Boulder excavation Class B
Hard rock excavation	Removal of material by blasting	Hard Rock excavation

The cable trenches shall conform to the Engineer's drawing entitled "Typical Cables in Trench, Manhole & Cable Route Marker Detail Layout".

The Contractor shall provide all cable trenches. The Contractor shall be responsible for any damage to any services which may exist on the site and shall cover all costs incurred for the repair of any services which are damaged during the trench excavations

Although a minimum cable trench width has been specified, the installation of two or more cables shall result in the Contractor engineering the actual cable trench width to ensure that all cables are not underrated.

Trenching that is to be undertaken within the existing MV substation shall be by hand and supervised by a competent person, approved by the Engineer. No trenching machines will be allowed within the Existing MV substation and MV equipment area.

WMA may assist with the identification of existing cables depending on availability of equipment. The onus lies on the Contractor to ensure that services have been adequately surveyed and recorded prior to excavation.

All backfill material shall have enough moisture content so as to allow for good compaction. Backfill material shall be laid in layers to a depth of 150mm and then compacted by a compaction machine, suitable for the work at hand. The contractor shall ensure that the cable bedding sand and backfill is of a good quality to ensure that the thermal resistivity of the ground is at least improved.

All trenching shall conform to the standard as laid down in SANS 10198.

The contractor shall also ensure that the cable trenches are properly fenced off at all times until the cables have been installed and the trenches backfilled.

Danger tape shall be installed as specified.

The cable trench shall be shored with timber boards where required to ensure safety to workers and the public and facilitate ease of installation.

All trenching shall be inspected by the Engineer prior to backfilling.

The tender prices for excavations shall include the following:

- a) Excavations of cable trenches.
- b) Levelling of the bottom of trenches.

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- c) Supply and laying of a 75 mm minimum layer of sifted soil.
- d) Supplying and covering of the cables with a 75 mm layer of sifted soil after the cables have been laid and spaced and after the inspection and approval by the Engineer.
- e) The backfilling and consolidation of trenches with soft soil.
- f) The removal of all surplus materials from the sites.
- g) Finishing and levelling of sites where excavations were done.

23 Cable route marker

Cable route markers shall be installed every 50m in straight runs and at every change of direction. These shall be of concrete pyramid type, with engraved aluminium label as detailed on drawing entitled "Typical Cables in Trench, Manhole & Cable Route Marker Detail Layout".

24 LOW VOLTAGE ELECTRICAL MOTORS

Reference shall be made to the General Mechanical Specification.

25 POWER FACTOR CORRECTION EQUIPMENT

25.1 General

A single power factor correction installation shall be provided under this contract within the proposed Motor Control Centre Switchboard as detailed in the Project Specification.

The power factor correction control equipment shall be housed within the tier entitled "PFC" with the associated capacitors mounted in the rear corner panel of the proposed Motor Control Centre Switchboard adjacent to the "PFC" tier.

The proposed power factor correction value required under this project shall be as per the Project Specification.

The power factor for the installation shall be corrected to not less than 0.98 lagging for all load conditions. A 6-step Reactive Control Relay shall be employed for the controlled switching of the 6 required capacitors to achieve the target power factor value. If this is insufficient, a 12-step controller may be employed, noting that each capacitor may not be larger than 100kVar.

25.2 Ventilation

The "PFC" tier and the cubicle housing the capacitors shall be designed for and equipment arranged for adequate airflow. Ventilation shall be by natural convection within the respective cubicle, but both cubicles shall be fitted with ventilation fans installed in the rear door of each cubicle, to transfer heat to the ambient.

25.3 Capacitors

Capacitors for power factor correction shall be arranged for operation on the three phase system and shall meet the following requirements:

25.3.1 General

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Suitable for power installations where harmonics, generated by single or multiple Variable Frequency Converters, are known to exist and where inductors are employed to assist in filtering these harmonics. Only 3-Phase capacitors are acceptable. Filled with non-toxic, biodegradable, PCB free oil. Vacuum impregnated with biodegradable impregnating oil. Provided with a container which shall not rupture or leak even after the capacitor is no longer serviceable following an internal fault of any magnitude.

25.3.2 Ratings

The capacitors shall have a nominal rating of 440V and shall clearly indicate the respective KVA_r outputs on the exterior of the Capacitor at 400V and 415V.

25.3.3 Protection

Protected against internal failure by a three phase, tear off, fuse.
The capacitors shall be fitted with discharge resistors to IEC 70 to reduce the residual voltage to less than 50V within 60 sec. after being disconnected from the supply.

25.3.4 Switching

Each 3-Phase capacitor installed shall be individually switched via a suitable rated contactor, whether it is the total step or a portion thereof.

25.4 Reactive Control Relay

The flush panel mounted controllers shall be provided with a minimum of:

Key operated, "Auto" "Off" "Manual" selector switch

Pilot light (multiple LED) indication for each set of capacitors in circuit.

Soft-touch keypad, integral with the controller, for accessing internal software and calling the various displays.

LED displays for alarms, operating values (such as VOLTS, AMPS, COS ϕ , kVA_r) and programme settings together with keypad adjustment for target and other set values. The display for each value shall be numeric.

Automatic set-up feature that shall locate the position of the CT equipment and investigate the installed capacitive and inductive devices together with their switching modes, before committing the data to memory, and arranging the set-up of the controller.

The set point for the target power factor shall be adjustable, at the keypad, in the range 0,85 Lagging to 0,95 Leading.

Self-diagnostic fault detection.

Alarms for loss of control system voltage and signals. (Controller inputs)

Indication of :

- insufficient compensation available to achieve target power factor
- the identity of the capacitor steps summoned.
- the capacitive fields.

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- the mode of operation (Auto or Manual) for each capacitive step
- the faults as they occur with date and time stamping.
- the 3rd, 5th, 7th, 9th, 11th, and 13th harmonics, displayed as a % of the fundamental.
- target power factor.
- Single phasing detection, with set identification.
- temperature of accommodation for capacitors and inductors.

RS 232 port for Up/Down loading of software and alarms to/from a laptop computer. Compatible with Modbus (or Modbus +) for future interfacing with SCADA system.

When the controller signals a contactor to close shortly after it has been opened, the contactor shall remain open until the capacitor potential has discharged to less than 50V.

25.5 Capacitor Contactors

Contactors shall be selected from the categories listed in IEC 60947-4-1 as follows:

Category AC6b Switching of three phase capacitor banks and detuned capacitors.

Contactors selected from any category shall have an expected life of 1,5 million operating cycles.

Only contactors with manufacturer's published kVA ratings shall be acceptable. Particular attention shall be given to any de-rating which may apply when switching capacitor banks.

Preference will be given for contactors specifically designed for capacitor switching in particular those contactors fitted with inrush limiting resistance, or inductances.

These inrush-limiting resistors shall be removed automatically from circuit once the main contactor poles have closed.

25.6 Contactor Bases

Each capacitor step shall be supplied by one only triple pole HRC fuse base. For short circuit protection, bus-bar mounted fuse bases are preferred. A rating between 1.5 and 1.8 times the rated step current is required, and the fuses shall be of the slow-blowing type.

If contactors with inrush limiting resistors as detailed above are installed then the fuse rating may be reduced to 1.2 to 1.3 times the rated step current.

Connecting cables shall be designed for 1.5 times the rated current values.

25.7 Indicator Lamps

Each capacitive step shall have a cluster LED green indicator lamp, energised via an auxiliary contact on the step contactor.

The appropriate panel cut-outs shall be provided in the system cubicle door to accommodate at least 2 additional steps.

25.8 Control Switches

25.8.1 Hand/Off/Auto switches

Hand/Off/Auto control switches shall be fitted to each capacitive step. The Hand position shall be wired to a phase other than that supplying the reactive relay.

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25.8.2 Maintenance/Normal Switch

A 2-position maintenance/normal key switch shall be fitted and wired to prevent unauthorised switching of the capacitor steps i.e. in "normal" position the Hand/Off/Auto switches shall be electrically disconnected. The key shall be retained in the maintenance position, and be removed in the normal position. Indication of the modes of operation is also required.

26 SUBSTATION ENCLOSURE & RMU PLINTHS

26.1 RMU PLinths

The Contractor shall install new concrete plinths for the mounting of proposed RMUs as per the Project Specification.

26.2 Substation Enclosure

substation enclosure shall be 5m x 3m and be erected as detailed in the Project Specification.

26.3 Substation Enclosure Surface Finish

The enclosed area of the substation shall be excavated to below normal ground level to a depth of 250mm.

A Damp Course Membrane (DPM), 250 micron thick, is to be laid in the excavated area. All seams in the DPM shall be sealed with pressure sensitive tape that is suitable for this type of application.

The edges of the DPM shall be turned upwards through 90° to the vertical plain measured from normal ground level. The vertical edge shall be extended to the normal ground level. After the DPM has been laid and sealed, a layer of 19mm stone chippings shall be laid above the DPM, up to a depth of 250mm.

26.4 Substation Enclosure Fencing Material

Posts, chain link mesh and other materials shall comply with the following:

Fencing posts:

3,00 m high x 75 mm outside diameter x 3 mm wall thickness steel fencing posts drilled capped and hot-dip galvanised after manufacture.

Intermediate stays:

25mm inside diameter x 2,50 mm wall thickness tubular steel stays, which shall be provided with securing lugs welded to each end with drilled holes and hot-dip galvanised after manufacture.

Corner stays:

25mm inside diameter x 2,50 mm wall thickness tubular steel corner stays which shall be provided with securing lugs with 40mm ø holes drilled at one end, and a square base plate welded to the other end and hot-dip galvanised after manufacture.

Chain link diamond mesh:

2,8 mm diameter galvanised steel wire green PVC coated chain link mesh to SANS 1373.

Straining Bolts:

M12 x 300 mm long galvanised steel straining eye bolts with nuts and washers.

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Straining wire:

3,15 - 3,95 mm diameter non-electrical single strand galvanised steel green PVC coated straining wire to SANS 675 and SANS 1373.

Binding wire:

1,8 mm diameter non-electrical single strand galvanised steel green PVC coated binding wire to SANS 675 and SANS 1373.

Barbed wire:

2,5 mm diameter double strand galvanised steel barbed wire to SANS 675 on 50 kg rolls.

The materials to be utilized in the making up of transformer enclosures shall conform to the design detailed on Drawing No. TSE2003-0034 attached to this Specification.

All items shall be hot dipped galvanised.

Paint finishes for poles and gates:

The gates, posts, and stays shall be of hot-dip galvanised steel in accordance with SANS ISO 1461. After galvanising, all parts shall be scrubbed with an approved water- rinse able solvent degreaser complying with SANS 1344 or equivalent neutralising agent. All surfaces shall be spray painted with one coat of calcium plumbate or zinc chromate primer, one coat universal undercoat and one finishing coat of gloss oil paint of H10 (Brilliant Green) of SABS 1091.

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Adequate drying time shall be allowed between the application of the respective coats.

27 ELECTRIC MOTORS

27.1 General

The motors required for this project are described in detail in the Mechanical Specification. Motors offered for this project to be controlled from a frequency inverter, shall be designed run on a supply from where the output will be 50Hz, and the rotor shall be balanced accordingly.

NB Any dimensions or arrangements given are approximate and the successful Tenderer will be deemed to have visited the site and checked the dimensions before proceeding with any work. Tenderers are required to price for a new, fabricated motor baseplate and coupling.

Motors offered by Contractors shall be accepted provided the units have a minimum of servicing requirements including greasing intervals.

Contractors shall be responsible for the alignment of the motor and pump units.

27.2 Rating

The electric motors shall be rated for operation on a 3-phase, 4-wire, 400/230 volt, 50Hz, AC supply, at sea level, in an ambient temperature up to 40°C. The rated power of the motor shall be in the range 7 to 10% in excess of the maximum power required. In addition, the new motor shall be rated so that, with the method of starting and drive arrangement used, the maximum period for the motor to reach full operating speed shall not exceed 10 seconds.

27.3 Specifications

Except as otherwise specified, the motor shall be a standard squirrel cage machine complying with SANS 1804 as amended, with IP66 enclosure and IC 411 cooling, and suitable for a damp environment. The motor shall be suitable for both "continuous running duty", Duty Class S1, and "intermittent periodic duty", Duty Class S3. Windings shall be copper conductors insulated with Class F material with Class B temperature rise. The motor shall be suitable for six starts per hour, two of which shall be consecutive.

The motor shall also be suitable for bi-directional operation.

27.4 Type

The type of motor (and starter if applicable) to be supplied is determined by the requirements of the application specified in the Detailed Specification and by the starting limitations specified in the Electrical Specification. In the absence of such specifications, a standard squirrel cage motor, arranged for horizontal operation, and complying with this Clause shall be offered.

27.5 Construction

Motor frames shall be of the totally enclosed fan cooled type with cast iron yoke frames and cast iron end covers. The end covers and yoke shall be properly machined and each cover shall locate on a spigoted register to ensure concentricity and parallelism.

The bearing housings shall be provided with grease nipples and where the grease nipples would be difficult or dangerous to reach with the motor running, extension tubes shall be provided.

27.6 Terminal Boxes

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Terminal boxes shall be mounted mid-height of the yoke, wherever possible, and arranged for cable entry from the lower side of the box. The two ends of each stator winding shall be "brought out" to the terminal box. The terminal box and terminals shall be provided with more than adequate space for terminating the single three core cable, to SANS 97, at the motor.

27.7 Thermistors and Heaters

The motor shall be provided with thermistors embedded in the windings of each phase. The thermistor tails shall be "brought out" to separate terminals mounted near the motor winding terminal block. In addition, the motor shall be fitted with "pocket" heaters. The heaters shall be mounted at the bottom of the motor frame and shall be easily replaced without dismantling the motor.

27.8 Variable Speed Applications

In applications where the motor speed is controlled by supply frequency variation, the motor shall be cooled by a separate motor driven fan supplied from a separate 50 Hz source and mounted "piggy-back" fashion on the main motor. This "piggy back" motor shall be provided with its own circuit breaker and starter in the same enclosure as that of the speed controlled motor. This requirement will be waived if the Contractor can provide test results to confirm that the drive and motor design with shaft mounted fan can operate in the application without overheating. This requirement does not apply to submerged motor applications.

27.9 Special Motors

Should the Tenderer wish to offer a different type of motor to that specified so as to obtain special starting characteristics and/or variable speed, a full technical specification of the motor shall be supplied and such specification shall be for the equipment to a standard at least equal to that of the motor specified above. In particular, no item of electrical protection shall be omitted.

27.10 Environmental Warning

Motor manufacturers are warned that the motor is to be installed in a corrosive and often damp environment. The motor shall therefore be adequately protected.

28 POSITIONS

The Engineer shall approve final positions and arrangements of all equipment forming part of this contract.

29 Redundant EQUIPMENT

All equipment made redundant during work on this Council's Plant contract shall be listed in writing and made available to the Engineer who shall provide final confirmation as to what equipment may be scrapped by the Contractor. This Council reserves the right to retain any equipment made redundant for use on this or other plants under its control.

30 FINISHING AND PAINTING OF MATERIALS AND EQUIPMENT

All equipment and materials supplied under this Contract, irrespective of whether it is for the electrical subcontract or not, shall comply with this Council's specifications.

The painting and finishing specifications are detailed in the General Mechanical Specification, and the onus is on the Electrical Contractor to familiarise with these specifications.

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31 OPERATION AND MAINTENANCE MANUALS

Operation and Maintenance (O & M) manuals are required for all major items of equipment. Where literature is supplied by the manufacturer, the Contractor shall omit all duplicate sections in other languages. The manual shall be in English only.

These O & M manuals are required for the commissioning of the works. The installation shall not be commissioned or the Subcontract deemed complete without these manuals.

The Contractor shall provide all electrical drawings on "CD" in a format capable of being retrieved directly into AutoCAD 2012.

The Contractor shall supply an "As-Built" cable schedule included in the electrical portion of the maintenance manual.

Equipment lists shall be provided with each drawing.

Specific requirements for the manual, layout and format etc., are as detailed in the General Mechanical Specification.

32 Spares and Tools

At completion of the work, before commissioning, the Contractor shall submit for approval by the Engineer, a full list of the spares that he intends providing.

Where specific spares are recommended by the supplier or manufacturer, these shall be included in full in the list for approval.

Generally, spares shall include the following:

LV fuses: 1 spare for every 2 installed.

Indicator lamps: 1 spare for every 10 installed.

Lamp lenses: 3 spare for each colour installed

Push buttons: 1 spare for every 3 or less of each colour and type installed.

Lamps of luminaires: 1 spare for every 10 or less of each type installed.

Any special tools required to perform routine maintenance on any specific item of equipment shall be provided under this contract.

33 EQUIPMENT APPROVAL

The Contractor shall submit detailed working drawings of all boxes, boards, panels, brackets, trays, etc. to the Engineer for approval prior to manufacture. The drawings shall be not less than A2 and shall clearly indicate the principal dimensions and at least two cross sections shall be provided. Door and cover plate details shall be given, together with details of hinges and catches. The work may not proceed until the drawings have been properly scrutinised and approved.

34 SCHEDULE OF EQUIPMENT

A complete list of fittings and other equipment intended for use on this Contract is to be submitted with the tender. This list shall contain manufacturers' names, catalogue numbers, etc. Where any item offered is not to specification, prior approval in writing shall be obtained from the Engineer before this can be offered.

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Should any item supplied not comply with the specification, an alternative which meets the specification is to be approved by the Engineer and provided at no additional cost to the Contract.

35 EQUIPMENT TO BE SUPPLIED AND INSTALLED

The Engineer reserves the right to call for samples of the equipment offered, to inspect the workmanship as the work proceeds and to either accept or reject the equipment, or workmanship. The Engineer's approval of the design, materials and workmanship shall in no way reduce the Contractor's liability to provide a complete and proper working plant which is abreast with modern technology.

All such samples may be retained until completion of the Contract. All such samples shall have securely attached thereto labels designating the Contract by name and number (if any), the name of the Contractor and any further relevant information.

Unless where specified and agreed to IN WRITING, all equipment supplied by all parties shall be new and unused.

36 CLAIMS & LIMITATIONS

The Contractor will be deemed to have visited the site and to have satisfied himself as to the nature of the work, to have acquainted himself with any limitations which may be imposed upon him and to have provided for any additional costs which he may consider necessary for the proper completion of the work. No claim will be recognised or considered after submission of price on the grounds of lack of knowledge of site conditions or limitations.

The installation shall include everything necessary whether specified in detail or not and shall be carried out in the best possible way to ensure a complete and first class installation to the approval of the Engineer.

37 UNIFORMITY

All items of the same type of equipment shall where at all possible - be of the same make and type for each item throughout the installation, to ensure interchange ability and ease of maintenance.

38 RADIO, TELEVISION, COMPUTER AND COMPUTER SYSTEM INTERFERENCE

The Contractor shall allow for interference suppression components where required, to ensure that the electrical installation shall not cause interference to radio, television, staff location, computer and computer systems.

39 DELIVERY

The Contractor must co-ordinate the delivery dates for all items of equipment supplied by him to allow adequate time for installation, commissioning and testing prior to contract completion.

To this end, the Contractor must ensure that shop drawings are presented to the Engineer for approval timeously, and a programme of submission of such drawings must be approved by the Engineer as specified in the Conditions of Tender.

Documentary proof is to be supplied of the placing of all orders for equipment having a protracted delivery period. No substitution of specified items will be allowed due to the late placing of orders, and no delay claims in this regard will be entertained.

40 CONTRACTOR'S STAFF

The work shall be done by, or at all times be under the personal supervision of an installation electrician appointed in writing by the Contractor as the Responsible Person, in terms of the requirements of the

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Machinery and Occupational Safety Act. This person shall be available during working hours, and shall be experienced in projects of the specified.

The Engineer may, if he deems fit, require that the Contractor removes or causes to be removed an employee of his from the specified premises by virtue of that person's incapability, appearance or any such reason which in the opinion of the Engineer, is valid.

At all times while on the specified premises, all artisan and labourer members of the Contractor's staff shall wear clothing adequately marked with the Contractor's name or acceptable identification.

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41 VARIATIONS

For the purpose of determining the cost of individual variations the Tenderer shall quote scheduled rates which would be accepted as a basis for the evaluation of extras and omission.

42 INSPECTIONS, TESTS, MEETINGS AND COMMISSIONING

42.1 General

The Tenderer shall allow in his Tender price for all costs (travel, accommodation, subsistence, etc.) for two persons to attend such tests or inspections.

The fact that the plant and equipment has satisfactorily passed any test made at the Subcontractor's works shall in no way lessen the responsibility of the Subcontractor to obtain the same results after it has been delivered and erected permanently on site.

42.2 Tests

The Contractor shall notify the Engineer at least 2 weeks in advance, should his presence be required for inspections or witnessing of tests.

42.3 Inspections

Works acceptance (function) tests shall be performed, which shall be witnessed by the Engineer and the Client or the Engineer's representative.

In the event that tests fail, the Contractor shall be required to perform such tests again. Should these test require the Engineer to be present again, the Engineer's cost for time and travel shall be recovered from the Contractor at rates as set out by the South African Association of Consulting Engineers.

All test certificates required in terms of the current SANS regulations shall be furnished before the project can be completed. These shall also be bound into the operating and maintenance manuals.

42.4 Meetings

It is expected that the Contractor will be represented at every Project meeting during the contract. Meetings will be held in two formats, Site meetings and Technical meetings. The Site meetings will be held monthly, and it is expected that the Subcontractor be represented by a senior person in the Subcontractor's firm, who can act on behalf of the Subcontractor.

At the Technical meetings, held between the Site meetings, the Subcontractor's representative may be a site or contracting foreman who is technically competent, having only to receive instructions on behalf of the Subcontractor.

The Subcontractor shall make provision in the pricing of his Preliminary and General costs for these meetings.

43 STANDBY GENERATOR stam

43.1 General

The requirement for the generators shall be provided as detailed in this specification.

43.2 Generic Details

The alternator and engine shall be mounted on a duplex base, and joined via a flexible coupling. The

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shafts shall be supported separately on their own bearings. Also, the alternator and engine units shall be mounted on independent support structures.

The generator shall be installed in the generator room as shown on the civil engineering drawings.

A separate fuel tank will not be necessary to the installation.

The generator sets shall be provided with a control panel located in the generator room. The control panel shall conform to the general requirements applicable to switchboards.

Alternator protection shall be provided by the standby generator Circuit Breaker.

This Contract includes all ducting necessary to complete the installation, including the supply and installation of both air inlet and outlet louvres. The Contractor shall size the louvres for sufficient air flow volumes.

The Contractor shall supply these louvres to the Engineer who in turn will arrange for the installation of these louvres by others.

Internal ducting shall be manufactured from hot dipped galvanised sheet metal, but external louvres shall be aluminium and painted (colour to be confirmed after award).

The generator battery-pack shall be mounted within a galvanised steel frame bolted to the floor. This frame shall not form part of the generator or generator base. The batteries shall be secured by way of a padlockable anti-theft bar. The battery stand shall be adequately earthed by the Contractor.

43.3 Generator Size and Load Details

43.3.1 Generator Sizing

The provisional rating for tender purposes of the generating set is (for standby application) provided in the Project Specification.

The loads on the generator set will be switched as required by the process. The generator shall therefore be sized for worst-case switching conditions.

43.3.2 Load Details

The standby generator will be used to provide standby power to the related equipment as specified in the Project Specification.

43.3.3 Fuel tank

The generator set shall be supplied with a "day tank" to form part of the generator set. The tank shall form part of the base of the generator set. The diesel fuel tank shall have the capacity to allow the running of the engine for at least 8 (eight) hours at full load. The onus will lie with the contractor to size it accordingly.

Provision shall be made to use a manual fuel pump which shall be supplied with the generator set including adequate hoses to facilitate ease of filling of the fuel tank from drums and other portable storage devices.

The Contractor shall specifically note that the following items, certain of which required within SANS10131:2004, shall be strictly enforced:

Material selection
Provision of welding details

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Requirement for an access hatch; specifically for access by maintenance personnel

Quality plan

Comprehensive details of couplings, fittings, level indication and drain valve

Details of hold down brackets and bolts

Fuel tank name plate

Comprehensive details of corrosion protection to be applied to the fuel tank and specifically deviations from the standards contained within this Specification.

Well documented and detailed drawings depicting the arrangement of the fuel tank.

43.4 Alternator

The alternator shall have a continuous output at 0,8 lagging power factor. The machine shall deliver a three-phase four-wire 50Hz supply at 400 Volts.

The alternator output voltage shall not drop by more than 15% under worst-case step loading.

Licences

The Contractor shall supply to WMA all original software licenses for any equipment installed and used for the control of the alternator.

Over current and short circuit protection

The alternator shall have one suitably rated main circuit breaker (moulded case) for alternator main output circuit protection.

The alternator main circuit breaker shall be of such a design so as to allow for shunt tripping from any emergency stop switches, or the emergency stop situated in the alternator control panel.

The emergency stop switch shall be in such a position to allow for easy access from any position within the generator room.

Change - over circuit breaker

The Contractor shall design control circuits that will allow for automatic change over from mains to alternator supply when the main supply fails. The alternator and main incomer circuit breakers shall be mechanically as well as electrically interlocked.

The alternator shall meet the following requirements

Synchronous

Operating at a speed of 1500 rpm

The alternator shall be capable of delivering 115% of its continuously rated power output, on the site, for a minimum of 15 minutes at the rated voltage, without damaging the alternator or shortening the life span.

Seals shall be provided to prevent the lubricating grease from migrating along the shaft to the rotor windings. (Pre-sealed bearings will not be accepted).

Grease cups shall be provided for each bearing in readily accessible positions, even if this means remotely mounting the cups.

The shaft-mounted fan shall be fitted at the air intake end of the machine and preferably this shall be the non-drive end.

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The exciter shall be of the brushless construction, inboard of the bearings, of three-phase full wave design with silicon rectifying diodes.

Insulation shall be non-hygroscopic, non-nutrient Class B on the exciter, Class F on the stator and Class H on the rotating pole pieces.

The alternator shaft shall be rolled steel. The rotating field pole shall be bolted to the shaft with all other rotating electrical components. This means that the shaft shall be free from electrical grounds on the shaft.

The alternator shall have the capability of permitting the measurement of the excitation voltage at rated speed. This voltage shall be obtainable under any load condition.

The rotating bridge assembly shall be mechanically constructed with glass cloth impregnated with an epoxy resin binder.

The alternator shall be 4-wire Y connected with all cable ends brought out to the terminal blocks in the alternator cable end box.

The feet shall have machined surfaces at the mounting rail positions for good axial parallelism and shall be designed to minimise noise and vibration transmitted to the bedplate.

The alternator shaft with its rotating equipment shall be dynamically balanced up to 25% over speed condition.

A heater shall be provided in the alternator, which shall be arranged to keep the machine warm, to prevent the ingress of moisture. The heater shall be energised whilst the machine is stationary and de-energised when the machine is operating.

Measures shall be taken to limit noise emission to an absolute minimum and to achieve this, use of a high efficiency-cooling fan may be necessary.

It should be noted that the electric load of the alternator will include harmonic load (i.e. up to 160kVA harmonic loading) which could be developed by the equipment being fed.

The components of the voltage regulator shall consist of semi-conductors, completely static and containing no electro mechanical relays or fuses. The regulator shall be of the solid-state electronic type. A circuit breaker for protection of the power circuit shall be provided with the voltage regulator.

Response time to changes in load shall be less than 10 milliseconds and shall maintain voltage regulation at 1% R.M.S., when:

Load varies between no load and full load

The power factor varies between 0,8 and unity

A speed change of up to 5% occurs

The regulator shall be capable of withstanding 5 G's from 20 to 500 Hertz.

Alarm equipment with indication and trip facilities

Any trip conditions shall be indicated on the alternator controller to allow easy visual identification of fault conditions and those alarms, which are annotated with the word TRIP shall incorporate facilities, which shall be arranged to stop the diesel engine driven alternator set.

The conditions shall include a minimum of the following:

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High engine temperature. [TRIP]
Low oil pressure. [TRIP]
Low cooling water level.
Low fuel level. [TRIP]
Excess electrical load on alternator. [TRIP]
Battery voltage low at starter motor cranking speed.
Failure of supply to engine immersion element.
Failure of supply to battery charger.
Start system inhibited (excessive start attempts).
Alternator output under voltage. [TRIP]
Alternator output over voltage. [TRIP]
Alternator output under frequency.
Alternator output over frequency. [TRIP]

All trip conditions shall not be resettable unless the fault has been cleared.

43.5 Prime-Mover

The prime-mover shall be a diesel engine specifically designed for the purpose of driving an alternator at a class AO governed speed of 1500 revolutions per minute.

The engine shall be freely available in the Republic of South Africa, including spares, servicing and workshop facilities.

The engine of the standby alternator set as supplied and installed shall be suitably rated to meet the requirements of this specification.

The exhaust gas temperature, measured in or on the manifold, shall not exceed the manufacturers stated limit, and in any case shall not exceed 500°C at 100% of the specified engine/alternator rating.

Turbo-charged engines will only be accepted provided the engine is designed and manufactured as such. The turbo-charger shall be fitted with a heat shield if near any combustible material. Turbo-charged engines shall be suitably sized to meet the step load performance specified. Reaction time of the turbo-charger shall not exceed the time specified in BS551.4, for class AO governing.

The Tenderer shall ensure that the manufacturer of the prime-mover shall provide the prime-mover intake and exhaust silencing, to ensure compliance with standards and specifications pertaining to the prime-mover considered. Should 'add on' silencing equipment be necessary for sound attenuation, then the 'add on' shall be to the approval of the manufacturer of the prime-mover.

43.6 Engine

The engine shall be provided with the following:

An enclosed flow, force feed lubrication system by a positive displacement type oil pump fed from engine oil sump.

A low oil pressure protection alarm.

Fuel and lubricating oil filters with replaceable elements and pressure by-pass.

An air-inlet manifold filter of the dry element type.

A fuel injection pump with a suitable governor, capable of controlling the engine speed in accordance with BS5514 class AO.

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A continuously rated fuel solenoid required for engine cut out. The control arm shall have only one knuckle joint and should an external spring be required it shall be anchored to a purpose made bracket.

A heavy-duty 26-volt charging alternator, regulator and batteries for engine starting. Battery shall be capable of at least 6 consecutive start attempts, each attempt at cranking calculate for duration of 5 seconds.

Provision shall be made to adequately protect the engine against failure of the cooling system (i.e. high temperature protection and alarm). '

"EMERGENCY STOP" button shall be fitted within the alternator control panel, affording maximum safety to the operators of the standby alternator set.

A rotary pump, with pipe, for the removal of the crankcase oil where oil is difficult to drain.

An acceptable over speed sensing device.

The engine shall be supported at the front by mounting brackets. An acceptable method of supporting the back of the engine in the event of alternator removal shall be supplied, such as loose mounting brackets.

The flywheel shall have a moment of inertia, which shall allow the cyclic irregularity of the set to fall within the limits specified by BS 5514 as amended and meet the specified performance. The flywheel shall be both statically and dynamically balanced.

The engine shall be fitted with the necessary devices to automatically protect the engine against low oil pressure, excessive temperature rise, etc. Further, suitable gauges shall be mounted on a suitable purpose made bracket, mounted within the prime-mover area, to afford visual inspection of the state of the standby generator set, operating parameters.

43.7 Exhaust and Silencing

All piping for the exhaust system shall be of grade 304 stainless steel. The silencers and all pipe support brackets shall also be of stainless steel.

The exhaust system, including silencers, shall be acoustically insulated with a preformed mineral wool inner layer sealed with asbestos free finishing plaster in order to satisfy the OHS Act requirements.

Exhaust outlets shall be fully protected against the ingress of rain.

The silencing system shall include a reactive silencer and an absorptive type silencer and all support brackets. A flexible connection of the bellows type shall be installed as close to the manifold(s) as possible to limit vibration transfer and to allow expansion under heating. The standard reactive (i.e. pulsation damper type) silencer shall be installed downstream of the flexible connection. The distance between the engine and the reactive silencer shall be designed to avoid resonance. An additional absorptive silencer, Burgess or equivalent, shall be installed downstream of the reactive silencer. The tail pipe shall have a length of at least 15 times the pipe diameter, measured downstream of the absorptive silencer.

Where the generator set is installed inside an enclosure or room, both silencers shall be installed inside the enclosure. The exhaust outlet shall be led outside the generator room to discharge at least 2,5 metres above ground level.

43.8 Starting and Stopping

The engines shall be easily started from cold, without the use of any special ignition devices, under summer as well as winter conditions, against full load. To ensure easy starting in cold weather the engines

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shall each be provided with a thermostatically controlled 230-250 volt AC. electric immersion heater fitted to the water jacket. The electric circuits for these heaters shall be taken from the respective battery charger control board and shall be de-energised once the alternator has reached a 'steady state' output.

Circuit-breaker protection (with earth-leakage) is required for each immersion heater circuit.

The starting control for the prime-mover shall make provision for three consecutive start attempts of 10 seconds duration, each with 10 seconds rest periods in between. After a 3 minute rest period provision shall be made for a further three start attempts also of 10 seconds duration. If the prime-mover fails to start after these six attempts, the control circuit shall inhibit further start attempts until the reason for the failure to start has been traced and rectified, whereupon it shall be possible to reset the inhibiting device. When the set fails to start a visual alarm shall indicate the fault.

43.9 Prime-Mover Batteries

The prime-mover batteries shall be deep charging lead acid type batteries. The Tenderer shall ensure that the batteries are rated for the application intended in this specification.

The batteries shall be mounted on free standing, corrosion resistant stand that shall be separate from the prime-mover, and allow for easy maintenance of all cells.

The battery stand shall incorporate a protective cover to prevent accidental contact with the battery terminals. The stand shall incorporate a cubicle to accommodate a hydrometer, which shall be provided with the unit.

43.10 Battery Charger

Automatic battery charging equipment of the constant current, voltage, monitoring type, shall be provided in a compartment, within the DB board. The battery charging equipment shall be isolated, with sheet steel barriers, from the remainder of the equipment in the control board. When the battery voltage reaches a pre-determined high level, the charger shall be switched off, thus enabling the battery to discharge to a pre-determined lower point, whereupon the charger shall again be switched on.

The battery charger circuit shall incorporate a "boost charge" with a lock out key switch, thus ensuring only authorised persons have access to the "boost" facility.

In the event of a mains failure, the supply to the battery charger shall be arranged to change over to the standby power output when the diesel engine driven alternator set is switched to its load, thus obviating the necessity for a separate charging device mounted on the engine.

43.11 Cooling Systems

The prime-mover shall be of the water cooled type and shall incorporate a built-on, heavy duty pattern, pressurised radiator, suitable for ambient temperatures up to 450 C. The cooling system shall be arranged to draw the air over the prime-mover and to force the cooling air through the radiator and into the duct which shall direct the air to the outside of the ISO container. Temperature sensing devices shall be provided which shall monitor temperatures in both the engine cooling and exhaust systems. The temperature monitors shall be provided with alarm and "shut down" features. The temperatures at which the alarms are set shall be adjustable within the range 85% to 98% of the value set for the temperature at which "shut down" occurs. The temperature at which "shut down" occurs shall be similarly adjustable but shall be set and sealed by the manufacturer. Should a high temperature be monitored, an alarm (both visual and audible) shall be provided. If the temperature continues to rise the alternator set shall automatically shut down when the "shut down" temperature setting is attained. Audible and visual alarms shall be indicated and enunciated when "shut down" occurs.

The audible alarms, at all levels, shall be provided with accept facilities but the visual alarms shall remain displayed until the cause is removed. All alarms and settings shall be provided on the control board.

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43.12 Lubrication

Each lubrication system shall comprise:

- a self-lubricated, positive displacement gear driven oil pump with a pressure relief valve
- full flow engine mounted oil filter of the replaceable element type equipped with an automatic by-pass valve (direct engine mounted no exposed oil lines)
- full flow oil cooler with an automatic by-pass valve
- pressure lubricated main, connecting rod, gudgeon pin, camshaft and rocker arm bearings
- spray oil cooled piston under crowns
- positive crankcase ventilation.
- low engine oil level sensor

Protection shall be provided against low oil system pressure. This protective device shall shut down the engine and give a visual and audible indication on the control board. The detection system shall be manually reset before the engine may be re-started.

The Contractor shall provide details of the recommended lubricants specified by the manufacturer in the operation and maintenance manuals.

43.13 Fuel Systems

The fuel system shall comprise:

One base tank consisting of a polyethylene inner fuel tank and a 304 stainless steel safety outer tank (with filler pipe protected with vandal proof locking covers exterior). The safety tank shall have a sight glass for visual inspections of the polyethylene tank and for leaks that may occur. The safety tank shall have a stop-cock for draining any such leakages.

Anti-fuel theft device/s fitted to tank filler piping.

Manual, self-lubricated, positive displacement, gear driven fuel transfer pump requiring no adjustment

One primary and one secondary fuel filter of the replacement element type, and a water trap of the "Automatic" type or equivalent.

An approved water trap/traps.

An indicating fuel level gauge.

A low fuel level alarm giving an audible and visual signal on the control board. A cancel device for the audible alarm is required.

A drain cock/s shall be provided on the fuel tank/s to permit the tank/s to be drained and cleaned. The drain cock/s shall be fitted with a padlocking facility.

A visual fuel level indication (non-electric or electronic)

Tank capacity for 12 hours uninterrupted operation, at the rated full load of the alternator.

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The fuel tank shall be designed, constructed and installed in accordance with SANS 10131: "The Storage and Handling of liquid Fuel, Part II – 1979 Large Consumer Installations".

Exterior of tank to be painted with a suitable diesel resistant paint.

The capacity of the fuel tank/s shall be stencilled on the outside of the tanks.

The fuel tank/s shall be supplied with fuel filled to the tank/s full capacity.

E-fuel tagging together with all electrical connections needed.

Sufficient 304 stainless steel bunding tank with drain facility.

Fuel Leak test

The fuel tank shall be tested for leaks prior to any paintwork that is to be undertaken and leak tests shall be witnessed by the Engineer.

43.14 Generator Tuition

All staff identified shall be provided with an awareness of the emergency power system. This shall include specific education as to the effect on the generator of starting motors and overloading the generator. Additionally, training shall be provided in the monitoring of the emergency power generator's fuel level and how to refuel.

The Contractor shall also provide specialised training to the Council's Electrician(s) responsible for the maintenance of the works, including the emergency power generator. This training shall also include a briefing of the control philosophy, wiring, electrical protection settings and configuration (including controllers) as detailed in this Contract.

44 GENERATOR CONTROL PANEL

44.1 General

The generator control panel shall be installed in the generator room as indicated on the civil drawings.

44.2 Construction

- (a) The generator control panel shall be a surface wall-mounted unit.
- (b) The unit shall be constructed from 3CR12 steel in accordance with SANS 1180 Part I and Part II as applicable.
- (c) The unit shall comprise a single section to house the control gear and generator controller. The panel door shall have padlockable hinged-door.
- (d) Cable entry shall be from below through an aluminium gland plate.

The generator control panel shall be coloured electric orange as per SANS 1091.

44.3 Switchgear and Controlgear

- (a) The controller device shall be a "Deepsea Electronics" Controller, or equal and approved. The

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generator controller shall be installed in the generator control panel.

It is envisaged that the Generator Controller will be fitted with a RS485 port for communicating with the PLC's in the respective MCC's. The Contractor shall ensure that he provides all equipment required for connection of the Generator Controller to this PLC, including cabling.

The contractor shall also include for the integration of the generator set controllers with the SCADA system. All necessary equipment and cabling shall be provided by the contractor.

(b) Local protection for the electrical distribution in the Generator Control Panel shall be effected by an MCB installed in the generator control panel. Surge protection will be provided in the respective MCC.

(c) The changeover switchgear and control gear shall be incorporated in this panel. The automatic changeover shall be controlled by the generator controller device. The changeover operation shall operate as follows at loss of main supply:

MCC mains supply circuit breaker shall remain in the closed position until the generator has reached full speed.

At full speed the mains supply circuit breaker shall open and after a one second delay the generator supply circuit breaker shall close.

The respective PLC shall start the loads as required to run under standby generator supply conditions.

When normal supply returns, the PLC shall control the return to mains power automatically.

The generator controller shall however include for a generator rundown period.

(d) The manual and automatic starting control shall make provision for three consecutive start attempts of 10 seconds duration, at 10 second intervals. The process shall be repeated after 3 minutes if the engine has failed to start. If the engine still fails to start the control circuit shall inhibit further start attempts until the reason for the failure to start has been traced and rectified, whereupon it shall be possible to reset the inhibiting device.

When the set fails to start, a visual alarm shall indicate that further start attempts have been inhibited.

(e) The generator controller shall be configured in order to provide the signals to the respective MCC PLC via a RS485 connection, for integration into the plant SCADA system.

The control panel shall have a suitably rated DIN rail mounted main circuit breaker which shall be clearly marked.

45 GENERATOR MATERIALS & CORROSION PROTECTION

The following materials and corrosion protection systems shall be applied to the generator equipment (noting that the paint systems indicated are detailed in the General Mechanical Specification):

Engine	:	System B/2
Alternator	:	system B/2
Radiator	:	system B/2
Genset base plate	:	hot dipped galvanised steel
Silencer	:	AISI type 3, 409 stainless steel
Silencer support brackets	:	AISI, 316 stainless steel
Silencer cladding	:	AISI, 316 stainless steel sheet
Air outlet ducting	:	Hot dipped galvanised sheet
Diesel fuel tank (external)	:	system C/2

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Fuel piping : 316 stainless steel
Ladders & platforms : Hot dipped galvanised steel
Diesel fuel tank (internal): Carboline 187 HFP with SA2½ surface preparation

Sound Attenuation

The prime-mover and alternator-combined noise level, when installed in the generator building shall not exceed 70 dbA measured 7m from the building, at full load. The sound attenuation louvres shall be manufactured from 304 stainless steel and be painted with a suitable type of paint that will bond onto the 304 stainless steel.

The Contractor shall notify the Engineer, prior to painting, to inspect and approve the attenuation louvres.

The contractor shall produce proof from his steel supplier to indicate the grade of steel supplied. The Contractor shall keep records to prove that the correct steel for the louvres has been used for manufacturing the louvres.

Sound attenuating materials that needs to be supported/attached within the container interior walls shall be secured behind perforated 1,6mm thick, 10mm diameter perforation, 3CR12 steel sheets . The perforated sheets shall be supported by a method that hides the support system. All joins of the 3CR12 sheets as well as all corners where sheets meet shall be finished off with aluminium 2mm thick aluminium flashing.

The Contractor shall submit detailed drawings with his Tender Offer.

C3.5 Management

CONTENTS

C3.5.1	FORMS FOR CONTRACT ADMINISTRATION
C3.5.2	PROGRAMMING AND PLANNING
C3.5.3	CONTRACTOR'S RESPONSIBILITY INTERMS OF THE OHS ACT
C3.5.4	WORKS NOT TO INTERFERE
C3.5.5	UNAUTHORIZED PERSONS
C3.5.6	MANAGEMENT MEETINGS
C3.5.7	ELECTRONIC PAYMENTS
C3.5.8	WAYLEAVES, PERMISSIONS AND PERMITS
C3.5.9	KEY PERSONNEL

3.5.1 FORMS FOR CONTRACT ADMINISTRATION

The Contractor shall submit with each monthly statement for payment the following updated returns:

- Project Labour Report
- HDI Contract Participation Expenditure Report
- Targeted Labour Contract Participation Expenditure Report

The format of the which are attached in OSD 8.

The Project Labour Report must include details of all labour (including that of sub-contractors) earning less than R160 per day (excluding any benefits) employed on this contract in the month in question.

3.5.4 WORKS NOT TO INTERFERE

The project is to be planned and programmed such that interference with the existing Works are kept to a

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minimum. Tie-ins into existing pipelines or structures are to be planned well in advance to minimise disruptions. The Contractor will advise the Boskrans WWTW plant manager and the Engineer a minimum of 2 weeks prior to any activity that could disrupt the Works in any form.

3.5.5 UNAUTHORIZED PERSONS

The Contractor shall keep unauthorized persons from the Works at all times.

3.5.6 MANAGEMENT MEETINGS

3.5.6.1 Technical Meetings

Technical meetings shall be held monthly on Site and will be called by the Engineer.

The Contractor shall arrange for the Contractor's project manager to attend these meetings.

The Engineer will make notes of the decisions taken and hand these to the project manager at the end of the meeting. The Contractor shall attend to these items and shall provide all present with copies of the notes within one working day

3.5.6.2 Site Meetings

Site meetings shall be held monthly.

3.5.6.3 Health and Safety Meetings

The Contractor is referred to the Health and Safety Specifications.

C3.5.7 ELECTRONIC PAYMENTS

The Contractor shall provide his banking details to enable electronic payments to be made; such payments shall be at the direction of Council's Director of Procurement.

C3.5.8 WAYLEAVES, PERMISSIONS AND PERMITS

The Contractor shall be responsible for obtaining all of the necessary wayleaves, permissions or permits applicable to working near any existing services or other infrastructure on Site and shall abide by the safety conditions imposed by such wayleaves, permissions or permits.

The Contractor shall ensure that all wayleaves, permissions and permits are kept on site and are available for inspection by the relevant service authorities on demand.

The Contractor shall also ensure that any wayleaves in respect of electricity services are renewed timeously every three months.

C3.5.9 KEY PERSONNEL

The Contractor shall submit an organogram of key personnel (stating position and responsibilities) and a schedule of the same listing contact particulars.

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METERING AND INDICATION EQUIPMENT

1. GENERAL

1.1 All meters and indicating instruments shall be of the flush mounted type. Meters not designed for flush mounting, shall be mounted on suitable brackets inside the equipment panel for relay panels, control panels and distribution boards. A suitable door with a glasscovered window shall then be provided in front of the meter.

1.2 Metering and indicating instruments shall be mounted at between 1,2 m and 2 m above floor level, except where the dimensions, type and mounting position of the panel make this impossible.

1.3 All meters shall be protected with suitable fuses.

2. AMMETERS

2.1 Ammeters shall be of the flush mounted, 96 mm square, quadratic scale type unless otherwise approved by the Engineer.

2.2 Ammeters shall comply with the relevant codes and specifications.

2.3 All ammeters shall be of the combined instantaneous and 15 minute integrating time lag thermal demand type unless otherwise specified in the project specification. The instantaneous movement shall be of the moving iron type to Accuracy Class 2,5 of BS 89. The accuracy of the thermal demand movement shall be within 3%.

2.4 The ammeter full scale reading shall correspond with the rated primary current of the associated current transformer with an extended scale to at least 120 % of the full scale value.

2.5 The scale plates of ammeters shall be marked with a red line at the full load current of transformers and motors, and at the associated current transformer primary rating in all other cases.

2.6 Ammeter movements shall be suitable for use in either 1 A or 5 A current transformer secondary circuits as specified*** in the project specification.

2.7 Ammeters shall be fitted with zero adjustment screws.

2.8 Each ammeter shall be clearly marked with the appropriate colour of the phase to which it is connected.

2.9 Where ammeters are to be used with dual ratio current transformers, loose scale plates shall be supplied for each ratio. The ratio shall be indicated on the scale plate.

2.10 Ammeters shall be mounted in a horizontal line on cabinets and cubicles.

3. VOLTMETERS

3.1 Voltmeters shall be of the suppressed zero, 96 mm square, quadratic scale, flush mounted type, unless otherwise specified.

3.2 Voltage transformers will not be used on 400/231 V systems. On all higher voltage systems, the voltmeters shall be supplied from voltage transformers with 110 V secondary windings.

3.3 Voltmeters shall comply with the relevant codes and specifications, and shall be of Accuracy

3.4 Voltmeter scales shall extend to at least 115% of the nominal system voltage. The nominal system voltage shall be clearly marked with a red line on the scale plate.

3.5 All voltmeters shall be fitted with zero adjustment screws.

3.6 All voltmeters shall be equipped with a voltage selector switch. This selector switch shall be suitable for phase to phase selection on high voltage three-wire systems and for both phase to phase and phase to neutral selection on low voltage four-wire systems. The selection switch shall be mounted directly underneath the voltmeter.

4. kWh, kW MAXIMUM DEMAND, kVA MAXIMUM DEMAND AND COMBINED kWh / kVA MAXIMUM DEMAND METERS

4.1 Three and single phase kWh meters, up to 80 A shall be directly-operated types and those above 80 A shall be operated through current transformers.

4.2 kW and kVA Maximum demand meters and combined kVA/kWh meters shall be operated through current transformers.

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4.3 All the above types of meters shall be of the directly-operated voltage type for voltages up to 400/230 V unless otherwise specified. Meters to be used on higher voltage systems shall be operated through voltage transformers with 110 V secondary windings.

4.4 kWh-Meters shall have cyclometer dials and shall be direct reading without the use of a multiplication factor. kWh-Meters or combined kWh/kVA maximum demand meters can, however, be of the non-direct reading type, but in this case, only one multiplication factor shall be used to obtain both the kWh and kVA readings.

4.5 Any multiplication factor applicable to any meter shall be clearly indicated on the meter, or on a label adjacent to the meter, in unit form and not as a combination of several factors. The manner in which this factor is calculated shall however also be displayed indicating the CT and VT ratios used.

4.6 All meters shall be fitted with security seal fitting facilities.

4.7 Maximum demand indicators shall be resettable from the front without the removal of any covers being necessary, and shall have security seal facilities.

4.8 The integrating period on all maximum demand meters shall be 30 minutes, unless otherwise specified.

4.9 Combined kVA maximum demand and kWh meters shall be the relevant codes and specifications suitable for the type of system in which it is to be used.

4.10 Meters shall comply with the the relevant codes and specifications. with Class 2,0 accuracy, unless otherwise specified

5. POWER FACTOR INDICATORS

5.1 Power factor meters shall comply with the relevant codes and specifications.

5.2 The meter shall be suitable for use on 3 phase, 3 or 4 wire system. Unbalanced conditions shall be allowed for.

5.3 Where power factor indication is specified in the project specification, only one meter shall be provided on each circuit where indication is required. The meter shall be installed on the Yellow phase circuit.

5.4 The meter shall be suitable for operation with the current and voltage transformers specified.

5.5 The scales of power factor indicators shall be calibrated at least from 0,6 leading to 0,6 lagging, or a wider range.

5.6 Power factor indicators shall be of the 96 mm square, or larger, flush mounted type.

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PO: OCCUPATIONAL HEALTH AND SAFETY SPECIFICATIONS

Specification in terms of the construction regulations 4(1)(a) of the Occupational Health and Safety Act, No. 85 of 1993

1. Background

In terms of the construction regulation 4(1)(a) of the Occupational Health and Safety Act, No. 85 of 1993, the Nkomazi Local Municipality, as the client, is required to compile a health and safety specification for the intended project and provide such specification to any prospective tenderer.

The client's further duties are as 4(1) to 4(6) in the Construction Regulations 2014.

2. Scope

3. OH&S MANAGEMENT

3.1 Structure and organization of OH&S responsibilities

3.1.1. Overall supervision and responsibility for OH&S

- The client is to ensure that the principal contractor, appointed in terms of construction regulation 4(1)(c), implements and maintains the agreed and approved OH&S plan.
- The chief executive officer of the principal contractor in terms of section 16(1) of the act is to ensure that the employer (as defined in the act) complies with the act. Annexure 2 - "Legal Compliance Audit" may be used for this purpose.
- Any OH&S Act (85 /1993), section 16(2) appointee/s as detailed in his/her respective appointment forms.
- The construction supervisor and assistant construction supervisor/s appointed in terms of construction regulation 6.

3.1.2. Further (specific) supervision responsibilities for OH&S

Appointments required by the act and regulations:

- OH&S representatives (sections 17/18 of the act)
- OH&S committees (sections 19/20 of the act)
- Risk assessor (construction regulation 7(1))
- Accident/incident investigations co-ordinator (general administrative regulation 9(2))
- Form/support work supervisor (construction regulation 10(a))
- Batch plant supervisor (construction regulation 18(1))
- Stacking & storage supervisor (construction regulation 26(a))
- Fire equipment inspector (construction regulation 27(h))
- Electrical installations, machinery & appliances inspector (construction regulation 22)
- Excavations supervisor (construction regulation 11(1))
- Demolition supervisor (construction regulation 12(1))
- OH&S officer (where necessary) (construction regulation 6(6))
- Person responsible for machinery (general machinery regulation 2)

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emergency, security and fire co-ordinator (construction regulation 27(h) & environmental regulation 9)

- Fire equipment inspector (construction regulation 27(h) environmental regulation 9)
- First aider (general safety regulation 3(2))
- Hazardous chemical substances supervisor (HCS regulations)
- Ladders inspector (general safety regulation 13A)
- Lifting equipment inspector (construction regulation 20)
- Operators & drivers of construction plant & vehicles (construction regulation 21(i))
- Structures supervisor (construction regulation 9)
- Users operators of construction equipment (construction regulation 21(i))
- Welding supervisor (general safety regulation 9)

3.2. **Communication and liaison**

- OH&S liaison between the client, the principal contractor, the other contractors, the consulting engineer and other concerned parties will be through the OH&S committee as in **3.10**.
- In addition to the above, communication may be directly to the client or his appointed agent, verbally or in writing, as and when the need arises.
- Consultation with the workforce on OH&S matters will be through their supervisors, OH&S representatives, the OH&S committee and their elected trade union representatives, if any.
- The principal contractor will be responsible for the dissemination of all relevant OH&S information to the other contractors e.g. design changes agreed with the client and the consulting engineer, instructions by the client and/or his/her agent, exchange of information between contractors, the reporting of hazardous/dangerous conditions/situations etc.

3.3. **OH&S file**

The Principal Contractor must, in terms of Construction Regulation 5 (7), keep a health and safety file on site at all times that must include all documentation required in terms of the Act and Regulations and must also include a list of all Contractors on site that are accountable to the Principal Contractor and the agreements between the parties and details of work being done. The following documents must be kept in the OH&S file:

- Notification of construction work (construction regulation 3)
- Copy of OH&S Act (updated) (general administrative regulation 4)
- Proof of registration and good standing with a COID insurer (construction regulation 4 (g))
- Copy of health and safety plan (construction regulation 5(1))
- OH&S programme agreed with client including the underpinning risk assessment and method statements (construction regulation 5(1))
Designs/drawings (construction regulation 5(8))
- A list of contractors (subcontractors) including copies of the agreements between the parties and the type of work being done by each contractor (construction regulation 9)
- Appointment/designation forms as per 3.1.1. and 3.1.2. above
- Registers as follows:
 - * Accident/incident register (annexure 1 of the general administrative regulations)
 - * OH&S representatives inspection register
 - * Form/support work inspection
 - * Excavations inspection
 - * Lifting equipment

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- * Demolition inspections
- * Designer's inspection of structures record
- * Batch plant inspections

- * Arc & gas welding & flame cutting equipment inspections
- * Construction vehicles & mobile plant inspections
- * Electrical installation and machinery inspections
- * Fire equipment inspection & maintenance
- * First aid
- * Hazardous chemical substances
- * Lifting tackle and equipment inspections
- * Inspection of cranes
- * Inspection of ladders
- * Inspection of vessels under pressure
- * Machinery inspections
- * Drivers/operators of mobile plant/construction vehicles daily inspections

The principal contractor will be required to submit the abovementioned registers monthly to the chairperson of the OH&S committee for endorsement.

The health & safety file must be handed over to the client on completion of the contract. It must contain all the documentation handed to the principal contractor by any subcontractors together with a record of all drawings, designs, materials used and other similar information concerning the completed project.

3.4 OH&S goals and objectives and arrangements for monitoring and review of OH&S performance

The principal contractor is required to maintain a compensation incidence frequency rate (CIFR) of at least 8 (refer annexure 3 - "measuring injury experience") and to report on this to the client on a monthly basis.

3.5. Identification of hazards and development of risk assessments, standard working procedures (SWP) and method statements

The principal contractor is required to develop risk assessments, standard working procedures (SWP) and method statements for each activity executed in the contract or project (refer to section 4. below "project/site specific requirements").

3.6. Arrangements for monitoring and review

3.6.1. Monthly audit by client

The client will be conducting a monthly audit to comply with construction regulation 4(1)(d) to ensure that the principal contractor has implemented and is maintaining the agreed and approved OH&S plan.

3.6.2. Other audits and inspections by client

The client reserves the right to conduct other ad hoc audits and inspections as deemed necessary.

A representative of the principal contractor must accompany the client on all audits and inspections and may conduct his/her own audit/inspection at the same time. Each party will, however, take responsibility for the results of his/her own

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audit/inspection results.

3.6.3 Reports

The principal contractor is required to provide the client with a monthly report in the format as per the attached annexure 4: "OHSE risk management report".

The principal contractor must report all incidents where an employee is injured on duty to the extent that he/she:

- dies
- becomes unconscious
- loses a limb or part of a limb
- is injured or becomes ill to such a degree that he/she is likely either to die, or to suffer a permanent physical defect, or likely to be unable for a period of at least 14 days either to work or continue with the activity for which he/she was usually employed

OR where:

- a major incident occurred
- the health or safety of any person was endangered
- where a dangerous substance was spilled
- the uncontrolled release of any substance under pressure took place
- machinery or any part of machinery fractured or failed resulting in flying, falling or uncontrolled moving objects
- machinery ran out of control

to the Provincial Director of the Department of Labour within seven days. (section 24 of the general administrative regulation 8). The principal contractor is required to provide the client with copies of all statutory reports required in terms of the act.

The principal contractor is required to provide the client with copies of all internal and external accident/incident investigation reports including the reports contemplated in 3.9. below.

3.6.4 Review

The principal contractor is to review the hazard identification, Risk assessments and SWP's at each two weekly site inspection/meeting as the construction work develops and progresses and each time that changes are made to the designs, plans and construction methods and processes.

The principal contractor must provide the client, other contractors and all other concerned parties with copies of any changes, alterations or amendments.

3.7 Site rules and other restrictions

3.7.1. Site OH&S rules

The principal contractor must develop a set of site-specific OH&S rules that will be applied to regulate the OH&S aspects of the construction.

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3.7.2. Security and emergency arrangements

The principal contractor must establish site access rules and implement and maintain these throughout the construction period.

Access control must include the rule that non-employees will not be allowed on site unaccompanied.

The principal contractor must develop a set of security rules and procedures and maintain these throughout the construction period.

The principal contractor must appoint a competent emergency controller who must develop emergency contingency plans for any emergency that may arise on site as indicated by the risk assessments. These must include a monthly practice/testing programme for the plans e.g. January: trench collapse, February: flooding etc. and practiced/tested with all persons on site at the time, participating.

3.8. Training

The contents and syllabi of all training required by the act and regulations must be included in the principal contractor's OH&S plan.

3.8.1. General induction training

All employees of the principal and other contractors to be in possession of proof of general induction training.

3.8.2. Site specific induction training

All employees of the principal and other contractors to be in possession of site specific OH&S induction training.

3.8.3. Other training

All operators, drivers and users of construction vehicles, mobile plant and other equipment to be in possession of valid proof of training.

All employees in jobs requiring training in terms of the act and regulations to be in possession of valid proof of training.

OH&S training requirements: (as required by the construction regulations and as indicated by the OH&S specification and the risk assessment/s):

1. General induction (section 8 of the act)
2. Site/job specific induction (also visitors) (sections 8 & 9 of the act)
3. Site/project manager
4. Construction supervisor
5. OH&S representatives (section 18(3) of the act)
6. Training of the appointees indicated in 3.1.1. & 3.1.2. above
7. Operation of cranes (driven machinery regulations 18(11))
8. Operators and drivers of construction vehicles & mobile plant (construction regulation 21)
9. Basic fire prevention & protection (environmental regulations 9 and construction regulation 27)
10. Basic first aid (general safety regulations 3)

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11. Storekeeping methods & safe stacking (construction regulation 26)
12. Emergency, security and fire co-ordinator

3.9. **Accident and incident investigation**

The principal contractor is responsible for the investigation of all accidents/incidents where employees and non-employees were injured to the extent that he/she had to be referred for medical treatment by a doctor, hospital or clinic (general administrative regulation 9).

The results of the investigation to be entered into the accident/incident register (general administrative regulation 9).

The principal contractor is responsible for the investigation of all non-injury incidents as described in section 24(1)(b) & (c) of the act and keeping a record of the results of such investigations including the steps taken to prevent similar accidents in future.

The principal contractor is responsible for the investigation of all road traffic accidents and keeping a record of the results of such investigations including the steps taken to prevent similar accidents in future.

3.10.1 **OH&S representatives and committees**

3.10.1 Designation of OH&S representatives

Where the principal contractor employs more than 20 persons (including the employees of other contractors (sub-contractors) he has to appoint one OH&S representative for every 50 employees or part thereof. General administrative regulation 6 requires that the appointment or election and subsequent designation of the OH&S representative are executed in consultation with employee representatives or employees (section 17 of the act and general administrative regulation 6 & 7).

OH&S representatives have to be designated in writing and the designation must include the area of responsibility of the person and term of the designation.

3.10.2 Duties and functions of the OH&S representatives

The principal contractor must ensure that the designated OH&S representatives conduct a minimum monthly inspection of their respective areas of responsibility using a checklist and report thereon to the principal contractor OH&S representatives must be included in accident/incident investigations.

OH&S representatives must attend all OH&S committee meetings.

3.10.3 Appointment of OH&S committee

The principal contractor must establish an OH&S committee consisting of all the designated OH&S representatives together with a number of management representatives (this number is not to exceed the number of OH&S representatives on the committee) and a representative of the client who shall act as the chairperson without a vote. The members of the OH&S committee must be appointed in writing.

The OH&S committee must meet minimum monthly and consider, at least, the following agenda:

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- Opening and welcome
- Present/apologies/absent
- Minutes of previous meeting
- Matters arising from the previous minutes
- OH&S representatives reports
- Incident reports & investigations
- Incident/injury statistics
- Other matters
- Endorsement of registers and the statutory documents by a representative of the principal contractor
- Close/next meeting

4. PROJECT / SITE SPECIFIC REQUIREMENTS

The following is a list of specific activities and considerations that have been identified for the project and the construction site and for which risk assessments, Standard working procedures (SWP), management and control measures and method statements (where necessary) have to be developed by the principal contractor:

- Clearing & grubbing of the area/site
- Site establishment including:
 - Office/s
 - Secure/safe storage for materials, plant & equipment
 - Ablutions
 - Sheltered eating areas
 - Maintenance workshop
 - Vehicle access to the site
- Dealing with existing structures (NB: existing pipelines are also a structure)
- Location of existing services
- Installation and maintenance of temporary construction electrical supply, lighting and equipment
- Adjacent land uses/surrounding property exposures
- Boundary and access control/public liability exposures (NB: the employer is also responsible for the OH&S of non-employees affected by his/her work activities)
- Health risks arising from neighbouring as well as own activities and from the environment e.g. threats by dogs, bees, snakes, lightning etc.
- Exposure to noise
- Exposure to vibration
- Protection against dehydration and heat exhaustion
- Protection from wet & cold conditions
- Dealing with HIV/Aids and other diseases
- Use of portable electrical equipment including
 - Angle grinder
 - Electrical drilling machine
 - Skill saw
- Excavations including
 - Ground/soil conditions
 - Trenching
 - Shoring
 - Drainage of trench
- Welding including
 - Arc welding
 - Gas welding

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- Flame cutting
- Use of LP gas torches and appliances
- Loading & offloading of trucks
- Aggregate/sand and other materials delivery
- Manual and mechanical handling
- Lifting and lowering operations

- Driving & operation of construction vehicles and mobile plant including
 - Trenching machine
 - Excavator
 - Bomag roller
 - Plate compactor
 - Front end loader
 - Mobile cranes and the ancillary lifting tackle
 - Parking of vehicles & mobile plant
 - Towing of vehicles & mobile plant
- * Use and storage of flammable liquids and other hazardous substances
- * Layering and bedding of trench floor
- * Installation of pipes in trench
- * Pressure testing of pipeline
- * Installing heat shrink joint sleeves
- * Backfilling of trench
- * Protection against flooding
- * Gabion work
- * Use of explosives
- * Protection from overhead power lines
- * As discovered by the principal contractor's hazard identification exercise
- * As discovered from any inspections and audits conducted by the client or by the principal contractor or any other contractor on site
- * As discovered from any accident/incident investigation.

Annexure 1: Construction occupational health – safety – environment audit system

Annexure 2: Guidelines for the development of a health and safety plan

Annexure 3: Guide to risk assessment

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ANNEXURE 1

CONSTRUCTION OHS ENVIRONMENT AUDIT SYSTEM

(based on the new construction regulations)

* Denotes items applicable to both construction sites and contractors plant / storage

1. Administrative & Legal Requirements

SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
Construction Reg 3	Notice of carrying out construction work	Department of Labour notified	
		Copy of notice available on site	
General Admin Reg 3	* Copy of OH&S Act (Act 85 of 1993)	Updated copy of act & regulations on site	
		Readily available for perusal by employees	
COID Act Section 80	* Registration with compens. insurer	Written proof of registration / letter of good standing available on site	
Construction Reg 4 & 5(1)	OH&S specification & plan	OH&S specification received from client	
		OH&S plan developed	
		Updated regularly	
Section 8(2)(d) and Construction Reg 6	* Hazard identification & risk assessment	Hazard identification carried out / recorded	
		Risk assessment and plan drawn up / updated	
		Risk assessment plan available on site	
		Employees/subcontractors informed / trained	
Section 16(2)	* Assigned duties (managers)	Responsibility of complying with the OH&S Act assigned to other person/s by CEO	
Construction Reg 5(2)	Designation of person responsible on site	Competent person appointed in writing as	
		Construction supervisor	
Construction Reg 5(5)(a)	Designation of subordinate person	Competent person appointed in writing as	
		Sub-ordinate construction supervisor	
Section 17 & 18	* Designation of occupational health & safety representatives	More than 20 employees – one OH&S representative, one additional OH&S rep. for each 50 employees or part thereof	
		Designation in writing, period and area of responsibility specified	
		Meaningful OH&S rep. reports	
		Reports auctioned by management	
Section 19 & 20	* Occupational health & safety committee/s	OH&S committee/s established	
		Members appointed in writing	
		Meetings held monthly	

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SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
		Minutes kept	
		Auctioned by management	

SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
Section 37	* Agreement with mandatories (subcontractors)	Written agreement with subcontractors	
		List of subcontractors displayed	
		Proof of registration with compensation insurer/letter of good standing	
		Construction work supervisor designated	
		Written arrangements concerning	
		OH&S reps & OH&S committee	
		Written arrangements regarding first aid	
Construction Reg 7	Fall prevention & protection	Competent person appointed to draw up and supervise the fall protection plan	
		Proof of appointees competence available on site	
		Risk assessment carried out for work at heights	
		Fall protection plan drawn up/updated	
		Available on site	
Construction Reg 8	Roof work	Competent person appointed to plan & supervise roof work	
		Proof of appointees competence available on site	
		Risk assessment carried out	
Construction Reg 8	Roof work	Roof work plan drawn up / updated	
		Roof work inspect before each shift. Inspection register kept	
		Employees medically examined for physical & psychological fitness. Written proof available	
Construction Reg 9	Structures	Information re. the structure being erected received from the designer including:	
		- geo-science technical report where relevant	
		- the design loading of the structure	
		- the methods & sequence of construction	
		- anticipated dangers/hazards/special measures to construct safely	

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SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
		Risk assessment carried out	
		Method statement drawn up	
		All above available on site	
		Structures inspected before each shift. Inspections register kept	

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SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
Construction Reg 10	Form work & support work	Competent person appointed in writing to supervise erection, maintenance, use and dismantling of support & form work	
		Design drawings available on site	
		Risk assessment carried out	
		Support & formwork inspected:	
		- before use/inspection - before pouring of concrete - weekly whilst in place - before stripping/dismantling. Inspection register kept	
Construction Reg 11	Scaffolding	Competent persons appointed in writing to:	
		- erect scaffolding (scaffold erector/s)	
		- act as scaffold team leaders	
Construction Reg 11	Scaffolding	- inspect scaffolding weekly and after inclement weather (scaffold inspector/s)	
		Written proof of competence of above appointees available on site	
		Copy of SABS 085 available on site	
		Risk assessment carried out	
		Inspected weekly / after bad weather	
		Inspection register/s kept	
Construction Reg 12	Suspended scaffolding	Competent persons appointed in writing to:	
		- erect suspended scaffolding (scaffold erector/s)	
		- act as suspended scaffold team leaders	
		- inspect suspended scaffolding weekly and after inclement weather (scaffold inspector/s) risk assessment conducted	
		Certificate of authorization issued by a registered professional engineer available on site / copy forwarded to the Department of Labour	

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SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
		The following inspections of the whole installation carried out by a competent person:	
		- after erection and before use	
		- daily prior to use. Inspection register kept	
		The following tests to be conducted by a competent person:	
		- load test of whole installation and working parts every 12 months	
		- hoisting ropes / hooks / load attaching devices quarterly. Tests log book kept	
		Employees working on suspended scaffold medically examined for physical & psychological fitness. Written proof available	
Construction Reg 13	Excavations	Competent person/s appointed in writing to supervise and inspect excavation work	
		Written proof of competence of above appointee/s available on site	
		Risk assessment carried out	
		Inspected:	
		- before every shift	
		- after any blasting	
		- after an unexpected fall of ground	
- after any substantial damage to the shoring			
		- after rain. Inspections register kept	
		Method statement developed where explosives will be / are used	
Construction Reg 14	Demolition work	Competent person/s appointed in writing to supervise and control demolition work	
		Written proof of competence of above appointee/s available on site	
		Risk assessment carried out	
		Engineering survey and method statement available on site	
		Inspections to prevent premature collapse carried out by competent person	

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SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
		before each shift. Inspection register kept	

SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
Construction Reg 16	Materials hoist	Competent person appointed in writing to inspect the material hoist	
		Written proof of competence of above appointee available on site	
		Materials hoist to be inspected weekly by a competent person. Inspections register kept	
Construction Reg 17	Caissons & coffer dams	Competent person appointed in writing to supervise, control & inspect the construction, installation/dismantling of caissons / coffer dams	
		Written proof of competence of above appointee available on site	
Construction Reg 17	Caissons & coffer dams	Risk assessment carried out to be inspected daily by a competent person. Inspections register kept	
Construction Reg 18	Explosive powered tools	Competent person appointed to control the issue of the explosive powered tools & cartridges and the service, maintenance and cleaning. Register kept of above	
		Empty cartridge cases / nails / fixing bolts returns recorded	
		Cleaned daily after use	
Construction Reg 19	Batch plants	Competent person appointed to control the operation of the batch plant and the service, maintenance and cleaning. Register kept of above	
		Risk assessment carried out	
		Batch plant to be inspected weekly by a competent person. Inspections register kept	
Construction Reg 20 / Mine Health & Safety Act (29 of 1996)	Tunnelling	Complying with Mines Health & Safety Act (29 of 1996)	
		Risk assessment carried out	
Construction Reg 21 / Driven Machinery Reg 18 & 19	Cranes & lifting machines equipment	Competent person appointed in writing to inspect cranes, lifting machines & equipment	
		Written proof of competence of above appointee available on site	
		Cranes & lifting tackle identified / numbered	

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SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
		Register kept for lifting tackle	
		Log book kept for each individual crane inspection:	
		- All cranes - daily by operator	
		- Tower crane/s – after erection / 6 monthly	
		- Other cranes – annually by comp. person	

SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
		- Lifting tackle(slings / ropes / chain slings etc.) - 3 monthly	
		Risk assessment carried out	
Construction Reg 22 / Electrical Machinery Reg 9 & 10 / Electrical Installation Reg	* Inspection & maintenance of electrical installation & equipment (including portable electrical tools)	Competent person appointed in writing to inspect / test the installation and equipment	
		Written proof of competence of above appointee available on site	
		Inspections:	
		- Electrical installation & equipment inspected after installation, after alterations and quarterly. Inspection registers kept	
		Portable electric tools and -lights and extension leads identified / numbered	
		Monthly visual inspection by user / issuer	
Construction Reg 2: Diving Regulations	Water environments	Storeman Register kept	
		Competent person appointed in writing to supervise diving operations and ensure maintenance, statutory inspection and testing by an approved inspection authority of equipment used	
		Written proof of competence of above appointee available on site	
		Proof of registration of all divers present on site available	
		Risk assessment carried out	
		Diving manual produced. Available on site	
		Record of voice communications kept	
		Diving operations record kept	
Each diver keeps a personal logbook. Entries countersigned by the diving supervisor			
Decompression tables available on site			

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SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
		Records of any decompression illness kept	
		Certificate of manufacture of any compression chamber or diving bell in use available on site	
Construction Reg 30 General Safety Reg 8(1)(a)	* Designation of stacking & storage supervisor	Competent person/s with specific knowledge and experience designated to supervise all stacking & storage	
		Written proof of competence of above appointee available on site	

SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
Construction Reg 31 / Environmental Reg 9	* Designation of a person to co-ordinate emergency planning and fire protection	Person/s with specific knowledge and experience designated to co-ordinate emergency contingency planning and execution and fire prevention measures	
		Emergency evacuation plan developed: - Drilled / practiced - Plan & records of drills/practices available on site	
		Fire risk assessment carried out	
		All fire extinguishing equipment identified and on register	
		Inspected weekly. Inspection register kept	
		Serviced annually	
		Construction Reg 32 / General Safety Reg 3	* First aid	Every workplace provided with sufficient number of first aid boxes (required where 5 persons or more are employed)
First aid freely available			
Equipment as per the list in the OH&S Act			
One qualified first aider appointed for every 50 employees (required where more than 10 persons are employed)			
List of first aiders and certificates			
Name of person/s in charge of first aid box/es displayed			
Location of F/aid box/es clearly indicated			
Signs instructing employees to report all			
Injuries/illness including first aid injuries			
	PSE risk assessment carried out		

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SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
Construction Reg 33 / General Safety Reg 2	Personal safety equipment (PSE)	Items of PSE prescribed / use enforced	
		Records of Issue kept	
		Undertaking by employee to use / wear PSE	
Construction Reg 34 / General Safety Reg 9	* Inspection & use of welding / flame cutting equipment	Competent person/s with specific knowledge and experience designated to inspect electric arc, gas welding and flame cutting equipment	
Construction Reg 34 / General Safety Reg 9	* Inspection & use of welding / flame cutting equipment	Written proof of competence of above appointee available on site	
		Equipment identified/numbered and entered into a register	
		Equipment inspected monthly. Inspection register kept	
Construction Reg 35 / Hazardous Chemical Substances (HCS)	* Control of storage & usage of HCS	Competent person/s with specific knowledge and experience designated to control the storage & usage of HCS	

SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
		Written proof of competence of above appointee available on site	
		Risk assessment carried out	
		Register of HCS kept / used on site	
Construction Reg 36 / Vessels under Pressure Reg	Vessels under pressure (VUP)	Competent person/s with specific knowledge and experience designated to supervise the use, storage, maintenance, statutory inspections & testing of VUP's	
		Written proof of competence of above appointee available on site	
		Risk assessment carried out	
		Certificates of manufacture available on Sste	
		Register of VUP's on site	
		Inspections & testing by approved inspection authority (AIA): - after installation/re-erection or repairs - every 36 months - register / log kept of inspections, tests. Modifications & repair	
Construction Reg 37	Construction vehicles & earth moving equipment	Operators/drivers appointed to:	
		- Carry out a daily inspection prior to use - Drive the vehicle/plant that he/she is competent to operate / drive	

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SECTION / REGULATION	SUBJECT	REQUIREMENTS	YES/NO
		Written proof of competence of above appointee available on site	
		Record of daily inspections kept	
Construction Reg 38 / General Safety Reg 13D	* Inspection of ladders	Competent person appointed in writing to inspect ladders	
		Ladders inspected at arrival on site and monthly thereafter. Inspections register kept	
Construction Reg 39 / General Safety Reg 13B	Ramps	Competent person appointed in writing to supervise the erection & inspection of ramps. Inspection register kept	

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ANNEXURE 2

GUIDELINES FOR THE DEVELOPMENT OF A HEALTH & SAFETY PLAN

1. Project background

In terms of the Construction Regulations [Regulation 4(1) (a)] of the Occupational Health and Safety Act, No 85 of 1993, the client is required to compile an occupational health and safety specification for each of its projects and the principle contractor, appointed by the client in terms of regulation 4(1)(c), is required to prepare an occupational health and safety plan. This plan has to be prepared in terms of regulation 5(1) as well as the client's occupational health and safety specification. In terms of regulation 4(2), the client and the principle contractor are required to agree on the occupational health and safety plan before any work may commence.

2. Framework for an occupational health and safety plan

2.1 Introduction

The principal contractor has to demonstrate to the client that he has a suitable and sufficiently documented occupational health and safety plan as well as the necessary competencies, experience and resources to perform the construction work safely. The principle contractor could be required to submit the following documentation for perusal and verification by the client:

- Management structure
- Quality plan
- Human resources plan
- Registered workplace skills plan
- "Letter of good standing" from the Compensation Commissioner or licensed compensation insurer
- Proof of induction and other training of employees
- Example copy minutes of previous occupational health and safety committee meetings and copies of incident investigation reports

2.2 Contents of an occupational health and safety plan

2.2.1 Occupational health and safety management programme

- Management of occupational health and safety risks
- Occupational health and safety structures and appointments
- Programme of occupational health and safety inspections
- Occupational health and safety representatives
- Occupational health and safety committee

2.2.2 Communication and management of the work

- Management structure and responsibilities
- Occupational health and safety goals for the project and arrangements for monitoring and review of occupational health and safety performance
- Arrangements for:
 - Regular liaison between parties on site
 - Consultation with the workforce
 - The exchange of design information between the client, engineer, supervisors and contractors on site
 - Handling design changes during the project
 - Selection and control of contractors

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- The exchange of occupational health and safety information between all contractors
- Security
- Site induction and onsite training
- Facilities and first-aid
- The reporting and investigation of accidents and incidents
- The production and approval of risk assessments and method statements
- Site OH&S rules
- Fire and emergency procedures
- Reporting to the client i.e. results of occupational health and safety inspections, incident and incident investigations and committee meetings
- Reporting of incidents to the Department of Labour and Compensation insurer where appropriate

2.2.3 Arrangements for controlling significant site risks

The following are some examples of the arrangements for controlling the most significant site risks:

- Safety risks
 - Services, including temporary electrical installations
 - Preventing employees from falling into excavations, from trucks, etc.
 - Work with, on or near fragile materials
 - Control of lifting operations
 - The maintenance of plant and equipment
 - Poor ground conditions
 - Traffic routes and segregation of vehicles and pedestrians
 - Storage of hazardous materials
 - Dealing with existing unstable structures/land
 - Accommodating adjacent land use
 - Other significant safety risks as and when identified
- Health risks
 - Storage and use of hazardous chemical substances
 - Dealing with contaminated land or material
 - Manual handling
 - Reducing noise and vibration
 - Provision of adequate lighting
 - Ventilation considerations
 - Extreme heat and cold temperature considerations
 - Dealing with HIV/Aids and other illnesses
 - Provision of and maintaining ablution and eating facilities
 - Other significant health risks as and when identified

2.2.4 Preparation of an occupational health and safety operational reference file/manual

The following are some of the requirements to be addressed:

- Layout, format and content requirements
- Arrangement for the collection and gathering of information
- Storage and archiving of all the information
- Copy to the client at completion of project

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Suggested contents of an OH&S file/manual

- OH&S Policy
- Notice of new project
- Site start-up
- Security measures
- Written designations & appointments
- Arrangements with contractors/mandataries
- OH&S rules and procedures
- Induction
- OH&S training
- OH&S promotion
- OH&S representatives
- OH&S committees
- Workplace facilities e.g. ablutions, sheltered eating areas etc.
- Protective equipment
- Workplace inspections and audits
- Investigation & reporting of incidents/accidents
- Mechanical safeguarding
- Electrical safeguarding
- Safeguarding against hazardous substances
- Lifting machinery & equipment
- Construction vehicles & mobile plant
- Welding, heating & flame cutting
- Excavations
- Protection of the environment affected by construction activities
- Keeping of records in terms of the OH&S Act (85 of 1993)

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ANNEXURE 3

GUIDE TO RISK ASSESSMENT

1. How to do it?

STEPS TO EFFECTIVE RISK ASSESSMENT

Step 1	Identifying the hazards
Step 2	Aim to identify major hazards, don't waste time on the minor & detail
Step 3	Involve as many people as possible in the process especially those at risk
Step 4	Gather all the information and analyse it
Step 5	Look at what actually occurs including non-routine operations
Step 6	Use a systematic approach to ensure all hazards are adequately addressed
Step 7	Assess the risks arising taking into account the effectiveness of controls
Step 8	Ensure the process is practical and realistic
Step 9	Always record the assessment in writing including assumptions and why

2. How serious is it?

PROBABILITY		CONSEQUENCES	
A	Common	1	Fatality or permanent disability
B	Has happened	2	Major injury
C	Could happen	3	Average lost time injury
D	Not likely	4	Minor injury
E	Practically impossible	5	Medical treatment or less

RISK RATING		ACTION
1 – 3	Serious	Immediate (within 1 week)
4 - 5	High	Within 1 month
6 – 7	Moderate	> 4 weeks
8 – 9	Acceptable	No action

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<p>Access towers Acid washing Aggregate / sand delivery Angle grinder Arc welding Armco barriers - installation Assem. of elements by boilermaker Back filling Bag filling Band saw Banksman Batch plant Bench grinder Bin scraper Block feeder Block machine Boom scraper Bricks – laying of brickwork Bulk earthworks Cement spray truck Clearing & grubbing of area / site Compr. gas cylinders-handling Compressors – air Concrete – placing of (1) Concrete – placing of (2) Confined spaces – working in conveyors Cutting – of earthworks David arm Deck panels – placing Depallet or operator Diss. assembly rejects Distribution boards – electrical Drivers – of vehicles Dry tile deracking Dumpers - concrete Electrical installation – maintenance of elevated positions Erecting – install / shutters Excavations (1) Excavations (2) Explosive powered tools Finger car Fire fighting prevention</p>	<p>Gas welding-cutting operations Guillotine Hand & spray painting Hand tools jacking – with hydraulic pump Hanging scaffolding Hauling High cut operations Jacking hydraulic pump (1) Jacking hydraulic pump (2) Kerb laying Landscaping Lathe Layering of (road work) materials Layering process Laying kerbs Laying of storm water drains Levelling – off materials Lifting concr. beams on to trailers Loading supervisor Loading / unloading - of trucks Loffels – placing / laying Machine operator Making of steel items Material delivery Materials handling Mixer operator Mobile cranes Pedestal drill Pedestal grinder Placing concrete Plastering Portable electric drill Portable electric tools Portable ladders Post tensioning Radial arm drill Refuelling vehicles / plant Reinforcing steel – placement (1) Reinforcing steel – placement (2) Road traffic signs – placement of Roadworks - deviations Roof truss erection Sandblasting</p>
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Fire prevention & protection Form work Friction saw Front end loader Fuel supply Gas cylinders – handling of Gas welding-cutting oper. Traffic control / regulation Trench excavation Use of angle grinder Use of port. elec. tools Wet tile racking Work confined spaces Work in elevated positions Working platforms Workshops	Scaffolding Shuttering – erection Shuttering – stripping Site establishment (1) Site establishment (2) Skill saw Spray painting Storm water pipes - laying Structural steel – erection Structural steel – laydown Surveying Suspended scaffolds Termite proofing Tile machine Tile stacking Timber feeder Tower cranes Traffic accommodation
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GENERAL CONDITIONS OF CONTRACT

The General Conditions of Contract are not included in this document and may be downloaded from the following website – <http://www.treasury.gov.za/divisions/ocpo/sc/GeneralConditions>.

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