



INVITATION TO BID TENDER COVER PAGE

YOU ARE HEREBY INVITED TO BID FOR THE REQUIREMENTS OF JOHANNESBURG WATER

BID NUMBER: JW OPS 035/22

CLOSING DATE: 29 July 2022

CLOSING TIME: 10:30 am

DESCRIPTION: STRIP, QUOTE AND REPAIR OF VALVES, PUMPS AND GEARBOXES ON AN "AS AND WHEN" REQUIRED BASIS FOR A PERIOD OF THIRTY-SIX (36) MONTHS.

Bidders are encouraged to attend a Non-compulsory tender briefing session: 06 July 2022 at 12:00 to 13:00 on Microsoft Teams: [Click here to join the meeting](#)

The successful bidder will be required to fill in and sign a written Contract Form (MBD 7).

BID DOCUMENTS MAY BE DEPOSITED IN THE BID BOX SITUATED AT GROUND FLOOR:

TURBINE HALL

65 NTEMI PILISO STREET

NEWTOWN

JOHANNESBURG

2001

SUPPLIER INFORMATION

NAME OF BIDDER			
POSTAL ADDRESS			
PHYSICAL ADDRESS			
TELEPHONE NUMBER			
CELLPHONE NUMBER			
E-MAIL ADDRESS			
VAT REGISTRATION NUMBER			
TAX COMPLIANCE STATUS	TCS PIN	CSD No	
[A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE/ SWORN AFFIDAVIT MUST BE SUBMITTED IN ORDER TO QUALIFY FOR PREFERENCE POINTS FOR B-BBEE]			
The 80/20-point scoring system will be applicable to this tender, i.e., 90 points for Price and 10 points for Preferential Procurement (BBBEE).			
TOTAL BID PRICE			R
TOTAL NUMBER OF DOCUMENTS SUBMITTED			
BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO:		TECHNICAL INFORMATION MAY BE DIRECTED TO:	
DEPARTMENT	Supply Chain Management	DEPARTMENT	Operations
CONTACT PERSON	Nthabiseng More	CONTACT PERSON	Nosipho Mokoena
TELEPHONE NUMBER	011 688 1512	TELEPHONE NUMBER	011 688 1585
E-MAIL ADDRESS	nthabiseng.more@jwater.co.za	E-MAIL ADDRESS	nosipho.mokoena@jwater.co.za



TERMS AND CONDITIONS FOR BIDDING

1. BID SUBMISSION:

- 1.1. BIDS MUST BE DELIVERED TO THE CORRECT ADDRESS BY THE STIPULATED TIME. LATE BIDS WILL NOT BE ACCEPTED
- 1.2. ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS PROVIDED– (NOT TO BE RE-TYPED)
- 1.3. TENDERERS ARE REQUIRED TO SUBMIT ONE ORIGINAL HARD COPY PLUS A SOFT COPY IN A USB
- 1.4. THIS BID IS SUBJECT TO JOHANNESBURG WATER SCM POLICY VERSION 11
- 1.5. THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT AND THE PREFERENTIAL PROCUREMENT REGULATIONS, 2017, THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER SPECIAL CONDITIONS OF CONTRACT.
- 1.6. TENDERS WILL BE OPENED IN PUBLIC SOON AFTER CLOSING TIME AND RECORDING OF RECEIVED DOCUMENTS BUT NOT LATER THAN 11:00 AT THE TENDER OFFICE LOCATED TURBINE HALL 65 NTEMI PILISO STREET NEWTOWN JOHANNESBURG 2001, GROUND FLOOR. TENDERERS NAMES AND TOTAL PRICES, WHERE PRACTICAL WILL BE, READ OUT.

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 FOREIGN SUPPLIERS MUST COMPLETE THE PRE-AWARD QUESTIONNAIRE IN PART B:3.
- 2.4 IN BIDS WHERE CONSORTIA / JOINT VENTURES / SUB-CONTRACTORS ARE INVOLVED, EACH PARTY MUST SUBMIT A SEPARATE TCS CERTIFICATE / PIN / CSD NUMBER.
- 2.5 BIDDER MUST BE REGISTERED ON THE CENTRAL SUPPLIER DATABASE (CSD), A CSD NUMBER MUST BE PROVIDED.

3. QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS

- | | |
|---|--|
| 3.1. DOES THE ENTITY HAVE A BRANCH IN THE RSA? | <input type="checkbox"/> YES <input type="checkbox"/> NO |
| 3.2. DOES THE ENTITY HAVE A PERMANENT ESTABLISHMENT IN THE RSA? | <input type="checkbox"/> YES <input type="checkbox"/> NO |
| 3.3. DOES THE ENTITY HAVE ANY SOURCE OF INCOME IN THE RSA? | <input type="checkbox"/> YES <input type="checkbox"/> NO |
| 3.4. IS THE ENTITY LIABLE IN THE RSA FOR ANY FORM OF TAXATION? | <input type="checkbox"/> YES <input type="checkbox"/> 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: NO BIDS WILL BE CONSIDERED FROM PERSONS IN THE SERVICE OF THE STATE.

SIGNATURE OF BIDDER:

CAPACITY UNDER WHICH THIS BID IS SIGNED:

DATE:

ACKNOWLEDGEMENT OF BID CONDITIONS

1. I/We hereby bid to supply all or any of the supplies and/or to render all or any of the services described in the attached documents to Johannesburg Water (SOC) Ltd on the terms and conditions and in accordance with the specifications stipulated in the bid documents (and which shall be taken as part of, and incorporated into, this bid) at the prices and on the terms regarding time for delivery and/or execution inserted therein.
2. I/We agree that -
 - (a) the offer herein shall remain binding upon me/us and open for acceptance by Johannesburg Water (SOC) Ltd during the validity period indicated and calculated from the closing time of the bid;
 - (b) this bid and its acceptance shall be subject to the terms and conditions embodied herein with which I am/we are fully acquainted;
 - (c) if I/we withdraw my/our bid within the period 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, Johannesburg Water (SOC) Ltd, without prejudice to its other rights, agree to the withdrawal of my/our bid or cancel the contract that may have been entered into between me/us and Johannesburg Water (SOC) Ltd and I/we will then pay to Johannesburg Water (SOC) Ltd any additional expense incurred by having either to 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; Johannesburg Water (SOC) Ltd shall also have the right to recover such additional expenditure by set-off against moneys which may be due or become due to me/us under this or any other bid or contract or against any guarantee or deposit that may have been furnished by me/us or on my/our behalf for the due fulfilment of this or any other bid or contract and pending the ascertainment of the amount of such additional expenditure to retain such moneys, guarantee or deposit as security for any loss Johannesburg Water (SOC) Ltd may sustain by reason of my/our default;
 - (d) if my/our bid is accepted the acceptance may be communicated to me/us by letter or order by ordinary post or registered post and that SA Post Office Ltd shall be regarded as my/our agent, and delivery of such acceptance to SA Post Office Ltd shall be treated as delivery to me/us;
 - (e) the law of the Republic of South Africa shall govern the contract created by the acceptance of my/our bid.
3. I/We furthermore confirm that I/we have satisfied myself/ourselves as to the correctness and validity of my/our bid; that the price(s) and rate(s) quoted cover all the work/item(s) specified in the bid documents and that the price(s) and rate(s) cover all my/our obligations under a resulting contract and that I/we accept that any mistakes regarding price(s) and calculations will be at my/our risk.
4. I/We hereby accept full responsibility for the proper execution and fulfilment of all obligations and conditions devolving on me/us under this agreement as the Principal(s) liable for the due fulfilment of this contract.
5. 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 sentence or judgement which may be pronounced against me/us as a result of such action.

SIGNATURE(S) OF BIDDER OR ASSIGNEE(S).....

DATE:.....

Capacity and particulars of the authority under which this bid is signed

Name of bidder.....

Postal address (in block letters)

Telephone No.(s)

Facsimile No:

Bid No.

Name of contact person (in block letters).....

INSTRUCTIONS TO BIDDERS

NB: Each bid must be submitted in a separate, sealed envelope on which the NAME AND ADDRESS OF THE BIDDER, THE BID NUMBER, DESCRIPTION OF BID AND THE CLOSING DATE must be clearly endorsed. The bid must be addressed to Supply Chain Management Unit, Johannesburg Water (SOC) Ltd and deposited in the BID BOX situated at the entrance : Turbine Hall, 65 Ntemi Piliso street, Newtown, Johannesburg.

It is the responsibility of the bidder to ensure that their/his / her bid document is submitted in a sealed envelope and placed in the Bid Box in good time so as not to miss the official deadline of 10:30 on the closing date.

Bid documents submitted via courier services will be acceptable provided that the bidder instructs such courier company or its representative to deposit the documents in the bid box. Documents should under no circumstances be handed to an employee of Johannesburg Water as it may not be held accountable in the event of any loss thereafter.

Bid documents may not be submitted via the South African Post Office as only bid documents received in the Bid Box at the time of closing will be taken into account.

IMPORTANT CONDITIONS

1. Bid documents must be completed using non-erasable black ink. Bids that are received contrary to this requirement will be disqualified. This condition applies to bid documents purchased as well as bid documents downloaded from the eTender portal.
2. Bids should be submitted on the official forms provided. Should any conditions of the bid be qualified by the bidder, Johannesburg Water may disqualify the bid.
3. If any of the conditions on this bid form are in conflict with any special conditions, stipulations or provisions incorporated in the bid, such special conditions, stipulations or provisions shall apply.
4. Bids received after the closing time and date will not be accepted and will be returned to the bidder unopened.
5. All bid documents must be in sealed envelopes and deposited in the Official Bid Box situated at Turbine Hall, 65 Ntemi Piliso Street, Newtown. Bidders are required to submit soft copy tender documents in a form of USB.
6. Bids should as far as possible be submitted in their entirety. Such bid documents should also comply with submission requirements as described therein, and should be bound in such a way that pages will not go missing.
7. Tender documents may be completed electronically without altering or tampering with any of the terms, conditions, specifications etc. in the tender documents.
8. It is an absolute requirement that the bidder's tax matters are in order. To this effect, the bidder must furnish their Tax Compliance Status Pin or CSD MAAA number for bids as requested elsewhere in the bid document.
9. Tenderers will be afforded a period of three (3) days to complete the following returnable documents (MBD Forms) in instances where such forms are incomplete.
10. Pricing schedule must be completed and signed. Bids that are received contrary to this requirement will be disqualified.
11. The evaluation on price alteration must be conducted as follows:
 - 11.1. Where the tender award strategy is to evaluate and award per item or category, the following must apply:
 - (i) If there is an alteration on the rate but no alteration on the total for the item or category, the bidder will not be disqualified
 - (ii) If there is an alteration on the total for the item/s without authentication, bidders will only be disqualified for alteration per item or category.
 - 11.2. Where the tender award strategy is to evaluate and award total bid offer, the following must apply:
 - (i) If there is an alteration on the rate, total for the line item, sub-total/ sum brought/carried forward for the section but no alteration on the total bid offer, the bidder will not be disqualified.
 - (ii) If there is an alteration on the total bid offer on form of offer then the amount in words must be considered or vice-versa.
 - (iii) If there is an alteration on the total bid offer and the amount in words without authentication, the bidders will be disqualified for the entire tender.
12. Tenderers are allowed to offer selective items (not all items as per BOQ) where applicable. Items that are left blank will be regarded as non-offered items.

CHECK-LIST FOR TENDER SUBMISSION

Completion of this check-list will assist the Tenderer in ensuring that they have complied with all the requirements for submission of this tender.

#	Description	Complied	
		Yes	No
1 Contact details provided	Name of tenderer		
	Contact person		
	Telephone No.		
	Fax No.		
	Email address		
	Cell No.		
2 Completion of documentation (Forms)	Provide an Authority to sign tender		
	Completed and signed (Acknowledgement of conditions)		
	Completed and signed Tender form and Pricing schedule		
	Completed MBD 3..1 - Firm Prices		
	Alterations (if any) authenticated		
	Completion of form MBD 6.1 – (Preference points claim)		
	Complete and sign MBD 4- Declaration of any potential Conflict of Interest		
	Complete and sign MBD 8- past Supply Chain Management Practices Form		
	Complete and sign MBD 5 (Declaration for Procurement above R10m)*		
	Complete and sign MBD 9- Certificate of Independent bid Determination		
	JV Agreement (if Applicable)		
3 Submission of documents	Completed Banking Details		
	Valid Tax Compliance Status Pin/ CSD MAAA number for Tenders		
	Valid BBBEE certificate (SANAS/CIPC) or Sworn affidavit signed by the EME representative and attested by a Commissioner of oaths.		
	Certified copy of a consolidated Valid BBBEE certificate for JV (if applicable)		
	Confirmation that you have no municipal commitments overdue for more than 90 days**(for both the bidder/company and for the directors)		
	Confirmation that suitable arrangements in place for arrear municipal obligations with your local municipality		
	Annual Financial statements for past 3 years (AFS) *		
4 Qualifications	Is your tender subject to any qualifications? If Yes, reference to such qualification/s and must be indicated below: -----		

* for tenders with an estimated total value exceeding R10m (VAT included)

** for all tenders regardless of value

Name of tenderer _____ Signature _____ Date _____



CERTIFICATE OF AUTHORITY

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

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

(I) Certificate For Company

I,, chairperson of the Board of Directors of, hereby confirm that by resolution of the Board taken on, Mr/Ms, acting in the capacity of, was authorized to sign all documents in connection with tender JW..... and any contract resulting from it on behalf of the company.

Chairman:

As Witnesses: 1.....

2.....

Date:



(II) **Certificate For Close Corporation**

We, the undersigned, being the key members in the business trading as
..... hereby authorize Mr/Ms , acting in the capacity of
....., to sign all documents in connection with the
tender and any contract resulting from it on our behalf.

NAME	ADDRESS	SIGNATURE	DATE

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



(III) Certificate For Partnership

We, the undersigned, being the key partners in the business trading as, , hereby authorize Mr/Ms , acting in the capacity of , to sign all documents in connection with the tender and any contract resulting from it on our behalf.

NAME	ADDRESS	SIGNATURE	DATE

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



(IV) Certificate For Joint Venture

This Returnable Schedule is to be completed by joint ventures.

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

NAME OF FIRM	ADDRESS	DULY AUTHORIZED SIGNATORY
Lead partner		Signature. Name Designation
		Signature. Name Designation
		Signature. Name Designation

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



(V) Certificate For Sole Proprietor

I,, hereby confirm that I am the sole owner of the Business
trading asand the person authorised
hereunder is duly authorized to sign all documents related to tender JW.....
and contract resulting therefrom.

Signature of Sole owner:

As Witnesses:

1.....

2.

Date:

EVALUATION CRITERIA

The tender will be evaluated and adjudicated in terms of the Municipal Finance Management Act (MFMA). Preferential Procurement Regulations 2017, Supply Chain Management Policy of Johannesburg Water (JW) and applicable Supply Chain Management Treasury Regulations.

Administrative Returnable document :

1. SARS one-time TAX PIN,
2. municipal statement of account for both Director and Company (not older than three [03] months or a valid lease agreement),
3. annual financial statements (AFS) three [03] years, (if required, audited financial statements)
4. Joint Venture / Consortium Agreement signed by all parties.
5. Valid BBBEE Certificate or certified copy thereof or a valid sworn affidavit
6. A completed and signed Invitation to Bid form MBD 1
7. A completed and signed Declaration of Interest form MBD 4
8. A completed and signed Declaration for procurement above R10 million (VAT included) form MBD 5
9. A completed and signed Preference Points Claim Form MBD 6.1
10. A completed and signed Declaration of Bidder's Past Supply Chain Management Practices MBD 8
11. A completed and signed Certificate of Independent Bid Determination (MBD 9)

B-BBEE validation requirements:

- a) Valid original BBBEE certificate or certified copy of valid BBBEE certificate (Only Valid BBBEE certificate must be accredited by SANAS) or valid Sworn Affidavit

- issued by the DTIC or the CIPC or in a similar format complying with commissioner of oath Act.
- b) In case of a JV, the tenderer must provide a joint venture agreement signed by all parties and proof of a consolidated valid original BBEE Certificate or certified copy of BBEE Certificate and scorecard of a joint venture is required. (both the agreement and the consolidated valid original BBEE Certificate or valid certified copy of BBEE Certificate must be submitted
 - c) A Bidder who qualifies as an Exempted Micro Enterprises (EME's) must submit a valid sworn affidavit.
 - d) A Bidder who qualifies as a Qualifying Small Enterprises (QSE's) and is more than 51% black owned must submit a sworn affidavit.
 - e) A Bidder who qualifies as a Qualifying Small Enterprises (QSE's) and is less than 51% black owned must submit a B-BBEE verification certificate issued by an Agency accredited by SANAS (South African National Accreditation System) which has to be valid, original or certified as a true copy of the original or the Bidder must submit an affidavit stipulating that their annual Total Revenue was between R10,000,000.00 (Ten Million Rand) and R50,000,000.00 (Fifty Million Rand) based on their latest Financial Statements/Management Accounts and other information available thereon. A Bidder must submit their latest Annual Financial Statements signed off by the professional Accountant or Auditor.
 - f) Bidders who do NOT qualify as EME's and QSE's as outlined in (c) and (d) above, must submit B-BBEE verification certificates that are issued by an Agency accredited by SANAS.
 - g) Public entities and tertiary institutions must also submit B-BBEE Status Level Verification Certificates together with their tenders.
 - h) Bidders who fail to submit a valid original or certified copy of their B-BBEE Certificate or Valid Sworn Affidavit will be disqualified. Valid Sworn Affidavits or certified copy of B-BBEE Certificate must comply with the requirements outlined in the Justices of the Peace and Commissioners of Oaths Act, no 16 of 1963 and its Regulations promulgated in Government Notice GNR 1258 of 21 July 1972 Justices of the Peace and Commissioners of Oaths Act, No. 16 of 1963.

i.e

- (i) The deponent shall sign the declaration in the presence of the commissioner of oaths (COA).
- (ii) Below the deponent's signature the COA shall certify that the deponent has acknowledged that he knows and understands the contents of the declaration and the COA shall state the manner, place, and date of taking the declaration.
- (iii) The COA shall sign the declaration and print his full name and business address below his signature; and State his designation and the area for

which he holds his appointment, or the office held by him if he holds his appointment ex officio.

N.B. Copy of certified copies will not be accepted.

Mandatory Requirement:

1. Registration with CSD,
2. Certified copy of a Valid Compensation of Injury Diseases Act (COIDA).

3. Functionality:

The following aspects will be considered during the technical evaluation:

3.1 For Strip, Quote and Repairs of Gearboxes

- a) The Tenderer (Company) must have a minimum of 3 years' experience where the repairs or maintenance of industrial gearboxes was completed successfully.
- b) The Tenderer (Company) is required to assign a minimum number of key personnel with the stipulated qualifications to execute the works.
- c) The Tenderer must submit the CV of the Artisan Fitter that will be allocated to this contract. The Artisan Fitter must have a minimum of 3 years' relevant work experience. The required experience must be after obtaining a trade test certificate.
- d) A site visit will be conducted at the tenderer's premises to evaluate the tenderer's equipment.

3.2 For Strip, Quote and Repairs of Pumps

- a) The tenderer (Company) must have 3 years' experience where the repairs or maintenance of pumps was completed successfully.
- b) The Tenderer (Company) is required to assign a minimum number of key personnel with the stipulated qualifications to execute the works.
- c) The tenderer must submit the CV of the Artisan Fitter that will be allocated to this contract. The Artisan Fitter must have a minimum of 3 years' relevant work experience. The required experience must be after obtaining a trade test certificate
- d) A site visit will be conducted at the tenderer's premises to evaluate the tenderer's equipment.

3.3 For Strip, Quote and Repairs of Valves

- a) The tenderer (company) must have 3 years' experience where the repairs or maintenance of valves was completed successfully.
- b) The Tenderer (Company) is required to assign a minimum number of key personnel with the stipulated qualifications to execute the works.
- c) The tenderer must submit the CV of the Artisan Fitter that will be allocated to this contract. The Artisan Fitter must have a minimum of 3 years' relevant work experience. The required experience must be after obtaining a trade test certificate
- d) A site visit will be conducted at the tenderer's premises to evaluate the tenderers equipment.



EVALUATION CRITERIA

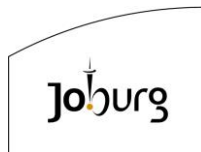


Gatekeepers (Technical)

Note: Tenderer will need to comply with the respective criteria for their area of expertise as indicated on the price schedule it is what they will be tendering for.

EVALUATION 1 – FOR GEARBOXES				
PART A: TENDERER'S EXPERIENCE, QUALIFICATION AND EXPERIENCE OF KEY PERSONNEL				
Criteria No.	Criteria	Description	Documentary Evidence	Submission Compliant (Yes/ No)
1.1	Tenderer's Experience	The Tenderer (Company) must have minimum of 3 years' experience where repairs or maintenance work of industrial gearboxes was completed successfully.	<p>The Tenderer (Company) must provide relevant reference letter(s) with proof that they have executed the required works in rendering services for the repairs or maintenance of industrial gearboxes successfully.</p> <p><i>The tenderer must request their client (where work was executed) to complete the templates attached in the tender document in full or provide reference letters in their client's letter head with all information as required per the template provided.</i></p>	Submission Compliant (Yes/ No)
The tenderer must achieve requirements for tenderer's experience in order to be considered for further evaluation.				

1.2	Key Personnel	<p>The Tenderer (Company) is required to assign a minimum number of key personnel with the stipulated qualifications to execute the works.</p>	<p>Tenderer (Company) is required to submit the stipulated qualifications for the minimum number of key personnel who will be assigned to this contract for the execution of the work.</p> <p>The following personnel will be required for this contract:</p> <ul style="list-style-type: none"> - Artisan Fitter: The Tenderer is required to provide a minimum of one (1) artisan fitter with a Fitter trade test certificate or Fitter & Turner trade test certificate or Millwright trade test certificate 	Submission Compliant (Yes/ No)
The tenderer must achieve requirements for Key personnel in order to be considered for further evaluation				
1.3	Experience of Key Personnel	<p>The tenderer's key personnel to be allocated for the execution of the contract must have experience on repairs or maintenance work of industrial gearboxes.</p> <p>Note: The tenderer must complete and submit the attached Curriculum Vitae template for their key personnel with relevant experience to the works required. The tenderer must provide a separate form for each key personnel as per the positions listed in the form.</p>	<p>The tenderer must have the following personnel for the execution of the works required for this contract:</p> <ul style="list-style-type: none"> - Artisan Fitter The Artisan Fitter is required to have a minimum of 3 years on the repair or maintenance of industrial gearboxes. The required experience must be after obtaining a trade test certificate 	Submission Compliant (Yes/ No)
The tenderer must achieve requirements for experience of key personnel in order to be considered for further evaluation				



EVALUATION CRITERIA



1.4	Capacity of Vehicles	Tenderer must submit valid proof of ownership or proof of lease documents for the vehicle that will be allocated for this contract (A minimum of 1 ton bakkie is required)	The tenderer must submit proof of ownership for vehicle(s) or letter of intent to hire if the intention is to hire the vehicle from the hiring company (A minimum of 1 ton bakkie is required).	Proof of ownership or Proof of lease document for vehicle Compliant (Yes/No)
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The tenderer must achieve requirements for the capacity of vehicle in order to be considered for further evaluation

PART B: SITE VISIT AT THE TENDERER'S PREMISES

Criteria No.	Criteria	Description of Inspection	Documentary Evidence	Allowable Scoring
1.5	A site visit will be conducted at the tenderer's premises/ workshop facilities to evaluate the tenderer's equipment. <i>If other facilities and equipment are outsourced, the tenderer must make necessary arrangements prior to the site visit for inspections to be conducted at those facilities and for the equipment to be assessed.</i>	On site, the tenderer will be required to demonstrate a gearbox test equipment under no or partial loading for the evaluation team to see that the facility has one present.	The tenderer must have and demonstrate a gearbox test equipment under no or partial loading in their workshop in order to be considered for further evaluation.	Gearbox test equipment present and demonstration performed (Yes/No)
		The tenderer must have and demonstrate infrared thermometer to conduct temperature tests on gearboxes	The tenderer must have and demonstrate infrared thermometer to conduct temperature tests on gearboxes in order to be considered for further evaluation.	Infrared thermometer present and demonstration performed (Yes/No)
		The tenderer must produce valid proof of calibration certificates for their required testing equipment: Valid proof of calibration certificates for the following testing equipment must be furnished by the tenderer: <ul style="list-style-type: none">Infrared thermometer to conduct temperature tests	The tenderer must produce proof of valid calibration certificates for stipulated testing equipment in order to be considered for further evaluation.	Calibration Certificates for Testing Equipment Compliant (Yes/No)

The tenderer must achieve all requirements at the site visit in order to be considered for further evaluation.



EVALUATION CRITERIA



EVALUATION 2 – FOR PUMPS

PART A: TENDERER'S EXPERIENCE, QUALIFICATION AND EXPERIENCE OF KEY PERSONNEL

Criteria No.	Criteria	Description	Documentary Evidence	Submission Compliant (Yes/ No)
2.1	Tenderer's Experience	The Tenderer (Company) must have minimum 3 years' experience where repairs or maintenance work of positive displacement, centrifugal pumps and axial pumps was completed successfully.	<p>The Tenderer (Company) must provide relevant reference letter(s) with proof that they have executed the required works in rendering services for the repair or maintenance work of positive displacement, centrifugal pumps and axial pumps successfully.</p> <p><i>The tenderer must request their client (where work was executed) to complete the templates attached in the tender document in full or provide reference letters in their client's letter head with all information as required per the template provided.</i></p>	Submission Compliant (Yes/ No)

The tenderer must achieve requirements for tenderer's experience in order to be considered for further evaluation.

2.2	Key Personnel	The Tenderer (Company) is required to assign a minimum number of key personnel with the stipulated qualifications to execute the works.	<p>Tenderer (Company) is required to submit the stipulated qualifications for the minimum number of key personnel who will be assigned to this contract for the execution of the work.</p> <p>The following personnel will be required for this contract:</p> <ul style="list-style-type: none"> - Artisan Fitter: The Tenderer is required to provide a minimum of one (1) artisan fitter with a Fitter trade test certificate or Fitter & Turner trade test certificate or Millwright trade test certificate 	Submission Compliant (Yes/ No)
<i>The tenderer must achieve requirements for Key personnel in order to be considered for further evaluation</i>				
2.3	Experience of Key Personnel	<p>The tenderer's key personnel to be allocated for the execution of the contract must have experience on repairs or maintenance work of positive displacement, centrifugal pumps and axial pumps</p> <p>Note: <i>The tenderer must complete and submit the attached Curriculum Vitae</i></p>	<p>The tenderer must have the following personnel for the execution of the works required for this contract:</p> <ul style="list-style-type: none"> - Artisan Fitter The Artisan Fitter is required to have a minimum of 3 years on the repair or maintenance of positive displacement, centrifugal pumps and axial pumps. The required experience must be after obtaining a trade test certificate 	Submission Compliant (Yes/ No)



EVALUATION CRITERIA



		<p><i>template for their key personnel with relevant experience to the works required. The tenderer must provide a separate form for each key personnel as per the positions listed in the form.</i></p>		
<p><i>The tenderer must achieve requirements for experience of key personnel in order to be considered for further evaluation</i></p>				
2.4	Capacity of Vehicles	<p>Tenderer must submit valid proof of ownership or proof of lease documents for hire that will be allocated for this contract (A minimum of 1 ton bakkie is required)</p>	<p>The tenderer must submit proof of ownership for vehicle(s) or letter of intent to hire if the intention is to hire the vehicle from the hiring company (A minimum of 1 ton bakkie is required).</p>	<p>Proof of ownership or Proof of lease document for vehicle Compliant</p> <p>(Yes/No)</p>
<p><i>The tenderer must achieve requirements for the capacity of vehicle in order to be considered for further evaluation</i></p>				

PART B: SITE VISIT AT THE TENDERER'S PREMISES				
Criteria No.	Criteria	Description of Inspection	Documentary Evidence	Allowable Scoring
2.5	<p>A site visit will be conducted at the tenderer's premises/ workshop facilities to evaluate the tenderer's equipment.</p> <p><i>If other facilities and equipment are outsourced, the tenderer must make necessary arrangements prior to the site visit for inspections to be conducted at those facilities and for the equipment to be assessed.</i></p>	<p>The tenderer must have and demonstrate pump loop testing facility to test pump's performance in flow, head, temperature and amps</p> <p>The facility should be able to test pumps which are driven by motors of at least 30 kW.</p>	<p>The tenderer must have and demonstrate pump loop testing facility to tests on pumps in order to be considered for further evaluation.</p>	<p>Pump loop testing facility present and demonstration performed</p> <p>(Yes/No)</p>
		<p>The tenderer must produce valid proof of calibration certificates for their required testing equipment:</p> <p>Valid proof of calibration certificates for the following testing equipment must be furnished by the tenderer:</p>	<p>The tenderer must produce proof of valid calibration certificates for all stipulated testing equipment in order to be considered for further evaluation.</p>	<p>Calibration Certificates for Testing Equipment Compliant</p> <p>(Yes/No)</p>



EVALUATION CRITERIA



- | | | | |
|--|---|--|--|
| | <ul style="list-style-type: none">• Pump test loop flow meter• Pump test loop pressure gauge• Infrared thermometer to conduct temperature tests• Ampere (Amp) meter for amps drawn | | |
|--|---|--|--|

The tenderer must achieve all requirements at the site visit in order to be considered for further evaluation.



EVALUATION CRITERIA



EVALUATION 3 – FOR VALVES				
PART A: TENDERER'S EXPERIENCE, QUALIFICATION AND EXPERIENCE OF KEY PERSONNEL				
Criteria No.	Criteria	Description	Documentary Evidence	Submission Compliant (Yes/ No)
3.1	Tenderer's Experience	The Tenderer (Company) must have minimum 3 years' experience where repairs or maintenance work of valves was completed successfully	<p>The Tenderer (Company) must provide relevant reference letter(s) with proof that they have executed the required works in rendering services for the repairs or maintenance work of valves successfully.</p> <p><i>The tenderer must request their client (where work was executed) to complete the templates attached in the tender document in full or provide reference letters in their client's letter head with all information as required per the template provided.</i></p>	Submission Compliant (Yes/ No)
The tenderer must achieve requirements for tenderer's experience in order to be considered for further evaluation.				
3.2	Key Personnel	The Tenderer (Company) is required to assign a minimum number of key personnel with the stipulated qualifications to execute the works.	<p>Tenderer (Company) is required to submit the stipulated qualifications for the minimum number of key personnel who will be assigned to this contract for the execution of the work.</p> <p>The following personnel will be required for this contract:</p> <ul style="list-style-type: none"> - Artisan Fitter: The Tenderer is required to provide a minimum of one (1) artisan fitter with a Fitter trade test certificate or Fitter & Turner trade test 	Submission Compliant (Yes/ No)



EVALUATION CRITERIA



			certificate or Millwright trade test certificate	
The tenderer must achieve requirements for Key personnel in order to be considered for further evaluation				
3.3	Experience of Key Personnel	<p>The tenderer's key personnel to be allocated for the execution of the contract must have experience on work for the repairs or maintenance of valves.</p> <p>Note: <i>The tenderer must complete and submit the attached Curriculum Vitae template for their key personnel with relevant experience to the works required. The tenderer must provide a separate form for each key personnel as per the positions listed in the form.</i></p>	<p>The tenderer must have the following personnel for the execution of the works required for this contract:</p> <ul style="list-style-type: none"> - Artisan Fitter The Artisan Fitter is required to have a minimum of 3 years on the repairs or maintenance of valves. The required experience must be after obtaining a trade test certificate. 	Submission Compliant (Yes/ No)
The tenderer must achieve requirements for experience of key personnel in order to be considered for further evaluation				



EVALUATION CRITERIA



3.4	Capacity of Vehicles	Tenderer must submit valid proof of ownership or proof of lease documents for hire that will be allocated for this contract (A minimum of 1 ton bakkie is required)	The tenderer must submit proof of ownership for vehicle(s) or letter of intent to hire if the intention is to hire the vehicle from the hiring company (A minimum of 1 ton bakkie is required).	Proof of ownership or Proof of lease document for vehicle Compliant (Yes/No)
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The tenderer must achieve requirements for the capacity of vehicle in order to be considered for further evaluation

PART B: SITE VISIT AT THE TENDERER'S PREMISES

Criteria No.	Criteria	Description of Inspection	Documentary Evidence	Allowable Scoring
3.5	A site visit will be conducted at the tenderer's premises/ workshop facilities to evaluate the tenderer's equipment. <i>If other facilities and equipment are outsourced, the tenderer must make necessary arrangements prior to the site visit for inspections to be conducted at those facilities and for the equipment to be assessed.</i>	The tenderer must have and demonstrate valve test equipment (hydraulic pressure and leak test) to valve's performance	The tenderer must have and demonstrate valve hydraulic pressure and leak equipment to tests valve in order to be considered for further evaluation.	Valve hydraulic pressure and leak equipment present and demonstration performed (Yes/No)
		The tenderer must produce valid proof of calibration certificates for their testing required equipment: Valid proof of calibration certificates for the following testing equipment must be furnish by the tenderer: • Pressure gauge on the valve test equipment	The tenderer must produce proof of valid calibration certificates for all stipulated testing facilities and equipment in order to be considered for further evaluation.	Calibration Certificates for Testing Facilities and Equipment Compliant (Yes/No)

The tenderer must achieve all requirements at the site visit in order to be considered for further evaluation.

The tenderer must achieve all requirements at the site visit in order to be considered for further evaluation. Further for the requirement of the site visit, the tenderer will be required to achieve all requirements at the site visit in order to be considered for the next stage of Pricing.

This shall apply to all the above set criteria as indicated on table 1, 2, and 3.

4. Financial offer:

The following aspects will be considered in the financial offer:

- 4.1. Costing for all items as described in the Pricing Schedule
- 4.2. Review of financial offer and discrepancies between total and calculations
- 4.3. Identify any parameters that may have a bearing on the financial offer, e.g. contract period, price escalations or adjustments required and life cycle costs.

When the value of the bid is estimated to exceed R50 000 000 (all applicable taxes included) the 90/10 preference point system shall be applicable,

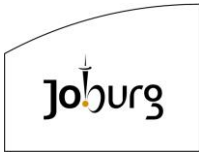
The maximum points for this bid are allocated as follows:

PREFERENCE POINT SYSTEM	POINTS
PRICE	90
B-BBEE STATUS LEVEL OF CONTRIBUTOR	10
Total points for Price and B-BBEE	100

Points awarded for B-BBEE Status Level of Contribution

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

B-BBEE Status Level of Contributor	Number of points (90/10 system)
1	10
2	9
3	8
4	5
5	4
6	3



EVALUATION CRITERIA



7	2
8	1
Non-compliant contributor	0

AWARD STRATEGY

The intention is to award the contract to the highest scoring tenderer based on their area of expertise and per category.

CONTACTABLE REFERENCE

To Johannesburg Water (SOC) Ltd

I, the undersigned being duly authorised to do so, hereby furnish a reference to Johannesburg Water relative to tender Contract No. **JW OPS 035/22 for Strip, Quote and Repair of Gearboxes, Pumps and Valves**

Name of Tenderer:.....

Description of Goods / Services provided

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

Duration: Year-Month-Day when the Goods / Services were provided:

Start Date.....

End Date.....

Was their performance satisfactory?

Yes / No*

*If **No** to any of the questions above, please furnish details.

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

Name of authorised person:

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

Telephone: **Mobile:**

Email:

Completed on behalf (name of business)

*NB: This document must be completed in full by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with **all** the above requirements. A separate form must be completed for each reference as required in the evaluation criteria. Failure to adhere to this requirement will result in such tender being prejudiced. Information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting and restriction from participating in any future government tender.*

CONTACTABLE REFERENCE

To Johannesburg Water (SOC) Ltd

I, the undersigned being duly authorised to do so, hereby furnish a reference to Johannesburg Water relative to tender Contract No. **JW OPS 035/22** for **Strip, Quote and Repair of Gearboxes, Pumps and Valves**

Name of Tenderer:.....

Description of Goods / Services provided

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

Duration: Year-Month-Day when the Goods / Services were provided:

Start Date.....

End Date.....

Was their performance satisfactory?

Yes / No*

*If **No** to any of the questions above, please furnish details.

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

Name of authorised person:

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

Telephone: **Mobile:**

Email:

Completed on behalf (name of business)

*NB: This document must be completed in full by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with **all** the above requirements. A separate form must be completed for each reference as required in the evaluation criteria. Failure to adhere to this requirement will result in such tender being prejudiced. Information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting and restriction from participating in any future government tender.*

CONTACTABLE REFERENCE

To Johannesburg Water (SOC) Ltd

I, the undersigned being duly authorised to do so, hereby furnish a reference to Johannesburg Water relative to tender Contract No. **JW OPS 035/22** for **Strip, Quote and Repair of Gearboxes, Pumps and Valves**

Name of Tenderer:.....

Description of Goods / Services provided

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

Duration: Year-Month-Day when the Goods / Services were provided:

Start Date.....

End Date.....

Was their performance satisfactory?

Yes / No*

*If **No** to any of the questions above, please furnish details.

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

Name of authorised person:

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

Telephone: **Mobile:**

Email:

Completed on behalf (name of business)

*NB: This document must be completed in full by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with **all** the above requirements. A separate form must be completed for each reference as required in the evaluation criteria. Failure to adhere to this requirement will result in such tender being prejudiced. Information provided will be verified and if found to be false or misrepresented, punitive measures will be instituted against the respective party including blacklisting and restriction from participating in any future government tender.*

Curriculum Vitae of Key Personnel

Provide separate forms for each key personnel as per the position listed in the form:

[illegible]**Certification:**

I, the undersigned, certify that, to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

Signature of person named in the schedule

.....
Date

Curriculum Vitae of Key Personnel

Provide separate forms for each key personnel as per the position listed in the form:

[illegible]**Certification:**

I, the undersigned, certify that, to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

Signature of person named in the schedule

.....
Date

Curriculum Vitae of Key Personnel

Provide separate forms for each key personnel as per the position listed in the form:

[illegible]**Certification:**

I, the undersigned, certify that, to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

.....
Signature of person named in the schedule

.....
Date

Tender Form and Price Schedules

To: Johannesburg Water (SOC) Ltd.

Having examined the Tender documents including Addenda Nos _____ [insert numbers], the receipt of which is hereby duly acknowledged, we, the undersigned, offer **JW OPS 035/22: Strip, Quote and Repair of Gearboxes, Pumps and Valves for a period of 36 months** as specified in conformity with the said Tender documents and as may be ascertained in accordance with the Schedule of Prices attached herewith and made part of this Tender.

Details of my / our offer are / are as follows:

We undertake, if our Tender is accepted, execute the contract in accordance with the requirements as specified.

We agree to abide by this Tender for a period of ninety (90) days from the date fixed for Tender opening, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

Until a formal Contract is prepared and executed, this Tender, together with your written acceptance thereof and your notification of award, shall constitute a binding Contract between us.

We understand that Johannesburg Water is not bound to accept the lowest or any tender it may receive, and that the contract may be awarded in whole or in part and to more than one tenderer.

Should my/our tender be successful, it be understood that a contract will come into existence for a period of 36 months which will commence from the date indicated in the letter of acceptance.

SCHEDULE OF PRICES

NB: 1. The evaluation on price alteration will be conducted as follows:

1.1. Where the tender award strategy is to evaluate and award per item or category, the following must apply:

- (i) If there is an alteration on the rate but no alteration on the total for the item or category, the bidder will not be disqualified**
- (ii) If there is an alteration on the total for the item/s without authentication, bidders will only be disqualified for alteration per item or category.**

1.2. Where the tender award strategy is to evaluate and award total bid offer, the following must apply:

- (i) If there is an alteration on the rate, total for the line item, sub-total/ sum brought/carried forward for the section but no alteration on the total bid offer, the bidder will not be disqualified.**
- (ii) If there is an alteration on the total bid offer on form of offer then the amount in words must be considered or vice-versa.**

-
- (iii) If there is an alteration on the total bid offer and the amount in words without authentication, the bidders will be disqualified for the entire tender.

ANY COMPLETION OF THE TENDER DOCUMENT IN PENCIL, ERASABLE INK OR OVERTYPING WILL NOT BE ACCEPTED AND WILL DISQUALIFY THE TENDER

Tender documents may be completed electronically without altering or tampering with any of the terms, conditions, specifications etc. in the tender documents. Bids that are received contrary to this requirement will be disqualified.

I/We, the undersigned hereby acknowledge myself/ourselves fully conversant with the details and conditions of the Contract and hereby agree to the JW OPS 035/22: Strip, Quote and Repair of Gearboxes, Pumps and Valves for a period of 36 months as described in accordance therewith :-

Also note:

1. All rates offered on the pricing schedule must be **Exclusive of VAT**.
2. The transport rate shall be measured as a distance from a contractually agreed contractor's premises (up to a maximum of 200km return) to the respective Johannesburg Water site. When collecting or delivery of the equipment to be repairs the Contractor shall only is permitted to charge a maximum of 100km for collection and 100km for delivery. Transport to collect equipment from JW and delivering equipment to JW (upon completion for repairs), will be paid as per the applicable AA rates at the time of travelling.
3. The strip and quote sum must include labor and consumables (i.e. stripping, measurement, quoting, cleaning).
4. The assemble sum must include labor and consumables (i.e. painting, fitting, conducting tests and drafting and submission of test reports).

PRICING SCHEDULE

1. GEARBOXES

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
1.1 For Gearboxes sizes ranging from 0kW – 5.5kW (Ranged on driving motor size)										
1.1.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
1.1.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
1.1.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
1.2 For Gearboxes sizes ranging from 7.5kW – 22kW (Ranged on driving motor size)										
1.2.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
1.2.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
1.2.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
1.3 For Gearboxes sizes ranging from 30kW – 45kW (Ranged on driving motor size)										
1.3.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
1.3.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
1.3.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
1.4 For Gearboxes sizes ranging from 55kW – 90kW (Ranged on driving motor size)										
1.4.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
1.4.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
1.4.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
1.5 For Gearboxes sizes ranging from 110kW and above (Ranged on driving motor size)										
1.5.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
1.5.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
1.5.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

For Gearboxes

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3	
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime
1.6	Mark up on spare parts	%	1	10%	10%	12.5%	12.5%	15%	15%
1.7	*Transport (to and from) light	km	1	AA Rates	AA Rates	AA Rates	AA Rates	AA Rates	AA Rates
1.8	*Transport (to and from) heavy (5 tons upwards)	km	1	R	R	R	R	R	R

***NB:- Transport to collect equipment from JW and delivering equipment to JW (upon completion for repairs), will be paid as per the applicable AA rates at the time of travelling (in line with the size of the vehicle).**

2. PUMPS

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
2.1. For Pumps sizes ranging from 0mm – 100mm (Delivery outlet diameter)										
2.1.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
2.1.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
2.1.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
2.2. For Pumps sizes ranging from 101mm – 250mm (Delivery outlet diameter)										
2.2.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
2.2.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
2.2.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
2.3. For Pumps sizes ranging from 251mm – 350mm (Delivery outlet diameter)										
2.3.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
2.3.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
2.3.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
2.4. For Pumps sizes ranging from 351mm – 450mm (Delivery outlet diameter)										
2.4.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
2.4.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
2.4.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
2.5. For Pumps sizes ranging from 451mm – 600mm (Delivery outlet diameter)										
2.5.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
2.5.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
2.5.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
2.6. For Pumps sizes ranging from 601mm – 750mm (Delivery outlet diameter)										
2.6.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
2.6.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
2.6.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
2.7. For Pumps sizes ranging from 751mm – 900mm (Delivery outlet diameter)										
2.7.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
2.7.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
2.7.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

For Pumps

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		*
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
2.8	Mark up on spare parts	%	1	10%	10%	12.5%	12.5%	15%	15%	
2.9	*Transport (to and from) light	km	1	AA Rates	AA Rates	AA Rates	AA Rates	AA Rates	AA Rates	
2.10	*Transport (to and from) heavy (5 tons upwards)	km	1	R	R	R	R	R	R	

NB:- Transport to collect equipment from JW and delivering equipment to JW (upon completion for repairs), will be paid as per the applicable AA rates at the time of travelling (in line with the size of the vehicle).

3. VALVES

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
3.1 For Valves sizes ranging from 0 – 100mm (Ranged on nominal diameter)										
3.1.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
3.1.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
3.1.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
3.2 For Valves sizes ranging from 101 – 250mm (Ranged on nominal diameter)										
3.2.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
3.2.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
3.2.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
3.3 For Valves sizes ranging from 251 – 350mm (Ranged on nominal diameter)										
3.3.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
3.3.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
3.3.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
3.4 For Valves sizes ranging from 351 – 450mm (Ranged on nominal diameter)										
3.4.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
3.4.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
3.4.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
3.5 For Valves sizes ranging from 451 – 600mm (Ranged on nominal diameter)										
3.5.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
3.5.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
3.5.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
3.6 For Valves sizes ranging from 601 – 750mm (Ranged on nominal diameter)										
3.6.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
3.6.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
3.6.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
3.7 For Valves sizes ranging from 751 – 900mm (Ranged on nominal diameter)										
3.7.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
3.7.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
3.7.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3		Totals for Y1, Y2 & Y3 Rates
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	
3.8 For Valves sizes ranging from 901 and above (Ranged on nominal diameter)										
3.8.1	Strip and Quote	Per Item	1	R	R	R	R	R	R	R
3.8.2	Repair, Assemble and Test	Per Item	1	R	R	R	R	R	R	R
3.8.3	Site work	Per Item	1	R	R	R	R	R	R	R
Sub-Total										R

For Valves

Item	Description	Unit	Quantity	Year 1		Year 2		Year 3	
				Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime	Rate Normal Time	Rate Overtime
3.9	Mark up on spare parts	%	1	10%	10%	12.5%	12.5%	15%	15%
3.10	*Transport (to and from) light	km	1	AA Rates	AA Rates	AA Rates	AA Rates	AA Rates	AA Rates

***NB:- Transport to collect equipment from JW and delivering equipment to JW (upon completion for repairs), will be paid as per the applicable AA rates at the time of travelling (in line with the size of the vehicle).**

AREA OF SPECIALISATION

The tenderer must indicate the company's area of specialization which he tenders for by ticking in the applicable block blow:

Item	Description	Tick where applicable
1.2.1	Strip, Quote and Repair of Valves	
1.2.2	Strip, Quote and Repair of Pumps	
1.2.3	Strip, Quote and Repair of Gearboxes	

All prices MUST include any other costs incurred to render the service. Additional charges post acceptance cannot be submitted as these will be rejected. All rates must exclude VAT.

NB: Failure to complete and sign this form in full and authenticate alterations with a full signature or initial will result in the elimination of the tender.

Contract Price

Firm Prices will be accepted

Failure to adhere to this requirement will prejudice your tender

Name of tenderer (in full): _____

Telephone number: _____

e-mail: _____

Name of person authorized
to sign this tender: _____
(BLOCK LETTERS)

Signature: _____ Date: _____ 2022

PRICING SCHEDULE – FIRM PRICES (PURCHASES)

NOTE: ONLY FIRM PRICES WILL BE ACCEPTED. NON-FIRM PRICES (INCLUDING PRICES SUBJECT TO RATES OF EXCHANGE VARIATIONS) WILL NOT BE CONSIDERED

IN CASES WHERE DIFFERENT DELIVERY POINTS INFLUENCE THE PRICING, A SEPARATE PRICING SCHEDULE MUST BE SUBMITTED FOR EACH DELIVERY POINT

Name of Bidder.....	Bid Number.....
Closing Time	Closing Date

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

ITEM NO.....

QUANTITY.....

DESCRIPTION.....

BID PRICE IN RSA CURRENCY **(ALL APPLICABLE TAXES INCLUDED).....

-
- Required by:
 - At:
 - Brand and Model
 - Country of Origin
 - Does the offer comply with the specification(s)? *YES/NO
 - If not to specification, indicate deviation(s)
 - Period required for delivery
*Delivery: Firm
 - Delivery basis

Note: All delivery costs must be included in the bid price, for delivery at the prescribed destination.

** "all applicable taxes" includes value- added tax, pay as you earn, income tax, unemployment insurance fund contributions and skills development levies.

*Delete if not applicable



CONTRACT NO. JW OPS 035/22

**STRIP QUOTE AND REPAIR OF
GEARBOXES, PUMPS AND VALVES**



TECHNICAL SPECIFICATIONS

1. CONTRACT DESCRIPTION

The contract entails the stripping, quoting and repairing of gearboxes, pumps and valves at various JW sites on an as and when required basis for the duration of the contract.

2. REQUIREMENTS

The appointed service provider(s) will be required to strip, quote and repair of gearboxes, pumps and valves at various JW sites which include the water treatment works, wastewater treatment works and other various JW sites which will be specified by the relevant delegated JW representatives. These services will be done on an “as and when” required basis.

The description of assets that JW is currently using is indicated clearly on the specifications of equipment (*specification attached*) as JW already has them installed at their various sites. For the equipment, the descriptions of assets indicate the type, size, make, model and power output.

The purpose of the list is to make the tenderer aware or to familiarise the tenderer with the type and magnitude of assets that will/may require repairs.

The assets are:

- a) PUMPS
- b) VALVES
- c) GEARBOXES

The full specifications of the various equipment that JW has is attached hereunder as **ANNEXURE A**

3. FUTHER INFORMATION

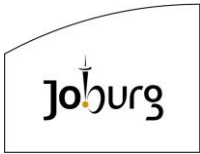
The service provider is required to provide the information as stipulated below for their technical representative whom JW will be able to communicate with for the duration of the contract.

NAME OF SERVICE PROVIDER'S REPRESENTATIVE
FROM WHOM FURTHER TECHNICAL
DETAILS MAY BE OBTAINED:

CONTACT DETAILS OF REPRESENTATIVE:

COMPANY NAME:

SIGNATURE OF TENDERER:



CONTRACT NO. JW OPS 035/22

**STRIP QUOTE AND REPAIR OF
GEARBOXES, PUMPS AND VALVES**

TECHNICAL SPECIFICATIONS



ANNEXURE A

(SPECIFICATION)



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PARTICULAR SPECIFICATION

M06: MECHANICAL AERATION EQUIPMENT

3	2012-07-30	General review	T Wellard	
2	2010-02-15	General review	J Ritchie	
1	2009-05-12	Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance		
Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water

PARTICULAR SPECIFICATION: M06: MECHANICAL AERATION EQUIPMENT

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M06.1 SCOPE

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of mechanical aeration turbines for aerobic compartments within a biological reactor of a wastewater treatment works. The Specification shall be read in conjunction with that of the Project Specification.

M06.2 INTERPRETATIONS

M06.2.1 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

M06.2.2 Standards

All design standards for the aeration equipment shall be subject to the latest amendments and editions of the following standard specifications:-

SANS 10400: 1990	: National Building Regulations
BS 5304: 1988	: 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 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 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
SANS 1034: 1975	: Grey iron castings

M06.2.3 General Requirements

This specification must be read in conjunction with the following specifications:-

M08: Volume M08: Particular Specification for Gearboxes

E01: Volume E01: Particular Specification for Electric Motors

G01: Particular Specification for Colour Codes

G02: Particular Specification for Corrosion Protection

M06.3 **DESIGN OF AERATION EQUIPMENT**

M06.3.1 General Design Parameters

Aeration equipment shall be designed such that the following requirements are met:-

- To facilitate manufacture, inspection, installation, maintenance, cleaning and repairs,
- To ensure safe and satisfactory operation and an acceptable life expectation under the ambient conditions prevailing at the Site,
- To prevent undue stresses being produced by expansion due to temperature changes.
- To keep maintenance costs to a minimum,
- To facilitate inter-changeability of units and/or sub-parts throughout the Contract works with regard to new equipment and equipment and/or sub-parts currently being used on the existing JW Wastewater Treatment Works,
- To operate without undue vibration and excessive noise. Maximum of 84dBA measured at 1 metre from operating equipment,
- 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
- To be suitable for operation 365 days per year, 24 hours per day under specified design conditions.

M06.3.2 Specific Aerator Design Parameters

All aeration equipment shall be surface mounted on a structural civil support platform.

The maximum oxygen transfer capacity for the aerators shall be taken as 1.8 kg O₂/kWh (as shaft to water) under standard conditions at sea level. Actual efficiencies shall be used in determining aerator sizes.

Claimed efficiencies of better than 1.9 kg O₂/kWh shall not be considered during adjudication of Tenders.

The maximum aerator turbine designed tip speed shall be 5 m/s. Variations in the tip speed of $\pm 5\%$ may be considered by the Engineer.

The aerator turbine operating speed shall typically be in the order of that specified in the following table.

Table showing approximate turbine operating speeds

Installed Motor Power	Turbine Operating Speed
110 kW	26 rpm
90 kW	33 rpm
75 kW	36 rpm
55 kW	40 rpm
45 kW	43 rpm
30 kW	48 rpm
22 kW	57 rpm
18.8 kW	63 rpm
15 kW	75 rpm

Variation in the submergence due to flow variations within the reactor basin under operating conditions shall be accommodated in the design of the aerator unit, i.e. the minimum and maximum basin operating levels. Details of the proposed aerators (as well as aerator power demand and oxygenation versus depth of immersion curves) shall be provided with the tender. The maximum operating level of each individual sized aerator shall not vary by more than 5 mm measured between any two (2) adjacent aerators units.

The aeration turbines shall preferably be of the axial flow design.

Turbines that have a proven record operating under South African conditions shall be considered for this project.

Tenderers shall indicate the pumping capacity of the offered aerator turbine units specified as required in the relevant technical data sheets.

Where necessary vortex formation shall be prevented by anti-vortex baffles, which shall be included in the tendered rates for the particular aerator. Details of materials and construction shall be submitted with the tender.

All submerged welds shall be of full penetration and continuous and in accordance with SANS 10 044 or latest relevant specification.

The Contract requires unsteady state test certificates to be submitted with the submission of the Tender, or tests shall be conducted by an approved laboratory under this section of the Contract and the Tender shall include in the Tender Price for such testing. Should acceptable oxygenation transfer test certificates not be submitted to the Engineer at time of Tender, this may render the submission invalid and shall be liable to rejection.

Failure to pass the stated tests shall result in unsteady state tests to be conducted by an approved laboratory in-situ. The costs of these tests as well as the remedial action to be taken to conform to the specifications shall be for the Contractor's account.

The control of the aeration shall be affected by means of a PLC control, switching aerators on or

off in response to signals received from Dissolved Oxygen probes (DO). The aerators offered shall be able to withstand the frequent on/off switching (limited to 6 starts per hour). The relevant control shall be supplied under this contract.

The direction of rotation of the aerator turbines shall be as specified in the project particular specification.

M06.4 AERATOR TURBINE DESIGN

M06.4.1 Turbine Design Parameters

Floating aerator impeller / shaft combinations will be preferred to assist in countering the mass of the turbine assembly.

The aerator impeller shall consist of a central hub with a number of robust vertical blades attached and supported below a circular support plate. Each blade shall be designed to encourage a high pumping flow rate of mixed liquor with minimum resistance.

The impeller shall be designed such that no cavitation takes place during operation. The impeller shall be non-clogging and shall be statically balanced prior to assembly with the drive shaft.

The complete turbine assembly shall be subjected to static balancing witnessed by the Engineer during manufacture and before final installation on site. A methodology shall be submitted by the Tenderer to accomplish this balancing to the satisfaction of the Engineer. Vibrations in operation are to be kept to a minimum and it will be the Contractors responsibility to check torsional vibration for each aerator assembly, both theoretically and in-situ.

The blades shall be welded to the underside of a disc. The materials used in the construction should have the following minimum thickness:-

- The horizontal discs shall be manufactured from a minimum material thickness of 12.5 mm.
- Turbine blade construction shall be a minimum of 8 mm.

Dimensional tolerances of the turbines shall be within 2 mm in all directions during manufacture.

It is considered imperative that complete mixing of the contents within the compartment shall take place. The Tenderer shall offer draught tubes or other devices to ensure the whole contents of the aeration basin is mixed without sludge deposition in the corners of the reactor compartment if considered necessary for the particular impeller offered.

A methodology of measuring this mixing efficiency shall accompany each Tender.

M06.4.2 Turbine Impellor Material

The turbine shall be manufactured from mild steel epoxy coated to the minimum thickness specified.

M06.4.3 Aerator Shaft

The aerator shaft shall be tubular and shall be flange bolted to both the impeller and the rigid coupling of the gearbox output shaft. The output shaft shall be rated for at least double the expected maximum torque.

Critical speed calculations of the shaft shall be provided with the tender. The selected shaft shall have a critical speed greater than four times the operational speed.

Shafts shall be manufactured from Schedule 80 mild steel or equivalent seamless heavy wall

tubing and flanges shall be employed to connect the turbine and the gearbox output half coupling. A half coupling shall be shrunk onto the output shaft spigot of the gearbox and secured by a bolted keep plate within the coupling itself. Machine bolted flanged connections or spigot recesses shall be employed to accurately align the turbine assembly and the shafts. Flanges are to be welded to the shafts and machined square afterwards.

The aerator and shaft shall be epoxy coated to a minimum thickness of 0.35 mm after manufacture. All aeration equipment shall comply with the requirements of Particular Specification G02: Corrosion Protection.

M06.4.4 Fasteners

All submerged fasteners shall be 316 SS and mating flanges shall be sealed against the ingress of any crevice corrosion by means of a sealant suitable for underwater conditions and approved by the Engineer.

M06.5 **GEARBOX ASSEMBLIES**

Each aerator shall be direct coupled to a suitable designed gearbox for vertical application and directly driven by a motor via a flexible coupling. Refer to Particular Specification M08: Gearboxes for a detailed specification on gearboxes.

M06.6 **AERATOR BASE PLATE AND JACKING BOLTS**

The gearbox support arrangement shall comprise a substantially designed and fabricated support base plate bolted to the gearbox and the whole assembly shall be carried on steel jacking bolts with individual adjustment for the aerator turbine submergence height. Support fabrications are to be HDG galvanized mild steel. The adjustment bolts shall cater for a total of 100mm vertical adjustment (+50 / -50mm) from the normal operating setting. The maximum permissible deflection of the jacking bolts under load shall be limited to their length divided by 180. High total vertical adjustment that results in an excessive length of jacking bolts is to be avoided.

It is essential that the base plate be robust and manufactured with stiffening to avoid any distortion of the support under operating conditions.

No shimming between the gearbox and base plate shall be allowed.

M06.7 **AERATOR MOTORS**

The electric motors shall be coupled to the gearboxes by means of a pin type flexible coupling.

The size of the aerators and aerator gearboxes shall be based on standard electric motor sizes, and shall be rated to absorb the total mechanical power delivered by the standard electric motor. The power available for aeration at the motor shaft shall be de-rated to 90% of motor rated power, i.e. an allowance of 10% shall be made for additional losses in the electrical motor at full load.

For a detailed specification for the electrical motors required refer to Particular Specification E01: Electric Motors.

M06.8 **METAL PREPARATION AND CORROSION PROTECTION**

Refer to the G02: Corrosion Protection.

M06.9 COLOUR CODES

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01: Colour Codes.

M06.10 AERATION EQUIPMENT PERFORMANCE

The complete turbine assembly shall be subjected to static balancing witnessed by the Engineer during manufacture and before final onsite installation. A methodology shall be submitted by the Tenderer to accomplish this dynamic balancing to the satisfaction of the Engineer. Vibrations in operation are to be kept to a minimum and it will be the Contractors responsibility to check this torsional vibration for each aerator assembly, both theoretically and in-situ.

M06.11 QUALITY MANAGEMENT (QM) AND QUALITY ASSURANCE

QM shall be categorised as 'critical and major' for this section of the Project.

M06.11.1 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.

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.

M06.11.2 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 requested to attend certain stages of completion of installation to ascertain compliance with the Specifications and to witness the Contractor's site inspections at the Engineer's discretion.

M06.11.3 Performance Testing

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.

In the case of gearboxes, they shall be subject to testing under operating conditions for at least 12 hours on the test bed. All results shall be available for inspection.

Before commissioning

- Check for correct oil level in gearboxes and that motors are greased properly.
- Ensure all HD bolts are torqued down correctly.
- The alignment and levelling of each assembly shall be checked and the results shall be available for inspection by the Engineer.
- Check correct submergence of each turbine and adjust on the jacking bolts.
- The electrical functions and control shall be checked by a responsible inspector prior to attempting to start any motor on this project.

After Initial Commissioning

- Ensure all oil pumps and flow or pressure switches are functional
- Check for correct operation of aerator rotation, speed, vibration and noise.
- Vibration readings.
- Note amperage drawn by each assembly.
- In-situ Oxygenation Efficiency Tests to determine the oxygen transfer efficiency of each aerator as well as the total oxygen transferred.

M06.11.4 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

M06.11.5 In-situ Oxygenation Efficiency Determination

Each aerator assembly shall be tested in order to verify the performance and oxygen transfer efficiency by means of the Steady State or in situ testing into mixed liquor under normal operating conditions. An item has been included in the Schedule of Prices for this work by the Successful Tenderer.

Procedure for Steady State Testing

It is imperative that the successful Tenderer employ a recognised testing authority to perform any efficiency testing that may be required under this section of the Contract and this will be subject to approval by the Engineer.

The Alpha and Beta correction factors shall be verified in a laboratory capable of determining these figures for use under this test.

In the aeration of activated sludge mixed liquor, at a certain temperature T degrees Centigrade, there is a dynamic steady state condition, at a certain oxygen concentration C, the driving force $C_s - C$ becomes such that the rate which oxygen is introduced is equal to the rate at which it is utilised by the bacteria within the aerated reactor.

This relationship can be represented by the following equation:-

In equation (1), r and C can be determined, and C_s (TO can be obtained from equation (2), so that the value of K (T) can be calculated. Its value at 20°C can be obtained by the use of the following relationship:-

- $K(T) = K(20) \times 1,02 (T-20)$
- $K(20) = K(T) \times 1,02 (20-T)$
- $OC = K(20) \times C_{1s} (20) \times V \times 10^{-3} \text{ kg/hr}$

Where:-

- $K(20) \times C_{1s} (20)$ saturation concentration of oxygen in mixed liquor containing 1 000 mg/l dissolved solids, at 20°C and 760 mm pressure (mg/l)
- V 9,02 mg/l volume of mixed liquor in basin under consideration (m³)
- OC oxygen capacity

Test Requirements

The actual test procedure shall be proposed by the Contractor but shall be approved by the Engineer before it is implemented if different from above.

Nevertheless, the following points shall be incorporated in the test procedure:-

- The Contractor shall provide four dissolved oxygen meters of approved make, all standardized and calibrated in accordance with the instructions supplied by the manufacturers
- The Contractor shall provide all meters, etc required for conducting the oxygen uptake rate tests
- The position of the DO probes shall be to the satisfaction of the Engineer
- The Contractor shall provide all meters required to measure the power consumption of the aerators during the steady oxygenation capacity test
- At least three consecutive tests shall be conducted
- The Contractor shall provide all meters, required for determination of the alpha and beta factors to enable the in-situ oxygenation efficiencies to be related to Standard Conditions.

M06.11.6 Steady State Oxygenation Capacity Determination

In the aeration of activated sludge mixed liquor, at a temperature of T°C, the following relationship holds:-

$$\frac{dC}{dt} = K(T) \times (C_s(T) - C) - r$$

Where

$$\frac{dC}{dt} = \text{rate of change of oxygen concentration (mg/l/h)}$$

K (T) = oxygen transfer co-efficient in mixed liquor at T°C (h⁻¹)

C_s (T)= saturation concentration of oxygen in mixed liquor at T°C and at the ambient barometric pressure (mg/l)

C = actual concentration of oxygen in the mixed liquor (mg/l)

r = oxygen update rate of the mixed liquor (mg/l/hr)

If it is assumed that, under normal conditions, as state of equilibrium exists in the system, then:-

$$\frac{dC}{dt} = 0$$

$$\text{and } K(T) \times (C_s(T) - C) = r$$

$$\text{i.e. } K(T) = \frac{r}{C_s(T) - C} \quad (1)$$

The value of C (T) to be used in equation (1) is calculated from the following relationship:-

$$C_s(T) = \frac{468 - 2,65S}{31,6 + T} \times \frac{P - P_w}{760 - P_w} \quad (2)$$

Where :-

C_s(T) = saturation concentration of oxygen in mixed liquor at T°C and P mm [pressure (mg/l)]

S = dissolved solids in mixed liquor (parts per 1000)

T = temperature of mixed liquor (°C)
P = barometric pressure (635 mm 1-1g)
Pw = saturation vapour pressure of water at T°C (mm 11g)

M06.12 MEASUREMENT AND PAYMENT

Payment under scheduled items shall be made per complete aerator installation as specified, electrical connections, civil preparation, coring and grouting, etc. Measurement and payment will distinguish between supply / delivery and installation / commissioning of the aerator units required.

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.

The Contractor shall include in the Tendered rate for straining of the gearbox oil after 600 hours of initial operation. The Contractor shall furnish the Engineer with a report recording any irregularities when cleaning the sieves after straining.



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PARTICULAR SPECIFICATION

M07: PROPELLER PUMPING EQUIPMENT

3	2012-07-30	Review of Balancing criteria	Y Pillay	
2	2010-03-07	General review	J Ritchie	
1	2009-05-12	Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance		
Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water

PARTICULAR SPECIFICATION: M07: MECHANICAL PROPELLER PUMPING EQUIPMENT

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M07.1 SCOPE

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of mechanical type propeller pumping equipment for the (a) and (b) recycles within the biological reactor unit process of a wastewater treatment works. The Specification shall be read in conjunction with that of the Project Specification and all relevant other Particular Specifications.

The scope of the equipment required under the Contract shall be project specification.

M07.1 INTERPRETATIONS

M07.1.1 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

M07.1.2 Standards

All design standards for the propeller pumping equipment shall be subject to the latest amendments and editions of the following standard specifications:-

SANS 10400: 1990	: National Building Regulations
BS 5304: 1988	: 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 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 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

M07.1.3 General Requirements

This specification must be read in conjunction with the following specifications:-

M08: Volume M08: Particular Specification for Gearboxes

E01: Volume E01: Particular Specification for Electric Motors

G01: Particular Specification for Colour Codes

G02: Particular Specification for Corrosion Protection

M07.2 **DESIGN OF PROPELLER PUMPING EQUIPMENT**

M07.2.1 General Design Parameters

Axial flow pumping equipment shall be designed such that the following requirements are met:-

- To facilitate manufacture, inspection, installation, maintenance, cleaning and repairs,
- To ensure safe and satisfactory operation for an acceptable life expectation of 12 years under the ambient conditions prevailing at the Site,
- To prevent undue stresses being produced by expansion due to temperature changes.
- To keep maintenance costs to a minimum,
- To facilitate inter-changeability of units and/or sub-parts throughout the Contract works with regard to new equipment and equipment and/or sub-parts currently being used on the existing JW Wastewater Treatment Works,
- To operate without undue vibration and excessive noise. Maximum of 85dBA measured at 1 metre from operating equipment,
- 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
- To be suitable for operation 365 days per year, 24 hours per day under specified design conditions.

M07.3 **GENERAL DESCRIPTION OF PUMPS**

M07.3.1 Specific Performance Design Parameters

The (a) and (b) -recycle pumping equipment shall be of the axial flow type capable of pumping large volumes of mixed liquor at relatively low resistance - (Head)

The pumping duty for each pumping set shall be specified in the Project Specification.

The design of the propeller blades shall be such as to eliminate the undue accumulation of rags and debris material around the impellers and the shaft.

The design of the inlet throat tube, propeller blades, flap non return valves etc shall be such that there is no air entrainment in the recycled liquor.

The recycle flow rate shall be adjustable. Adjustability in the flow rate shall be accomplished by means of varying the pitch angle of the blades or by means of a v-belt driven pulley arrangement.

A surface mounted cantilever type design shall be required to eliminate submerged driven bearings supporting the driven shaft of the pump.

Different types of metals shall be isolated from one another to prevent corrosion due to galvanic reaction.

M07.4 PROPELLER PUMP DESIGN

M07.4.1 Body

The pump body shall be fabricated from Grade 300 W galvanised mild steel in accordance with SANS 1431 : 2003, or made of cast iron and shall be designed to house the upper and lower bearing assemblies.

M07.4.2 Propeller Shaft

The propeller shaft shall be manufactured from 304 L stainless steel suitable designed to transmit the imposed torque loads induced by the propeller and withstand all cantilevered loads imposed under undue conditions during operation.

M07.4.3 Propeller Blades

The propeller blade shall be of a well proven swept back design selected to achieve the required head and flow characteristics and must be manufactured from 304 L cast stainless steel. The propeller blade shall be locked to the lower end of the shaft.

M07.4.4 Balancing

The blade assembly shall be subjected to static and dynamic balancing before final onsite installation. Vibrations in operation shall be kept to a minimum and it will be the Contractors responsibility to check this torsional vibration for each pump set assembly, in-situ.

The propeller shall have a maximum vibration velocity of 2.5 mm/s at specified conditions. Static balancing alone is not acceptable as there is no qualitative measurement of the remaining amount of unbalance left in the assembly, and does not confront the basic definition of checking unbalance against a known standard.

M07.4.5 Throat Tube

A suitable designed throat tube constructed from 304 L stainless steel shall be provided. This item shall be grouted into the exiting civil structure.

The clearance between the propeller and throat tube must ensure that a minimum of liquid slip takes place thus maintaining maximum efficiency. Bell mouthed inlet and outlet openings must be incorporated to ensure smooth entry and exit flow conditions.

M07.4.6 Corrosion Protection

All mild steel members shall be prepared and coated in accordance with Particular Specification G02: Corrosion Protection.

The corrosion protection of Stainless steel welds shall entail pickling and passivating in accordance with Particular Specification G02: Corrosion Protection.

M07.4.7 Bearings

All bearings shall be designed for a life of at least 100 000 hours at an (L 10) rating. Bearings for the output shaft shall be designed to withstand bending, up thrust, down pull and radial loads imposed by the pump impellor. Tenderer's shall indicate what these forces are and how these shall be accommodated.

Calculations shall be submitted with the Tender. Failure to do so may render the Tender invalid. The bearings shall carry all axial and radial loads and accommodate any thermal expansion. Bearings should be sealed against the ingress of liquid and must be selected for a L10 life in excess of 100 000 hours.

For ease of lubrication all bearing grease pipes must be piped to grease nipples on the outer cover of the pump support frame.

M07.4.8 Fasteners

All submerged and concrete securing fasteners shall be 316 SS. All mating flanges shall be sealed against the ingress of any crevice corrosion by means of a sealant suitable for underwater conditions and approved by the Engineer.

M07.4.9 Colour Coding

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01: Colour Coding.

M07.5 **MOTOR AND DRIVE**

Belt driven pumps are preferable to gearbox driven pumps.

The upper end of the drive assembly must be fitted with an adjustable tensioning bracket for mounting the drive motor. This arrangement shall make provision for adjustment of "v" belt tension and allow for changing pulleys without difficulty. All rotating elements shall be provided with adequate guarding to cater for all probable pulley sizes.

The guards must be domed to avoid water ponding and contamination of the "v" belts and upper bearing, whilst allowing adequate air cooling for belts.

A suitably rated motor must be provided and the motor power transmitted to the shaft by adequately rated "v" belts. Should one belt break, the remaining belt / belts must be capable of transmitting the required power without overload.

The electrical motor supplied shall conform to the Particular Specification E01: Electrical Motors. The motor must be rated at least 20% above the maximum absorbed power and must be weatherproofed for unprotected conditions.

M07.6 **FLAP GATES**

Each pump chamber delivery port shall be fitted with a 304 L stainless steel non-return flap to prevent the flow from the duty pump flowing back through the standby unit delivery port.

The gates shall be mounted in a suitable 304 L stainless steel frame correctly sized to suite the delivery port detailed. The flap gate shall be bolted over the opening onto the concrete wall surface. The frame shall be sealed against the concrete with a durable and approved material.

A gate with robust hinges along the upper edge must be suspended from the frame and swing closed under no flow conditions with minimal pressure differential. The hinge design must allow the gate to seat squarely on the seat in the frame. Adequately sized Stainless Steel mounting

bolts shall be used to fix the frame in position.

M07.7 OPERATION

Provision must be made to vary the blade pitch and the rotational speed, the latter by changing a pulley on the V-belt drive.

M07.8 INSTALLATION

The pump shall be placed on a mounted base which shall be suitable for bolting to the concrete plate form floor above the pump chamber. Levelling spacer with a minimum thickness of 20mm shall be grouted by means of a non-shrink grout between the base plate and the concrete surface.

M07.9 QUALITY MANAGEMENT (QM) AND QUALITY ASSURANCE

QM shall be categorised as 'critical and major' for this section of the Project.

M07.9.1 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.

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.

M07.9.2 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 requested to attend certain stages of completion of installation to ascertain compliance with the Specifications and to witness the Contractor's site inspections at the Engineer's discretion.

M07.9.3 Performance Testing

Works testing

Each item of equipment shall be subject to inspection and testing prior to despatch from the works. All test (including static and dynamic balancing) results shall be made available to the Engineer for verification or when the QCP's require intervention or hold points for inspection.

Before commissioning

- Check that all bearings are greased properly.
- Ensure that the belts are correctly tensioned.
- Ensure all HD bolts are torqued down correctly.
- The alignment and levelling of each assembly shall be checked and the results shall be available for inspection by the Engineer.
- Check that the correct clearance tolerance within the throat tube prevails.
- The electrical functions and control shall be checked by a responsible inspector prior to attempting to start any motor on this Project.

After Initial Commissioning

- Ensure all oil pumps and flow or pressure switches are functional
- Check for correct operation of aerator rotation, speed, vibration and noise.
- Note amperage drawn by each assembly.
- Measure the flow delivered by each pump

M07.9.4 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

M07.10 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 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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PARTICULAR SPECIFICATION

M08: MECHANICAL GEARBOXES

3	2012-07-30	General review	T Wellard	
2	2010-02-15	General review	J Ritchie	
1	2009-05-12	Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance		
Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water

PARTICULAR SPECIFICATION: M08: MECHANICAL GEARBOXES

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M08.1 SCOPE

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of complete Gearboxes. The Specification shall be read in conjunction with the Project Specification.

M08.2 INTERPRETATIONS

M08.2.1 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

M08.2.2 Standards

All design standards for the mechanical gearboxes shall be subject to the latest amendments and editions of the following standard specifications:-

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 1044-3	: 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 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

M08.2.3 General Requirements

This specification must be read in conjunction with the following specifications:-

G01: Particular Specification for Colour Codes

G02: Particular Specification for Corrosion Protection

M08.3 GEARBOXES

M08.3.1 Design Parameters

The Tenderer shall submit with his Tender a catalogue of the make of gearbox offered and indicate how the selection of gearboxes was made.

Unless otherwise stated, the gearboxes shall be directly mounted to the motor. The gears shall be helical gears which are used in applications with high speeds, large power transmission and low noise levels.

Gear drives shall be sized to ensure that the running load peak does not exceed the endurance limits of the components.

Gearboxes shall have an efficiency of not less than 96% on two stage reduction and 95% on three stage reduction.

Simple cooling may be by convection from the gearbox casings but without assistance from cooling fins or fans. Adequate other cooling means shall be provided as applicable. The exterior of the gearbox shall be free from dust or moisture traps. Access for inspection purposes shall be allowed for in the design of the gearbox casing. Maintenance free oil lock seals on the high speed shafts shall be a standard design feature.

Where the lubrication system requires the use of an oil pump then the circulation system will be fitted with an oil flow switch in order for any no flow or low flow conditions to be monitored on the works SCADA system. This will require that a potential free contact capable of switching 500 mA at 230 Volts A.C. be provided.

The bearing span shall be suitably selected for vertical gearbox application and shall promote shaft support for the intended application. Rigid lateral load distribution shall be by means of a standardized pinioned arrangement reducing noise and vibration.

A rigid half coupling shall be shrunk onto the output shaft of the gearbox and shall be secured by an additional keep plate and bolted connection in a recognised manner.

Substantial eye bolts shall be provided for all reasonable lifting purposes.

The gearboxes shall carry the manufacturer's identification details together with the rated shaft speeds, output power and maximum ambient operating temperature.

The gearboxes shall conform to the relevant British Standards and AGMA ratings with respect to the following requirements:

- (a) The design ambient temperature shall be 45°C.
- (b) The noise at 100% of the full output power and 45°C ambient shall not exceed 90 dBA as measured 1 m in distance from the equipment.

(c) The gearing shall give double the life of the bearings when subjected to similar loadings.

The design of the gearbox shall be such that the following calculation shall be adhered to: -

$$\frac{\text{Actual Radial Load}}{\text{Permissible Actual Radial}} + \frac{\text{Actual Axial Load}}{\text{Permissible Axial Load}} \text{ shall be } \leq 1,0$$

Calculations shall be submitted. Failure to do so may render the Tender invalid.

Tenderers shall state in their tenders whether external oil filters, flow and pressure switches are included in their offer.

A stainless steel ball valve and extension drain pipe and plug shall be provided to facilitate oil changes by the maintenance staff. The termination of this drain shall be accessible from the operating platform.

M08.3.2 Gears

The gears shall be high efficiency case hardened helical gears and rated in accordance with the AGMA Code of Practice 420.04 for continuous operation. The gears shall be manufactured from high cast iron to BS 1542 Class 220 or an equivalent standard.

Semi-hardened and subsequently machined gears will not be accepted. Pinions shall be manufactured in accordance with AGMA 390.02 Class 12.

M08.3.3 Service Factor

The service factors indicated in the table below shall be based upon the installed power:-

Process Units	Service Factor
Rotating Bridges: Sedimentation & Clarifier Tanks	1.5
Rotating Scraper System: WAS Thickeners & Fermentation Tanks	1.75
Aerators	2.25
Mixers	2
Screw & Plunger Pumps	2.25
Centrifugal Pumps	2
Dosing Pumps	2
Mechanical Screens	2

M08.3.4 Bearings

Roller bearings shall be used throughout. Taper roller bearings shall be used to sustain radial and thrust loads. Bearings shall be designed for a design life in excess of the indicated hours in the table below, in accordance with ISO.281. Bearings for the output shaft shall be designed to withstand bending, up thrust, down pull and radial loads imposed by the equipment being driven. Tenderer's shall indicate what these forces are and how these shall be accommodated.

The Contractor shall ensure the lubricant used for the initial filling and specified in the maintenance manual, is adequate for prolonged operation in ambient temperatures of up to 45°C without overheating.

Process Units	Design Life	Operation
Rotating Bridges: Sedimentation & Clarifier Tanks	L10 for 75 000	Continuous
Rotating Scraper System: WAS Thickeners & Fermentation Tanks	L10 for 75 000	Continuous
Aerators	L10for 100 000	Continuous
Mixers	L10 for 100 000	Continuous
Screw & Plunger Pumps	L10 for 100 000	Continuous
Centrifugal Pumps	L10 for 100 000	Continuous
Dosing Pumps	L10 for 100 000	Continuous
Mechanical Screens	L10 for 75 000	Continuous

M08.3.5 Lubrication

The gearboxes shall be constructed with a dry well for the low speed shaft bearing to avoid complete drainage of oil in the event of an oil seal failure. Provision to monitor the oil level must be provided. The bearing shall be grease lubricated with the greasing point easily accessible.

A stainless steel ball valve and extension drain pipe and plug shall be provided to facilitate oil changes by the maintenance staff. The termination of this drain shall be accessible from the operating platform.

M08.3.6 Gearbox / Motor Coupling

The coupling shall be fully rated to transmit the motor full load power and tested to prove static and dynamic balance. The coupling shall accommodate small axial, lateral and angular misalignments without imposing undue stresses on the shaft and bearings. The coupling shall be enclosed in a stationery solid-plate guard to the Engineers satisfaction.

M08.3.7 V-belt

V-belts shall be designed to withstand the high tension and high power drives, shall be long wearing, tough and trouble free. The V-belt cover shall be oil, heat and ozone resistant in order to protect the inner components. The compression section shall provide excellent gripping action and a high coefficient of friction, but shall also allow an initial start-up clutching action in order to eliminate power spikes and excessive bearing loading. The moulded cogs shall provide optimum flexibility with minimal build up of heat.

M08.3.8 Flexible Couplings

Flexible couplings consist of two types: gear type and multiple disc/diaphragm type. The gear type uses gear teeth to make them flexible and is either grease lubricated or oil lubricated depending upon their size. Diaphragm couplings do not require any form of lubrication and the flexibility is created by a series of multiple discs or a diaphragm made of spring steel and flexes as the shaft rotate.

Misalignment of the coupling is to be prevented by proper alignment of the coupling by means of a taper gauge or set of feeler gauges and a straight edge or dial indicator. Two types of misalignments are encountered by flexible couplings: Angular misalignment and parallel misalignment. Any adjustment to correct the misalignment in one direction may affect the other direction and both the angular and parallel alignment shall be checked after each adjustment.

A periodic check of the coupling alignment shall be performed.

M08.3.9 Housing

The gearbox shall be manufactured high strength cast iron which enables the gearbox to be used in harsh environments.

A breather designed to prevent moisture from entering the housing of the gearbox, shall be fitted to each unit supplied under this contract. Breather unit allowing continues oil spillage due to the overfilling of the gearbox shall not be accepted.

Oil level sight glasses (fully protected and UV resistant) shall be provided with levels marked for running and filling minimum and maximum positions respectively. These shall be arranged for easy viewing and shall take into account the angle of mounting.

M08.3.10 Shaft

The Input and output shafts shall be of sufficient dimension in order to avoid excessive torsional or bending stresses and deflection. The impeller shall be secured to the shaft in such a way that it can be readily removed without any damage to the impeller and the shaft.

The shafts shall be protected by replaceable sleeves manufactured from non-corrosive material. The shaft shall be manufactured from stainless steel.

M08.4 SPARES AND TOOLS

The Tenderer must submit on the appropriate schedule a priced list of spare parts which it is recommended should be kept by the water treatment plant for maintenance of the plant. Spares which the Management 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 for not less than 15 years.

Tenderers must 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.

M08.5 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

M08.6 METAL PREPARATION AND CORROSION PROTECTION

Refer to Particular Specification G02: Corrosion Protection

M08.7 COLOUR CODES

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01: Colour Codes.

M08.8 QUALITY MANAGEMENT (QM) AND QUALITY ASSURANCE

QM shall be categorised as 'critical and major' for this section of the Project.

M08.8.1 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.

M08.8.2 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 Contractor's site activities at the Engineer's discretion.

M08.9 SYSTEM PERFORMANCE

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.

Gearboxes shall be subject to testing under operating conditions for at least 12 hours on the test bed. All results shall be available for inspection.

Before commissioning

- Check for correct oil level in gearboxes
- Ensure all HD bolts are torqued 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.

After Initial Commissioning

- Ensure all oil pumps and flow or pressure switches are functional
- Vibration testing

M08.9.1 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. The Contractor shall be requested to drain and replace the oil in each gearbox before the expiry of

the defects liability period. The drained oil shall be sieved and inspected for any contamination in the oil. In the event of any unusual contamination, (metal deposits etc) the Contractor, will take the necessary steps, to investigate the cause, and where required to replace and or repair the gearbox (s) at no cost to the employer.

M08.10 MEASUREMENT AND PAYMENT

Measurement and payment will distinguish between supply/delivery and installation/commission as well as per installation point. The respective tender rates shall cover all costs from supply to commission of each gearbox but excluding the electrical power supply and electrical cable connection.

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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PARTICULAR SPECIFICATION

M09: MECHANICAL ARCHIMEDIAN SCREW PUMPS EQUIPMENT

3	2012-07-30	General update and re-issue	J Ritchie	
2	2010-02-15	General review	J Ritchie	
1	2009-05-12	Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance		
Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water

PARTICULAR SPECIFICATION: M09: MECHANICAL ARCHIMEDIAN SCREW PUMPS EQUIPMENT

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M09.1 SCOPE

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of mechanical archimedian screw pumps and related equipment installed within a concrete trough structure at wastewater treatment works. The Specification shall be read in conjunction with that of the Project Specification.

M09.2 INTERPRETATIONS

M09.2.1 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

M09.2.2 Standards

All design standards for the Archimedian screw pumps shall be subject to the latest amendments and editions of the following standard specifications:-

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 1044-3	: 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 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

M09.2.3 General Requirements

This specification must be read in conjunction with the following specifications:-

M08: Particular Specification for Gearboxes

E01: Particular Specification for Electric Motors

G02: Particular Specification for Corrosion Protection

M09.2.4 Screw Pumps

M09.2.5 General

This Contract calls for the supply, delivery, installation and commissioning of Archimedean screws.

The quantity, capacity, lift and installation layout are specified in the Project Specification.

The equipment to be installed shall include but not limited to: motors, mechanical overload release couplings, gearboxes, anti-reverse rotation devices, flexible final couplings, top and bottom bearings, bed-plates, splash plates, lubrication equipment and all fasteners and anchor bolts.

M09.2.6 Detail of Screws

The rotating screw assembly shall consist of a centre tube seam welded by the tube-maker with cold formed helices fillet-welded thereto and stub shaft housings at each end. All parts shall be of ample dimensions and strength to minimize deflection and properly machined and assembled to ensure perfectly free running.

M09.2.6.1.1 *Torque Tubes*

The upper and lower ends of the torque tubes shall be equipped with internal watertight bulkheads, inboard of the flanges. The torque tube shall be air pressure tested. The maximum design stress shall not exceed 20 N per mm².

All welds between the torque tube segments and at the torque tube end flanges shall be full penetration welds. The end plates shall be provided with tapped boltholes and indexes to fit the flange of the shaft extensions. The shaft extensions shall consist of a flange with index to fit the tube end plate and matching bolts.

A solid upper drive shaft and a lower stub shaft shall be fastened to the upper and lower end of the spiral screw with high strength bolts. The material of the centre tube and helices shall be structural steel to BS 4360.

M09.2.6.1.2 *Flights*

Flights shall be helical shaped and continuously welded to the torque tube on both sides of the flight. The screw shall be statically balanced and shall be placed in a lathe in which the flights shall be machined to a true radius.

Helices shall be evenly spaced and accurately shaped to a cylindrical shape. The helices at the leading end of the screw shall be reinforced. The spiral screw shall be designed for a minimum deflection. The deflection shall not exceed L/2 500 of the bearing centre distance when calculated as a simple horizontal beam uniformly loaded with a dead load of the screw.

M09.2.6.1.3 *Screw Assembly*

Primary and secondary stresses in the screw assembly shall be calculated in accordance with BS 153: Part 3B and the design and fabrication shall be in accordance with BS 153: Part 4.

The design life of the screw assembly shall be assessed in accordance with Code of Practice for Fatigue – BS 5400: Part 10.

Stress calculations shall not include any allowance that might be claimed by the attachment of the helices to the centre tube or to buoyancy when the screw is lifting fluid.

M09.2.6.1.4 Welds

The submerged arc welding process shall be used with the exception of the attachment of the helices, with approval testing of welding procedures in compliance with BS 4870.

Longitudinal and circumferential welds only shall be made to the centre tube except for the attachment of helices, which shall be by a continuous fillet weld interrupted where it intersects centre tube welds.

Circumferential welds shall not occur at a greater distance than 20% from the extremities of the finished tube and preferably at the lower end only when joining tubes.

All longitudinal and circumferential welds shall be radio graphed.

M09.2.6.1.5 Screw Pumps

The screw pumps shall be designed taking into account the TWL in the sump. The pumps shall operate at this level and the tendency for the rotating assembly of the pump to float shall be taken into consideration when selecting bearing and other components and also in the design of the screw assembly.

Provision shall be made in the design for lifting by slings around the centre tube. Lifting lugs shall not be welded to the centre tube.

M09.2.6.1.6 Stub shafts

The stub shafts at each end of the centre tube shall effect a gradual reduction in diameter and shall be steel castings, to BS 4360. The stub shafts shall be steel forgings to BS 970: Part 1 and the fastenings to the housings shall not under any circumstances be subject to cyclical stressing.

The stub shaft shall be readily removable from the housing prior to transport and readily replaceable at Site. The fixing arrangements for stub shafts shall be air and watertight.

M09.2.7 Bearings

M09.2.7.1.1 Bottom Bearing

The bottom bearing shall preferably be pivoted so as to facilitate alignment of the screw and provision shall also be made to take account of the resultant force on the screw due to the higher water level mentioned above.

A spare complete bottom bearing is to be supplied as a spare for each size and type of bottom bearing.

M09.2.7.1.2 Bottom Bearing Housing

The bottom bearing housing and mounting shall be designed to withstand radial forces only including upward forces due to buoyancy during static sump level conditions. The bearing shall be split on its horizontal centre line together with the phosphor bronze renewable feather keyed bearing shell to facilitate inspection without disturbance of the stub shaft or the need to support the screw.

The lower bearing housing shall be designed to exclude water and shall not contain less than two lip seals. The lip seals shall be protected from abrasive materials by a seal cover.

Seals shall be split and readily changed without the disturbance of the stub shafts or the need to support the screw.

The bottom of the bearing housing shall be fitted with an inspection plate that can be removed in order to inspect the lower bearing without disassembling the lower stub shaft.

Each half of the bottom bearing shells shall be spirally grooved such that rotation of the journal assists the passage of lubricant through the bearing surfaces.

The design of the bearing housing and shells shall provide for repositioning the bottom shell to the top position and vice versa when wear has taken place.

M09.2.7.1.3 Lubrication

Lubrication shall be continuous and automatic by means of a light grease or oil system pressurised by an electric motor driven plunger pump or oil hydraulic reservoir in the form of a power pack. If the former is chosen, the grease shall return to a suitable removable receptacle located on a bracket fixed to the external sump wall or, if the latter, a return pipe shall be provided to return oil to the reservoir via a suitable inclined 'in-line' filter.

The lubricant shall be piped to the bottom bearing via a high-pressure nylon tube housed in a PVC pipe duct down the side of the trough behind the splash plate or cast into the concrete structure.

Provision shall be made for priming the system (30 second for oil or 60 seconds for light grease) prior to start up of the pump. An adjustable pressure relief valve shall be provided for either system together with a pressure gauge and pressure switch.

An external stationary shroud shall be provided to prevent detritus affecting the bearing or lubrication pipes during operation.

M09.2.7.1.4 Top Bearing

The top bearing shall be designed to accommodate the entire thrust including upward forces due to buoyancy of the rotating parts of the screw together with a proportion of the radial forces. The thrust shall be transferred from the shaft to the bearing by means of a thrust ring or lock nuts. A "circlip" arrangement will not be acceptable. The bearing shall be grease lubricated with a Stauffer "tell-tale" (or equivalent) lubricator accessible from the machinery room and shall have seals on both ends. It shall be possible to easily dismantle and replace this bearing without removing the stub shaft.

The top bearing shall be mounted on a rigid support frame, which shall also seal the opening in the motor room wall. This frame shall be of Type 304L stainless steel.

Bearings shall be designed for a B10 life in excess of 100 000 hours. The Contractor shall submit proof of the required bearing rating.

M09.2.7.1.5 Fasteners and Anchor Bolts

All fasteners and anchor bolts in the trough or exposed the outside of the building, shall be of Type 304 or Type 316 stainless steel provided that the allowable stresses are not exceeded in which case special high tensile fasteners shall be required.

M09.2.8 Gearboxes

Each screw shall be directly coupled to a suitable gearbox through a flexible coupling with the

gearbox in line and directly driven by a motor through a mechanical overload release coupling. It shall be noted that the gearbox will be mounted at an angle and must be designed accordingly. Refer to Particular Specification M08: Mechanical Gearboxes for a detailed specification for gearboxes.

M09.2.8.1 Gearbox/Motor Coupling

The coupling between motor and gearbox shall be of the mechanical overload release type with manual resetting facility. The incorporation of a shear pin will not be acceptable. The coupling shall instantaneously protect the motor and gearbox should the screw suddenly become arrested in rotation. The coupling shall be fully rated to transmit the motor full load power and tested to prove the above features together with static and dynamic balance.

M09.2.8.2 Gearbox and Motor Mounting

The gearbox shall be mounted directly to a purpose designed concrete plinth. The motor shall be provided with slide rails, which shall be mounted to the above plinth.

M09.2.9 Electric Motors

Refer to Particular Specification E01: Electric Motors for a detailed specification for Electric motors.

Starting characteristics of motors shall be suitable for the equipment offered.

M09.2.9.1 Bearings

Bearings shall be adequate to withstand continuous operation when supporting the rotor shaft inclined at the angle specified in the Project Specific Specification. Bearings shall be sealed or self-lubricated, provided with a readily accessible filter and clearly visible oil level indicator.

M09.2.10 Screw Troughs

The Contractor shall be responsible for the final alignment of the trough to provide the correct clearances, and for the supervision of the formation of the trough.

The trough shall extend between the pump inlet sump and the discharge channel without distortion.

The trough shall be so shaped as to avoid 'wedges' between screws and sidewalls and to provide for the return of any excess liquid or solids without interference with pump rotation.

The trough shall preferably have its profile shaped by means of the screw itself, after installation, in order to minimise clearance and maximize efficiency.

M09.2.10.1 Side Profiles

In order to contain the pumped liquid on the high water level side of the screw axis, caused by the rotation of the pump, special side profiles shall be fitted. The profiles shall be fixed to the concrete through and the channel sidewall using approved stainless steel fixing bolts, to maintain a small clearance around approximately 230° of the screw circumference.

M09.3 METAL PREPARATION AND PROTECTION

Refer to Particular Specification G02: Corrosion Protection.

M09.4 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 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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PARTICULAR SPECIFICATION

M12: MECHANICAL ELUTRIATION PUMPS

3	2012-07-30	General review	Y Pillay	
2	2010-02-15	General review	J Ritchie	
1	2009-05-12	Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance		
Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water

PARTICULAR SPECIFICATION: M12: MECHANICAL ELUTRIATION PUMPS

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M12.1 SCOPE

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of plunger type pumps for wastewater treatment. The Specification shall be read in conjunction with that of the Project Specification.

M12.2 INTERPRETATIONS

M12.2.1 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

M12.2.2 Standards

All design standards for the elutriation equipment shall be subject to the latest amendments and editions of the following standard specifications:-

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 1044-3	: Welding Part 3: The fusion of steel (including stainless steel): Tests for the approval of welding procedures
SANS 10064	: The preparation of steel surfaces for coating
SANS 10102-4	: Selection of pipes for buried pipelines Part 1: General Provisions
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
BS EN 12162:2001	: Liquid pumps. Safety requirements. Procedure for hydrostatic testing
BS EN 60041:1995	: Field acceptance tests to determine the hydraulic performance of hydraulic turbines, storage pumps and pump-turbines.
BS EN 60994:1993	: Guide for field measurement of vibrations and pulsations in hydraulic

machines (turbines, storage pumps and pump-turbines)

SANS 1123	:	Pipe Flanges
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)
BS 5316 Part 2	:	Pump test codes

M12.2.3 General Requirements

This specification must be read in conjunction with the following specifications:-

M08: Particular Specification for Gearboxes

M20: Particular Specification for Valves

M21: Particular Specification for Pressure Pipework

E01: Particular Specification for Electric Motors

G01: Particular Specification for Colour Codes

G02: Particular Specification for Corrosion Protection

Automation and Control Design Standards Volume 8: Flow Measurement

Automation and Control Design Standards Volume 11: Temperature Measurement

M12.3 DESIGN OF PLUNGER TYPE PUMPS

M12.3.1 General Design Parameters

Plunger Pumps shall be designed such that the following requirements are met:-

- To facilitate manufacture, inspection, installation, maintenance, cleaning and repairs,
- To ensure safe and satisfactory operation for an acceptable life expectation of 12 years under the ambient conditions prevailing at the Site,
- To prevent undue stresses being produced by expansion due to temperature changes.
- To 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
- To be suitable for operation 365 days per year, 24 hours per day under specified design conditions.
- The duty point preferably should be slightly to the left of the maximum efficiency point.
- The duty head should be at least 50% higher than the pump run out condition.
- The pump close valve pressure should be at least 20% higher than the duty head.

M12.3.2 Design Parameters

The pumps shall have stable non-overloading characteristics. Detailed performance curves for each pump type shall be provided by the Tenderer.

The curves shall indicate the following:

- Head (metres) vs. flow (litres per second)
- Power absorbed in kW
- Efficiency
- Net positive suction head curves indicating the safety operation as well as 3% head decay values.

M12.3.3 Pump Efficiency

The efficiency curve shall be flat over a wide range in order to provide efficient working at various pump operating conditions.

M12.4 PLUNGER PUMPS

Plunger pumps operate at high pressures over a long period of time, have large internal clearances thereby preventing clogging, operate continuously and have variable flow. Plunger pumps are designed to pump sludge up to 12% solids.

M12.4.1 Plungers

The pump plungers shall be manufactured from stainless steel and shall have a plugged drain hole in the bottom which shall be accessible through the top of the plunger.

M12.4.2 Gearboxes

Refer to Particular Specification M08: Mechanical Gearboxes for a detailed specification on gearboxes.

M12.4.3 Motor

The motor shall be electrically driven and shall be directly coupled to the pump. Refer to Particular Specification E01: for a detailed specification for Electric motors.

M12.4.4 Pump Casings

The pump casings shall be free of blow holes, internal projections, cavities or any other defects. The pump casing shall be manufactured from cast iron and protected against corrosion on the inside and outside by fusion bonded epoxy.

M12.4.5 Bearings

All bearings shall be designed for a life of at least 100 000 hours at an (L10) rating. Bearings for the output shaft shall be designed to withstand bending, up thrust, down pull, thermal expansion and radial loads imposed by the impeller.

M12.4.5.1 Bearing Housing

The bearing housing shall be manufactured from cast iron and shall be oil bath lubricated. Oil level sight glasses shall be provided with level markers for running and filling minimum and maximum positions respectively. These shall be arranged for easy viewing and shall take into account the angle of mounting.

The bearing housing and motor stool design shall provide accurate, self-aligning mounting for the flanged electric motor.

M12.4.5.2 Lubrication

In the case where oil lubrication is required, adequate provision shall be made for the cooling of

the oil. The bearings shall be required to operate at temperatures no higher than 60°C.

Oil reservoirs of sufficient capacity shall be fitted with easily accessible oil level indicators, which are to be clearly marked in order to indicate the oil standing and running levels.

M12.4.6 Testing

Pumps shall be factory tested for compliance with the performance and coating specifications and test certificates shall be supplied to the Engineer before delivery commences. The tested pump performances shall be within 5% of the operating curve of the pump offered in the Tender. Operating curves must be submitted with the Tender. The Engineer must be given 14 days notice of such tests so that his representative and/or that of the Employer, can witness the tests.

M12.5 **VALVES**

Valve chambers shall be provided on the inlet and outlet sections of the pumps.

M12.5.1 Pressure Relief Valves

Pressure relief valves shall be provided on the suction and discharge lines of the pump. The valves shall be factory set in order to prevent pump damage or motor overload. Refer to Particular Specification M20: for a detail on pressure relief valves.

M12.5.2 Sampling Valves

A sampling valve shall be provided on the discharge side of the plunger pumps. Refer to Particular Specification M18 for a detail on sampling valves.

M12.6 **MONITORING DEVICES**

Full detail of all monitoring devices offered must be submitted with the Tender.

M12.6.1 Pressure Gauges

Pressure gauges shall be fitted with an isolating cock, shall be vibration and shock resistant and shall be calibrated to read with an accuracy of $\pm 1\%$ of the indicated pressure. Three 20mm minimum diameter ball valves shall be employed to zero the gauge, to isolate it and to vent to atmosphere. A chemical seal shall be used to insulate the gauge from the media being measured.

The faceplate diameters of the pressure gauges shall be at least 100 mm. The gauges shall indicate the water pressure in kilopascal and shall have a range of a maximum of 50% higher than the normal maximum working pressure. All gauge glass must conform to internationally recognize standards. These standards include DIN 7081, BS 3463 and JIS B 8211.

The pipe socket requirements shall be included for.

M12.6.2 Temperature Detectors

If required oil lubricated bearings and glands shall be fitted with temperature detectors must be PT100 – RTD's.

If grease lubricated bearings are offered, the Tenderer will indicate in his Tender if temperature detectors can in fact be used. If temperature detectors are not feasible, an alternative means of monitoring bearings must be offered.

M12.6.3 Vibration Detectors

If the vibration of the motor pump exceeds the pre-set level, the vibration detectors in the bearing housing shall cause the pump to trip.

M12.6.4 No-flow Protection

- (a) Each pump casing shall be fitted with a flow meter on the discharge side to protect the pumps against no flow conditions.

M12.6.5 Indicator on Automatic Air Vent

If an automatic air vent is required for the pump casing, it shall be fitted with an indicator to indicate the open and closed positions of the air vent. The air vent shall be suitable for remote operation and air vent control shall be mounted on the control panel inside the pump station.

M12.6.6 Gland Leakage

If a gland leakage device is required in order to monitor the gland leakage it shall be supplied and fitted with adjustable alarm contacts designed to close when gland rises to a pre-set value.

M12.7 **VIBRATION AND NOISE**

The pumps as well as the motors shall comply with the requirements of BS 4999.

M12.8 **PIPEWORK**

The suction and discharge pipework shall be manufactured from 304L stainless steel. Refer to Particular Specification M21: Pressure Pipework for a detailed specification on pipework.

M12.9 **CORROSION PROTECTION**

Refer to Particular Specification G02: Corrosion Protection

M12.10 **DESIGNATION AND INFORMATION PLATES**

Each pump shall be supplied with an information plate secured to the pump casing in a visible position indelibly marked with the following details:-

- Maker's name, pump type and serial number
- Year of manufacture
- Rated duty of pump in litres per second
- Head in metres at rated duty
- Pump speed in r/min
- Mass of completely assembled pump in kilogram

M12.11 **INTERCHANGEABILITY**

Where two or more similar pump units are required, these units will be identical in all respects.

All similar parts of items supplied will be interchangeable without any additional machining or fitting.

M12.12 RECOMMENDED SPARE PARTS

The Tenderer must submit details of spare parts recommended to be kept in store by the Employer with his Tender.

The detail will include a full description of the parts, part identification, number required, guaranteed delivery time and total price delivered to Site.

M12.13 OPERATION AND MAINTENANCE MANUAL

The Contractor shall hand over to the Engineer four sets of the Operation and Maintenance Manual compiled for each installation not later than at the time of commissioning of the installation. These manuals are a prerequisite for final take over of the plant.

The Operation and Maintenance Manual will be printed on durable paper and will consist of the following:

- (a) Brief description of the plant and installation.
- (b) Concise operating instructions.
- (c) Routine maintenance instruction.
- (d) Precautionary measures, elementary trouble location, rectifying measures and emergency actions.
- (e) Detailed information on equipment.
- (f) Lists of spare parts including names and addresses of suppliers.

M12.14 DRAWINGS

The drawings included in the Tender Documents are the Engineer's proposal for the plant layout. Should the Tenderer offer alternative layouts, he shall submit drawings with his Tender in order for it to be evaluated.

Before the Contractor carries out any work, he will submit detailed working drawings to be approved by the Engineer. Approval of these drawings does not relieve the Contractor from his responsibility for the correctness of the drawings.

M12.15 INSTALLATION

The pump set foundation shall consist of a solid concrete block sufficiently massive and rigid to provide continuous support for the base-plate throughout its whole length. The foundation shall be kept 25 mm low to allow for levelling of the base-plate. Foundation bolt pockets in the foundation shall be 100 mm square if shuttered, or 100 mm diameter if drilled.

Steel packers shall be set up and embedded in a quick setting compound to within 6 mm of the final height of the bottom base-plate pad. Steel packers shall be placed adjacent to and on each side of the foundation bolt holes. Alignment of the base-plate shall be done with laminated packers on top of the steel packers already set.

Foundation bolts shall be left for 72 hours after grouting before tightening.

After levelling, alignment and tightening of foundation bolts, the base-plate shall be grouted with the aid of shuttering on the outside, to 30 mm above the lower flanges of the base-plate. The cavity between the lower flange and the foundation shall be completely filled.

The pump and motor shall be aligned to within ± 0.025 mm full indicator movement on dial gauge, regardless of the coupling type. After the pump and motor feet are tightened down, ad pipework erected and tightened, both angular and parallel alignment shall be checked and recorded at each quarter revolution. These readings shall be submitted to the 'Engineer and is a prerequisite for handover.

Upon completion, dowel pins shall be fitted to facilitate relocation at any future time.

M12.16 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.

M12.17 INSPECTION, TESTING AND COMMISSIONING

M12.17.1 Testing by Manufacturer

The Manufacturer will carry out all tests on materials, quality control tests, dimensional checking and routine tests on parts to ensure that the pumps and materials conform to the requirements of the relevant SANS or BS specifications and to this Specification. The Engineer will not necessarily attend these tests but records must be kept and all test results will be made available to the Engineer.

M12.17.2 Witnessed Testing

In addition to the above, a number of performance tests will also be carried out in the testing facility of the supplier before equipment is transported to Site. These tests can be carried out in the workshop of the manufacturer/supplier if it is suitably equipped or another approved test facility.

The Engineer may witness these tests and the Contractor will notify the Engineer two weeks in advance of the date and place at which the equipment may be inspected and tested. When tests and inspections have met the satisfaction of the Engineer a certificate of workshop acceptance will be issued. These certificates are a prerequisite before payment for "Materials on Site" can be passed. The Engineer's acceptance will in no way relieve the Manufacturer of any of his obligations to design, manufacture and supply pumps strictly in accordance with the Specification.

Performance tests shall include:-

- (a) Hydraulic tests on the pump casing. The test pressure will be equal to $1\frac{1}{2}$ times the maximum working pressure at the delivery end of the pump. The testing will be done with blank flanges bolted onto the flanges. The pressure will be maintained for at least 15 minutes. No sign of sweating, leaking, undue deformation and stressing or defect of any kind will be evident during the test period.
- (b) Tests to prove that the rotating parts are dynamically balanced.
- (c) Performance tests on pump and driving unit.
- (d) NPSH requirements if called for in the Project Specifications.

A performance test shall be carried out in accordance with BS 5316 Part 2 - Class B tests if specified. Unless otherwise stated, the Contractor will be required to conduct the performance

test on the combined pump/motor unit.

If a performance test of the pump and its driving unit is not possible at the manufacturer's works, this shall be stated in the Tender with reasons to allow the Engineer opportunity to make alternative proposals.

M12.17.3 Testing by an Independent Facility

The Employer may require that an independent testing facility or institution such as the South African Bureau of Standards carry out performance tests. A separate item for performance testing will be provided in the Schedule of Quantities to allow for this.

M12.17.4 Failure to Pass Performance Test

Should the pump unit fail the performance test, whether performed at the manufacturer's works or at an independent institution, the Engineer shall authorise any amendments to the plant which may be considered necessary to meet the guaranteed quantities within the permissible tolerances laid down in BS 5316 Part 2 - Class B tests and prove with further test that the equipment conform to the Specification.

All costs involved in the re-testing of pump units will be borne by the Contractor.

Should the pump unit fail to pass the test with more than 5% variation on the actual guaranteed figures, the engineer will reject the pump unit and request the Contractor to replace the unit so rejected. Should the pump unit still fail to pass the test, but the actual figures do not vary by more than 5% from the actual guaranteed figures, the Engineer may :-

- (a) Request the Contractor to carry out amendments to ensure the compliance of the unit with the Specification; or
- (b) Accept the equipment but impose a penalty for non-compliance on the Contractor.

A sum will be calculated based on the additional energy used over the life expectancy of the equipment and this will be deducted from the Contract price for each pump set for every kilowatt by which the gross demand exceeds the guaranteed figure with permissible tolerances.

M12.17.5 Commissioning

On completion of the installation the Contractor will check all items for satisfactory functioning. He will then inform the Engineer of his intention to commission the plant. The Engineer may request control measurements on pump alignment at this stage.

A detailed programme of his proposed commissioning procedures will be submitted not later than two weeks prior to the commissioning date.

Tests on site will be carried out in accordance with BS 5316 Part 1 - Class C tests.

After a successful running period of 4 hours (to be witnessed by the Engineer) the Contractor will hand over the installation to the Employer as well as the Operation and Maintenance Manuals. The Completion Certificate will only be issued after the units have been in successful operation for 14 consecutive days and the acceptance tests successfully completed.

During the first 14 days of operation, the Contractor will rectify any problems with the units on Site within 24 hours of being telephonically notified. During the remainder of the maintenance period, the Contractor will, within 14 days of being notified, commence rectifying any possible problems that the Employer may encounter with the equipment supplied under this Contract.

Should the Contractor fail to meet the above requirements, the Employer may appoint others to undertake the necessary repair work at the Contractor's cost.

During the Maintenance period the pump units will be operated to suit the water demand requirements of the Employer.

M12.17.6 Tests at the Site of the Works

The Engineer may require that site tests are performed to verify performance figures guaranteed by the Contractor. Flow rate, total head and power input to the pump/motor units shall be determined, as accurate as Site conditions permit, for one or more points on the pump curves close to the specified duty point. The Contractor shall provide suitable instruments with recent calibration certificates.

Should these measured and calculated quantities differ from those guaranteed by more than the tolerances allowed by BS 5316 Part 1 - re-testing of the unit at any testing facility, or the recalibration of the measuring instruments.

Should the subsequent test results still fall outside the allowable tolerances, Clause P201.7.4 shall apply, and call costs shall be borne by the Contractor. In the event of the subsequent test being successful, costs shall be borne by the Employer.

M12.18 **COLOUR CODES**

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01.

M12.19 **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 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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PARTICULAR SPECIFICATION

M18: MECHANICAL CENTRIFUGAL PUMPS

3	2012-07-30	General review	Y Pillay	
2	2010-02-16	General review	J Ritchie	
1	2009-05-12	Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance		
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PARTICULAR SPECIFICATION M18: MECHANICAL CENTRIFUGAL PUMPS

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M18.1 SCOPE

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of Centrifugal Pumps. The Specification shall be read in conjunction with that of the Project Specification.

M18.2 INTERPRETATIONS

M18.2.1 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

M18.2.2 Standards

All design standards for the centrifugal pumps 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 1044-3	:	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
BS EN ISO 14847:1999	: Rotary positive displacement pumps. Technical requirements
BS EN 734:1995	: Pumps and pump units for liquids. Common safety requirements
BS EN 12162:2001	: Liquid pumps. Safety requirements. Procedure for hydrostatic testing
BS EN 60041:1995	: Field acceptance tests to determine the hydraulic performance of hydraulic turbines, storage pumps and pump-turbines.
BS EN 60994:1993	: Guide for field measurement of vibrations and pulsations in hydraulic machines (turbines, storage pumps and pump-turbines)
BS EN 22858:1993	: End-suction centrifugal pumps (rating 16 bar). Designation, nominal duty point and dimensions
BS EN 23661:1993	: End-suction centrifugal pumps. Baseplate and installation dimensions
BS EN 733:1995	: End-suction centrifugal pumps, rating with 10 bar with bearing bracket. Nominal duty point, main dimensions, designation system
SANS 1123	: Pipe Flanges
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
BS 5316 Part 2	: Pump test codes

M18.2.3 General Requirements

This specification must be read in conjunction with the following specifications:-

M08: Particular Specification for Gearboxes

M21: Particular Specification for Pressure Pipework

E01: Particular Specification for Electric Motors

G01: Particular Specification for Colour Codes

G02: Particular Specification for Corrosion Protection

Automation and Control Design Standards Volume 8: Flow Measurement

Automation and Control Design Standards Volume 11: Temperature Measurement

M18.3 PUMPS

M18.3.1 Design Parameters

Centrifugal pumps shall have stable non-overloading characteristics and the shaft speed shall not exceed 1500 rpm.

The pumps shall be of the highest quality and shall be suitable for continuous operation over long periods with a minimum amount of maintenance at high-sustained efficiency.

In all applications, with exception of clear water pumps, non-clogging impellers must be used. Pumps shall be designed as to remove the impeller cover without moving the pump, pipe work or motor. Each pump shall have a drip tray with a 20 mm diameter galvanised drain pipe to the nearest drainage point.

The pump design shall make adequate provision for the balancing of residual axial thrust. Pumps shall be supplied complete with suction and delivery pressure gauges complete with air-bleed and isolating cocks, shaft couplings and guards, gland leakage piping, base plates, foundation bolts and other necessary equipment.

Detailed performance curves for the pump type shall be provided at the time of tendering.

The curves shall indicate the following:

- Head (metres) vs. flow (litres/second) - 0% to 120% duty flow
- Power absorbed in kW - 50% to 120% of duty flow
- Pump efficiency – 0% to 120% duty flow
- Net positive suction head curves required by the pumps at the specified flow rate.

The efficiency curve shall be flat over a wide range in order to provide efficient working at various pump operating conditions.

Pumps shall be able to operate without cavitation over a full range as specified without throttling. Pumps are required to operate continuously at an ambient temperature of 40°C.

The following quantities shall be guaranteed by the Contractor:

- Minimum flow rate of the pump at the specified total head.
- Maximum power demand at the specified total head.
- Minimum efficiency at the specified total head.
- Maximum net positive suction head required by the pump at the specified flow rate.

Multiple Units

Unless specified arrangements incorporating multiple units coupled in series in order to achieve the duty specified for each complete pump set shall only be offered as an alternative.

The mechanical equipment to be supplied under this Contract shall be installed, tested and commissioned on concrete structures, constructed by others, to the dimensions indicated on the construction detail drawings.

M18.3.2

Pump Casing

The pump casings shall be manufactured from cast iron or cast steel depending on the stresses corresponding to the required test pressures. Unless otherwise stated the dimensions and drilling of the suction and discharge flanges shall be SANS 1123 to the design pressures as specified but with a minimum of 10 Bar.

The pressure rating of the flanges shall at least be equal to the maximum static pressure plus the pump shut-off pressure.

Casings shall be designed for not less than the following working pressures or 1.5 times the actual working total discharge pressure, whichever is the greater.

Horizontal Split casing	:	1000 kPa
End Suction type	:	1000 kPa
Vertical Split Casing	:	600 kPa
Multistage	:	1.5 times working pressure.

End suction pumps

End suction pumps are arranged with a central suction connection and a tangential discharge connection. Both these connections shall be suitably flanged.

The casings shall be split at right angles to the shaft to enable the easy withdrawal of the impeller assembly. The volute casing shall be preferably a separate casing from the pump bearing and base assembly, but bolted and spigoted thereto.

For end suction pumps of more than 5.5l/s and not more than 70 l/s capacity, the casing shall be arranged to have a removable casing cover on the motor side so that the pump may be dismantled without disturbing the suction or delivery piping.

Horizontally split casings

These shall be double entry type casings, which are split on the axial centreline. The suction and delivery branches must be cast integral with the part of the pump incorporating the pump base.

The other half of the casing must be easily removable for an internal examination of the pump without the necessity of disturbing either the suction or delivery pipe work or rotating assembly.

The casing shall be fitted with suitable renewable corrosion resisting wearing rings and bushes in all positions where fine clearances require to be maintained. Wearing rings shall be made of high quality bronze or stainless steel.

All casings must be fitted with ceramic or stainless steel neck rings where fine clearances must be maintained between stationary and moving parts, to suit the fluid pumped.

Semi-concentric back pull-out design casings

The pump casing shall be semi-concentric back pull-out design, with the first half of the circumference after the pump outlet being cylindrical. The remaining circumference shall spiral outwards towards the flanged centreline discharge. The casing shall be manufactured from cast iron.

All casings shall be provided with the following tappings as a minimum requirement:-

- One suction pressure gauge tapping
- One discharge pressure gauge tapping
- One bleeder cock tapping
- One filling point tapping
- Suitable tapping or, where possible, internal drilling to provide water for the glands.

All casings shall be heavily ribbed and strengthened as necessary to resist hydraulic forces, and internal passages shall be smoothly finished to minimize hydraulic forces.

M18.3.3

Pump Impeller

Each impeller after machining and dressing shall be independently statically balanced and the

complete rotating assembly with coupling shall be dynamically balanced.

All impellers shall be of a non over loading design.

Impellers shall be securely keyed and fixed to the shaft by means of suitable shaft nuts and locking sleeves.

All bolting devices must be securely locked so that they cannot accidentally come loose. Bolting devices shall be made of corrosion resistant materials.

M18.3.4 Pump Shaft

The pump shafts shall be of sufficient dimension in order to avoid excessive torsional or bending stresses and deflection.

The pump shaft shall be designed so that the critical speed of the rotating assembly is well above the maximum pump operating speed.

The impeller shall be secured to the shaft in such a way that it can be readily removed without any damage to the impeller and the shaft.

The shafts shall be protected by replaceable sleeves manufactured from non-corrosive material. The shaft shall be manufactured from stainless steel.

M18.3.5 Shaft Coupling

The pump and motor shall be connected by a flexible coupling in such a way as to prevent them from uncoupling regardless of which way the impeller may be rotating.

The coupling shall accommodate small axial, lateral and angular misalignments without imposing undue stresses on the shaft and bearings. The coupling shall be enclosed in a stationery solid-plate guard to the Engineers satisfaction.

M18.4 **BEARINGS**

All bearings shall be suitable for shaft rotation in both directions. All bearings shall be designed for a life of at least 100 000 hours at an (L10) rating. Bearings for the output shaft shall be designed to withstand bending, up thrust, down pull, thermal expansion and radial loads imposed by the impeller.

The rotating assembly shall be positively located in the axial direction and thrust bearings will therefore be required.

For ease of lubrication all bearing grease pipes must be piped to grease nipples on the outer cover of the pump support frame.

M18.4.1 Bearing Housing

The bearing housing shall be manufactured from cast iron and shall be oil bath lubricated. Oil level sight glasses shall be provided with level markers for running and filling minimum and maximum positions respectively. These shall be arranged for easy viewing and shall take into account the angle of mounting.

The bearing housing and motor stool design shall provide accurate, self-aligning mounting for the flanged electric motor.

M18.4.2 Lubrication

In the case where oil lubrication is required, adequate provision shall be made for the cooling of

the oil. The bearings shall be required to operate at temperatures no higher than 60°C.

Oil reservoirs of sufficient capacity shall be fitted with easily accessible oil level indicators, which are to be clearly marked in order to indicate the oil standing and running levels.

M18.5 GLANDS AND SEALS

Low pressure glands of the stuffing box pattern shall allow repacking without having to dismantle the pump.

If mechanical seals are offered they shall be manufactured from 316 SS to prevent the pump from leaking and shall be cartridge-type seals with O-rings and silicon carbide or tungsten carbide faces.

The cartridge seal shall be pre-assembled and pre-tested, requiring no adjustments and settings from the installer. Any springs required to push the seal faces together shall be shielded from the fluid that is to be pumped. The cartridge shall include a heat treated sleeve and an iron seal gland.

Full details of the seals and glands indicating the materials, finishes, clearances etc. shall be submitted with the Tender.

A spare mechanical seal for each size and type shall be supplied.

M18.6 VENT COCKS

Vent cocks shall be fitted at all high points to the pump casing. These cocks shall be adequately sized in order to allow the trapped air to be released freely.

An automatic air vent shall be fitted to each pump casing if specified. This device shall be suitable for the remote operation of an indicator to show the open and closed positions of the air vent.

M18.7 BASE PLATE

The base plate of the pump and motor shall be rigid. The pump and motor shall be situated on the upper face of each base plate, which shall be machined flat and smooth to ensure that the pump and motor are bedded properly without the use of spacers.

The pump/motor base plate shall be completely aligned prior to grouting and provision shall be made to grout within the base plate itself to facilitate vibration-free operation.

Base plates which have a mass greater than 200 kg shall have two jacking bolts at right angles with a lock nut at every corner of the unit.

M18.8 DRIVE UNIT

The pump shall be driven by a fixed electric speed motor and a speed reducer. Refer to Particular Specification E01: Electric Motors for a detailed specification for Electric motors.

M18.8.1 Gearbox / Motor Coupling

The coupling shall be fully rated to transmit the motor full load power and tested to prove the above features together with static and dynamic balance. The motor shall be coupled to the gearbox input shaft with either a V-belt or a flexible coupling. V-belts and couplings are to be provided with protective cover guards.

M18.9 GEARBOX

Refer to M08: Volume M08: Mechanical Specification for Gearboxes.

M18.10 MONITORING DEVICES

Full detail of all monitoring devices offered must be submitted with the Tender.

M18.11 PRESSURE GAUGES

Pressure gauges shall be fitted with an isolating cock, shall be vibration and shock resistant and shall be calibrated to read with an accuracy of $\pm 1\%$ of the indicated pressure. Three 20mm minimum diameter ball valves shall be employed to zero the gauge, to isolate it and to vent to atmosphere. A chemical seal shall be used to insulate the gauge from the media being measured.

The faceplate diameters of the pressure gauges shall be at least 100 mm. The gauges shall indicate the water pressure in kilopascal and shall have a range of a maximum of 50% higher than the normal maximum working pressure. All gauge glass must conform to internationally recognized standards. These standards include DIN 7081, BS 3463 and JIS B 8211.

A calibration certificate is to be provided with each pressure gauge.

M18.12 TEMPERATURE DETECTORS

If required oil lubricated bearings and glands offered shall be fitted with temperature detectors. The temperature detectors shall be PT100 – RTD's

If grease lubricated bearings are offered, the Tenderer will indicate in his Tender if temperature detectors can in fact be used. If temperature detectors are not feasible, an alternative means of monitoring bearings must be offered.

M18.13 NO-FLOW PROTECTION

- (a) Each pump shall be protected against no flow by a flow meter installed in the discharge line from the pump.

M18.14 INDICATOR ON AUTOMATIC AIR VENT

If an automatic air vent is required for the pump casing, it shall be fitted with an indicator to indicate the open and closed positions of the air vent. The air vent shall be suitable for remote operation and air vent control shall be mounted on the control panel inside the pump station.

M18.15 GLAND LEAKAGE

If a gland leakage device is required in order to monitor the gland leakage it shall be supplied and fitted with adjustable alarm contacts designed to close when gland leakage rises to a pre-set value.

M18.16 PIPEWORK

All suction and delivery pipes shall be connected to the pump casing by means of flexible connections. All flexible connections shall be installed as close to the pump's casings as possible, and in any event, shall be between the suction valve and the pump casing and delivery non-return valve and the pump casing. In all cases the flexible connection shall be in the section of piping of smallest diameter.

Double victualic joint are generally preferred for flexible connections, but approved re-enforced rubber bellow units are acceptable for low-pressure services.

All valves and pipework external to the pump casing and separated there from by means of flexible connections shall be securely anchored to prevent movement.

Refer to Particular Specification M21: Volume M21 Pressure Pipework for a detailed specification on pipework.

M18.17 HOLDING DOWN BOLTS

The contractor shall be responsible for the supply of all necessary holding down bolts for the machines supplied by him/her. The holding down bolts shall be manufactured from 316 SS.

All bolts necessary for assembling all equipment shall be supplied by the contractor.

M18.18 VIBRATION AND NOISE

The pumps as well as the motors will comply with the requirements of BS 4999. The Contractor may be requested by the Engineer to carry out vibration tests. The noise level shall not exceed 85 dBA at 1m.

M18.19 CORROSION PROTECTION

Refer to Particular Specification G02: Corrosion Protection

M18.20 DESIGNATION AND INFORMATION PLATES

Each pump shall be supplied with an information plate secured to the pump casing in a visible position indelibly marked with the following details:-

- Maker's name, pump type and serial number
- Year of manufacture
- Rated duty of pump in litres per second
- Head in metres at rated duty
- Pump speed in r/min
- Mass of completely assembled pump in kilogram

M18.21 INTERCHANGEABILITY

Where two or more similar pump units are required, these units will be identical in all respects.

All similar parts of items supplied will be interchangeable without any additional machining or fitting.

M18.22 RECOMMENDED SPARE PARTS

The Tenderer must submit details of spare parts recommended to be kept in store by the Employer with his Tender.

The detail will include a full description of the parts, part identification, number required, guaranteed delivery time and total price delivered to Site.

M18.23 OPERATION AND MAINTENANCE MANUAL

The Contractor shall hand over to the Engineer four sets of the Operation and Maintenance

Manual compiled for each installation not later than at the time of commissioning of the installation. These manuals are a prerequisite for final take over of the plant.

The Operation and Maintenance Manual will contain the following:

- (a) Brief description of the plant and installation.
- (b) Concise operating instructions.
- (c) Routine maintenance instruction.
- (d) Precautionary measures, elementary trouble location, rectifying measures and emergency actions.
- (e) Detailed information on equipment.
- (f) Lists of spare parts including names and addresses of suppliers.

M18.24 DRAWINGS

The drawings included in the Tender Documents are the Engineer's proposal for the plant layout. Should the Tenderer offer alternative layouts, he shall submit drawings with his Tender in order for it to be evaluated.

Before the Contractor carries out any work, he will submit detailed working drawings to be approved by the Engineer. Approval of these drawings does not relieve the Contractor from his responsibility for the correctness of the drawings.

M18.25 INSTALLATION

The pump and motor shall be aligned to within ± 0.025 mm full indicator movement on dial gauge, regardless of the coupling type. After the pump and motor feet are tightened down, ad pipework erected and tightened, both angular and parallel alignment shall be checked and recorded at each quarter revolution. These readings shall be submitted to the Engineer and is a prerequisite for handover.

Upon completion, dowel pins shall be fitted to facilitate relocation at any future time.

M18.26 INSPECTION, TESTING AND COMMISSIONING

M18.26.1 Testing by Manufacturer

The Manufacturer will carry out all tests on materials, quality control tests, dimensional checking and routine tests on parts to ensure that the pumps and materials conform to the requirements of the relevant SANS or BS specifications and to this Specification. The Engineer will not necessarily attend these tests but records must be kept and all test results will be made available to the Engineer.

M18.26.2 Witnessed Testing

In addition to the above, a number of performance tests will also be carried out in the testing facility of the supplier before equipment is transported to Site. These tests can be carried out in the workshop of the manufacturer/supplier if it is suitably equipped or another approved test facility.

The Engineer may witness these tests and the Contractor will notify the Engineer two weeks in advance of the date and place at which the equipment may be inspected and tested. When tests and inspections have met the satisfaction of the Engineer a certificate of workshop

acceptance will be issued. These certificates are a prerequisite before payment for "Materials on Site" can be passed. The Engineer's acceptance will in no way relieve the Manufacturer of any of his obligations to design, manufacture and supply pumps strictly in accordance with the Specification.

Performance tests shall include:-

- (a) Hydraulic tests on the pump casing. The test pressure will be equal to 1½ times the maximum working pressure at the delivery end of the pump. The testing will be done with blank flanges bolted onto the flanges. The pressure will be maintained for at least 15 minutes. No sign of sweating, leaking, undue deformation and stressing or defect of any kind will be evident during the test period.
- (b) Tests to prove that the rotating parts are dynamically balanced.
- (c) Performance tests on pump and driving unit.
- (d) NPSH requirements if called for in the Project Specifications.

A performance test shall be carried out in accordance with BS 5316 Part 2 - Class B tests if specified. Unless otherwise stated, the Contractor will be required to conduct the performance test on the combined pump/motor unit.

If a performance test of the pump and its driving unit is not possible at the manufacturer's works, this shall be stated in the Tender with reasons to allow the Engineer opportunity to make alternative proposals.

M18.26.3 Testing by an Independent Facility

The Employer may require that an independent testing facility or institution such as the South African Bureau of Standards carry out performance tests. A separate item for performance testing will be provided in the Schedule of Quantities to allow for this.

M18.26.4 Failure to Pass Performance Test

Should the pump unit fail the performance test, whether performed at the manufacturer's works or at an independent institution, the Engineer shall authorise any amendments to the plant which may be considered necessary to meet the guaranteed quantities within the permissible tolerances laid down in BS 5316 Part 2 - Class B tests and prove with further test that the equipment conform to the Specification.

All costs involved in the re-testing of pump units will be borne by the Contractor.

Should the pump unit fail to pass the test with more than 5% variation on the actual guaranteed figures, the engineer will reject the pump unit and request the Contractor to replace the unit so rejected.

Should the pump unit still fail to pass the test, but the actual figures do not vary by more than 5% from the actual guaranteed figures, the Engineer may :-

- (a) Request the Contractor to carry out amendments to ensure the compliance of the unit with the Specification; or
- (b) Accept the equipment but impose a penalty for non-compliance on the Contractor. A sum will be calculated based on the additional energy used over the life expectancy of the equipment and this will be deducted from the Contract price for each pump set for every kilowatt by which the gross demand exceeds the guaranteed figure with permissible tolerances.

M18.26.5 **Commissioning**

On completion of the installation the Contractor will check all items for satisfactory functioning. He will then inform the Engineer of his intention to commission the plant. The Engineer may request control measurements on pump alignment at this stage.

A detailed programme of his proposed commissioning procedures will be submitted not later than two weeks prior to the commissioning date.

After a successful running period of 4 hours (to be witnessed by the Engineer) the Contractor will hand over the installation to the Employer as well as the Operation and Maintenance Manuals. The Completion Certificate will only be issued after the units have been in successful operation for 14 consecutive days and the acceptance tests successfully completed.

During the first 14 days of operation, the Contractor will rectify any problems with the units on Site within 24 hours of being telephonically notified. During the remainder of the maintenance period, the Contractor will, within 14 days of being notified, commence rectifying any possible problems that the Employer may encounter with the equipment supplied under this Contract.

Should the Contractor fail to meet the above requirements, the Employer may appoint others to undertake the necessary repair work at the Contractor's cost.

M18.26.6 **Tests at the Site of the Works**

The Engineer may require that site tests are performed to verify performance figures guaranteed by the Contractor. Flow rate, total head and power input to the pump/motor units shall be determined, as accurate as Site conditions permit, for one or more points on the pump curves close to the specified duty point. The Contractor shall provide suitable instruments with recent calibration certificates.

Should these measured and calculated quantities differ from those guaranteed by more than the tolerances allowed by BS 5316 Part 1 - re-testing of the unit at any testing facility, or the recalibration of the measuring instruments.

Should the subsequent test results still fall outside the allowable tolerances, Clause M18.28.4 shall apply, and all costs shall be borne by the Contractor. In the event of the subsequent test being successful, costs shall be borne by the Employer.

M18.27 **COLOUR CODES**

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01.

M18.28 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 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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PARTICULAR SPECIFICATION

M20: MECHANICAL VALVES: MANUFACTURE AND SUPPLY

Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water
3	2012-07-30	General review	T Wellard	
2	2010-02-16	General review	J Ritchie	
1	2009-05-12	Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance		

PARTICULAR SPECIFICATION M20: MECHANICAL VALVES: MANUFACTURE AND SUPPLY

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M20.1 SCOPE

This Specification covers the manufacture, testing and supply of sluice, butterfly, air, gate, reflux, diaphragm, flow limiter and pressure reducing valves for use in pressure pipelines for the conveyance of raw or potable water at ambient temperatures.

M20.2 INTERPRETATIONS

M20.2.1 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

M20.2.2 Standards

For the purposes of this Specification the latest issues of the following standard specifications will apply:-

SANS 1700	:	Fasteners
SANS 135	:	Isometric Bold Screws and Nuts (Lexagon & square/coarse thread free fit series)
SANS 136	:	Isometric Precision Hexagon Head Bolts and Screws and Hexagon Nuts (coarse thread medium fit series)
SANS 144	:	Cast Iron Single-door Reflux Valves
SANS 191	:	Cast Steel Gate Valves
SANS 192	:	Cast Steel Single-door Reflux Valves
SANS 664	:	Cast Iron Gate Valves for Waterworks and heavy Industrial Purposes
SANS 936	:	Cast Iron Spheroidal Graphite Iron Castings
SANS 1431	:	Steel
BS 3100	:	Cast Steel
BS 4504	:	Flange Drilling
BS 5155	:	Cast Iron and Carbon Steel Butterfly Valves
SIS 05 59 00	:	Pictorial Surface Preparation Standards for Painting Steel Surfaces
ISO 2441	:	Pipe Line Flanges for General use - Shapes and Dimensions of Pressure Tight Surfaces
SANS 1123	:	Steel Pipe Flanges

M20.2.3 General Requirements

This specification must be read in conjunction with the following specifications:-

G01: Particular Specification for Colour Codes

G02: Particular Specification for Corrosion Protection

M20.3 GENERAL REQUIREMENTS

Satisfactory temporary end cover shall be provided to protect threads, flanges and prepared ends of valves from damage during transportation and handling on site.

Valves shall be so transported, stored and handled as to prevent damage. Valves damaged in any way shall be removed from the site.

The Contractor shall satisfy the Engineer as to the sufficiency of the place of manufacture regarding manufacturing, testing and inspection equipment to ensure that the production of valves is strictly in accordance with this Specification.

M20.3.1 Pressure Rating

The design pressure for the valve is specified in the Tender Document either in/or the Project Specification, Drawings and Schedule of Quantities. The minimum pressure rating for valves shall be 10 Bar. Valves shall be capable of withstanding the applicable test pressure as specified in SABS 664. Test pressure shall be maintained for 5 minutes and the valve bodies shall be watertight in all aspects.

M20.3.2 Wastewater Liquids and chemicals

Various different chemicals are used to treat wastewater. These include:-

- Ferric chloride
- Chlorine
- Polymer (Polyelectrolytes)
- Ammonium bromide

Valves used for the above mentioned chemicals shall be manufactured from highly non-reactive polymer such as Polyvinylidene Fluoride (PVDF) and PVC.

Valves which encounter raw wastewater, treated wastewater and sludge shall be manufactured from corrosive resistant material.

M20.3.3 Guarantee

All valves shall be guaranteed against faulty design, materials and workmanship until the end of the maintenance period on the Main Contract. During this period the Contractor shall be required to attend to and rectify any defects, which occur due to faulty design, materials or workmanship at his own cost.

M20.3.4 Operating and Maintenance Manuals

A copy of the Operating and Maintenance Manual for each valve type and different valve manufactures shall be bound in with the Operating and Maintenance Manual for the project. The manual shall be A4 size and properly bound. Drawings larger than A3 size shall be contained in separate plastic pockets.

M20.3.4.1 Contents

- A copy of the signed factory test certificate shall be bound in with the manual, while the original shall be handed to the Engineer.
- Operating instructions
- Maintenance instructions
- Lubrication instructions
- Spare parts list
- Drawings
- Brochures

M20.3.5 Jointing Material

Jointing material shall comply with SANS 1700. Valves shall be supplied complete with bolts, nuts, washers (2 per bolt) and gaskets for joining up to adjacent mating flanges.

Bolts shall be of stainless steel in all open applications (e.g. in valve chambers, reservoirs, etc.) and galvanised when buried provided the flanges are protected with DENSO mastic and tape. The bolt shall be long enough to allow at least two screw threads to protrude from the nut when the assembly is fully tightened. A washer must be provided both under the bolt head and the nut.

M20.3.6 Contact between Dissimilar Metals

When flanges of dissimilar metals are bolted together, the internal epoxy coating shall cover the contact area of the flange without any break.

Suitable insulation material shall be used between the contact faces of dissimilar metals of which the potential difference exceeds 0,3 V. Where corrodible metal is welded to a corrosion resistant metal, the protection coating specified shall overlap onto the latter by at least 5 mm.

M20.4 FABRICATION

M20.4.1 General

(a) Marking of Valves

The design pressure in MPa shall be hard stamped on the edge of flanges to valves, to be visible from the top of valves.

(b) By-passes

Where indicated in the Project Specification or the Schedule of Quantities, valves shall be supplied with by-passes. Such by-passes shall be bolted on to the body of the valve and not to the adjoining pipework.

(c) Hand wheels and Direction of Closure

Where valves are required to be supplied with hand wheels, the rims of such hand wheels shall be machined to a smooth finish if specified. Arrows shall be cast on the hand wheels together with the wording "TO OPEN" or "TO CLOSE" - Closing being by the clockwise rotation of the spindle unless otherwise specified.

(d) For cap top valves an aluminium disc of at least 100 mm diameter with the same wording and arrows shall be slipped over the spindle and retained by the cap.

If specified in the Project Specification, valves shall be fitted with indicators representing

the valve status, showing fully open, fully closed and intermediate positions. Such indicators shall be corrosive proof and of robust design.

(e) Flanges

Unless otherwise indicated flanges shall conform, in all respects, to the requirements of SANS 1123 appropriate for the class of valve specified.

Should required sizes fall beyond the range of SANS 1123, flange dimensions shall confirm to the requirements as specified.

The Contractor shall obtain written confirmation of required flange drilling from the Engineer prior to the commencement of manufacture.

Sufficient clearance shall be allowed between the body of the valve and the flange to enable proper tightening of bolts. Tapped holes shall only be allowed in exceptional cases and with the Engineer's written consent.

(f) Information to be Supplied

Complete details of each valve offered must be provided at the time of tendering. This information will include at least the following:-

- Description
- Manufacturer's figure number
- Flange drilling
- Maximum working pressure (in kPa)
- Maximum unbalanced pressure (in kPa)
- Test pressure (in kPa)
- Material of components
- Gearing
- Accessories

M20.5 BUTTERFLY VALVES

Butterfly Valves shall be of the full-bore type and NOT reduced bore type with flanged ends. Valves larger than 200mm shall be fitted with gearboxes.

M20.5.1 Opening and Closing

All valves shall be capable of being opened or closed by hand under an unbalanced pressure equal to the design pressure without any difficulty. The disc shall close with a positive action with no possibility of slamming shut during any stage of the closing operation and the valve shall be capable of operating at any opening without variation of disc position or flutter of the disc.

The direction of the spindle rotation for valve closing shall be clockwise.

M20.5.2 Valve Body

Valve bodies shall be manufactured from cast iron or cast steel depending on test pressures and as specified.

The valve body shall have integral hubs for shaft bearing housings. Valves shall be provided with supporting feet and lifting rings where specified. A flow direction arrow shall either be cast into the body or shall be a brass plate screwed onto the body with brass screws.

M20.5.3 Discs

Discs shall be manufactured from cast iron or cast steel depending on test pressures and as specified. Discs shall be a single casting having a smooth streamlined design to minimize resistance to water flow.

The disc shall be off-set in the body to ensure simultaneous contact around its perimeter and shall have a positive non-slamming closing action.

M20.5.4 Seats and Seals

The profiles of the seats shall be smooth and continuous and shall provide adequate "lead in" for the resilient seal during closure of the disc to prevent excessive seating torque requirements. The seats shall be fixed to the valve body with stainless steel countersunk screws to facilitate replacement.

The seals shall be of the resilient type with non-weathering, non-sticking, long life properties. Seals shall be replaceable and shall be secured to the edge of the disc by means of a retaining ring. Sealing rings and seal retaining rings shall be manufactured from stainless steel.

The design of the seat and seal shall allow replacement thereof without removing the valve from the line.

M20.5.5 Shafts

Valve shafts shall be of high grade stainless steel. Valve shafts shall either be continuous through the disc or of a stub shaft design as described in the Project Specification and will be horizontal to the installed valve position. In the case of the sub-shaft type, each stub shaft shall extend into the disc hub for a distance of at least 1.5 times the shaft diameter.

All keys, dowel pins and taper pins used to attach the shaft to the disc shall be mechanically secured. The shaft shall be so sealed that the only two wetted parts shall be the disc and the seat.

M20.5.6 Bearings

Class 16 (1600 kPa) valves or valves with diameters of 350 mm or bigger shall be fitted with two-way adjustable bearings in order to permit precise disc-to-seat positioning at all times.

Positive bearing retention shall also be provided so that the bearing will not shift under operating conditions. The valve shall be capable of being installed and operated in any position.

The bearings shall be self-lubricating, long lasting sleeve-type bearings shall be fitted in the hubs of the valve body and at least one set of thrust bearings shall be provided.

M20.5.7 Gearboxes

Where it is necessary or where it is specified valves shall be operated via manually operated gearboxes

Gearboxes shall be self-locking and capable of holding the disc in a fixed position for any extended period of time.

Gearboxes shall be geared to be operated against the maximum unbalanced pressure with an effort not exceeding 200 N with each hand on the rim of a standard hand wheel. (Total effort = 400 N).

Gearboxes shall also be fitted with mechanical stops to prevent excessive turning and shall be

provided with replaceable shear pins. One spare shear pin shall be provided with each valve.

All gearboxes shall be equipped with position indicators, adjustable travel stops and indications of the "open" and "closed" positions.

The design of the gearbox shall readily allow for conversion to motorised drive at a later stage if required.

M20.6 AIR RELEASE VALVES

M20.6.1 Water works anti-shock and air release

Air valves shall be manufactured from cast iron or stainless steel depending on the test pressures and the project specification and of the single chamber design with cylindrical solid polymer control floats incorporating anti-shock design during high velocity air discharge.

The orifice plate, internals and body bolts shall be of stainless steel. All components of the valve shall be easily replaceable. All internals made of stainless steel that will be in contact with the fluid shall be lined or coated with a polyurethane paint to prevent cathodic action.

The design of the valve shall be such as to preclude the loss of water or the possibility of the float being blown shut by the passage of air when the accumulation of air in the pipeline is being released.

The valves shall be positive in the action to admit a free and full supply of air when the pipeline is being emptied or when the operating conditions demand.

Valves shall respond to the presence of accumulated air under normal working conditions by discharging it through a small orifice at any pressures within the specified design range.

Valves shall react immediately to pipeline drainage by full opening of the large orifice to allow unrestricted air intake. Valves shall not exhibit leaks or weeping past the large orifice seal at the maximum working pressure.

M20.6.2 Air Valves (Sewage)

Where air valves are required on sewage or industrial effluent pumping mains, they shall be specifically designed for such usage. Ordinary waterworks pattern air valves will not be acceptable.

Air valves shall be installed with an isolating valve on the inlet.

Full details of the air valves offered shall be provided at the time of tendering.

M20.6.3 Air Valves (Water Mains)

The following types of air valves as indicated on the Drawings and/or listed in the Schedule of Quantities are required.-

Type SO : Small orifice, single ball, lever type air valve which permits the escape of air from the pipe under working pressure.

Type LO : Large orifice, single ball air valve which allow air to enter the pipe when the pipe is being emptied and permit air to escape from the pipe when it is being filled.

Type DO : A combined small and large orifice air valve, the small orifice operating as the type SO and the large orifice as type LO above.

The size of the air valve shall be specified on the Drawings or in the Schedule of Quantities by the inlet diameter.

Air valves shall be suitable for the working pressure indicated on the Drawings or stated in the Schedule of Quantities.

All air valves shall be flanged and fitted with an isolating valve on the inlet pipe and a drain cock unless otherwise stated.

The air valves should be so designed that the balls are prevented from sticking.

Cover plates shall allow free discharge or intake of air, but shall prevent the ingress of foreign matter.

Valves shall be drop tight on shut-off and the design of the valve shall prevent balls from sticking.

When discharging large volumes of air at high rates the ball must not be caught up in the escaping air stream and close before all air has been released.

Tenderers shall submit full particulars of the air valves tendered on with the tender.

M20.6.4 Special Valves

All valves other than sluice and air valves shall be classified as special valves. The general requirements, pressure ratings, protective layers, flanges, markings, tests, etc. as specified in this Section will be applicable to the special valves. The particular valve will be further specified in the Project Specification.

M20.7 **GATE VALVES**

All gate valves shall comply with the requirements of SABS 664 and shall carry the SABS mark. Gate valves shall completely clear the bore of the valve in the fully open position. The direction of closing shall be clearly marked on the bonnet of the valve. Valves shall be drip-tight from zero to maximum working pressure under test conditions.

M20.7.1 Wedge Gate Valves

Valve seat and gate rings shall be manufactured from bronze to BS 1400 LG2.

Valves except flange faces shall be coated externally and internally with self-etching primer followed by one or more coats of fusion bonded epoxy material to give a total film thickness of at least 250 microns all applied in accordance with the manufacturer's specifications.

Valves where specified shall be supplied with fully enclosed, grease-packed, single-train spur gearboxes with a 3:1 or 4:1 ratio as specified.

Where required bronze gate guides and shoes shall be fitted as additional.

Integral mounted by-pass assemblies shall be fitted as additional where required.

M20.7.1.1 **Auxiliary Fittings**

Wedge gate valves of 300 mm diameter and larger shall be fitted with the following auxiliary fittings:-

- Drain Plugs

300 mm diameter valves and larger shall be supplied with gunmetal drain-plugs screwed into the lowest point of the valve and the valve body shall be suitably drilled and tapped to accept the drain-plug. The plug must be in position when the test pressure is applied.

- Ball Bearing thrust Collars

300 mm diameter valves and larger shall be fitted with ball-races on the top and bottom of the thrust collars. The ball-races shall be totally enclosed in a grease-packed cover, which shall be sealed to prevent the egress of grease. Provision must be made for lubricating the ball-races and the lubrication arrangement shall allow for re-greasing while the valve is under pressure.

M20.7.2 Knife Gate Valves

The valve body shall be cast iron with soft rubber lining. Spindle and blade are to be manufactured from stainless steel. Valve seals are to be re-packable and reversible made from Nitrile rubber with PTFE scrapers, to withstand solid particles and grit associated with wastewater and sludge.

Hand wheels shall be rising spindle types. Knife gate valves shall be installed vertically at all times.

M20.7.3 Resilient Seal Valves

Resilient Seal valves ensure tight compression sealing without wear and shall be used as isolating valves. Valve bodies shall have unobstructed, pocket-free, bores i.e. no seating protrusions or gate well, with inclined seats and gate guides to eliminate deposits in the valve body.

The spindle seal shall have at least two Nitrile Butadine rubber to DIN 3770 o-rings located in a corrosion-resistant housing and a wiper ring to prevent ingress of dirt. A back seal shall permit replacement of spindle seats under pressure, with the gate in the fully open position.

The cast iron gate shall be fully covered with a Nitrile Butadine rubber sheath fully bonded to the gate by vulcanising.

Valves shall be smooth bore and shall operate without the use of any wedging action, which may scuff or damage the rubberised gate.

Valves shall be coated with a fusion bonded epoxy coating of minimum thickness 200 microns.

M20.8 **NEEDLE VALVES**

Type NLV1 needle valves of sizes 50 NB and under shall be used for flow control of dilution water. Needle valves shall be manufactured from stainless steel and shall adhere to ASTM A 351.

The valve shall be hand operated and the ends of the body shall be screwed to BSP.

M20.9 **SPECIAL VALVES**

All valves used for special operations and conditions shall be carefully selected.

Tenderers are required to submit full details of the valves offered and the final selection shall be subjected to the approval of the Engineer. The valves offered shall not be accepted as substitutes for the standard valves specified.

M20.10 REFLUX/NON RETURN VALVES

Valves used for sewage effluent or sludge shall be self cleansing at the base of the gate. The interior shall be smooth and free from any projections.

Valve bodies shall be of cast iron or cast steel depending on the test pressures and the project specification.

Valve doors shall be of cast steel or cast iron. Body rings, door rings and spindles shall be manufactured from stainless steel.

The following types of reflux valves as specified shall be supplied:-

- (a) Single sloping swing door for sizes up to 400 mm.
- (b) Double sloping swing door for sizes larger than 400 mm and up to 800 mm.
- (c) Multiple sloping swing doors for sizes larger than 800 mm.

Valve bodies and seals shall be free of pockets that will allow dirt accumulation.

Valve doors shall be designed to prevent fluttering and shall allow rapid but non-slamming closure on reversal of flow. The gate shall swing free in the body and in fully open position shall not obstruct the flow.

Valves shall seal effectively under all operating conditions and the design shall be such that the gate rests against the seat in the absence of flow or of differential pressure without the aid of springs or external counterweights.

Where specified in the Project Specification, valve doors shall be balanced by attaching counterweights and levers, or hydraulic dampers to the extended valve spindle.

Where valves are fitted to buried pipe lines, only hydraulic dampers shall be used.

M20.11 DIAPHRAGM VALVES

The valve is to be able to handle sludge's, rags and grit as expected in waste treatment works. The valve body must be designed to minimise turbulence and give 100% leak tight closure.

The valve must have a smooth bore and minimise wear from abrasion and allow for rodding when sludge's set in the pipeline.

The valve operating mechanism must be sealed from service and atmosphere.

The diaphragm must be manufactured from tough, resilient type natural rubber of sufficient grade to handle abrasives, acids and alkalis as expected in sewage works.

The valve body is to be cast iron with sufficient corrosion and erosion protection to last the useful life of the valve.

M20.12 BALL VALVES

M20.12.1 Type BLV1

This type is used for general purposes for sizes of 50 NB and under. The ball and stem shall be manufactured from 316 SS and the body shall be 304 SS.

The seat and the gland shall be PTFE material. The valve body shall be of the reduced bore type with ends screwed to BSP. The valve shall be lever operated.

M20.12.2 Type BLV2

BLV2 type ball valves are used for sludge lines. The valve shall be short pattern reduced bore type, fully lined with a Polypropylene or fluorocarbon resin liner.

All interior surfaces including the ball, stem and collar shall be lined to ensure that there is no contact between the metallic components and the lined media. The liners shall be securely retained by means of dovetail grooves within the bore and shall extend over the flange faces.

M20.12.3 Valve Body

The body of the valves shall be manufactured from ductile iron and all external bolts, nuts and gland followers shall be grade 316 material.

M20.13 PRESSURE REDUCING VALVE ANGLE/GLOBE PATTERN TYPE

The pressure reducing valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure.

M20.13.1 Main Valve

The valve shall be hydraulically operated, pilot-actuated, single or double chamber globe or angle pattern. The valve shall consist of three major components: the body, with seat installed; the cover, with bearings installed; and the diaphragm assembly.

The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure.

Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.

M20.13.2 Main Valve Body

The valve body and cover shall be of cast material. Ductile iron is standard and other materials shall be available. No fabrication or welding shall be used in the manufacturing process.

The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat inset. No O-ring type discs shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edges and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across its surface.

M20.13.2.1 Diaphragm

The diaphragm assembly containing a non-magnetic 304 stainless steel stem with sufficient diameter to withstand high hydraulic pressures shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. No centre guides shall be permitted. The stem shall be drilled and tapped in the cover and to receive and affix accessories as may be deemed necessary.

The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure.

The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The centre hole for the main valve stem must be sealed by the vulcanised

process or a rubber grommet sealing the centre stem hole from the operating pressure.

The diaphragm must withstand a Mullins Burst Test of a minimum of 4000 kPa per layer of nylon fabric and shall be cycle tested 100 000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully opened or fully closed position.

M20.13.2.2 Valve Cover

The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat in 15 mm and smaller size valves shall be threaded into the cover and body. The valve seat in 200 mm and larger size valves shall be retained by flat head machine screws for ease of maintenance. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits.

To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No pinned covers to the valve body shall be permitted. Cover bearing, disc retainer, and seat shall be made of the same material. All necessary repairs and/or modifications other than the replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted.

M20.13.2.3 Valve Manufacturer

The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three year from date of shipment, provided the valve is installed and used in accordance with all applicable instructions. Electrical components shall have a one year warranty.

The valve manufacturer shall be able to supply a complete line of equipment from 32 mm through to 600 mm sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a cavitation chart which shall show flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity and if there will be cavitation damage.

M20.13.3 Material Specification

Valve Size	: 50-300 mm
Main valve body and cover	: Cast Iron
Main valve trim	: Stainless steel
End detail	: SABS 1123 table 1600/3 or 2500/3 as specified
Pressure rating	: 0-50°
Coating	: Fusion bonded epoxy

Desired options:-

- X43 "y" strainer or equivalent on pilot piping
- Three ball valves on pilot piping, inlet, outlet and line to cover chamber
- 63 mm diameter pressure gauge, glycerine filled, fitted with 10 mm stainless steel ball valve on Tee-piece on inlet and outlet pilot piping.

M20.13.4 Pilot Control System

The pressure reducing pilot control shall be direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm, and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting.

The pilot control system shall include a fixed orifice. No variable orifices shall be permitted. The pilot system shall include opening speed control on all valves 100 mm and smaller.

Three-way pilot controls will not be acceptable if the connection of TECHNOLOG "Autowat" or "Ecawat" controllers is specified.

The pilot control shall have a second downstream sensing port which can be utilised to install a pressure gauge.

A full range of spring settings shall be available in the range of 0 to 3000 kPa.

A direct factory representative shall be made available for the start-up service, inspection and necessary adjustments.

M20.13.5 Material Specification for Pilot Control

Pressure rating	: 1600 kPa or 2500 kPa as specified
Trim	: Stainless Steel
Tubing and Fittings	: Brass compression fittings with copper tubing
Adjustment range	: 200 to 2000 kPa or 100 to 500 kPa
Operating fluids	: Water

M20.14 **PRESSURE REDUCING VALVE (SINGLE DIAPHRAGM LINER-OPERATED TYPE)**

M20.14.1 Function

The pressure reducing valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure.

M20.14.2 Main Valve

The valve shall be hydraulically operated, pilot activated automatic control valve for pressure reducing service. The valve shall consist of two parts: stainless steel body and an elastomeric liner. The valve shall be positioned in line and be controlled via an external pilot control valve.

M20.14.3 Material Specification

Valve Size	:50-300mm
Main valve Body	: 316 Stainless steel, investment cast
End Detail (50 to 100 mm)	: Wafer pattern
End Detail (150 to 300mm)	: SABS 1123 Table 1600/3 or 2500/3 as specified
Pressure rating	: 1600 kPa or 2500 kPa as specified
Temperature range	: 0 to 70°
Liner Material	: Natural Rubber

Liner retainer : 316 Stainless Steel
Coating : Fusion bonded epoxy

Desired options:-

- X43 “y” strainer or equivalent on pilot piping
- Three ball valves on pilot piping, inlet, outlet and line to cover chamber
- 63 mm diameter pressure gauge, glycerine filled, fitted with 10 mm stainless steel ball valve on Tee-piece on inlet and outlet pilot piping.

M20.14.4 Pilot Control System

The pressure reducing pilot control shall be direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall include a fixed orifice. No variable orifices shall be permitted. The pilot system shall include opening speed control on all valves 100 mm and smaller.

Three-way pilot controls will not be acceptable if the connection of TECHNOLOG “Autowat” or “Ecowat” controllers is specified.

The pilot control shall have a second downstream sensing port which can be utilised to install a pressure gauge.

A full range of spring settings shall be available in the range of 0 to 3000 kPa.

A direct factory representative shall be made available for the start-up service, inspection and necessary adjustments.

M20.14.5 Material Specification for Pilot Control

Pressure rating : 1600 kPa or 2500 kPa as specified
Trim : Stainless Steel
Tubing and Fittings : Brass compression fittings with copper tubing
Adjustment range : 200 to 2000 kPa or 100 to 500 kPa
Operating fluids : Water
Desired Options : -

M20.15 FLOW LIMITER VALVES

M20.15.1 Screwed type limiter valves

The limiter valve shall consist of a screwed fitting with a rubber control ring orifice insert, which affects a consistent flow control within $\pm 10\%$ of the rated flow for a differential pressure across the valves over a range extending from 100 kPa to 1100 kPa.

The body of the limiter valve shall be made of uPVC plastic and shall female screwed at both ends to B.S.P.

The control rings shall be made of flexible nitrile elastomer rubber and must be able to move on a tapered seat in the body as the flow increases and be replaceable. The valve must be complete with control rings for the specified initial flow, which may be replaced in the future

(post-contract) for the final flow settings. The flow settings for the flow limiter valves are indicated in the Project Specification.

The screwed type limiter valve must be stamped with the flow in litres per minute and with an arrow to indicate the direction of flow.

A flow test must be conducted at the suppliers factory or test facilities, on one sample each of 20 mm, 25 mm and 32 mm flow limiter valve as prepared for use in the contract, over the following differential pressures:

Differential Pressure (kPa)	Tolerance limit on rated flow
50	± 50%
100	± 10%
150	± 10%
200	± 10%
300	± 101%
1000	± 10%

The measurement of flow rates must be to the satisfaction of the Engineer. If any one of the samples should fail to provide a flow rate within the tolerances specified, then all valves for installation on the contract must be tested for a selection of pressures on the contract must be tested for a selection of pressures up to the static pressures to be expected at installation sites, all to the satisfaction of the Engineer.

M20.15.2

Wafer type limiter valves

The limiter valves shall consist of a wafer pattern with a rubber control ring orifice insert, which effects a consistent flow control within ± 10% of the rated flow for a differential pressure across the valve over a range extending from the 100 kPa to 110 kPa.

The body of the limiter valve shall be made of uPVC plastic.

The control rings shall be made flexible nitrile elastomer rubber and shall be able to move on a tapered seat in body as the flow increases and be replaceable. The valve shall be complete with control rings for the specified initial flow, which may be replaced in the future (post-contract) for the final flow settings. The flow settings for the flow limiter valves are given in the Project Specification.

The limiter valve must be stamped with the flow in litres per minute and with an arrow to indicate the direction of flow.

A flow test must be conducted at the suppliers factory or test facilities, on one sample each of 50 mm and 80 mm flow limiter valve as prepared for use in the contract, over the following differential pressures:-

Differential Pressure (kPa)	Tolerance limit on rated flow
50	± 50%
100	± 10%
150	± 10%
200	± 10%
300	± 101%
1000	± 10%

The measurement of flow rates must be to the satisfaction of the Engineer. If any one of the samples should fail to provide a flow rate within the tolerances specified, then all valves for installation on the contract must be tested for a selection of pressures on the contract must be tested for a selection of pressures up to the static pressures to be expected at installation sites, all to the satisfaction of the Engineer.

M20.16 VALVE GEARBOXES

Gearboxes shall not be an integral part of the main body but shall be separate unit mounted to the body for easy removal. All gears shall be machine cut and fully enclosed and the lubrication shall be of the permanent type.

Positive stops shall be provided to prevent over opening or over closing of the units and visual indication of the point of travel at all positions in the open/close cycle shall be provided.

Torque limiting devices shall be fitted to prevent damage to gears and casings due to over tightening. Design of valves and gearboxes shall be such that leakage from the valve along the shaft cannot enter the gearbox.

M20.17 PROTECTION OF VALVES

M20.17.1.1 Internal Protection

Internal surfaces of valve bodies and discs shall be grit blasted to a Sa ½ of SIS 05 59 00 finish. Successive coats of an approved non-toxic epoxy resin paint suitable for spray application (Copon EP2300 or similar) shall then be applied to give a final dry film thickness of 300 µm. Drying times between successive layers will depend on environmental conditions and will be strictly in accordance with the requirements of the paint manufacturer.

As an alternative to the protection as specified above, the Contractor may be required to use either a solvent-less epoxy paint system or a fusion bonded epoxy powder coating. For fusion-bonded epoxy, a final dry film thickness of 250 µm is required.

Details of the protection required shall be given in the Project Specification.

M20.17.1.2 External Protection

External surfaces of valve bodies and discs shall be grit blasted to a Sa 2½ of SIS 05 59 00 finish. Successive coats of an approved non-toxic epoxy resin paint suitable for spray application (Copon EP2300 or similar) shall then be applied to give a final dry film thickness of 400 µm. Drying times between successive layers will depend on environmental conditions and will be strictly in accordance with the requirements of the paint manufacturer.

Where the specification does not call for an external surface consisting of an epoxy coating, the following shall apply:-

External surfaces of valve bodies shall be wire brushed to a Sa 3 of SIS 05 59 00 standard and painted with one layer zinc chromate primer to SANS 679 Type I (dried film thickness 50 µm). This shall be followed by two alkyd-based undercoats (each coat 25 µm thick) and one alkyd-based enamel finishing coat to SANS 630 Grade I (dried film thickness 25 µm). Final colour shall be as specified by the Engineer.

Machined flanges shall be painted with a protective coating of shellac or similar.

Refer to Particular Specification G02: Corrosion Protection

M20.18 TOLERANCES

The tolerances as specified in the appropriate SANS or BS standards shall apply to this Contract.

M20.19 COLOUR CODES

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01.

M20.20 TESTING AND INSPECTION

M20.20.1 Testing by Manufacturer

The Manufacturer shall carry out all tests to ensure that valve materials conform to the requirements of the relevant SANS or BS Specification. The Engineer shall not necessarily attend these tests but records must be kept and all test results and tests certificates must be provided to the Engineer.

M20.20.2 Testing by Independent Body

The Engineer may appoint an independent recognised body to conduct control tests. The Manufacturer shall provide samples required for such tests free of charge and the independent body in accordance with the relevant SANS or BS Specification shall do sampling.

The cost of such control tests shall be borne by the Employer.

M20.20.3 Inspection

Visual, operational and dimensional inspection of valves as well as inspection of protective coatings shall be carried out by the Engineer and/or the Manufacturer in the Manufacturer's workshop prior to the despatch of valves to site.

The Engineer's inspection will in no way relieve the manufacturer of any of his obligations to design, manufacture and supply valves strictly in accordance with the Specification.

M20.20.4 Hydrostatic Testing

The Engineer shall witness all hydrostatic tests and the Manufacturer shall give at least one week notification to the Engineer of the proposed dates for such tests.

Valve bodies shall be close ended tested to 2 x working pressure. Test pressures shall be maintained for at least 5 minutes and valve bodies shall be water tight in all respects.

Assembled valves shall be open-ended tested to 1.5 x working pressure for material strength and soundness. Valves shall be drop tight over the complete range of pressures from 0 to 1.5 x working pressure.

Each valve shall be supplied with a test certificate certifying that it complies in all respects with the requirements of this Specification.

M20.21 MEASUREMENT AND PAYMENT

Payment under scheduled items shall be made per complete installation as specified. Measurement and payment will distinguish between supply / delivery and installation / commissioning of the equipment.

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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PARTICULAR SPECIFICATION

M26: MECHANICAL DOSING PUMPS

3	2012-07-30	General update and re-issue	B Van Den Berg	
2	2010-02-16	General review	J Ritchie	
1	2009-05-12	Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance		
Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water

PARTICULAR SPECIFICATION M19: DOSING PUMPS

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M26.1 **SCOPE**

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of Dosing Pumps. The Specification shall be read in conjunction with the Project Specification

M26.2 **INTERPRETATIONS**

M26.2.1 **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

M26.2.2 **Standards**

All design standards for the dosing pumps shall be subject to the latest amendments and editions of the following standard specifications:-

BS 5304	:	Code of practice for safeguarding of machinery
SANS 9096-1: 1994	:	Testing of welders, where applicable to the type of welding required
SANS 1044-3	:	Welding Part 3: The fusion of steel (including stainless steel): Tests for the approval of welding procedures
SANS 10064	:	The preparation of steel surfaces for coating
SANS 10102-4	:	Selection of pipes for buried pipelines Part 1: General Provisions
SANS 10111-2-1	:	Engineering Drawing Part 1: General principles Engineering Drawing Part 2: Geometric Tolerancing Section 1
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
SANS 1123	:	Pipe Flanges

- BS 4999 : General requirements for rotating electrical machines. Specification for standard dimensions
- SIS 05 59 00 : Pictorial Surface Preparation Standards for Painting Steel Surface)
- BS 5316 Part 2 : Pump test codes

M26.2.3 General Requirements

This specification must be read in conjunction with the following specifications:-

M20: Particular Specification for Valves

M21: Particular Specification for Pressure Pipework

E01: Particular Specification for Electric Motors

G01: Particular Specification for Colour Codes

G02: Particular Specification for Corrosion protection

M26.3 **DOSING PUMPS**

M26.3.1 General Design Parameters

Dosing pumps shall be designed such that the following requirements are met:-

- To facilitate manufacture, inspection, installation, maintenance, cleaning and repairs,
- To ensure safe and satisfactory operation and an acceptable life expectation under the ambient conditions prevailing at the Site,
- To prevent undue stresses being produced by expansion due to temperature changes.
- To 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
- To be suitable for operation 365 days per year, 24 hours per day under specified design conditions.

M26.3.2 General

This Contract calls for the supply, delivery, installation and commissioning of ferric chloride, ammonium bromide, chlorine and polymer dosing pumps. The pumps shall be utilised for dewatering, phosphate removal and to reduce BOD as well as removing heavy metals, larvae eggs, pathogenic content, suspended solids and colloidal content.

The mechanical equipment to be supplied under this Contract shall be installed, tested and commissioned on concrete structures, constructed by others, to the dimensions indicated on the construction detail drawings.

Any handling of ferric chloride, chlorine, polymer and ammonium bromide shall be done in accordance with the safety rules and regulations as stipulated per chemical.

The flow rate shall be controlled by setting the dosing pump speed to obtain the desired flow.

M26.3.3 Design Parameters

Double diaphragm dosing, self-priming pumps shall be used to dose the reactor with ferric chloride, chlorine, polymer and ammonium bromide. The speed of the pumps shall not exceed 800 rpm. The dosing rate of the pumps shall be 0.5 l/s at 6m or as specified.

M26.3.4 Welds and fasteners

All flanges, bolts, nuts and other steel components are to be galvanized or 304 or 316 SS.

M26.4 DOSING PUMP PARAMETERS

The flow rate of the ferric chloride, chlorine, polymer and ammonium bromide shall be controlled by setting the dosing pump speed to obtain the desired flow. Provision shall be made to lock a setting once selected to the sludge flow rate to achieve a constant ferric chloride, polymer and ammonium bromide to sludge volume ratio. The dosing system shall be integrated into the SCADA system.

M26.4.1 Diaphragms

The pump diaphragms shall & seals be manufactured from a material that has excellent resistance to aggressive fuels and chemicals and cuts, such as Teflon (PTFE) and Fluoro-elastomer/viton (FPM).

M26.4.2 Drive Unit

The drive unit consists of a motor coupled to a stroke mechanism which shall be housed in cast iron. It shall be manufactured from a material that can withstand extreme operating conditions and corrosive chemicals such as cast iron.

M26.4.3 Motor

The motor shall be able to withstand the dosing rate of the pump. The motor shall be electrically driven and shall be directly coupled to the pump. Refer E01: Volume E01: Particular Specification for electric motors.

The housing shall be manufactured from corrosion resistant and durable material.

M26.4.4 Gearbox

Refer M08: Volume M08: Particular Specification for Mechanical Gearboxes.

M26.4.5 Pump Head and Valves

The pump head, pressure valve and suction valve shall be manufactured from highly non-reactive polymer such as Polyvinylidene Fluoride (PVDF) and PVC. The pressure relief discharge shall be piped back to the storage tank on the suction side of the pumps.

The positive displacement pump shall be protected from excess discharge pressure by means of a spring loaded relief valve or by other proprietary safety equipment.

All relief valves shall be positively locked at the pressure setting and protected against accidental adjustment by wiring or other obvious suitable means. All relief valves shall be constructed in such a way that the pressure setting is preserved when the valve is dismantled for inspection. Refer to particular Specification M20: Volume 20 for detail on valves.

M26.5 Pipes

Each dosing line is to be fitted with a flow indicator of flow range 0 to 1 l/s with bypass piping.

Bends and branches shall provide non-turbulent flow conditions and the layout of the pipe work shall be such as to facilitate dismantling and inspection.

Plastic pipes with glass fibre reinforcement or PVC lining shall be used to transport the ferric chloride, chlorine and ammonium bromide. Polyelectrolytes shall be transported in stainless

steel pipes. Refer to Particular Specification PMP for a detailed specification on pipes.

The pipes are to be properly supported and arranged so that all the stresses created in the pipeline by static and dynamic forces will be taken up by suitable anchors.

Where specific size is not given, pipework shall be sized so as to limit the maximum flow velocities to 1.5 m/s on the suction and 2 m/s on the delivery pipework. Refer to M21: Volume M21: Particular Specification for Pressure Pipework for a detailed specification on pipes.

M26.6 Pulsation Dampeners

Where not included in the pump specifications, pulsation dampeners shall be included in all dosing pipework. This item shall be included under the quotation for pipework.

M26.7 **AREA AROUND CHEMICAL DOSING PUMPS**

This area is subject to spillage of chemical solution due to leaking glands, cleaning of filters, etc. the area around the chemical dosing tanks. The area will be delineated as indicated on the drawings by building a concrete plinth around it.

M26.8 **TRANSFER POLYELECTROLYTE PUMP**

The chemical transfer pumps that will deliver the chemicals from the storage facility shall be centrifugal pumps lined with acid resistant material and adequately protected internally. The pumps must be self priming and shall be seal less plastic pumps or equivalent, with a throttling valve.

The lined acid material shall be a thermoplastic layer moulded onto the pump housing. The transfer rate of the pumps shall be 8 l/s at 6m or as specified. The speed of the pumps shall not exceed 800 rpm.

Refer to Mechanical Specification M18: Volume M18: Centrifugal Pumps.

M26.9 **PIPING FOR TRANSFER OF CHEMICALS**

- All piping to be used for the transfer of concentrated or diluted chemicals shall be either rigid uPVC or rubber suitable for handling highly corrosive suspensions. The diameter of pipes shall be as indicated on the drawings.
- All piping to be used for potable water in the buildings and surrounding area shall be of stainless steel.
- All plastic piping running along walls or ceilings shall be supported continuously, for example in suitably protected lightweight metal channels.

M26.10 **PRESSURE GAUGES**

Pressure gauges shall be fitted with an isolating cock, shall be vibration and shock resistant and shall be calibrated to read with an accuracy of $\pm 1\%$ of the indicated pressure. Three 20mm minimum diameter ball valves shall be employed to zero the gauge, to isolate it and to vent to atmosphere. A chemical seal shall be used to insulate the gauge from the media being measured.

The faceplate diameters of the pressure gauges shall be at least 100 mm. The gauges shall indicate the water pressure in kilopascal and shall have a range of a maximum of 50% higher than the normal maximum working pressure. All gauge glass must conform to internationally recognize standards. These standards include DIN 7081, BS 3463 and JIS B 8211.

The pipe socket requirements shall be included.

Pressure gauges are to be accompanied with calibration certificates.

M26.11 **PIPEWORK**

The following items shall be supplied and installed by the contractor:-

- (1) The dosing pump pipework
- (2) The storage tank pipework
- (3) The transfer pump pipework

The pipework shall be manufactured from 304L stainless steel.

M26.12 **CORROSION PROTECTION**

Refer to Particular Specification G02: Corrosion Protection

M26.13 **COLOUR CODES**

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01: Colour Coding.

M26.14 **TESTING**

M26.14.1 **Works Testing**

Before delivery of the pumps a works test, to be witnessed by the Engineer or his representative, is to be carried out to the approval of the Engineer. The motors to be supplied with the pumps shall be used in the tests.

During the test of the pumps careful records are to be kept of the power consumed, the quantity delivered and the pumping head. From these records the capacities and efficiencies of the plant shall be calculated to determine whether they are in compliance with the guaranteed figures submitted by the Contractor.

The Contractor shall be responsible for the costs incurred in works testing and shall be included in the tendered price.

M26.15 **MEASUREMENT AND PAYMENT**

Measurement and payment will distinguish between supply/delivery and installation/commission as well as per installation point. The respective tender rates shall cover all costs from supply to commission of each pump but excluding the electrical power supply and electrical cable connection.

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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PARTICULAR SPECIFICATION

M28: MACERATORS

3	2012-07-30	Issued	J Ritchie	
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1	2010-03-09	First Issue	J Ritchie	
Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water

PARTICULAR SPECIFICATION M28: MACERATORS

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M28.1 SCOPE

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of Macerators. The specification has been compiled based on practical experience of Johannesburg Water in the installation and maintenance of equipment of this nature.

The Specification shall be read in conjunction with that of the Project Specification.

M28.1.1 INTERPRETATIONS

M28.1.1.1 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

M28.1.1.2 Standards

All design standards for the Macerators shall be subject to the latest amendments and editions of the following standard specifications:-

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 1044-3	: 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 10111-2-1	: Engineering Drawing Part 1: General principles Engineering Drawing Part 2: Geometric Tolerance 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
SANS 1123	: Pipe Flanges
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

M28.1.1.3 General Requirements

This specification must be read in conjunction with the following specifications:-

M08: Particular Specification for Gearboxes

M21: Particular Specification for Pressure Pipework

E01: Particular Specification for Electric Motors

G01: Particular Specification for Colour Codes

G02: Particular Specification for Corrosion Protection

M28.2 IN LINE MACERATORS

M28.2.1 General Requirements

Each macerator shall be of the heavy duty type, in line design complete with cutter stacks, gear reduction motor, and motor. If a control panel is required then reference should be made to the project specific specification.

If the macerator is to be installed into an open channel then it shall come complete with guide rails and support channels as specified.

The macerator shall be suitable for flow rates and pressures as specified in the project specific specification

M28.2.2 Construction

M28.2.2.1 Macerator Assembly

Each macerator shall include cutters, spacers, shafts, bearings, seals, side rails, top and bottom housings, drive speed reducer and motor. They shall be of the 2 shaft design, capable of continuous operation and dry running.

The 2 shaft design shall consist of 2 parallel shafts alternately stacked with individual intermeshing cutters and spacers positioned on the shaft to form a helical pattern. The 2 shafts shall counter-rotate (rotate into one another) with the driven shaft operating at 80% the speed of the drive shaft.

M28.2.2.2 Cutters and Spacers

- a. Individual cutters and spacers shall be made from 4130 AR500 heat treated alloy steel to BS EN 10028-2: 2003, surface ground for uniformity and through-hardened to a minimum 50-52 HRC.
- b. Cutters and spacers both shall have hexagonal center holes to fit the hexagonal shafts.
- c. The macerator shall be supplied with 11 tooth cam cutters on both shafts. To maintain particle size the maximum height of the tooth above the root diameter shall be 13mm. Cutter to cutter root diameter overlap shall be between 2mm and 6mm to maintain the best possible cutting efficiency while incurring the least amount of frictional losses. The maximum clearance between overlapping cutters of opposing shafts is 0.28mm.
- d. Cutters exert a minimum force at the tooth tip of 9,685 N/kW during momentary load peaks.

M28.2.2.3 Scrapers

- a. The scrapers shall be made from 4130 heat treated alloy steel to BS EN 10028-2 : 2003.
- b. Individual scrapers shall be fitted into the drive side rail, or both drive and driven side rails, and contact the aligning spacer to remove any buildup of solids.
- c. The scrapers shall be self-aligning for a proper fit.

M28.2.2.4 Shafts

- a. The macerator drive and driven shafts shall be made from 4140 heat treated hexagonal steel to BS EN 10028-2 : 2003 with a tensile strength rating of not less than 1027 kN/m².
- b. Hexagonal shafts shall measure nominally 63.5mm across the flats.

M28.2.2.5 Shaft Bearings and Seals

- a. The cutter shafts shall have seal cartridge assemblies at both ends designed to take the radial and axial loads.
- b. The sealed cartridge assembly shall consist of deep groove ball bearings, O-ring seals made of Buna-N elastomers and a mechanical seal rated to 6 bar with tungsten carbide faces to allow for deflection of the shafts when under axial load.
- c. For special conditions alternative O-ring materials for the cartridge assembly shall be considered, such as Viton and Teflon.

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M28.2.2.6 Slide rails

- a. The side rails shall be made from austempered ductile cast iron to BS EN 1564 : 1997.
- b. The inside profile of the side rails shall be concave to follow the radial arc of the cutters.
- c. Side rails shall have evenly spaced slots that increase flow and decrease head loss.

M28.2.2.7 End Housing and Covers

- a. Macerator end housings shall be made from austempered ductile cast iron to BS EN 1564 : 1997 with a flow deflector which is designed to protect the bushings while guiding particles directly into the cutting chamber.

- b. Top covers shall be made from austempered ductile cast iron to BS EN 1564 : 1997 and the bottom covers from hot rolled plate to BS EN 10139 : 1998.

M28.2.2.8 Reducers

- a. The speed reducer shall be grease filled, planetary type reducer with a 500% shock load capacity. The reduction ratio be 1 : 35.
- b. The input shaft of the reducer shall be directly coupled to the motor with a 3 piece coupling, and the output shaft of the reducer shall be coupled to the macerator with a 2 piece coupling. Alternatively the motor and reducer can be a combined unit.

M28.2.2.9 Motors

Motors shall be suitably rated for the maximum duty of the macerator and shall comply with E01: Particular Specification for Electric Motors.

M28.2.2.10 Support System for in-Channel mounted Macerators

If an in-channel mounted macerator is specified then it shall be supplied complete with a channel support frame and guide rails with adjustable mountings brackets to suit the channel width and depth specified.

The support frame shall be manufactured from a welded hollow section, angle and plate construction in 304 stainless steel.

M28.3 Control Panels

If the control panel for the Macerator be required as specified in the project specific specification then it shall comply with the specification unless otherwise specified.

The controller shall provide independent control of the macerator and shall be individually rated for the size of motor.

The power supply shall be suitable for a 400 volts, 3 phase, 50Hz.

Operation

The controller shall be equipped with a 3 position selector switch, HAND – OFF/RESET – AUTO.

- | | | |
|-----------|---|--|
| OFF/RESET | - | Macerator will not run |
| OFF/RESET | - | Macerator can only be reset with switch in this position |
| HAND | - | Macerator will run when "Start" push button is pressed and stop when "Stop" push button is pressed |
| AUTO | - | Macerator will start/stop when controlled by remote dry contact |

Components

Enclosure

- a. Enclosures shall be single door, mild steel enclosure, rated to IP65 and suitable for wall mounting. Powder coated RAL 7032. Fitted with corrosion resistant hinges and latches.
- b. The enclosure shall house the control devices, relays, terminal blocks and reversing motor starters.

Control Devices

- a. Pilot devices shall be mounted on the enclosure front panel.
- b. Indicators for POWER ON, RUN and FAIL, shall be LED type pilot lights.
- c. Lights and selector switches shall be heavy duty IP65 type.
- d. Control transformer shall be protected by 2 primary fuses and 1 secondary fuse. The 110 volt secondary shall have 1 leg grounded.
- e. Relay contacts shall be provided for the macerator RUN and FAIL signal outputs. The contacts shall be rated 2 amps, 110 volts, resistive load.

Motor Starter

- a. Starter shall be full-voltage, 110 volt, reversing type operating coil.
- b. Forward and reverse contactors on the starters shall have both mechanical and electrical interlocks.
- c. Overload relays (OL) shall be adjustable so that the range includes the full load amps (FLA) rating and service factor.

Safety Features

- a. When a macerator jam occurs in the macerator HAND or AUTO modes the controller will stop the macerator, then reverse the macerator rotation to clear the obstruction. If the jam is cleared, the controller shall return the macerator to normal operation. When up to 2 additional reversing cycles (total 3) occur within 30 seconds the controller shall de-energises the macerator motor and shall activate the macerator fail indicator and relay.
- b. If a power failure occurs while the macerator is running, operation shall resume when the power is restored.
- c. If a power failure occurs while the macerator is in a fail condition the fail indicator shall re-activate when power is restored.
- d. The controller shall provide overload protection for the motor through an overload relay mounted directly on the macerator motor starter.
- e. If short-circuit protection is required to be supplied by others then this should be specified in the tender submission.
- f. Controller reset shall be from the local panel controls only.

Full detail of all control panel and monitoring devices offered must be submitted with the Tender.

M28.4

Pressure Gauges

Pressure gauges complete with isolating cock shall be fitted upstream and downstream of each Macerator and shall be vibration and shock resistant and shall be calibrated to read with an accuracy of $\pm 1\%$ of the indicated pressure. Three 20mm minimum diameter ball valves shall be employed to zero the gauge, to isolate it and to vent to atmosphere. A chemical seal shall be used to insulate the gauge from the media being measured.

The faceplate diameters of the pressure gauges shall be at least 100 mm. The gauges shall indicate the water pressure in kilopascal and shall have a range of a maximum of 50% higher than the normal maximum working pressure. All gauge glass must conform to internationally recognized standards. These standards include DIN 7081, BS 3463 and JIS B 8211.

A calibration certificate is to be provided with each pressure gauge.

M28.5 Corrosion Protection

Refer to Particular Specification G02: Corrosion Protection

M28.6 Designation and Information Plates

Each Macerator shall be supplied with an information plate secured to the Macerator main Body in a visible position indelibly marked with the following details:-

- Maker's name, Macerator type and serial number
- Year of manufacture
- Rated duty of Macerator in litres per second
- Head loss in metres at rated duty
- Macerator speed in r/min
- Mass of completely assembled Macerator in kilogram

M28.7 Interchange Ability

Where two or more similar Macerators are required, these units will be identical in all respects.

All similar parts of items supplied will be interchangeable without any additional machining or fitting.

M28.8 Recommended Spare Parts

The Tenderer must submit details of spare parts recommended to be kept in store by the Employer with his Tender.

The detail will include a full description of the parts, part identification, number required, guaranteed delivery time and total price delivered to Site.

M28.9 Operation and Maintenance Manual

The Contractor shall hand over to the Engineer four sets of the Operation and Maintenance Manual compiled for each installation not later than 4 weeks before the schedules commissioning of the Macerators. These manuals are a prerequisite for final takeover of the plant.

The Operation and Maintenance Manual will contain the following:

- (a) Brief description of the plant and installation.
- (b) Concise operating instructions.
- (c) Routine maintenance instruction.
- (d) Precautionary measures, elementary trouble location, rectifying measures and emergency actions.
- (e) Detailed information on equipment.
- (f) Lists of spare parts including names and addresses of suppliers.

M28.10 Drawings

The drawings included in the Tender Documents are the Engineer's proposal for the plant layout. Should the Tenderer offer alternative layouts, he shall submit drawings with his Tender in order for it to be evaluated.

Before the Contractor carries out any work, he will submit detailed working drawings to be approved by the Engineer. Approval of these drawings does not relieve the Contractor from his responsibility for the correctness of the drawings.

M28.11 Installation

The Macerator unit shall be installed in the pipe line without any undue strain being imposed on the unit from the inlet and outlet pipework.

If required the macerator unit shall be mounted on a support plinth and secured firmly thereto prior to connecting the inlet and outlet pipework. Upon completion, dowel pins shall be fitted to facilitate relocation at any future time.

M28.12 INSPECTION, TESTING AND COMMISSIONING

M28.12.1 Testing by Manufacturer

The Manufacturer will carry out all tests on materials, quality control tests, dimensional checking and routine tests on parts to ensure that the Macerators and materials conform to the requirements of the relevant SANS or BS specifications and to this Specification. The Engineer will not necessarily attend these tests but records must be kept and all test results will be made available to the Engineer.

M28.12.2 Witnessed Testing

In addition to the above, a number of performance tests will also be carried out in the testing facility of the supplier before equipment is transported to Site. These tests can be carried out in the workshop of the manufacturer/supplier if it is suitably equipped or another approved test facility.

The Engineer may witness these tests and the Contractor will notify the Engineer two weeks in advance of the date and place at which the equipment may be inspected and tested. When tests and inspections have met the satisfaction of the Engineer a certificate of workshop acceptance will be issued. These certificates are a prerequisite before payment for "Materials on Site" can be passed. The Engineer's acceptance will in no way relieve the Manufacturer of any of his obligations to design, manufacture and supply Macerators strictly in accordance with the Specification.

Performance tests shall include:-

- (a) Hydraulic tests on the Macerator casing. The test pressure will be equal to $1\frac{1}{2}$ times the maximum working pressure at the delivery end of the Macerator. The testing will be done with blank flanges bolted onto the flanges. The pressure will be maintained for at least 15 minutes. No sign of sweating, leaking, undue deformation and stressing or defect of any kind will be evident during the test period.
- (b) Tests to prove that the rotating parts are dynamically balanced.
- (c) Performance tests on Macerators and driving unit.

If a performance test of the Macerator unit is not possible at the manufacturer's works, this shall be stated in the Tender with reasons to allow the Engineer opportunity to make alternative proposals.

M28.12.3 Failure to Pass Performance Test

Should the Macerator unit fail the performance test, whether performed at the manufacturer's works or at an independent institution, the Engineer shall authorise any amendments to the plant which may be considered necessary to meet the guaranteed quantities within the

permissible tolerances laid down in BS 5316 Part 2 - Class B tests and prove with further test that the equipment conform to the Specification.

All costs involved in the re-testing of the Macerator units will be borne by the Contractor.

Should the Macerator unit fail to pass the test with more than 5% variation on the actual guaranteed figures; the engineer will reject the Macerator unit and request the Contractor to replace the unit so rejected.

Should the Macerator unit still fail to pass the test, but the actual figures do not vary by more than 5% from the actual guaranteed figures, the Engineer may :-

- (a) Request the Contractor to carry out amendments to ensure the compliance of the unit with the Specification; or
- (b) Accept the equipment but impose a penalty for non-compliance on the Contractor. A sum will be calculated based on the additional energy used over the life expectancy of the equipment and this will be deducted from the Contract price for each Macerator set for every kilowatt by which the gross demand exceeds the guaranteed figure with permissible tolerances.

M28.13 Commissioning

On completion of the installation the Contractor will check all items for satisfactory functioning. He will then inform the Engineer of his intention to commission the plant. The Engineer may request control measurements on Macerator alignment at this stage.

A detailed programme of his proposed commissioning procedures will be submitted not later than two weeks prior to the commissioning date.

After a successful running period of 4 hours (to be witnessed by the Engineer) the Contractor will hand over the installation to the Employer as well as the Operation and Maintenance Manuals. The Completion Certificate will only be issued after the units have been in successful operation for 14 consecutive days and the acceptance tests successfully completed.

During the first 14 days of operation, the Contractor will rectify any problems with the units on Site within 24 hours of being telephonically notified. During the remainder of the maintenance period, the Contractor will, within 14 days of being notified, commence rectifying any possible problems that the Employer may encounter with the equipment supplied under this Contract.

Should the Contractor fail to meet the above requirements, the Employer may appoint others to undertake the necessary repair work at the Contractor's cost.

M28.14 Tests at the Site of the Works

The Engineer may require that site tests are performed to verify performance figures guaranteed by the Contractor. Flow rate, pressure loss and power input to the Macerator units shall be determined, as accurate as Site conditions permit. The Contractor shall provide suitable instruments with recent calibration certificates.

Should the subsequent test results still fall outside the allowable tolerances, Clause M28.12.3 shall apply, and all costs shall be borne by the Contractor. In the event of the subsequent test being successful, costs shall be borne by the Employer.

M28.15 Colour codes

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01.

M28.16 MEASUREMENT AND PAYMENT

Payment under scheduled items shall be made per complete Macerator set installation as specified, electrical connections, civil preparation, coring and grouting, etc. Measurement and payment will distinguish between supply, delivery and installation, testing and commissioning of the required Macerator units.

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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PARTICULAR SPECIFICATION

M29: POSITIVE DISPLACEMENT SLUDGE PUMPS

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PARTICULAR SPECIFICATION M29: POSITIVE DISPLACEMENT SLUDGE PUMPS

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M29 SCOPE

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of Positive displacement pumps for pumping sludge.

The specification covers progressive cavity type and lobe type pumps.

The Specification shall be read in conjunction with that of the Project Specification.

M29.1 INTERPRETATIONS

M29.1.1 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

M29.1.2 Standards

All design standards for the centrifugal pumps 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 1044-3	:	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 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
BS EN ISO 14847:1999	: Rotary positive displacement pumps. Technical requirements
BS EN 734:1995	: Pumps and pump units for liquids. Common safety requirements
BS EN 12162:2001	: Liquid pumps. Safety requirements, Procedure for hydrostatic testing
BS EN 60041:1995	: Field acceptance tests to determine the hydraulic performance of hydraulic turbines, storage pumps and pump-turbines.
BS EN 60994:1993	: Guide for field measurement of vibrations and pulsations in hydraulic machines (turbines, storage pumps and pump-turbines)
BS EN 22858:1993	: End-suction centrifugal pumps (rating 16 bar). Designation, nominal duty point and dimensions
BS EN 23661:1993	: End-suction centrifugal pumps. Base plate and installation dimensions
BS EN 733:1995	: End-suction centrifugal pumps, rating with 10 bar with bearing bracket. Nominal duty point, main dimensions, designation system
SANS 1123	: Pipe Flanges
ISO 281	: Rolling bearings -- Dynamic load ratings and rating life
BS 4999	: General requirements for rotating electrical machines. Specification for standard dimensions
BS 5316 Part 2	: Pump test codes

M29.1.3 General Requirements

This specification must be read in conjunction with the following specifications:-

M08: Particular Specification for Gearboxes

M21: Particular Specification for Pressure Pipework

E01: Particular Specification for Electric Motors

G01: Particular Specification for Colour Codes

G02: Particular Specification for Corrosion Protection

Automation and Control Design Standards Volume 8: Flow Measurement

Automation and Control Design Standards Volume 11: Temperature Measurement

M29.2 PROGRESSIVE CAVITY TYPE PUMPS

M29.2.1 Design Parameters

Progressive cavity pumps shall be suitable for pumping sludge with a solids concentration up to 10% and can consist of primary sludge, waste activated sludge, digested sludge, raw sewage and a mixture of various types of sludge.

The sludge will be screened prior to passing through the pumps; the pumps shall be able to pump any solids which will pass through a single dimensional screen with an aperture of 6mm

as well as small inorganic particles, and grit.

Tenderers should note that the sludge being pumped can contain fibrous/stringing materials.

The pumps shall be selected such that the operating speed shall not cause premature wear of the wearing parts. It is envisaged that the rotor speed shall not exceed 350 rpm. Any pump operating above this speed must be motivated by the tenderer and shall submit references where pumps have been operating satisfactory at speeds above 350 rpm trouble free for at least three years under similar conditions.

The pumps shall be of the highest quality and shall be suitable for continuous operation over long periods with a minimum amount of maintenance at high-sustained efficiency.

The pumps shall be capable of rotating in either direction, depending on the pipe work configuration.

Detailed performance curves for the pump type shall be provided at the time of tendering.

The curves shall indicate the following:

- Head (metres) vs. flow (litres/second) - 0% to 120% duty flow
- Power absorbed in kW - 50% to 120% of duty flow
- Pump efficiency – 0% to 120% duty flow
- Net positive suction head curves required by the pumps at the specified flow rate.

Pumps shall be able to operate without cavitation over a full range as specified without throttling. Pumps are required to operate continuously at an ambient temperature of 40°C.

The following quantities shall be guaranteed by the Contractor:

- Minimum flow rate of the pump at the specified total head.
- Maximum power demand at the specified total head.
- Minimum efficiency at the specified total head.
- Maximum net positive suction head required by the pump at the specified flow rate.

Multiple Units

Unless specified arrangements incorporating multiple units coupled in series in order to achieve the duty specified for each complete pump set shall only be offered as an alternative.

The mechanical equipment to be supplied under this Contract shall be installed, tested and commissioned on concrete structures, constructed by others, to the dimensions indicated on the construction detail drawings.

M29.2.2 Pump Casing

Suction and discharge housings are to be manufactured from GG25 cast or approved material suitable for the pumped liquid.

Casings shall be designed for not less than the following working pressures or 1.5 times the actual working total discharge pressure, whichever is the greater.

Progressive Cavity Type Pumps : 1600 kPa

All casings shall be provided with the following tapings as a minimum requirement:-

- One suction pressure gauge tapping
- One discharge pressure gauge tapping
- One bleeder cock tapping
- One filling point tapping

- Suitable tapping or, where possible, internal drilling to provide water for the glands.

Unless otherwise stated the dimensions and drilling of the suction and discharge flanges shall be SANS 1123 to the design pressures as specified but with a minimum of 16 Bar.

The pressure rating of the flanges shall at least be equal to the maximum static pressure plus the pump shut-off pressure.

M29.2.3

Manufacture

The various components of the pump shall comply with the following:

- Drive shaft.** Shall be manufactured from high quality steel compatible with the pumped liquid. The shafts shall be hard chromed-plated in the gland area to ensure excellent wear resistance.
- Stuffing Box.** The stuffing box shall be designed for heavy duties. The gland shall be packed with a braided packing of appropriate material to suit the pumped liquid and operating pressure.
- Approved Mechanical Seals.** Shall be installed where specified in the Project Specific Specification. Seal housing shall be manufactured as separate castings from 316 stainless steel or appropriate contact material and shall fit in place of the stuffing box (M29.2.3b). The seal housing shall have large clearance for the internal rotary seal to prevent clogging. The seals shall be double where appropriate. The mechanical seal is to be so situated in the suction housing to ensure the best possible flushing of the seal by the product. Additionally the mechanical seal housing is to have a flushing connection. Seal faces are to be silicon carbide or tungsten carbide. Full details of the seals and glands indicating the materials, finishes, clearances etc. shall be submitted with the Tender.
- Castings.** Suction and discharge housings are to be manufactured from GG25 cast.
- Flex-shaft drive.** The drive between the main shaft and the rotor shall be by means of a flexible drive shaft adequately proportioned for torque and thrust for either direction of rotation. Morse tapers shall be fitted on both ends of the flexible shaft.
- Coupling Rods.** Shall be proportioned to handle the rotor load and eccentricity.
- Rotors.** Shall be hardened and hard chrome plated where appropriate. The rotors shall be manufactured E-8, 316 stainless steel or special alloy, as appropriate for the pumped liquid.
- Stator Housing.** Shall be manufactured from an approved thick walled seamless steel tube.
- Stators.** Shall be bonded to the stator housing. The stator material shall be either nitrile, EPDM or other approved material to be compatible with the pumped liquid. Temperature sensors shall be provided on the stator to prevent dry running. The stator design shall include a moulded conical entry on the suction side to increase chamber filling efficiency
- Bearings.** Shall be high thrust, taper-roller or ball bearings in adequate proportions designed to last for at least 40 000 working hours under the working conditions.

M29.2.4

Lubrication

In the case where oil lubrication is required, adequate provision shall be made for the cooling of the oil. The bearings shall be required to operate at temperatures no higher than 60°C.

Oil reservoirs of sufficient capacity shall be fitted with easily accessible oil level indicators, which are to be clearly marked in order to indicate the oil standing and running levels.

M29.3 LOBE TYPE PUMPS

M29.3.1 Design Parameters

Lobe type pumps shall be suitable for pumping sludge with a solids concentration up to 10% and can consist of primary sludge, waste activated sludge, digested sludge, raw sewage and a mixture of various types of sludge.

The sludge will be screened prior to passing through the pumps; the pumps shall be able to pump any solids which will pass through a single dimensional screen with an aperture of 6mm as well as small inorganic particles, and grit.

Tenderers should note that the sludge being pumped can contain fibrous/stringing materials.

The pumps shall be selected such that the operating speed shall not cause premature wear of the wearing parts. It is envisaged that the rotor speed shall not exceed 350 rpm. Any pump operating above this speed must be motivated by the tenderer and shall submitted references where pumps have been operating satisfactory at speeds above 350 rpm trouble free for at least three years under similar conditions.

The pumps shall be of the highest quality and shall be suitable for continuous operation over long periods with a minimum amount of maintenance at high-sustained efficiency.

The pumps shall be capable of rotating in either direction, depending on the pipe work configuration.

Detailed performance curves for the pump type shall be provided at the time of tendering.

The curves shall indicate the following:

- Head (metres) vs. flow (litres/second) - 0% to 120% duty flow
- Power absorbed in kW - 50% to 120% of duty flow
- Pump efficiency – 0% to 120% duty flow
- Net positive suction head curves required by the pumps at the specified flow rate.

Pumps shall be able to operate without cavitation over a full range as specified without throttling. Pumps are required to operate continuously at an ambient temperature of 40°C.

The following quantities shall be guaranteed by the Contractor:

- Minimum flow rate of the pump at the specified total head.
- Maximum power demand at the specified total head.
- Minimum efficiency at the specified total head.
- Maximum net positive suction head required by the pump at the specified flow rate.

Multiple Units

Unless specified arrangements incorporating multiple units coupled in series in order to achieve the duty specified for each complete pump set shall only be offered as an alternative.

The mechanical equipment to be supplied under this Contract shall be installed, tested and commissioned on concrete structures, constructed by others, to the dimensions indicated on the construction detail drawings.

M29.3.2 Pump Casing

Suction and discharge housings are to be manufactured from GG25 cast or approved material suitable for the pumped liquid.

Casings shall be designed for not less than the following working pressures or 1.5 times the actual working total discharge pressure, whichever is the greater.

Lobe Type Pumps : 1600 kPa

All casings shall be provided with the following tapings as a minimum requirement:-

- One suction pressure gauge tapping
- One discharge pressure gauge tapping
- One bleeder cock tapping
- One filling point tapping
- Suitable tapping or, where possible, internal drilling to provide water for the glands.

Unless otherwise stated the dimensions and drilling of the suction and discharge flanges shall be SANS 1123 to the design pressures as specified but with a minimum of 16 Bar.

The pressure rating of the flanges shall at least be equal to the maximum static pressure plus the pump shut-off pressure.

M29.3.3

Manufacture

The various components of the pump shall comply with the following:

- Castings.** Each pump shall be of heavy duty, positive displacement rotary lobe design with gray cast iron casing and smooth end cover, of 230 – 260 Brinell hardness. The front cover shall be constructed of gray cast iron, with a minimum Brinell hardness of 230 – 260, and permit removal of the rotors without disturbing piping, bearings, and mechanical seals. It shall also be machined to accept a reversible front wear plate, constructed of Hardox 500 material or equal, with a minimum brinell hardness of 550.
- Rotors.** Shall utilize two four-lobe rotors, which are driven through positive timing gears running in oil. Solid gray cast iron cores shall be covered with a layer of Buna-N Durometer hardness 65-72. The geometry of the rotor core shall be the same as that of the finished rotor. Rotor vane geometry shall be convoluted to provide pressure-pulse free operation. Rotors shall be positioned to the shaft by replaceable hardened key ways, and secured to the shaft by internal/external expansion bolt and flush discs requiring no recesses in the end cover.
- Shafts.** Shall be of carbon steel C45 fitted with replaceable stainless steel sleeves where passing through the seal area. They shall be timed in their rotation by straight cut timing gears running in a separate oil chamber which also contains the ball and roller bearings for each shaft. The shaft shall be a minimum of 60 mm in diameter where the rotors, bearings, and mechanical seals contact the shaft, to decrease the potential of torsional shaft fatigue.
- Approved Mechanical Seals.** Block-ring type mechanical seals shall be provided for each positive displacement pump. Seals shall be in a cartridge format and individually tested. A blocking chamber located behind the mechanical seal, and in front of the bearing housing lip seal shall be moulded into the casting of the pump. This chamber shall be suitable for fill, from the side of the pump, through nipples, and have an external oil bottle to review the status of the mechanical seals operation, mounted on the top of the pump, located in easy view of the operator.
- Flange Port Castings.** Port connections shall be SABS / DIN standard flanges; size specified on Data Sheet. They shall be at an angle upwards to allow gas to escape from the pump and hot dipped galvanized, for long life, and corrosion resistance.
- Removable End Covers.** Shall be flush with no recesses or dead pockets where solids can accumulate. The cover shall be sealed with Buna "N" O-ring and provide complete access to the pump chamber without disconnecting pipe work glands or bearings.

- g) The pump, gear reducer and motor shall be mounted on a galvanized steel base plate complete with necessary couplings, guards, and mounting hardware.
- h) Vibration: Pumps and motors shall operate at any point within their operating range without undue noise and vibration. Vibration at any point in the operating range shall not exceed the limits allowed by the Hydraulic Institute.
- i) **Housing Adjustment.** The top and bottom housing segments of the pump shall be constructed of gray cast iron and be adjustable based on wear. The adjustment shall be accomplished by simply moving stainless steel shims from one hole to the next in the pump housing, allowing for the closing of tolerance around the rotors.

M29.3.4 Lubrication

In the case where oil lubrication is required, adequate provision shall be made for the cooling of the oil. The bearings shall be required to operate at temperatures no higher than 60°C.

Oil reservoirs of sufficient capacity shall be fitted with easily accessible oil level indicators, which are to be clearly marked in order to indicate the oil standing and running levels.

M29.4 VENT COCKS

Vent cocks shall be fitted at all high points to the pump casing. These cocks shall be adequately sized in order to allow the trapped air to be released freely.

An automatic air vent shall be fitted to each pump casing if specified. This device shall be suitable for the remote operation of an indicator to show the open and closed positions of the air vent.

M29.5 BASE PLATE

The base plate of the pump and motor shall be rigid. The pump and motor shall be situated on the upper face of each base plate, which shall be machined flat and smooth to ensure that the pump and motor are bedded properly without the use of spacers.

The pump/motor base plate shall be completely aligned prior to grouting and provision shall be made to grout within the base plate itself to facilitate vibration-free operation.

Base plates which have a mass greater than 200 kg shall have two jacking bolts at right angles with a lock nut at every corner of the unit.

M29.6 DRIVE MOTOR

The pump shall be driven by a fixed electric speed motor. Refer to Particular Specification E01 Electric Motors for a detailed specification for Electric motors.

M29.7 MOTOR / GEARBOX / PUMP COUPLING

The motor/gearbox / pump coupling shall be fully rated to transmit the motor full load power and tested to prove the above features together with static and dynamic balance. The motor shall be coupled to the gearbox input shaft with either a V-belt or a flexible coupling. V-belts and couplings are to be provided with protective cover guards.

M29.8 GEARBOX

Where the pump is driven via a gearbox Reference is to be made to M08: Mechanical Specification for Gearboxes.

M29.9 MONITORING DEVICES

Full detail of all monitoring devices offered must be submitted with the Tender however the minimum protection required is as follows:

M29.9.1 Pressure Gauges

Pressure gauges shall be fitted with an isolating cock, shall be vibration and shock resistant and shall be calibrated to read with an accuracy of $\pm 1\%$ of the indicated pressure. Three 20mm minimum diameter ball valves shall be employed to zero the gauge, to isolate it and to vent to atmosphere. A chemical seal shall be used to insulate the gauge from the media being measured.

The faceplate diameters of the pressure gauges shall be at least 100 mm. The gauges shall indicate the water pressure in kilopascal and shall have a range of a maximum of 50% higher than the normal maximum working pressure. All gauge glass must conform to internationally recognized standards. These standards include DIN 7081, BS 3463 and JIS B 8211.

A calibration certificate is to be provided with each pressure gauge.

M29.9.2 Temperature Detectors

If required oil lubricated bearings and glands offered shall be fitted with temperature detectors. The temperature detectors shall be PT100 – RTD's

If grease lubricated bearings are offered, the Tenderer will indicate in his Tender if temperature detectors can in fact be used. If temperature detectors are not feasible, an alternative means of monitoring bearings must be offered.

M29.9.3 No-flow Protection

- (a) Each pump shall be protected against no flow by a flow meter installed in the discharge line from the pump.

M29.9.4 Indicator on Automatic Air Vent

If an automatic air vent is required for the pump casing, it shall be fitted with an indicator to indicate the open and closed positions of the air vent. The air vent shall be suitable for remote operation and air vent control shall be mounted on the control panel inside the pump station.

M29.9.5 Gland Leakage

If a gland leakage device is required in order to monitor the gland leakage it shall be supplied and fitted with adjustable alarm contacts designed to close when gland leakage rises to a pre-set value.

M29.10 PIPEWORK

All suction and delivery pipes shall be connected to the pump casing by means of flexible connections. All flexible connections shall be installed as close to the pump's casings as possible, and in any event, shall be between the suction valve and the pump casing and delivery non-return valve and the pump casing. In all cases the flexible connection shall be in the section of piping of smallest diameter.

Double victualic joint are generally preferred for flexible connections, but approved re-enforced rubber bellow units are acceptable for low-pressure services.

All valves and pipework external to the pump casing and separated there from by means of flexible connections shall be securely anchored to prevent movement.

Refer to Particular Specification M21: Pressure Pipework for a detailed specification on pipework.

M29.11 HOLDING DOWN BOLTS

The contractor shall be responsible for the supply of all necessary holding down bolts for the machines supplied by him/her. The holding down bolts shall be manufactured from 316 SS.

All bolts necessary for assembling all equipment shall be supplied by the contractor.

M29.12 VIBRATION AND NOISE

The pumps as well as the motors will comply with the requirements of BS 4999. The Contractor may be requested by the Engineer to carry out vibration tests. The noise level shall not exceed 85 dBA at 1m.

M29.13 CORROSION PROTECTION

Refer to Particular Specification G02: Corrosion Protection

M29.14 DESIGNATION AND INFORMATION PLATES

Each pump shall be supplied with an information plate secured to the pump casing in a visible position indelibly marked with the following details:-

- Maker's name, pump type and serial number
- Year of manufacture
- Rated duty of pump in litres per second
- Head in metres at rated duty
- Pump speed in r/min
- Mass of completely assembled pump in kilogram

M29.15 INTERCHANGEABILITY

Where two or more similar pump units are required, these units will be identical in all respects.

All similar parts of items supplied will be interchangeable without any additional machining or fitting.

M29.16 RECOMMENDED SPARE PARTS

The Tenderer must submit details of spare parts recommended to be kept in store by the Employer with his Tender.

The detail will include a full description of the parts, part identification, number required, guaranteed delivery time and total price delivered to Site.

M29.17 OPERATION AND MAINTENANCE MANUAL

The Contractor shall hand over to the Engineer four sets of the Operation and Maintenance

Manual compiled for each installation not later than at the time of commissioning of the installation. These manuals are a prerequisite for final take over of the plant.

The Operation and Maintenance Manual will contain the following:

- (a) Brief description of the plant and installation.
- (b) Concise operating instructions.
- (c) Routine maintenance instruction.
- (d) Precautionary measures, elementary trouble location, rectifying measures and emergency actions.
- (e) Detailed information on equipment.
- (f) Lists of spare parts including names and addresses of suppliers.

M29.18 DRAWINGS

The drawings included in the Tender Documents are the Engineer's proposal for the plant layout. Should the Tenderer offer alternative layouts, he shall submit drawings with his Tender in order for it to be evaluated.

Before the Contractor carries out any work, he will submit detailed working drawings to be approved by the Engineer. Approval of these drawings does not relieve the Contractor from his responsibility for the correctness of the drawings.

M29.19 INSTALLATION

The pump and motor shall be aligned to within ± 0.025 mm full indicator movement on dial gauge, regardless of the coupling type. After the pump and motor feet are tightened down, ad pipework erected and tightened, both angular and parallel alignment shall be checked and recorded at each quarter revolution. These readings shall be submitted to the Engineer and is a prerequisite for handover.

Upon completion, dowel pins shall be fitted to facilitate relocation at any future time.

M29.20 INSPECTION, TESTING AND COMMISSIONING

M29.20.1 Testing by Manufacturer

The Manufacturer will carry out all tests on materials, quality control tests, dimensional checking and routine tests on parts to ensure that the pumps and materials conform to the requirements of the relevant SANS or BS specifications and to this Specification. The Engineer will not necessarily attend these tests but records must be kept and all test results will be made available to the Engineer.

M29.20.2 Witnessed Testing

In addition to the above, a number of performance tests will also be carried out in the testing facility of the supplier before equipment is transported to Site. These tests can be carried out in the workshop of the manufacturer/supplier if it is suitably equipped or another approved test facility.

The Engineer may witness these tests and the Contractor will notify the Engineer two weeks in advance of the date and place at which the equipment may be inspected and tested. When tests and inspections have met the satisfaction of the Engineer a certificate of workshop

acceptance will be issued. These certificates are a prerequisite before payment for "Materials on Site" can be passed. The Engineer's acceptance will in no way relieve the Manufacturer of any of his obligations to design, manufacture and supply pumps strictly in accordance with the Specification.

Performance tests shall include:-

- (a) Hydraulic tests on the pump casing. The test pressure will be equal to 1½ times the maximum working pressure at the delivery end of the pump. The testing will be done with blank flanges bolted onto the flanges. The pressure will be maintained for at least 15 minutes. No sign of sweating, leaking, undue deformation and stressing or defect of any kind will be evident during the test period.
- (b) Tests to prove that the rotating parts are dynamically balanced.
- (c) Performance tests on pump and driving unit.
- (d) NPSH requirements if called for in the Project Specifications.

A performance test shall be carried out in accordance with BS 5316 Part 2 - Class B tests if specified. Unless otherwise stated, the Contractor will be required to conduct the performance test on the combined pump/motor unit.

If a performance test of the pump and its driving unit is not possible at the manufacturer's works, this shall be stated in the Tender with reasons to allow the Engineer opportunity to make alternative proposals.

M29.20.3 Testing by an Independent Facility

The Employer may require that an independent testing facility or institution such as the South African Bureau of Standards carry out performance tests. A separate item for performance testing will be provided in the Schedule of Quantities to allow for this.

M29.20.4 Failure to Pass Performance Test

Should the pump unit fail the performance test, whether performed at the manufacturer's works or at an independent institution, the Engineer shall authorise any amendments to the plant which may be considered necessary to meet the guaranteed quantities within the permissible tolerances laid down in BS 5316 Part 2 - Class B tests and prove with further test that the equipment conform to the Specification.

All costs involved in the re-testing of pump units will be borne by the Contractor.

Should the pump unit fail to pass the test with more than 5% variation on the actual guaranteed figures, the engineer will reject the pump unit and request the Contractor to replace the unit so rejected.

Should the pump unit still fail to pass the test, but the actual figures do not vary by more than 5% from the actual guaranteed figures, the Engineer may :-

- (a) Request the Contractor to carry out amendments to ensure the compliance of the unit with the Specification; or
- (b) Accept the equipment but impose a penalty for non-compliance on the Contractor. A sum will be calculated based on the additional energy used over the life expectancy of the equipment and this will be deducted from the Contract price for each pump set for every kilowatt by which the gross demand exceeds the guaranteed figure with permissible tolerances.

M29.20.5 Commissioning

On completion of the installation the Contractor will check all items for satisfactory functioning. He will then inform the Engineer of his intention to commission the plant. The Engineer may request control measurements on pump alignment at this stage.

A detailed programme of his proposed commissioning procedures will be submitted not later than two weeks prior to the commissioning date.

After a successful running period of 4 hours (to be witnessed by the Engineer) the Contractor will hand over the installation to the Employer as well as the Operation and Maintenance Manuals. The Completion Certificate will only be issued after the units have been in successful operation for 14 consecutive days and the acceptance tests successfully completed.

During the first 14 days of operation, the Contractor will rectify any problems with the units on Site within 24 hours of being telephonically notified. During the remainder of the maintenance period, the Contractor will, within 14 days of being notified, commence rectifying any possible problems that the Employer may encounter with the equipment supplied under this Contract.

Should the Contractor fail to meet the above requirements, the Employer may appoint others to undertake the necessary repair work at the Contractor's cost.

M29.20.6 Tests at the Site of the Works

The Engineer may require that site tests are performed to verify performance figures guaranteed by the Contractor. Flow rate, total head and power input to the pump/motor units shall be determined, as accurate as Site conditions permit, for one or more points on the pump curves close to the specified duty point. The Contractor shall provide suitable instruments with recent calibration certificates.

Should these measured and calculated quantities differ from those guaranteed by more than the tolerances allowed by BS 5316 Part 1 - re-testing of the unit at any testing facility, or the recalibration of the measuring instruments.

Should the subsequent test results still fall outside the allowable tolerances, Clause M18.28.4 shall apply, and call costs shall be borne by the Contractor. In the event of the subsequent test being successful, costs shall be borne by the Employer.

M29.21 COLOUR CODES

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01.

M29.22 MEASUREMENT AND PAYMENT

Payment under scheduled items shall be made per complete pump set installation as specified, electrical connections, civil preparation, coring and grouting, etc. Measurement and payment will distinguish between supply, delivery and installation, testing and commissioning of the required number of complete pump sets.

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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PARTICULAR SPECIFICATION

M33: MECHANICAL ELUTRIATION PUMPS

1	30/07/2012	General up Date and Reissue	J Ritchie	
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Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water

PARTICULAR SPECIFICATION M32: ELUTRIATION PUMPS

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M33.0 SCOPE

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of Elutriation Centrifugal Pumps. The Specification shall be read in conjunction with that of the Project Specification.

M33.1 INTERPRETATIONS

M33.1.1 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

M33.1.2 Standards

All design standards for the centrifugal pumps 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 1044-3	: 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 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
BS EN ISO 14847:1999	: Rotary positive displacement pumps. Technical requirements
BS EN 734:1995	: Pumps and pump units for liquids. Common safety requirements
BS EN 12162:2001	: Liquid pumps. Safety requirements. Procedure for hydrostatic testing
BS EN 60041:1995	: Field acceptance tests to determine the hydraulic performance of hydraulic turbines, storage pumps and pump-turbines.
BS EN 60994:1993	: Guide for field measurement of vibrations and pulsations in hydraulic machines (turbines, storage pumps and pump-turbines)
BS EN 22858:1993	: End-suction centrifugal pumps (rating 16 bar). Designation, nominal duty point and dimensions
BS EN 23661:1993	: End-suction centrifugal pumps. Baseplate and installation dimensions
BS EN 733:1995	: End-suction centrifugal pumps, rating with 10 bar with bearing bracket. Nominal duty point, main dimensions, designation system
SANS 1123	: Pipe Flanges
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
BS 5316 Part 2	: Pump test codes

M33.1.3 General Requirements

This specification must be read in conjunction with the following specifications:-

E01: Particular Specification for Electric Motors

G01: Particular Specification for Colour Codes

G02: Particular Specification for Corrosion Protection

M33.2 DESIGN PARAMETERS

Centrifugal pumps shall have stable non-overloading characteristics and the shaft speed shall not exceed 1500 rpm and preferable operate at a lower speed to reduce wear.

The pumps shall be designed for continuous operating service and constructed as follows to meet the intended service and shall be warranted for a period of two full years after date of shipment.

Materials of construction shall be selected to handle elutriation overflow and sludge with a pH ranging from 5.5 to 6.5. The sludge generally has a solids content of 3.5% and can contain grit carried over from the grit removal equipment and solids that are of a stringing substance in nature.

M33.3 PUMPS

M33.3.1 Pump Casing

The pump casing shall be tangential discharge of back pull out design allowing for removal of rotating element without disturbing piping connections. The casing shall be a modified

concentric volute design to reduce the radial loads. The radial load shall not exceed 600 lbs at any given point on the pump curve. The casing shall be constructed of CD4MCU Stainless Steel. All casing sections shall have heavy wall thickness to provide long life under abrasive and corrosive operating conditions. All mating surfaces shall have register fits to ensure proper alignment.

M33.3.2 Pump Shaft and shaft Sleeves

The shaft shall be of high strength AISI 1144 Stress proof Alloy Steel. The shaft shall be accurately machined and polished and of sufficient size to transmit full driver output without excessive flexure or stressing.

Shaft shall be protected by a renewable shaft sleeve which extends through the stuffing box and under the gland. The sleeve shall be grooved on the inside for an o-ring to prevent leakage along the shaft and shall be positively locked to prevent rotation. The sleeve O.D. shall be a minimum of 0.375 inches over the shaft diameter and constructed of 420 S.S H.T. min 400 BHN.

M33.3.3 Impeller

The impeller shall be CD4MCu Stainless Steel with the two-port design. Impellers will have back vanes to reduce axial thrust and lower the stuffing box pressure. Internal vane edges shall be well rounded to present smooth flow. Impeller shall have a straight non-tapered bore and shall be dynamically balanced, keyed to the shaft and further secured with a Stainless Steel washer and a Stainless Steel impeller lock screw. The impeller shall be fixed at location with no expected or required adjustment.

M33.3.4 Wear Rings

Replaceable double suction wear rings shall be provided. The rings shall be of the peripheral design requiring no axial adjustment. One ring shall be press fit into the case and the opposite ring shall press onto the impeller eye. The rings shall be constructed of AISI 420 heat treated hardened Stainless Steel. The rings shall be hardened to a minimum of 400-500 Brinnell with a minimum of 50 Brinnell hardness difference between rings to prevent galling.

M33.3.5 Bearings

The bearing frame shall be constructed of fine grain ASTM A48 Class 30 Grey Iron. The bearing frame shall be line bored for exact concentricity and be equipped with antifriction style bearings. The bearings shall be both ball or roller style properly sized to accommodate all thrusts both mechanical and hydraulic imposed upon them. The frame shall be designed for captured bearing positioning and shall not require any field axial adjustment. The bearings shall have a minimum calculated B-10 bearing life rating of 100,000 hours at the stated design condition. A complete bearing life stress and loading calculation shall be provided by the pump manufacturer to illustrate compliance with this requirement. Bearing lubrication shall be either grease or oil with proper provisions, drains, vents or reliefs to facilitate easy re-lubrication in the field.

M33.3.6 Mechanical Seal

The mechanical seal chamber shall be of a "Cycloseal" design, where deflector vanes pass past the back plate thus reducing the pressure on the mechanical seal whilst evacuating all foreign matter away from the seal faces. The design shall allow for continuous operation

without the need for external flush water or venting. Back plate and deflector vanes shall be constructed of CD4MCU Stainless Steel. A single mechanical seal, (John Crane Type 1, Tungsten Carbide VS Silicon Carbide) shall be provided.

M33.3.7 Shaft Coupling

The pump and motor shall be connected by a flexible coupling in such a way as to prevent them from uncoupling regardless of which way the impeller may be rotating.

The coupling shall accommodate small axial, lateral and angular misalignments without imposing undue stresses on the shaft and bearings. The coupling shall be enclosed in a stationery solid-plate guard to the Engineers satisfaction.

M33.4 PUMP PERFORMANCE DATA

Detailed performance curves for the pump type shall be provided at the time of tendering.

The curves shall indicate the following:

- Head (metres) vs. flow (litres/second) - 0% to 120% duty flow
- Power absorbed in kW - 50% to 120% of duty flow
- Pump efficiency – 0% to 120% duty flow
- Net positive suction head curves required by the pumps at the specified flow rate.

The efficiency curve shall be flat over a wide range in order to provide efficient working at various pump operating conditions.

Pumps shall be able to operate without cavitation over a full range as specified without throttling. Pumps are required to operate continuously at an ambient temperature of 40°C.

The following quantities shall be guaranteed by the Contractor:

- Minimum flow rate of the pump at the specified total head.
- Maximum power demand at the specified total head.
- Minimum efficiency at the specified total head.
- Maximum net positive suction head required by the pump at the specified flow rate.

M33.5 VENT COCKS

Vent cocks shall be fitted at all high points to the pump casing. These cocks shall be adequately sized in order to allow the trapped air to be released freely.

An automatic air vent shall be fitted to each pump casing if specified. This device shall be suitable for the remote operation of an indicator to show the open and closed positions of the air vent.

M33.6 BASE PLATE

The base plate of the pump and motor shall be rigid. The pump and motor shall be situated on the upper face of each base plate, which shall be machined flat and smooth to ensure that the pump and motor are bedded properly without the use of spacers.

The pump/motor base plate shall be completely aligned prior to grouting and provision shall be made to grout within the base plate itself to facilitate vibration-free operation.

Base plates which have a mass greater than 200 kg shall have two jacking bolts at right angles with a lock nut at every corner of the unit.

M33.7 DRIVE UNIT

The pump shall be driven by a fixed electric speed motor and a speed reducer. Refer to Particular Specification E01 Volume E01: Electric Motors for a detailed specification for Electric motors.

M33.8 MONITORING DEVICES

Full detail of all monitoring devices offered must be submitted with the Tender.

M33.9 PRESSURE GAUGES

Pressure gauges shall be fitted with an isolating cock, shall be vibration and shock resistant and shall be calibrated to read with an accuracy of $\pm 1\%$ of the indicated pressure. Three 20mm minimum diameter ball valves shall be employed to zero the gauge, to isolate it and to vent to atmosphere. A chemical seal shall be used to insulate the gauge from the media being measured.

The faceplate diameters of the pressure gauges shall be at least 100 mm. The gauges shall indicate the water pressure in kilopascal and shall have a range of a maximum of 50% higher than the normal maximum working pressure. All gauge glass must conform to internationally recognized standards. These standards include DIN 7081, BS 3463 and JIS B 8211.

A calibration certificate is to be provided with each pressure gauge.

M33.10 TEMPERATURE DETECTORS

If required oil lubricated bearings and glands offered shall be fitted with temperature detectors. The temperature detectors shall be PT100 – RTD's

If grease lubricated bearings are offered, the Tenderer will indicate in his Tender if temperature detectors can in fact be used. If temperature detectors are not feasible, an alternative means of monitoring bearings must be offered.

M33.11 NO-FLOW PROTECTION

- (a) Each pump shall be protected against no flow by a clamp on flow meter installed in the discharge line from the pump.

M33.12 INDICATOR ON AUTOMATIC AIR VENT

If an automatic air vent is required for the pump casing, it shall be fitted with an indicator to indicate the open and closed positions of the air vent. The air vent shall be suitable for remote operation and air vent control shall be mounted on the control panel inside the pump station.

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If a gland leakage device is required in order to monitor the gland leakage it shall be supplied and fitted with adjustable alarm contacts designed to close when gland leakage rises to a pre-set value.

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The contractor shall be responsible for the supply of all necessary holding down bolts for the machines supplied by him/her. The holding down bolts shall be manufactured from 316 SS.

All bolts necessary for assembling all equipment shall be supplied by the contractor.

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The pumps as well as the motors will comply with the requirements of BS 4999. The Contractor may be requested by the Engineer to carry out vibration tests. The noise level shall not exceed 85 dBA at 1m.

M33.16 CORROSION PROTECTION

Refer to Particular Specification G02: Corrosion Protection

M33.17 DESIGNATION AND INFORMATION PLATES

Each pump shall be supplied with an information plate secured to the pump casing in a visible position indelibly marked with the following details:-

- Maker's name, pump type and serial number
- Year of manufacture
- Maximum and fitted impellor diameter
- Rated duty of pump in litres per second
- Head in metres at rated duty
- Pump speed in r/min
- Mass of completely assembled pump in kilogram

M33.18 INTERCHANGEABILITY

Where two or more similar pump units are required, these units will be identical in all respects.

All similar parts of items supplied will be interchangeable without any additional machining or fitting.

M33.19 RECOMMENDED SPARE PARTS

The Tenderer must submit details of spare parts recommended to be kept in store by the Employer with his Tender.

The detail will include a full description of the parts, part identification, number required, guaranteed delivery time and total price delivered to Site.

M33.20 OPERATION AND MAINTENANCE MANUAL

The Contractor shall hand over to the Engineer four sets of the Operation and Maintenance Manual compiled for each installation not later than at the time of commissioning of the installation. These manuals are a prerequisite for final take over of the plant.

The Operation and Maintenance Manual will contain the following:

- (a) Brief description of the plant and installation.
- (b) Concise operating instructions.
- (c) Routine maintenance instruction.
- (d) Precautionary measures, elementary trouble location, rectifying measures and emergency actions.
- (e) Detailed information on equipment.
- (f) Lists of spare parts including names and addresses of suppliers.

M33.21 DRAWINGS

The drawings included in the Tender Documents are the Engineer's proposal for the plant layout. Should the Tenderer offer alternative layouts, he shall submit drawings with his Tender in order for it to be evaluated.

Before the Contractor carries out any work, he will submit detailed working drawings to be approved by the Engineer. Approval of these drawings does not relieve the Contractor from his responsibility for the correctness of the drawings.

M33.22 INSTALLATION

The pump and motor shall be aligned to within ± 0.025 mm full indicator movement on dial gauge, regardless of the coupling type. After the pump and motor feet are tightened down, and pipework erected and tightened, both angular and parallel alignment shall be checked and recorded at each quarter revolution. These readings shall be submitted to the Engineer and is a prerequisite for handover.

Upon completion, dowel pins shall be fitted to facilitate relocation at any future time.

M33.23 INSPECTION, TESTING AND COMMISSIONING

M33.23.1 Testing by Manufacturer

The Manufacturer will carry out all tests on materials, quality control tests, dimensional checking and routine tests on parts to ensure that the pumps and materials conform to the requirements of the relevant SANS or BS specifications and to this Specification. The Engineer will not necessarily attend these tests but records must be kept and all test results will be made available to the Engineer.

M33.23.2 Witnessed Testing

In addition to the above, a number of performance tests will also be carried out in the testing facility of the supplier before equipment is transported to Site. These tests can be carried out in the workshop of the manufacturer/supplier if it is suitably equipped or another approved test facility.

The Engineer may witness these tests and the Contractor will notify the Engineer two weeks in advance of the date and place at which the equipment may be inspected and tested. When tests and inspections have met the satisfaction of the Engineer a certificate of workshop acceptance will be issued. These certificates are a prerequisite before payment for "Materials on Site" can be passed. The Engineer's acceptance will in no way relieve the Manufacturer of any of his obligations to design, manufacture and supply pumps strictly in accordance with the Specification.

Performance tests shall include:-

- (a) Hydraulic tests on the pump casing. The test pressure will be equal to 1½ times the maximum working pressure at the delivery end of the pump. The testing will be done with blank flanges bolted onto the flanges. The pressure will be maintained for at least 15 minutes. No sign of sweating, leaking, undue deformation and stressing or defect of any kind will be evident during the test period.
- (b) Tests to prove that the rotating parts are dynamically balanced.
- (c) Performance tests on pump and driving unit.
- (d) NPSH requirements if called for in the Project Specifications.

A performance test shall be carried out in accordance with BS 5316 Part 2 - Class B tests if specified. Unless otherwise stated, the Contractor will be required to conduct the performance test on the combined pump/motor unit.

If a performance test of the pump and its driving unit is not possible at the manufacturer's works, this shall be stated in the Tender with reasons to allow the Engineer opportunity to make alternative proposals.

M33.23.3 Testing by an Independent Facility

The Employer may require that an independent testing facility or institution such as the South African Bureau of Standards carry out performance tests. A separate item for performance testing will be provided in the Schedule of Quantities to allow for this.

M33.23.4 Failure to Pass Performance Test

Should the pump unit fail the performance test, whether performed at the manufacturer's works or at an independent institution, the Engineer shall authorise any amendments to the plant which may be considered necessary to meet the guaranteed quantities within the permissible tolerances laid down in BS 5316 Part 2 - Class B tests and prove with further test that the equipment conform to the Specification.

All costs involved in the re-testing of pump units will be borne by the Contractor.

Should the pump unit fail to pass the test with more than 5% variation on the actual guaranteed figures, the engineer will reject the pump unit and request the Contractor to replace the unit so rejected.

Should the pump unit still fail to pass the test, but the actual figures do not vary by more than 5% from the actual guaranteed figures, the Engineer may :-

- (a) Request the Contractor to carry out amendments to ensure the compliance of the unit with the Specification; or
- (b) Accept the equipment but impose a penalty for non-compliance on the Contractor. A sum will be calculated based on the additional energy used over the life expectancy of the equipment and this will be deducted from the Contract price for each pump set for every kilowatt by which the gross demand exceeds the guaranteed figure with permissible tolerances.

M33.23.5 Commissioning

On completion of the installation the Contractor will check all items for satisfactory functioning. He will then inform the Engineer of his intention to commission the plant. The Engineer may request control measurements on pump alignment at this stage.

A detailed programme of his proposed commissioning procedures will be submitted not later than two weeks prior to the commissioning date.

After a successful running period of 4 hours (to be witnessed by the Engineer) the Contractor will hand over the installation to the Employer as well as the Operation and Maintenance Manuals. The Completion Certificate will only be issued after the units have been in successful operation for 14 consecutive days and the acceptance tests successfully completed.

During the first 14 days of operation, the Contractor will rectify any problems with the units on Site within 24 hours of being telephonically notified. During the remainder of the maintenance period, the Contractor will, within 14 days of being notified, commence rectifying any possible problems that the Employer may encounter with the equipment supplied under this Contract.

Should the Contractor fail to meet the above requirements, the Employer may appoint others to undertake the necessary repair work at the Contractor's cost.

M33.23.6 Tests at the Site of the Works

The Engineer may require that site tests are performed to verify performance figures guaranteed by the Contractor. Flow rate, total head and power input to the pump/motor units shall be determined, as accurate as Site conditions permit, for one or more points on the pump curves close to the specified duty point. The Contractor shall provide suitable instruments with recent calibration certificates.

Should these measured and calculated quantities differ from those guaranteed by more than the tolerances allowed by BS 5316 Part 1 - re-testing of the unit at any testing facility, or the recalibration of the measuring instruments.

Should the subsequent test results still fall outside the allowable tolerances, Clause M18.28.4 shall apply, and call costs shall be borne by the Contractor. In the event of the subsequent test being successful, costs shall be borne by the Employer.

M33.24 COLOUR CODES

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01.

M33.25 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 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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PARTICULAR SPECIFICATION

M34: MECHANICAL SLUICE/CHANNEL GATES, ADJUSTABLE WEIRS, HAND STOPS AND STOP LOGS

1	30/7/2012	General up Date and reissue	J Ritchie	
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Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water

**PARTICULAR SPECIFICATION M34: MECHANICAL SLUICE/CHANNEL GATES, ADJUSTABLE WEIRS,
HAND STOPS AND STOP LOGS
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M34.1 SCOPE

This Specification covers the manufacture, testing and supply of sluice / channel gates, adjustable weirs, hand stops and stop logs for use in waste water and potable water treatment plants at ambient temperatures.

M34.2 INTERPRETATIONS

M34.2.1 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

M34.2.2 Standards

For the purposes of this Specification the latest issues of the following standard specifications will apply:-

SANS 1700	:	Fasteners
SANS 135	:	Isometric Bold Screws and Nuts (Lexagon & square/coarse thread free fit series)
SANS 136	:	Isometric Precision Hexagon Head Bolts and Screws and Hexagon Nuts (coarse thread medium fit series)
SANS 1431	:	Steel
BS 3100	:	Cast Steel
BS 4504	:	Flange Drilling
SIS 05 59 00	:	Pictorial Surface Preparation Standards for Painting Steel Surfaces
ISO 244	:	Pipe Line Flanges for General use - Shapes and Dimensions of Pressure Tight Surfaces
SANS 1123	:	Steel Pipe Flanges

M34.2.3 General Requirements

This specification must be read in conjunction with the following specifications:-

G01: Particular Specification for Colour Codes

G02: Particular Specification for Corrosion Protection

M34.3 GENERAL REQUIREMENTS

Sluice / channel gates, adjustable weirs, hand stops and stop logs shall be so transported, stored and handled as to prevent damage. Equipment damaged in any way shall be removed

from the site repaired or replaced to the satisfaction of the engineer.

The Contractor shall satisfy the Engineer as to the sufficiency of the place of manufacture regarding manufacturing, testing and inspection equipment to ensure that the production of equipment is strictly in accordance with this Specification.

M34.3.1 Pressure Rating

The design pressure for the sluice / channel gates, adjustable weirs, hand stops and stop logs is specified in the Tender Document in the Project Specification, Drawings and Schedule of Quantities.

M34.3.2 Wastewater Liquids and chemicals

Sluice / channel gates, adjustable weirs, hand stops and stop logs which encounter raw wastewater, treated wastewater and sludge shall be manufactured from corrosive resistant material.

M34.3.3 Guarantee

All sluice / channel gates, adjustable weirs, hand stops and stop logs shall be guaranteed against faulty design, materials and workmanship until the end of the maintenance period on the Main Contract. During this period the Contractor shall be required to attend to and rectify any defects, which occur due to faulty design, materials or workmanship at his own cost.

M34.3.4 Operating and Maintenance Manuals

A copy of the Operating and Maintenance Manual for each equipment type shall be bound in with the Operating and Maintenance Manual for the project. The manual shall be A4 size and properly bound. Drawings larger than A3 size shall be contained in separate plastic pockets.

M34.3.5 Contents

A copy of the signed factory test certificate shall be bound in with the manual, while the original shall be handed to the Engineer.

Operating instructions

Maintenance instructions

Lubrication instructions

Spare parts list

Drawings

Brochures

M34.3.6 Jointing Material

Jointing material shall comply with SANS 1700. sluice / channel gates, adjustable weirs, hand stops and stop logs shall be supplied complete with bolts, nuts, washers (2 per bolt) and gaskets for joining up to adjacent mating flanges and or concrete mounting.

Bolts shall be of stainless steel and shall be long enough to allow at least two screw threads to protrude from the nut when the assembly is fully tightened. A washer must be provided both under the bolt head and the nut.

M34.3.7 Contact between Dissimilar Metals

When flanges of dissimilar metals are bolted together, the internal epoxy coating shall cover the contact area of the flange without any break.

Suitable insulation material shall be used between the contact faces of dissimilar metals of

which the potential difference exceeds 0,3 V. Where corrodible metal is welded to a corrosion resistant metal, the protection coating specified shall overlap onto the latter by at least 5 mm.

M34.4 MATERIALS

The thickness of materials shall be suitable for the duty required.

M34.5 DESIGN

All parts shall be designed for the duty required, but the minimum factor of safety against structural failure shall not be less than 3, based on the working stress of the material. In the design, due consideration shall be given to the thickness of materials with regard to corrosion and operating conditions. The force required at a hand wheel or crank to raise a gate or open a valve shall be in the order of 100 Newton, and the design parameters must be submitted in the Technical Schedule.

M34.6 SLUICE AND CHANNEL GATES

The sliding frames, floor seats and gates of wall mounted as well as channel type gates with head frame shall be made of grade 304L stainless steel or as specified. All gates shall be well guided with no possibility of jamming. The gates shall be held uniformly against the side facings of the frames by the action of adjustable wedges and shall provide drop-tight closure under the operating conditions. Sluice gates shall be of the standard or flush invert type fitted with renewable seals of a non-biodegradable material on the invert.

Channel gates shall be dimensioned such that their installation in the channels and openings shown on the drawings is facilitated. The channel gates shall be standard items and shall be installed so that head frames shall be flush with vertical channel walls and do not project horizontally into the channel. Vertical sliding frames and floor seat to be cast into concrete so as to leave an unobstructed waterway to dimensions indicated in the schedule. Pre-formed recess details for casting in of frames to be submitted by the supplier. Head frame bridge for a channel gate to allow indicated water level to pass under the gate when in UP-position.

All nuts, bolts, washers and other components shall be manufactured from same grade stainless steel specified for gate.

Gates shall be robustly designed and constructed, having vertical and horizontal ribs to withstand pressures from both directions. The matching head frame for channel gates shall be adequately designed to resist distortion, and both the gate and the frame shall have machined seating faces to ensure perfect sealing. The head frame shall extend above the concrete channel, to support the gate in the fully open position.

Seating pressure as well as unseating pressure may act on any channel or circular sluice gate and the sluice gate shall be able to resist these pressures.

Holding down bolts of penstocks fixed against concrete walls shall be made of Grade 304 Stainless Steel.

Channel gates shall be provided with rising spindles as well as approved transparent position indicators as requested.

M34.7 ADJUSTABLE OVERFLOW TILTING WEIRS

The adjustable overflow tilting weirs shall comply with the following requirements:

- (i) 304L stainless steel manufacture or as specified.
- (ii) Stainless steel indicators showing the degree of adjustment of the weirs in mm enclosed in an approved transparent tube.
- (iii) Be horizontal after installation with a maximum allowable variation from the horizontal not exceeding 1 mm.
- (iv) Be equipped with rounded side plates and be watertight underneath and at the sides of the frame.
- (v) Holding-down bolts, washers, etc. shall be of same grade stainless steel as specified for weir.

M34.8 HAND STOPS

- (i) The following requirements shall be applicable to hand stops:
- (ii) Supplied with an aluminum frame extending to the top of the concrete or masonry. The frame shall be grouted into a recess in the concrete or masonry. Details of such recess to be submitted by supplier. Hand stop shall be capable of sliding in and out of the frame.
- (iii) Hand stop shall seal 100% watertight under all circumstances. This may be achieved with the use of neoprene sealing material.
- (iv) Hand stops and frames shall be manufactured from 6 mm aluminum plate and shall be robust and provided with reinforcing elements designed by the supplier to the approval of the Engineer. The reinforcing elements shall effectively prevent buckling under full static head conditions.

M34.9 OPERATING GEAR

- M34.9.1 Spindles to be extended as required and secured to structure to Engineer's approval.
- M34.9.1.1 Arrows shall be cast on all hand wheels together with the wording "OPEN" or "CLOSE". The closing direction shall be clockwise unless otherwise specified.
- M34.9.1.2 Gates shall be fitted with position indicators. Fully closed, fully open and intermediate positions shall be indicated in corrosive proof and robust design indicators.
- M34.9.2 Channel gate - Head frame bridge across with hand wheel or actuator on rising spindle.
- M34.9.3 Gates and Tilting Weirs
- Hand wheels or actuators installed in the following manner.
- Platform-mounted hand wheel pedestal (PMP)
- Hand wheel pedestal on wall support bracket (HPWB)
- Stub hand wheel pedestal on wall support bracket (SHWB)
- Tee-key on support bracket (TKSB)
- Grid-mounted hand wheel pedestal (GMP)

M34.10 STOPLOGS

A stop log set shall comply with the following requirements:

- (i) Stop log sets shall be supplied with stainless steel frames extending to the top of the concrete or masonry. The frames shall be grouted into the recess in the concrete or masonry in such a way that the stop logs are capable of sliding in and out of the frame. The stop logs sets shall be watertight under all normal operational circumstances.
- (ii) Stop logs and frames shall be manufactured from stainless steel plate. Each stop log shall be provided with reinforcing elements designed by the supplier to the approval of the Engineer. The reinforcing shall effectively prevent buckling under full differential static head conditions.
- (iii) The maximum vertical dimension of any individual stop log shall not exceed 150 mm.
- (iv) Each individual stop log in any one set shall have the same vertical and horizontal dimensions.
- (v) Each individual stop log shall be provided with two lifting lugs.
- (vi) A neat stainless steel stand or pair of stainless steel hooks shall be installed in close proximity to each installed set of stop logs for the storing of stop logs when removed from the frame.
- (vii) Each set of stop logs shall be provided with two portable stainless steel lifting hooks, each fastened with a 200 kg capacity stainless steel anti-loss chain or UV-stabilized 200 kg capacity nylon rope to a suitable bracket on the hand railing or walkway structure. The chain or rope shall be long enough to facilitate easy operation of the lifting hooks. The lifting hooks shall be used to manipulate individual stop logs in to lifting lugs
- (viii) Enough individual stop logs shall be supplied in each set to effectively span a minimum distance

M34.11 RECOMMENDED SPARE PARTS

The Tenderer must submit details of spare parts recommended to be kept in store by the Employer with his Tender.

The detail will include a full description of the parts, part identification, number required, guaranteed delivery time and total price delivered to Site.

M34.12 OPERATION AND MAINTENANCE MANUAL

The Contractor shall hand over to the Engineer four sets of the Operation and Maintenance Manual compiled for each installation not later than at the time of commissioning of the installation. These manuals are a prerequisite for final takeover of the plant.

The Operation and Maintenance Manual will contain the following:

- (a) Brief description of the plant and installation.
- (b) Concise operating instructions.
- (c) Routine maintenance instruction.
- (d) Precautionary measures, elementary trouble location, rectifying measures and emergency actions.
- (e) Detailed information on equipment.
- (f) Lists of spare parts including names and addresses of suppliers.

M34.13 DRAWINGS

The drawings included in the Tender Documents are the Engineer's proposal for the plant layout. Should the Tenderer offer alternative layouts, he shall submit drawings with his Tender in order for it to be evaluated.

Before the Contractor carries out any work, he will submit detailed working drawings to be approved by the Engineer. Approval of these drawings does not relieve the Contractor from his responsibility for the correctness of the drawings.

M34.14 INSTALLATION

The equipment shall be installed, aligned and grouted in to position without distortion of the frame and or gate/weir which may cause damage to the sealing arrangement of the equipment.

M34.15 INSPECTION, TESTING AND COMMISSIONING

M34.15.1 Testing by Manufacturer

The Manufacturer will carry out all tests on materials, quality control tests, dimensional checking and routine tests on parts to ensure that the pumps and materials conform to the requirements of the relevant SANS or BS specifications and to this Specification. The Engineer will not necessarily attend these tests but records must be kept and all test results will be made available to the Engineer.

M34.15.2 Witnessed Testing

In addition to the above, a number of performance tests will also be carried out in the testing facility of the supplier before equipment is transported to Site. These tests can be carried out in the workshop of the manufacturer/supplier if it is suitably equipped or another approved test facility.

The Engineer may witness these tests and the Contractor will notify the Engineer two weeks in advance of the date and place at which the equipment may be inspected and tested. When tests and inspections have met the satisfaction of the Engineer a certificate of workshop acceptance will be issued. These certificates are a prerequisite before payment for "Materials on Site" can be passed. The Engineer's acceptance will in no way relieve the Manufacturer of any of his obligations to design, manufacture and supply pumps strictly in accordance with the Specification.

M34.15.3 Testing by an Independent Facility

The Employer may require that an independent testing facility or institution such as the South African Bureau of Standards carry out performance tests. A separate item for performance testing will be provided in the Schedule of Quantities to allow for this.

M34.15.4 Failure to Pass Performance Test

Should the equipment fail any test, whether performed at the manufacturer's works or at an independent institution, the Engineer shall authorise any amendments to the equipment which may be considered necessary to meet the specifications and prove with further test that the equipment conform to the specification.

All costs involved in the re-testing of equipment will be borne by the Contractor.

M34.15.5 Commissioning

On completion of the installation the Contractor will check all items for satisfactory functioning. He will then inform the Engineer of his intention to commission the plant.

A detailed programme of his proposed commissioning procedures will be submitted not later than two weeks prior to the commissioning date.

The Completion Certificate will only be issued after the equipment has been in successful operation for 14 consecutive days.

During the first 14 days of operation, the Contractor will rectify any problems with the equipment on Site within 24 hours of being telephonically notified. During the remainder of the maintenance period, the Contractor will, within 14 days of being notified, commence rectifying any possible problems that the Employer may encounter with the equipment supplied under this Contract.

Should the Contractor fail to meet the above requirements, the Employer may appoint others to undertake the necessary repair work at the Contractor's cost.

M34.16 COLOUR CODES

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01.

M34.17 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 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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PARTICULAR SPECIFICATION

M39: DISCFLO PUMPS

1	2012-07-30	Issued	J Ritchie	
0	2012-4-30	Issued for comments	Y Pillay	
Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water

PARTICULAR SPECIFICATION M39: MECHANICAL DISCFLO PUMPING EQUIPMENT

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M39.1 SCOPE

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of mechanical centrifugal discflo pumps and related equipment installed at wastewater treatment works. The Specification shall be read in conjunction with that of the Project Specification.

M39.2 INTERPRETATIONS

M39.2.1 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

M39.2.2. Standards

All design standards for the Archimedian screw pumps 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 1044-3	: 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
BS EN ISO 14847:1999	: Rotary positive displacement pumps. Technical requirements
BS EN 734:1995	: Pumps and pump units for liquids. Common safety requirements
BS EN 12162:2001	: Liquid pumps. Safety requirements. Procedure for hydrostatic testing
BS EN 60041:1995	: Field acceptance tests to determine the hydraulic performance of hydraulic turbines, storage pumps and pump-turbines.
BS EN 60994:1993	: Guide for field measurement of vibrations and pulsations in hydraulic machines (turbines, storage pumps and pump-turbines)
BS EN 22858:1993	: End-suction centrifugal pumps (rating 16 bar). Designation, nominal duty point and dimensions
BS EN 23661:1993	: End-suction centrifugal pumps. Baseplate and installation dimensions
BS EN 733:1995	: End-suction centrifugal pumps, rating with 10 bar with bearing bracket. Nominal duty point, main dimensions, designation system
SANS 1123	: Pipe Flanges
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
BS 5316 Part 2	: Pump test codes

M39.2.3 General Requirements

This specification must be read in conjunction with the following specifications:-

E01: Particular Specification for Electric Motors

G02: Particular Specification for Corrosion Protection

The pump shall be specifically designed to pump high concentrations of waste solids. The pump assembly shall be mounted horizontally outside the tank with a standard inlet flange, cleanout, suction and delivery, pressure taps, drain connection and mounting base plate.

A combination of vacuum/pressure gauge shall be installed on the suction side of the pump along with a discharge pressure gauge on the discharge side of the pump in order to monitor the system performance from initial start-up and system operation shall be installed.

The design of the pumping equipment shall include for standby capacity. Duty rotation shall be based on the operational hours of each pump. The pipe work shall be arranged such that any one pump can be operated.

A suitably designed enclosure for the pump installation shall be provided for. The enclosure shall protect the installation from the natural elements the details of which is given on the drawings.

The pump shall carry the manufacturer's identification details together with the rated shaft speeds, output power and maximum ambient operating temperature.

M39.3 DISCFLO TYPE PUMPS

Discflo type pumps shall be used for mixing the sludge within the digesters. The pumps shall be of the centrifugal type that incorporates non-impingement pumping action, with minimal contact between pump and fluid (non-contact pumping mechanism) i.e. principle of a boundary layer and viscous drag. The pump casing shall be of a semi-concentric back pull-out type design.

Refer to Particular Specification M18: Centrifugal Pumps and Particular Specification E01: Electrical Motors design requirements.

M39.3.1 Disc

The spacing, size and number of disc's in the discpac must be configured according to the fluid conditions, head and flow rate requirements.

The Disc's shall be manufactured from cast alloy steel and shall be dynamically balanced.

M39.3.4 Pump Shaft

The pump shafts shall be of sufficient dimension in order to avoid excessive torsional or bending stresses and deflection.

The pump shaft shall be designed so that the critical speed of the rotating assembly is well above the maximum pump operating speed.

The disc shall be secured to the shaft in such a way that it can be readily removed without any damage to the disc and the shaft.

The shafts shall be protected by replaceable sleeves manufactured from non-corrosive material. The shaft shall be manufactured from stainless steel.

M39.3.5 Shaft Coupling

The pump and motor shall be connected by a flexible coupling in such a way as to prevent them from uncoupling regardless of which way the impeller may be rotating.

The coupling shall accommodate small axial, lateral and angular misalignments without imposing undue stresses on the shaft and bearings. The coupling shall be enclosed in a stationery solid-plate guard to the Engineers satisfaction.

M39.4 BEARINGS

All bearings shall be suitable for shaft rotation in both directions. All bearings shall be designed for a life of at least 100 000 hours at an (L10) rating. Bearings for the output shaft shall be designed to withstand bending, up thrust, down pull, thermal expansion and radial loads imposed by the impeller.

The rotating assembly shall be positively located in the axial direction and thrust bearings will therefore be required.

For ease of lubrication all bearing grease pipes must be piped to grease nipples on the outer

cover of the pump support frame.

M39.4.1 Bearing Housing

The bearing housing shall be manufactured from cast iron and shall be oil bath lubricated. Oil level sight glasses shall be provided with level markers for running and filling minimum and maximum positions respectively. These shall be arranged for easy viewing and shall take into account the angle of mounting.

The bearing housing and motor stool design shall provide accurate, self-aligning mounting for the flanged electric motor.

M39.4.2 Lubrication

In the case where oil lubrication is required, adequate provision shall be made for the cooling of the oil. The bearings shall be required to operate at temperatures no higher than 60°C.

Oil reservoirs of sufficient capacity shall be fitted with easily accessible oil level indicators, which are to be clearly marked in order to indicate the oil standing and running levels.

M39.5 **GLANDS AND SEALS**

Low pressure glands of the stuffing box pattern shall allow repacking without having to dismantle the pump.

If mechanical seals are offered they shall be manufactured from 316 SS to prevent the pump from leaking and shall be cartridge-type seals with O-rings and silicon carbide or tungsten carbide faces.

The cartridge seal shall be pre-assembled and pre-tested, requiring no adjustments and settings from the installer. Any springs required to push the seal faces together shall be shielded from the fluid that is to be pumped. The cartridge shall include a heat treated sleeve and an iron seal gland.

Full details of the seals and glands indicating the materials, finishes, clearances etc. shall be submitted with the Tender.

A spare mechanical seal for each size and type shall be supplied.

M39.6 **VENT COCKS**

Vent cocks shall be fitted at all high points to the pump casing. These cocks shall be adequately sized in order to allow the trapped air to be released freely.

An automatic air vent shall be fitted to each pump casing if specified. This device shall be suitable for the remote operation of an indicator to show the open and closed positions of the air vent.

A suitable safety vent and flame arrestor shall be installed to prevent methane from causing any problems to the operators or with surrounding equipment if within in a digester application.

M39.7 BASE PLATE

The base plate of the pump and motor shall be rigid. The pump and motor shall be situated on the upper face of each base plate, which shall be machined flat and smooth to ensure that the pump and motor are bedded properly without the use of spacers.

The pump/motor base plate shall be completely aligned prior to grouting and provision shall be made to grout within the base plate itself to facilitate vibration-free operation.

Base plates which have a mass greater than 200 kg shall have two jacking bolts at right angles with a lock nut at every corner of the unit.

M39.8 DRIVE UNIT

The pump shall be driven by a fixed electric speed motor and a speed reducer. Refer to Particular Specification E01 Volume E01: Electric Motors for a detailed specification for Electric motors.

M39.8.1 Motor Coupling

The coupling shall be fully rated to transmit the motor full load power and tested to prove the above features together with static and dynamic balance. The motor shall be coupled to the gearbox input shaft with either a V-belt or a flexible coupling. V-belts and couplings are to be provided with protective cover guards.

M39.9 MONITORING DEVICES

Full detail of all monitoring devices offered must be submitted with the Tender.

M39.10 PRESSURE GAUGES

Pressure gauges shall be fitted with an isolating cock, shall be vibration and shock resistant and shall be calibrated to read with an accuracy of $\pm 1\%$ of the indicated pressure. Three 20mm minimum diameter ball valves shall be employed to zero the gauge, to isolate it and to vent to atmosphere. A chemical seal shall be used to insulate the gauge from the media being measured.

The faceplate diameters of the pressure gauges shall be at least 100 mm. The gauges shall indicate the water pressure in kilopascal and shall have a range of a maximum of 50% higher than the normal maximum working pressure. All gauge glass must conform to internationally recognized standards. These standards include DIN 7081, BS 3463 and JIS B 8211.

A calibration certificate is to be provided with each pressure gauge.

M39.11 TEMPERATURE DETECTORS

If required oil lubricated bearings and glands offered shall be fitted with temperature detectors. The temperature detectors shall be PT100 – RTD's

If grease lubricated bearings are offered, the Tenderer will indicate in his Tender if temperature detectors can in fact be used. If temperature detectors are not feasible, an alternative means of monitoring bearings must be offered.

M39.12 NO-FLOW PROTECTION

(a) Each pump shall be protected against no flow by a flow meter installed in the discharge

line from the pump.

M39.13 INDICATOR ON AUTOMATIC AIR VENT

If an automatic air vent is required for the pump casing, it shall be fitted with an indicator to indicate the open and closed positions of the air vent. The air vent shall be suitable for remote operation and air vent control shall be mounted on the control panel inside the pump station.

M39.14 GLAND LEAKAGE

If a gland leakage device is required in order to monitor the gland leakage it shall be supplied and fitted with adjustable alarm contacts designed to close when gland leakage rises to a pre-set value.

M39.15 PIPEWORK

All suction and delivery pipes shall be connected to the pump casing by means of flexible connections. All flexible connections shall be installed as close to the pump's casings as possible, and in any event, shall be between the suction valve and the pump casing and delivery non-return valve and the pump casing. In all cases the flexible connection shall be in the section of piping of smallest diameter.

Double Victaulic joint are generally preferred for flexible connections, but approved re-enforced rubber bellow units are acceptable for low-pressure services.

All valves and pipework external to the pump casing and separated there from by means of flexible connections shall be securely anchored to prevent movement.

Refer to Particular Specification M21: Volume M21 Pressure Pipework for a detailed specification on pipework.

M39.16 HOLDING DOWN BOLTS

The contractor shall be responsible for the supply of all necessary holding down bolts for the machines supplied by him/her. The holding down bolts shall be manufactured from 316 SS.

All bolts necessary for assembling all equipment shall be supplied by the contractor.

M39.17 VIBRATION AND NOISE

The pumps as well as the motors will comply with the requirements of BS 4999. The Contractor may be requested by the Engineer to carry out vibration tests. The noise level shall not exceed 85 dBA at 1m.

M39.18 CORROSION PROTECTION

Refer to Particular Specification G02: Corrosion Protection

M39.19 DESIGNATION AND INFORMATION PLATES

Each pump shall be supplied with an information plate secured to the pump casing in a visible position indelibly marked with the following details:-

- Maker's name, pump type and serial number
- Year of manufacture
- Rated duty of pump in litres per second

- Head in metres at rated duty
- Pump speed in r/min
- Mass of completely assembled pump in kilogram

M39.20 INTERCHANGEABILITY

Where two or more similar pump units are required, these units will be identical in all respects.

All similar parts of items supplied will be interchangeable without any additional machining or fitting.

M39.21 RECOMMENDED SPARE PARTS

The Tenderer must submit details of spare parts recommended to be kept in store by the Employer with his Tender.

The detail will include a full description of the parts, part identification, number required, guaranteed delivery time and total price delivered to Site.

M39.22 OPERATION AND MAINTENANCE MANUAL

The Contractor shall hand over to the Engineer four sets of the Operation and Maintenance Manual compiled for each installation not later than at the time of commissioning of the installation. These manuals are a prerequisite for final take over of the plant.

The Operation and Maintenance Manual will contain the following:

- (a) Brief description of the plant and installation.
- (b) Concise operating instructions.
- (c) Routine maintenance instruction.
- (d) Precautionary measures, elementary trouble location, rectifying measures and emergency actions.
- (e) Detailed information on equipment.
- (f) Lists of spare parts including names and addresses of suppliers.

M39.23 DRAWINGS

The drawings included in the Tender Documents are the Engineer's proposal for the plant layout. Should the Tenderer offer alternative layouts, he shall submit drawings with his Tender in order for it to be evaluated.

Before the Contractor carries out any work, he will submit detailed working drawings to be approved by the Engineer. Approval of these drawings does not relieve the Contractor from his responsibility for the correctness of the drawings.

M39.24 INSTALLATION

The pump and motor shall be aligned to within ± 0.025 mm full indicator movement on dial gauge, regardless of the coupling type. After the pump and motor feet are tightened down, and pipework erected and tightened, both angular and parallel alignment shall be checked and recorded at each quarter revolution. These readings shall be submitted to the Engineer and is a prerequisite for handover.

Upon completion, dowel pins shall be fitted to facilitate relocation at any future time.

M39.25 INSPECTION, TESTING AND COMMISSIONING

M39.25.1 Testing by Manufacturer

The Manufacturer will carry out all tests on materials, quality control tests, dimensional checking and routine tests on parts to ensure that the pumps and materials conform to the requirements of the relevant SANS or BS specifications and to this Specification. The Engineer will not necessarily attend these tests but records must be kept and all test results will be made available to the Engineer.

M39.25.2 Witnessed Testing

In addition to the above, a number of performance tests will also be carried out in the testing facility of the supplier before equipment is transported to Site. These tests can be carried out in the workshop of the manufacturer/supplier if it is suitably equipped or another approved test facility.

The Engineer may witness these tests and the Contractor will notify the Engineer two weeks in advance of the date and place at which the equipment may be inspected and tested. When tests and inspections have met the satisfaction of the Engineer a certificate of workshop acceptance will be issued. These certificates are a prerequisite before payment for "Materials on Site" can be passed. The Engineer's acceptance will in no way relieve the Manufacturer of any of his obligations to design, manufacture and supply pumps strictly in accordance with the Specification.

Performance tests shall include:-

- (a) Hydraulic tests on the pump casing. The test pressure will be equal to 1½ times the maximum working pressure at the delivery end of the pump. The testing will be done with blank flanges bolted onto the flanges. The pressure will be maintained for at least 15 minutes. No sign of sweating, leaking, undue deformation and stressing or defect of any kind will be evident during the test period.
- (b) Tests to prove that the rotating parts are dynamically balanced.
- (c) Performance tests on pump and driving unit.
- (d) NPSH requirements if called for in the Project Specifications.

A performance test shall be carried out in accordance with BS 5316 Part 2 - Class B tests if specified. Unless otherwise stated, the Contractor will be required to conduct the performance test on the combined pump/motor unit.

If a performance test of the pump and its driving unit is not possible at the manufacturer's works, this shall be stated in the Tender with reasons to allow the Engineer opportunity to make alternative proposals.

M39.25.3 Testing by an Independent Facility

The Employer may require that an independent testing facility or institution such as the South African Bureau of Standards carry out performance tests. A separate item for performance testing will be provided in the Schedule of Quantities to allow for this.

M39.25.4 Failure to Pass Performance Test

Should the pump unit fail the performance test, whether performed at the manufacturer's works or at an independent institution, the Engineer shall authorise any amendments to the plant

which may be considered necessary to meet the guaranteed quantities within the permissible tolerances laid down in BS 5316 Part 2 - Class B tests and prove with further test that the equipment conform to the Specification.

All costs involved in the re-testing of pump units will be borne by the Contractor.

Should the pump unit fail to pass the test with more than 5% variation on the actual guaranteed figures, the engineer will reject the pump unit and request the Contractor to replace the unit so rejected.

Should the pump unit still fail to pass the test, but the actual figures do not vary by more than 5% from the actual guaranteed figures, the Engineer may :-

- (a) Request the Contractor to carry out amendments to ensure the compliance of the unit with the Specification; or
- (b) Accept the equipment but impose a penalty for non-compliance on the Contractor. A sum will be calculated based on the additional energy used over the life expectancy of the equipment and this will be deducted from the Contract price for each pump set for every kilowatt by which the gross demand exceeds the guaranteed figure with permissible tolerances.

M39.25.5 Commissioning

On completion of the installation the Contractor will check all items for satisfactory functioning. He will then inform the Engineer of his intention to commission the plant. The Engineer may request control measurements on pump alignment at this stage.

A detailed programme of his proposed commissioning procedures will be submitted not later than two weeks prior to the commissioning date.

After a successful running period of 4 hours (to be witnessed by the Engineer) the Contractor will hand over the installation to the Employer as well as the Operation and Maintenance Manuals. The Completion Certificate will only be issued after the units have been in successful operation for 14 consecutive days and the acceptance tests successfully completed.

During the first 14 days of operation, the Contractor will rectify any problems with the units on Site within 24 hours of being telephonically notified. During the remainder of the maintenance period, the Contractor will, within 14 days of being notified, commence rectifying any possible problems that the Employer may encounter with the equipment supplied under this Contract.

Should the Contractor fail to meet the above requirements, the Employer may appoint others to undertake the necessary repair work at the Contractor's cost.

M39.25.6 Tests at the Site of the Works

The Engineer may require that site tests are performed to verify performance figures guaranteed by the Contractor. Flow rate, total head and power input to the pump/motor units shall be determined, as accurate as Site conditions permit, for one or more points on the pump curves close to the specified duty point. The Contractor shall provide suitable instruments with recent calibration certificates.

Should these measured and calculated quantities differ from those guaranteed by more than the tolerances allowed by BS 5316 Part 1 - re-testing of the unit at any testing facility, or the recalibration of the measuring instruments.

Should the subsequent test results still fall outside the allowable tolerances, Clause M18.28.4 shall apply, and call costs shall be borne by the Contractor. In the event of the subsequent test being successful, costs shall be borne by the Employer.

M39.26 COLOUR CODES

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification G01.

M39.27

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 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.

Item	Colour Name	Code to SANS 1091
<u>Pipes / Valves</u>		
Inlet pipework	Cornflower Blue	F29
Valves on inlet pipework	Cornflower Blue	F29
Outlet pipework	Canary Yellow	C61
Valves on outlet pipework	Canary Yellow	C61
Bypass pipework	Brilliant Green	H10
Valves on bypass pipework	Brilliant Green	H10
Meters on bypass pipework	Brilliant Green	H10
Scours / Overflow	White	N/A
<u>Electrical</u>		
Electric Panels External	Light Orange	B26
Electric Panels Internal	White	N/A
Motors and Pumps	Deep Pastel Green	H28
Motor Cows	Light Orange	B26
Coupling / Motor Guards	Golden Yellow	B49
Cranes	Golden Yellow	B49
Gearboxes	Navy Light Grey	G29

Colour Samples

580B-5 Cornflower Blue
Behr



Brilliant Green H10



Canary Yellow C61



Light Orange B26



Golden Yellow B49



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GEARBOXES, PUMPS AND VALVES**



SPECIAL CONDITIONS

SPECIAL CONDITIONS

GENERAL

NB: The attention of the tenderer is drawn to the fact that General Conditions of Contract (JW13) shall apply, where applicable, to this contract.

1. DEFINITIONS:

- 1.1 That "Johannesburg Water (SOC) Ltd" shall herein after be referred to as "JW".
- 1.2 The "Managing Director" shall mean the Managing Director: Johannesburg Water (SOC) Ltd or his authorised representative.
- 1.3 "Vat" shall mean Value Added Tax in terms of the Value Added Tax Act 89 of 1991 as amended.
- 1.4 "Regional Maintenance Manager" shall mean the JW Maintenance Manager of one of the JW sites or his authorised representative.
- 1.5 "Service provider or Service Provider" shall mean the recommended tenderer who has been awarded the tender and has entered into a formal contract with JW upon acceptance of the appointment

2. PRICE:

- 2.1 All prices shall exclude Value Added Tax (VAT) at the standard rate as gazetted from time to time by the Minister of Finance in terms of the Value Added Tax Act 89 of 1991 as amended.
- 2.2 The pricing schedule (JW4) must be completed in full and all alterations must be authenticated with a signature.

Failure to comply with this requirement will render the tender liable for rejection on grounds of being incomplete.
- 2.3 With their rate offered, the service provider will be required to include the cost of all consumables required during the repairs.
- 2.4 The "strip and quote" rate will be quoted as per equipment and the rate must include labour and consumables (i.e. stripping, measurement, quoting, cleaning, and producing and submitting assessment report).
- 2.5 The "repair, assemble and test" rate will be quoted as per equipment and the rate must include labour and consumables (i.e. repairing, sandblasting, painting, fitting, conducting tests, and formulating and submitting tests reports).
- 2.6 Site work rate will be quoted as per equipment and the rate must include labour and consumables (i.e. installation, testing and commissioning).



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| 3. CONTRACT PRICE ADJUSTMENT: | 3.1 | A firm price tender is required for rates provided on Year 1, Year 2 and Year 3 for the duration of the contract. |
| 4. SURETY BOND: | 4.1 | No surety bond shall be required in terms of this contract. |
| 5. COMPLIANCE WITH LEGISLATION: | 5.1 | The Service provider shall comply with all Municipal By-laws, and any other Laws, Regulations or Ordinances and shall give all notices and pay all fees required by the provisions of such By-laws and Regulation specified therein. |
| | 5.2 | The Service provider shall comply with all the requirements prescribed in the technical specification, unless otherwise stated. |
| 6. SAFETY: | 6.1 | Without derogation from the generality of Clause 5.1, or from any other provision of this contract, the Service provider shall comply in all respects with the safety and other requirements of the Occupational Health Safety Act 85 of 1993 and the regulations applicable. |
| | 6.2 | The service provider shall also comply with all Occupational Health and Safety requirements as prescribed at JW sites and premises; whether conducting work on site or merely collecting equipment. |
| | 6.3 | The tenderer(s) will be required to compile and submit a Health and Safety File for approval by the JW OHS Department prior to commencement of the contract. |
| 7. INSURANCE AND INDEMNIFICATION: | 7.1 | In addition to any insurance required to be held by the Service provider in terms of the Occupational Injuries and Diseases Act No.130 of 1993, the Service provider must be fully insured against all accidents, loss or damage arising out of the conditions or operation of the vehicles or execution of any work including all Third Party risks. |
| | 7.2 | The Service provider hereby indemnifies and agrees to keep indemnified throughout the period of the contract JW against all claims by third parties or the Service provider's own employees resulting from the operations carried out by the Service provider under this contract up until the date of acceptance. |
| | 7.3 | A current certificate of good standing in terms of the Compensation for Occupational Injuries and Diseases Act, 1993 must be furnished by the Service provider within 21 days of notification of acceptance of the tender. Proof of renewal or extension of insurance cover must be furnished by the Service provider whenever required by JW. |
| | 7.4 | The Service provider shall be liable for any damages or injury of whatever nature caused directly or indirectly as a result of his operations, to any of JW's or Municipal Government or Private Property or to his own vehicles and personnel. |



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**8. REMEDIES, BREACH,
WHOLE AGREEMENT,
WAIVER VARIATION
AND INDULGENCES:**

7.6 The service provider shall be liable against any damage or theft of JW assets in his possession and or in transit and must be insured and indemnify should such instances happen.

8.1 If the supplier or any person employed or associated with him or in the case of a Company, a Director or shareholder or person similarly associated with such Company, either directly or indirectly gives or offers to give any gratuity, reward or commission or other bribe to person in the employ of JW this contract shall be avoidable at the instance of JW.

8.2 If the Service provider has not complied with the Managing Director's requirements or if he is in breach of any of the Conditions of this contract and:

8.2.1 Fails to remedy such breach within 14 (fourteen) days of receipt of written notice requiring it to do so (or if not reasonably possible to remedy the breach within 14 (fourteen) days), within such further period as may be reasonable in the circumstances, provided that the Service provider furnishes evidence within the period of 14 (fourteen) days reasonably satisfactory to JW, that it has taken whatever steps are available to it to commence remedying the breach), then the JW shall be entitled, without notice and in addition to any other remedy available to it at law or under this agreement, including obtaining an interdict, to cancel this agreement or to claim specific performance of any obligation whether or not the due date for performance has arrived, in either event without prejudice to JW's right to claim damages.

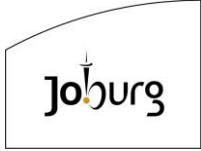
8.2.2 Should JW elect to cancel the contract then and in such instance a certificate presented by the Managing Director of JW shall constitute proof of the service provider's indebtedness to JW.

8.3 This agreement constitutes the entire agreement between the parties relating to the matter hereof.

8.4 No amendment or consensual cancellation of this agreement or any provision or term hereof or of any agreement, bill of exchange or other document issued or executed pursuant to or in terms of this agreement and no settlement of any dispute arising under this agreement and no extension of the time, waiver or relaxation or suspension of any of the provisions or terms of this agreement or of any agreement, bill of exchange or other document issued pursuant to or in terms of this agreement shall be binding unless recorded in a written document signed by the parties. Any such extension, waiver or relaxation or suspension, which is so given or made, shall be strictly construed as relating to the matter in respect whereof it was made or given.

9.DISPUTES:

9.1 In the event of any dispute arising between JW and the Service provider in connection with or arising out of the contract, it shall be



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referred to the Managing Director of JW who shall state his decision in writing and give notice of the same to the Service provider within 28 days of the dispute having been submitted to the Managing Director of JW. Such decision shall be binding upon the Service provider subject to clause 9.2.

- 9.2 Should the Service provider be dissatisfied with the decision of the Managing Director he/she may, within 28 days after receiving notice of such decision, require that the issue or issues be referred to a single arbitrator to be agreed upon between the parties or, failing agreement, to be nominated by the Chairman of the Association of Arbitrators and any such reference shall be deemed to be submission to the arbitration of a single arbitrator in terms of the Arbitration Act, 1965. The award of the arbitrator shall be final and binding on both parties.
- 9.3 Not later than one week after receipt of notice calling for arbitration, JW may give notice to the Service provider that the dispute or disputes be settled by Court of Law having jurisdiction.

**10. SCOPE OF
CONTRACT:**

- 10.1 The tenderer will be required to strip, quote and repair pumps, valves and/or gearboxes from the various JW wastewater treatment works, pump stations and other specified JW sites on an "as and when" required basis for a period of thirty-six (36) months.
- i) The service provider will be required to complete and sign the equipment collection when collecting any equipment for repairs at the JW sites.
- This form shall also be completed and signed when delivering / returning that particular equipment to the JW sites.
- ii) The relevant authorised JW representative will also sign that same form (referred to herein Clause 10.1 (i)) during collection and delivery of equipment.
- iii) A copy of the form (referred to herein Clause 10.1 (i) and (ii)), will then be issued to the service provider upon delivery of the equipment to JW.
- 10.2 The tenderer will be required to strip the equipment (pumps or gearboxes or valves) and provide JW with a comprehensive (detailed) quotation of the required work, the costs breakdown and failure assessment report within five (5) working days after stripping the equipment.
- i) JW reserves the right to inspect the stripped equipment prior to approval of the work.
- ii) The comprehensive quotation (referred to herein Clause 10.2) must include a "pre-quotation" from the OEM (Original Equipment



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Manufacturer) for the components / parts / spares which the service provider intends to use when carrying out any repair and maintenance work.

- iii) Every comprehensive repair quote (referred to herein Clause 10.2 (ii)) must also include / indicate the Total Cost of Replacement of the equipment.

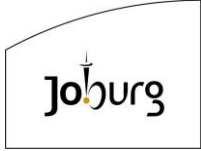
Thereafter the Authorised JW representative shall:-

- 10.2.1 Issue an approval to commence with repairs / maintenance through a Purchase Order/ Purchase Instruction.
- 10.2.2 Issue a letter instructing the service provider to commence with repairs / maintenance on the equipment.

The Service provider will then assemble the equipment and return the equipment to relevant JW site.

The strip, repair, assembling and transport rate will then be applied in this instance.

- 10.3 Upon completion of works (repairs and/or maintenance), the service provider shall deliver the equipment to the respective JW sites.
 - i) The service provider shall include a data park with the following documents: comprehensive job card, detailed invoice, delivery note, completed quality control forms, site acceptance form (where applicable)
 - ii) Comprehensive job card and detailed invoice shall outline all the work done and consumables used, as well as any parts fitted or replaced on the equipment.
 - iii) For every work / job that entails replacement of parts, the detailed quality control forms must also include OEM pre-invoices and material certificates (where applicable) for each part or spare replaced or fitted.
 - iv) Detailed quality control forms must also include assembly check sheets, paint check sheets, factory release form and test reports confirming the operational assessment condition of the equipment post repair / maintenance / replacement.
 - v) The detailed quality control forms must also include Warrantee Certificates for every repair and replacement work.
 - vi) Where scope of work includes installation, the detailed quality control forms must also include site acceptance forms approved by JW authorised representative.



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- vii) One request by JW, the detailed invoice (referred to herein Clause 10.3 (i)) must be accompanied by **All** replaced parts upon delivery of the equipment to the respective JW sites.

Failure to do so shall result in the non-signing of the Delivery Note (i.e. the JW Representative will not endorse the work done by the service provider) and will result in non-payment of the service provider.

- viii) Equipment must be rendered of “good condition” in whole and not in parts.
- ix) The comprehensive job card (referred to herein in Clause 10.3 (i)) must include the equipment’s serial number, equipment type, make and size of equipment.

- 10.4 In an Emergency, work will be authorised by JW official email or a letter instructing the service provider to undertake specified work and Overtime rates will be effected.

The email or letter must be written by either the respective JW Regional Maintenance Manager.

- i) Payment for all emergency work must conform to the requirements of Clause 10.3

- 10.5 For any additional work (not covered under the contract scope) that might be required on the equipment at the time of repairs / maintenance, the service provider shall only commence upon receipt of JW official purchase order.

- 10.6 All gearboxes and pumps repaired by the service provider must be pre-filled with oil and greased by the service provider prior to delivering the equipment to JW.

Only oil and grease that is recommended by the relevant equipment manufacturer may be used.

The authorised JW representative will confirm that this has been done by signing the equipment collection and delivery form.

11. WARRANTY:

- 11.1 The provisions of this contract shall be subject to the warranties that apply to new parts supplied by the service provider for repairs of pumps, gearboxes and valves for the duration of the contract.

Therefore, if the rectification of a defect in these assets or the replacement of a part is covered by warranty, such rectification/replacement shall be done at no cost to JW.

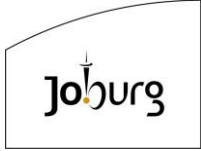


**CONTRACT NO. JW OPS 035/22
STRIP QUOTE AND REPAIR OF
GEARBOXES, PUMPS AND VALVES**



SPECIAL CONDITIONS

- 11.2 The warranty period referred herein Clause 11.1 above, will be for a period of six (6) months from the time that the equipment installed at the applicable JW site and is in use.
- 11.3 For the equipment that has a run hour meter, the warranty will be equivalent to operational hours as per run hour meter from the time of installation.
- 12. QUANTITIES:**
- 12.1 No quantities are given due to the nature of this contract.
- It is the tenderer's responsibility to conduct thorough assessment to understand the condition and age of the equipment to be repaired or maintained.
- Also, the tenderer is encouraged to familiarise themselves with all JW sites (wastewater treatment works, pump stations, etc.) and the distances to be travelled when collecting and delivering equipment as well as when conducting site work.
- 13. VALIDITY OF TENDER:**
- 13.1 The Tender shall be valid for a period of ninety (90) days from the date of closing of Tenders.
- 14. ADJUDICATION OF TENDERS:**
- 14.1 The highest, lowest or any tender will not necessarily be accepted by JW. JW reserves the right to adjudicate the Tender to its best interest and will not necessarily award the tender in whole or in part and to more than one tenderer.
- 14.2 JW will inspect the premises of the tenderers for the purpose of adjudication.
- 15. COMPLETENESS:**
- 15.1 Failure to complete all forms as required will render the tender liable to rejection on the grounds of being incomplete.
- 16. PAYMENT:**
- 16.1 The method and conditions of payment to be made to the service provider(s) under this contract shall be in accordance to JW's conditions of payment.
- The attention of the service provider is brought to the following additional requirements:
- i) The service provider is required to submit a comprehensive job card and detailed invoice as prescribed under Clause 10.3 and all its requirements. Failure to provide these documents will result in non-payment of the invoices.
 - ii) The service provider shall submit the invoice for work done as well as the statement to the relevant JW site and representative for which services were rendered for.
- Payment will be processed based on 30 days from the date of statement subject to any adjustment by the Regional Maintenance



**CONTRACT NO. JW OPS 035/22
STRIP QUOTE AND REPAIR OF
GEARBOXES, PUMPS AND VALVES**



SPECIAL CONDITIONS

Manager or authorised JW Representative in respect of errors, downtime, penalties or any other claim that 'JW' may have in respect of this contract.

17. INSPECTIONS:

- 17.1 The Regional Maintenance Manager or any official of JW on their behalf may at any time by appointment with the service provider inspect the material and workmanship relating to maintenance work performed by the service provider.

18. REPLACEMENT PARTS:

- 18.1 All spare parts used for repairs, must be parts approved by the Original Equipment Manufacturer (OEM) and/or SABS approved for gearboxes only.

SABS certification for the gear cutter (cutting gears) must be attached to the invoices for gearboxes.

- 18.2 All spare parts used for repairs, must not be of inferior quality. Where they may be found to be defective prior to the prescribed.

Warranty period (herein referred to in Clause 11.1 and Clause 11.2) will be applied.

19. RESPONSE TIMES:

- 19.1 The service provider's response times for collection of equipment for normal repairs will be 24 hours and 4 hours for emergency work; from the time of receiving the request from JW.

20. TURNAROUND TIMES:

- 20.1 The turnaround time for repairing equipment shall be 24 hours for emergencies and a maximum of 3 months (for normal repairs).

21. PENALTIES:

- 21.1 Instead of exercising its rights in terms of Clause 22 of the General Conditions of Contract (JW 13), the relevant Manager may, at his discretion impose the following penalties:

- i) If the service provider fails to meet the 4 hours (for emergencies) and to 24 hours (for normal work) response times from the official time of order, the service provider will incur penalties amounting to 10% (ten percent) of their total invoice for that specific job.

This 10% penalty will be charged per day of delay in returning the repaired equipment to JW up to a maximum of 5 days.

- ii) If the Service provider fails to meet the 24 hours (for emergencies) to maximum of 3 months (for normal work) turnaround times from the official time of order, the service provider will incur penalties amounting to 15% (fifteen percent) of their total invoice for that specific job.

This 15% penalty will be charged per day of delay in returning the repaired equipment to JW up to a maximum of 5 days.



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SPECIAL CONDITIONS

- iii) In all cases where there are delays in completing the job (normal jobs or emergency jobs), the Service provider must supply written explanations prior to the job deadline, indicating the cause thereof.

If in the opinion of the Regional Maintenance Manager, Senior Manager or Authorised JW representative the delay was unavoidable, no penalties will be deducted in effecting payment for that invoice and the deadline will be extended as per agreement with the Regional Maintenance Manager, Senior Manager or Authorised JW representative.

- iv) Where, in the opinion of the relevant Regional Maintenance Manager, Senior Manager or Authorised JW representative any delays could reasonably have been avoided, the penalties shall be exercised as stipulated above on Clauses 21.1 (i) and (ii).

**22. FURTHER
INFORMATION:**

- 22.1 Should the tenderer have any queries regarding this tender; he/she must submit these in writing to:

Ms Nosipho Mokoena

Email: nosipho.mokoena@jwater.co.za

Tell: (011) 688 1585, during when and immediately after the tender is advertised.

23. NOTICE:

- 23.1 Any NOTICE or communication required or permitted to be given in terms of this agreement shall be valid and effective only if in writing and may be given in one or more of the following manners:-

- 23.1.1 Sent by prepaid registered post (by airmail if appropriate) in an envelope correctly addressed to it at an address chosen as its *domicilium citandi et executandi* to which post it is delivered, in which event such notice shall be deemed to have been received on the 7th (seventh) business day after posting (unless the contrary is proved);

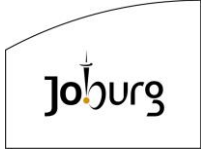
Or

- 23.1.2 Delivered by hand to a responsible person during ordinary business hours at the physical address chosen as its *domicilium citandi et executandi*, in which event such notice shall be deemed to have been received on the day of delivery;

Or

- 23.1.3 Sent by telefax to its chosen telefax number, in which event such notice shall be deemed to have been received on the date of dispatch (unless the contrary is proved).

- 23.2 Notwithstanding anything to the contrary herein contained a written notice or communication actually received by a party shall be adequate written notice or communication to it notwithstanding that




**CONTRACT NO. JW OPS 035/22
STRIP QUOTE AND REPAIR OF
GEARBOXES, PUMPS AND VALVES**



SPECIAL CONDITIONS

it was not sent to or delivered at its *domicilium citandi et executandi*.

 Johannesburg Water	SAFETY, HEALTH & ENVIRONMENTAL (SHE) SPECIFICATION	
	TENDER NUMBER:	JW OPS 035/22
	PROJECT LOCATION:	Various areas within CoJ
	PROJECT DESCRIPTION:	STRIP, QUOTE AND REPAIR OF VALVES, PUMPS AND GEARBOXES

Returnable Annexure A: Acknowledgement of SHE Specification & Annexures

DECLARATION BY CONTRACTOR

I, the undersigned, and representing the tenderer as indicated hereby acknowledge that I have obtained copies of the following listed documentation and confirm that I fully understand the contents thereof and confirm compliance thereto in the event of being successful:

- OHS Specification (Volume 2)
- Annexure 1: Baseline Risk Assessment
- Annexure 2: Medical Screening Policy
- Annexure 3: Contractor Competency Evaluation
- Annexure 4: Sign off form
- Annexure 5: Environmental Management Plan
- Annexure 6: Waste Management Plan
- Annexure 7: COVID-19 Guideline
- Annexure 8: Risk Assessment

We furthermore commit to:

- Comply with all applicable SHE related legal and other requirements.
- Inform all staff of their role in managing environmental impacts and safety hazards on site.

Signed at on this Day of 20.....

Name of tenderer	
Name of Authorized person	
Authorized Signature*	

*Signature must be as per form JW 3.3 as applicable

NB: Failure to complete this form in full and have it signed as required will result in elimination

MBD 4

DECLARATION OF INTEREST

1. No bid will be accepted from persons in the service of the state¹.
2. Any person, having a kinship with persons in the service of the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid. In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons connected with or related to persons in service of the state, it is required that the bidder or their authorised representative declare their position in relation to the evaluating/adjudicating authority.

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

3.1 Full Name of bidder or his or her representative:.....

3.2 Identity Number:

3.3 Position occupied in the Company (director, trustee, hareholder²):.....

3.4 Company Registration Number:

3.5 Tax Reference Number:.....

3.6 VAT Registration Number:

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

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

3.8.1 If yes, furnish particulars.

.....

¹MSCM Regulations: "in the service of the state" means to be –

- (a) a member of –
 - (i) any municipal council;
 - (ii) any provincial legislature; or
 - (iii) the national Assembly or the national Council of provinces;
- (b) a member of the board of directors of any municipal entity;
- (c) an official of any municipality or municipal entity;
- (d) an employee of any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No.1 of 1999);
- (e) a member of the accounting authority of any national or provincial public entity; or
- (f) an employee of Parliament or a provincial legislature.

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

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

3.9.1 If yes, furnish particulars.....

.....

3.10 Do you have any relationship (family, friend, other) with persons in the service of the state and who may be involved with the evaluation and or adjudication of this bid? **YES / NO**

3.10.1 If yes, furnish particulars.

.....

.....

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

3.11.1 If yes, furnish particulars

.....

.....

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

3.12.1 If yes, furnish particulars.

.....

.....

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

3.13.1 If yes, furnish particulars.

.....

.....

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

3.14.1 If yes, furnish particulars:

.....

.....

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

Full Name	Identity Number	State Employee Number

.....
Signature

.....
Date

.....
Capacity

.....
Name of Bidder

DECLARATION FOR PROCUREMENT ABOVE R10 MILLION (VAT INCLUDED)

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

- *1 Are you by law required to prepare annual financial statements for auditing? YES / NO**
- *In the event the Annual Financial Statements submitted with this tender reflect that the tenderer is not required by law to have such statement audited, Johannesburg Water reserves the discretion to interpret your selection of "Yes" as a "No" and analyse it accordingly.*
- 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. YES / NO**

- 2. If the bidder is not required by law to prepare annual financial statements for auditing, they shall be required to furnish their Annual Financial Statements -**
- i. for the past three years , or
 ii. since their establishment if established during the past three years
- 3. Do you have any outstanding undisputed commitments for municipal services towards a municipality or any other service provider in respect of which payment is overdue for more than 30 days? YES / NO**
- 3.1 If no, this serves to certify that the bidder has no undisputed commitments for municipal services towards a municipality or other service provider in respect of which payment is overdue for more than 30 days.**
- 3.2 If yes, provide particulars.**

4. 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?

4.1 If yes, furnish particulars

.....

5. 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

5.1 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

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

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

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

1. GENERAL CONDITIONS

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

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

1.2

- a) The value of this bid is estimated to **exceed** R50 000 000 (all applicable taxes included) and therefore the **90/10** preference point system shall be applicable; or
- b) Either the 80/20 or 90/10 preference point system will be applicable to this tender (*delete whichever is not applicable for this tender*).

1.3 Points for this bid shall be awarded for:

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

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

	POINTS
PRICE	90
B-BBEE STATUS LEVEL OF CONTRIBUTOR	10
Total points for Price and B-BBEE must not exceed	100

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

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

2. DEFINITIONS

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

3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

4. POINTS AWARDED FOR PRICE

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

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

80/20

or

90/10

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

Where

Ps = Points scored for price of bid under consideration

Pt = Price of bid under consideration

P_{min} = Price of lowest acceptable bid

4.2 FORMULAE FOR DISPOSAL OR LEASING OF STATE ASSETS AND INCOME-GENERATING PROCUREMENT

4.3 POINTS AWARDED FOR PRICE

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

80/20

or

90/10

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

Where

P_s = Points scored for price of bid under consideration

P_t = Price of bid under consideration

P_{max} = Price of highest acceptable bid

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

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

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

6. BID DECLARATION

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

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

- 7.1 B-BBEE Status Level of Contributor:.....=(maximum of 10 or 20 points)
(Points claimed in respect of paragraph 7.1 must be in accordance with the table reflected in paragraph 4.1 and must be substantiated by relevant proof of B-BBEE status level of contributor.

8. SUB-CONTRACTING

- 8.1 Will any portion of the contract be sub-contracted?

(*Tick applicable box*)

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

8.1.1 If yes, indicate:

- i) What percentage of the contract will be subcontracted.....%
- ii) The name of the sub-contractor.....
- iii) The B-BBEE status level of the sub-contractor.....
- iv) Whether the sub-contractor is an EME or QSE

(Tick applicable box)

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

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

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

9. DECLARATION WITH REGARD TO COMPANY/FIRM

9.1 Name of
company/firm:.....

9.2 VAT registration
number:.....

9.3 Company registration
number:.....

9.4 TYPE OF COMPANY/ FIRM

- ☐ Partnership/Joint Venture / Consortium
 - ☐ One person business/sole propriety
 - ☐ Close corporation
 - ☐ Company
 - ☐ (Pty) Limited
- [TICK APPLICABLE BOX]

9.5 DESCRIBE PRINCIPAL BUSINESS ACTIVITIES

.....

.....

.....

9.6 COMPANY CLASSIFICATION

- ☐ Manufacturer
 - ☐ Supplier
 - ☐ Professional service provider
 - ☐ Other service providers, e.g. transporter, etc.
- [TICK APPLICABLE BOX]

9.7 **MUNICIPAL INFORMATION**

Municipality where business is situated:

Registered Account Number:

Stand Number:.....

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

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

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

WITNESSES

1.

2.

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

DATE:

ADDRESS

.....
.....

DECLARATION OF BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES

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

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

4.3.1	If so, furnish particulars:		
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 five years on account of failure to perform on or comply with the contract?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
4.7.1	If so, furnish particulars:		

CERTIFICATION

**I, THE UNDERSIGNED (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

CERTIFICATE OF INDEPENDENT BID DETERMINATION

- 1 This Municipal Bidding Document (MBD) must form part of all bids¹ invited.

- 2 Section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, prohibits an agreement between, or concerted practice by, firms, or a decision by an association of firms, if it is between parties in a horizontal relationship and if it involves collusive bidding (or bid rigging).² Collusive bidding is a *pe se* prohibition meaning that it cannot be justified under any grounds.

- 3 Municipal Supply Regulation 38 (1) prescribes that a supply chain management policy must provide measures for the combating of abuse of the supply chain management system, and must enable the accounting officer, among others, to:
 - a. take all reasonable steps to prevent such abuse;
 - b. reject the bid of any bidder if that bidder or any of its directors has abused the supply chain management system of the municipality or municipal entity or has committed any improper conduct in relation to such system; and
 - c. cancel a contract awarded to a person if the person committed any corrupt or fraudulent act during the bidding process or the execution of the contract.

- 4 This MBD serves as a certificate of declaration that would be used by institutions to ensure that, when bids are considered, reasonable steps are taken to prevent any form of bid-rigging.

- 5 In order to give effect to the above, the attached Certificate of Bid Determination (MBD 9) must be completed and submitted with the bid:

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

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

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

(Bid Number and Description)

in response to the invitation for the bid made by:

(Name of Municipality / Municipal Entity)

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

I certify, on behalf of:_____that:

(Name of Bidder)

1. I have read and I understand the contents of this Certificate;
2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect;
3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder;
4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign, the bid, on behalf of the bidder;
5. For the purposes of this Certificate and the accompanying bid, I understand that the word "competitor" shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:
 - (a) has been requested to submit a bid in response to this bid invitation;
 - (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and
 - (c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder

6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However communication between partners in a joint venture or consortium³ will not be construed as collusive bidding.
7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:
 - (a) prices;
 - (b) geographical area where product or service will be rendered (market allocation)
 - (c) methods, factors or formulas used to calculate prices;
 - (d) the intention or decision to submit or not to submit, a bid;
 - (e) the submission of a bid which does not meet the specifications and conditions of the bid; or
 - (f) bidding with the intention not to win the bid.
8. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.
9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.

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

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

.....
Signature

.....
Date

.....
Position

.....
Name of Bidder

CONTRACT FORM - PURCHASE OF GOODS/WORKS

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.

PART 1 (TO BE FILLED IN BY THE BIDDER)

1. I hereby undertake to supply all or any of the goods and/or works 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.

2. 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;
 - Tax compliant status Pin;
 - Pricing schedule(s);
 - Technical Specification(s);
 - Preference claims for Broad Based Black Economic Empowerment Status Level of Contribution in terms of the Preferential Procurement Regulations 2017;
 - Declaration of interest;
 - Declaration of bidder's past SCM practices;
 - Certificate of Independent Bid Determination;
 - Special Conditions of Contract;
 - (ii) General Conditions of Contract; and
 - (iii) Other (specify)

3. 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.

4. 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.

5. I declare that I have no participation in any collusive practices with any bidder or any other person regarding this or any other bid.

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

NAME (PRINT)

CAPACITY

SIGNATURE

NAME OF FIRM

DATE

WITNESSES

1

2.

DATE:

CONTRACT FORM - PURCHASE OF GOODS/WORKS**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/works 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/works 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.

ITEM NO.	PRICE (ALL APPLICABLE TAXES INCLUDED)	BRAND	DELIVERY PERIOD	B-BBEE STATUS LEVEL OF CONTRIBUTION	MINIMUM THRESHOLD FOR LOCAL PRODUCTION AND CONTENT (if applicable)

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

SIGNED ATON.....

NAME (PRINT)

SIGNATURE

OFFICIAL STAMP

WITNESSES

1.

2.

DATE

CONTRACT FORM - RENDERING OF SERVICES

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

PART 1 (TO BE FILLED IN BY THE SERVICE PROVIDER)

1. I hereby undertake to render services described in the attached bidding documents to (name of the institution)..... in accordance with the requirements and task directives / proposals 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 date of the bid.
2. 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;
 - Tax compliant status Pin;
 - Pricing schedule(s);
 - Filled in task directive/proposal;
 - Preference claims for Broad Based Black Economic Empowerment Status Level of Contribution in terms of the Preferential Procurement Regulations 2017;
 - Declaration of interest;
 - Declaration of Bidder's past SCM practices;
 - Certificate of Independent Bid Determination;
 - Special Conditions of Contract;
 - (ii) General Conditions of Contract; and
 - (iii) Other (specify)
3. 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 services 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.
4. 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 fulfilment of this contract.
5. I declare that I have no participation in any collusive practices with any bidder or any other person regarding this or any other bid.
6. I confirm that I am duly authorised to sign this contract.

NAME (PRINT)

CAPACITY

SIGNATURE

NAME OF FIRM

DATE

WITNESSES

1

2

DATE:

CONTRACT FORM - RENDERING OF SERVICES**PART 2 (TO BE FILLED IN BY THE PURCHASER)**

1. 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).
2. An official order indicating service delivery instructions is forthcoming.
3. 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.

DESCRIPTION OF SERVICE	PRICE (ALL APPLICABLE TAXES INCLUDED)	COMPLETION DATE	B-BBEE STATUS LEVEL OF CONTRIBUTION	MINIMUM THRESHOLD FOR LOCAL PRODUCTION AND CONTENT (if applicable)

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

SIGNED AT ON

NAME (PRINT)

SIGNATURE

OFFICIAL STAMP

WITNESSES

1

2

DATE:



JOHANNESBURG WATER (SOC) LTD

**GENERAL CONDITIONS OF
CONTRACT**

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1. Definitions 1. The following terms shall be interpreted as indicated:

1.1 "Closing time" means the date and hour specified in the bidding documents for the receipt of bids.

1.2 "Contract" means the written agreement entered into between the purchaser and the supplier, as recorded in the contract form signed by the parties, including all attachments and appendices thereto and all documents incorporated by reference therein.

1.3 "Contract price" means the price payable to the supplier under the contract for the full and proper performance of his contractual obligations.

1.4 "Corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution.

1.5 "Countervailing duties" are imposed in cases where an enterprise abroad is subsidized by its government and encouraged to market its products internationally.

1.6 "Country of origin" means the place where the goods were mined, grown or produced or from which the services are supplied. Goods are produced when, through manufacturing, processing or substantial and major assembly of components, a commercially recognized new product results that is substantially different in basic characteristics or in purpose or utility from its components.

1.7 "Day" means calendar day.

1.8 "Delivery" means delivery in compliance of the conditions of the contract or order.

1.9 "Delivery ex stock" means immediate delivery directly from stock actually on hand.

1.10 "Delivery into consignees store or to his site" means delivered and unloaded in the specified store or depot or on the specified site in compliance with the conditions of the contract or order, the supplier bearing all risks and charges involved until the goods are so delivered and a valid receipt is obtained.

1.11 "Dumping" occurs when a private enterprise abroad market its goods on own initiative in the RSA at lower prices than that of the country of origin and which have the potential to harm the local industries in the RSA.

1.12 "Force majeure" means an event beyond the control of the supplier and not involving the supplier's fault or negligence and not foreseeable. Such events may include, but is not restricted to, acts of the purchaser in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes.

1.13 "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of any bidder, and includes collusive practice among bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the bidder of the benefits of free and open competition.

1.14 "GCC" means the General Conditions of Contract.

1.15 "Goods" means all of the equipment, machinery, and/or other materials that the supplier is required to supply to the purchaser under the contract.

1.16 "Imported content" means that portion of the bidding price represented by the cost of components, parts or materials which have been or are still to be imported (whether by the

supplier or his subcontractors) and which costs are inclusive of the costs abroad, plus freight and other direct importation costs such as landing costs, dock dues, import duty, sales duty or other similar tax or duty at the South African place of entry as well as transportation and handling charges to the factory in the Republic where the goods covered by the bid will be manufactured.

1.17 "Local content" means that portion of the bidding price, which is not included in the imported content provided that local manufacture does take place.

1.18 "Manufacture" means the production of products in a factory using labour, materials, components and machinery and includes other related value-adding activities.

1.19 "Order" means an official written order issued for the supply of goods or works or the rendering of a service.

1.20 "Project site," where applicable, means the place indicated in bidding documents.

1.21 "Purchaser" means the organization purchasing the goods.

1.22 "Republic" means the Republic of South Africa.

1.23 "SCC" means the Special Conditions of Contract.

1.24 "Services" means those functional services ancillary to the supply of the goods, such as transportation and any other incidental services, such as installation, commissioning, provision of technical assistance, training, catering, gardening, security, maintenance and other such obligations of the supplier covered under the contract.

1.25 "Supplier" means the successful bidder who is awarded the contract to maintain and administer the required and specified service(s) to the State.

1.26 "Tort" means Delict

1.27 "Turnkey" means a procurement process where one service provider assumes total responsibility for all aspects of the project and delivers the full end product / service required by the contract.

1.28 "Written" or "in writing" means hand-written in ink or any form of electronic or mechanical writing.

2. Application

2.1 These general conditions are applicable to all bids, contracts and orders including bids for functional and professional services (excluding professional services related to the building and construction industry), sales, hiring, letting and the granting or acquiring of rights, but excluding immovable property, unless otherwise indicated in the bidding documents.

2.2 Where applicable, special conditions of contract are also laid down to cover specific goods, services or works.

2.3 Where such special conditions of contract are in conflict with these general conditions, the special conditions shall apply.

3. General 3.1 Unless otherwise indicated in the bidding documents, the purchaser shall not be liable for any expense incurred in the preparation and submission of a bid. Where applicable a non-refundable fee for documents may be charged.

3.2 Invitations to bid are usually published in locally distributed news media and on the municipality/municipal entity website.

4. Standards 4.1 The goods supplied shall conform to the standards mentioned in the bidding documents and specifications.

5. Use of contract documents and information inspection

5.1 The supplier shall not, without the purchaser's prior written consent, disclose the contract, or any provision thereof, or any specification, plan, drawing, pattern, sample, or information furnished by or on behalf of the purchaser in connection therewith, to any person other than a person employed by the supplier in the performance of the contract. Disclosure to any such employed person shall be made in confidence and shall extend only so far as may be necessary for purposes of such performance.

5.2 The supplier shall not, without the purchaser's prior written consent, make use of any document or information mentioned in GCC clause 5.1 except for purposes of performing the contract.

5.3 Any document, other than the contract itself mentioned in GCC clause 5.1 shall remain the property of the purchaser and shall be returned (all copies) to the purchaser on completion of the supplier's performance under the contract if so required by the purchaser

5.4 The supplier shall permit the purchaser to inspect the supplier's records relating to the performance of the supplier and to have them audited by auditors appointed by the purchaser, if so required by the purchaser.

6. Patent Rights

6.1 The supplier shall indemnify the purchaser against all third-party claims of infringement of patent, trademark, or industrial design rights arising from use of the goods or any part thereof by the purchaser.

6.2 When a supplier develops documentation / projects for the municipal owned entity (MOE), the MOE shall retain ownership of any written opinion, advice, presentation or other deliverable that the supplier produces for the MOE in its tangible form on payment of all fees due, owing and payable to the supplier. The ownership of the intellectual property rights in the services, products of the services and the methodology and technology used to perform the services and all its working papers shall be retained by the supplier.

7. Performance security

7.1 Within thirty (30) days of receipt of the notification of contract award, the successful bidder shall furnish to the purchaser the performance security of the amount specified in SCC.

7.2 The proceeds of the performance security shall be payable to the purchaser as compensation for any loss resulting from the supplier's failure to complete his obligations under the contract.

7.3 The performance security shall be denominated in the currency of the contract, or in a freely convertible currency acceptable to the purchaser and shall be in one of the following forms:

- (a) a bank guarantee or an irrevocable letter of credit issued by a reputable bank located in the purchaser's country or abroad, acceptable to the purchaser, in the form provided in the bidding documents or another form acceptable to the purchaser; or
- (b) a cashier's or certified cheque.

7.4 The performance security will be discharged by the purchaser and returned to the supplier not later than thirty (30) days following the date of completion of the supplier's

performance obligations under the contract, including any warranty obligations, unless otherwise specified.

8. Inspections, tests and analyses

8.1 All pre-bidding testing will be for the account of the bidder.

8.2 If it is a bid condition that goods to be produced or services to be rendered should at any stage be subject to inspections, tests and analyses, the bidder or contractor's premises shall be open, at all reasonable hours, for inspection by a representative of the purchaser or organization acting on behalf of the purchaser.

8.3 If there are no inspection requirements indicated in the bidding documents and no mention is made in the contract, but during the contract period it is decided that inspections shall be carried out, the purchaser shall itself make the necessary arrangements, including payment arrangements with the testing authority concerned.

8.4 If the inspections, tests and analyses referred to in clauses 8.2 and 8.3 show the goods to be in accordance with the contract requirements, the cost of the inspections, tests and analyses shall be defrayed by the purchaser.

8.5 Where the goods or services referred to in clauses 8.2 and 8.3 do not comply with the contract requirements, irrespective of whether such goods or services are accepted or not, the cost in connection with these inspections, tests or analyses shall be defrayed by the supplier.

8.6 Goods and services which are referred to in clauses 8.2 and 8.3 and which do not comply with the contract requirements may be rejected.

8.7 Any contract goods may on or after delivery be inspected, tested or analysed and may be rejected if found not to comply with the requirements of the contract. Such rejected goods shall be held at the cost and risk of the supplier who shall, when called upon, remove them immediately at his own cost and forthwith substitute them with goods, which do comply with the requirements of the contract. Failing such removal the rejected goods shall be returned at the suppliers cost and risk. Should the supplier fail to provide the substitute goods forthwith, the purchaser may, without giving the supplier further opportunity to substitute the rejected goods, purchase such goods as may be necessary at the expense of the supplier.

8.8 The provisions of clauses 8.4 to 8.7 shall not prejudice the right of the purchaser to cancel the contract on account of a breach of the conditions thereof, or to act in terms of Clause 22 of GCC.

9. Packing

9.1 The supplier shall provide such packing of the goods as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage. Packing, case size weights shall take into consideration, where appropriate, the remoteness of the goods' final destination and the absence of heavy handling facilities at all points in transit.

9.2 The packing, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the contract, including additional requirements, if any, and in any subsequent instructions ordered by the purchaser.

10. Delivery and documents

10.1 Delivery of the goods and arrangements for shipping and clearance obligations, shall be made by the supplier in accordance with the terms specified in the contract.

11. Insurance

11.1 The goods supplied under the contract shall be fully insured in a freely convertible currency against loss or damage incidental to manufacture or acquisition, transportation, storage and delivery in the manner specified.

12. Transportation

12.1 Should a price other than an all-inclusive delivered price be required, this shall be specified.

13. Incidental Services

13.1 The supplier may be required to provide any or all of the following services, including additional services, if any:

(a) performance or supervision of on-site assembly and/or commissioning of the supplied goods;

(b) furnishing of tools required for assembly and/or maintenance of the supplied goods;

(c) furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied goods;

(d) performance or supervision or maintenance and/or repair of the supplied goods, for a period of time agreed by the parties, provided that this service shall not relieve the supplier of any warranty obligations under this contract; and

(e) training of the purchaser's personnel, at the supplier's plant and/or on-site, in assembly, start-up, operation, maintenance, and/or repair of the supplied goods.

13.2 Prices charged by the supplier for incidental services, if not included in the contract price for the goods, shall be agreed upon in advance by the parties and shall not exceed the prevailing rates charged to other parties by the supplier for similar services.

14. Spare parts

14.1 As specified, the supplier may be required to provide any or all of the following materials, notifications, and information pertaining to spare parts manufactured or distributed by the supplier:

(a) such spare parts as the purchaser may elect to purchase from the supplier, provided that this election shall not relieve the supplier of any warranty obligations under the contract; and

(b) in the event of termination of production of the spare parts:

(i) advance notification to the purchaser of the pending termination, in sufficient time to permit the purchaser to procure needed requirements; and

(ii) following such termination, furnishing at no cost to the purchaser, the blueprints, drawings, and specifications of the spare parts, if requested.

15. Warranty

15.1 The supplier warrants that the goods supplied under the contract are new, unused, of the most recent or current models, and that they incorporate all recent improvements in design and materials unless provided otherwise in the contract. The supplier further warrants that all goods supplied under this contract shall have no defect, arising from design, materials, or workmanship (except when the design and/or material is required by the purchaser's specifications) or from any act or omission of the supplier, that may develop under normal use of the supplied goods in the conditions prevailing in the country of final destination.

15.2 This warranty shall remain valid for twelve (12) months after the goods, or any portion thereof as the case may be, have been delivered to and accepted at the final destination indicated in the contract, or for eighteen (18) months after the date of shipment from the port or place of loading in the source country, whichever period concludes earlier, unless specified otherwise.

15.3 The purchaser shall promptly notify the supplier in writing of any claims arising under this warranty.

15.4 Upon receipt of such notice, the supplier shall, within the period specified and with all reasonable speed, repair or replace the defective goods or parts thereof, without costs to the purchaser.

15.5 If the supplier, having been notified, fails to remedy the defect(s) within the period specified, the purchaser may proceed to take such remedial action as may be necessary, at the supplier's risk and expense and without prejudice to any other rights which the purchaser may have against the supplier under the contract.

16. Payment 16.1 The method and conditions of payment to be made to the supplier under this contract shall be specified.

16.2 The supplier shall furnish the purchaser with an invoice accompanied by a copy of the delivery note and upon fulfilment of other obligations stipulated in the contract.

16.3 Payment shall be made within 30 days of receipt of the supplier statement, provided the statement submitted is correct and submitted to Johannesburg Water before the end of the month. The invoice for which payment is required must be correct, must be reflected on the statement referred to above and also be submitted by no later than the end of the month.

16.4 Payment will be made in Rands unless otherwise stipulated.

17. Prices

17.1 Prices charged by the supplier for goods delivered and services performed under the contract shall not vary from the prices quoted by the supplier in his bid, with the exception of any price adjustments authorized or in the purchaser's request for bid validity extension, as the case may be.

18. Variation in contractual hours

18.1 In the event that work to be performed in terms of this contract be completed in less than the envisaged time, or in the event that the duration of such work exceeds the envisaged time pursuant to the approval by JW of an exception report referred to in clause 8 of the Scope of Work, the rate per hour payable to the contractor shall remain the same.

19. Assignment 19.1 The supplier shall not assign, in whole or in part, its obligations to perform under the contract, except with the purchaser's prior written consent.

20.Subcontracts

20.1 The supplier shall notify the purchaser in writing of all subcontracts awarded under this contracts if not already specified in the bid. Such notification, in the original bid or later, shall not relieve the supplier from any liability or obligation under the contract.

21. Delays in the supplier's performance

21.1 Delivery of the goods and performance of services shall be made by the supplier in accordance with the time schedule prescribed by the purchaser in the contract.

21.2 If at any time during performance of the contract, the supplier or its subcontractor(s) should encounter conditions impeding timely delivery of the goods and performance of services, the supplier shall promptly notify the purchaser in writing of the fact of the delay, its likely duration and its cause(s). As soon as practicable after receipt of the supplier's notice, the purchaser shall evaluate the situation and may at his discretion extend the supplier's time for performance, with or without the imposition of penalties, in which case the extension shall be ratified by the parties by amendment of contract.

21.3 The right is reserved to procure outside of the contract small quantities or to have minor essential services executed if an emergency arises, the supplier's point of supply is not situated at or near the place where the goods are required, or the supplier's services are not readily available.

21.4 Except as provided under GCC Clause 25, a delay by the supplier in the performance of its delivery obligations shall render the supplier liable to the imposition of penalties, pursuant to GCC Clause 22, unless an extension of time is agreed upon pursuant to GCC Clause 22.2 without the application of penalties.

21.5 Upon any delay beyond the delivery period in the case of a goods contract, the purchaser shall, without cancelling the contract, be entitled to purchase goods of a similar quality and up to the same quantity in substitution of the goods not supplied in conformity with the contract and to return any goods delivered later at the supplier's expense and risk, or to cancel the contract and buy such goods as may be required to complete the contract and without prejudice to his other rights, be entitled to claim damages from the supplier.

22. Penalties

22.1 Subject to GCC Clause 25, if the supplier fails to deliver any or all of the goods or to perform the services within the period(s) specified in the contract, the purchaser shall, without prejudice to its other remedies under the contract, deduct from the contract price, as a penalty, a sum calculated on the delivered price of the delayed goods or unperformed services using the current prime interest rate calculated for each day of the delay until actual delivery or performance. The purchaser may also consider termination of the contract pursuant to GCC Clause 23.

23. Termination for default

23.1 The purchaser, without prejudice to any other remedy for breach of contract, by written notice of default sent to the supplier, may terminate this contract in whole or in part:

(a) if the supplier fails to deliver any or all of the goods within the period(s) specified in the contract, or within any extension thereof granted by the purchaser pursuant to GCC Clause 21.2;

(b) if the supplier fails to perform any other obligation(s) under the contract; or

(c) if the supplier, in the judgement of the purchaser, has engaged in corrupt or fraudulent practices in competing for or in executing the contract.

23.2 In the event the purchaser terminates the contract in whole or in part, the purchaser may procure, upon such terms and in such manner, as it deems appropriate, goods, works or services similar to those undelivered, and the supplier shall be liable to the purchaser for any excess costs for such similar goods, works or services. However, the supplier shall continue performance of the contract to the extent not terminated.

23.3 Where the purchaser terminates the contract in whole or in part, the purchaser may decide to impose a restriction penalty on the supplier by prohibiting such supplier from doing business with the public sector for a period not exceeding 10 years.

23.4 If a purchaser intends imposing a restriction on a supplier or any person associated with the supplier, the supplier will be allowed a time period of not more than fourteen (14) days to provide reasons why the envisaged restriction should not be imposed. Should the supplier fail to respond within the stipulated fourteen (14) days the purchaser may regard the supplier as having no objection and proceed with the restriction.

23.5 . Any restriction imposed on any person by the purchaser will, at the discretion of the purchaser, also be applicable to any other enterprise or any partner, manager, director or other person who wholly or partly exercises or exercised or may exercise control over the enterprise of the first-mentioned person, and with which enterprise or person the first-mentioned person, is or was in the opinion of the purchaser actively associated.

23.6 If a restriction is imposed, the purchaser must, within five (5) working days of such imposition, furnish the National Treasury, with the following information:

- (i) the name and address of the supplier and / or person restricted by the purchaser;
- (ii) the date of commencement of the restriction
- (iii) the period of restriction; and
- (iv) the reasons for the restriction.

These details will be loaded in the National Treasury's central database of suppliers or persons prohibited from doing business with the public sector.

23.7 . If a court of law convicts a person of an offence as contemplated in sections 12 or 13 of the Prevention and Combating of Corrupt Activities Act, No. 12 of 2004, the court may also rule that such person's name be endorsed on the Register for Tender Defaulters. When a person's name has been endorsed on the Register, the person will be prohibited from doing business with the public sector for a period not less than five years and not more than 10 years. The National Treasury is empowered to determine the period of restriction and each case will be dealt with on its own merits. According to section 32 of the Act the Register must be open to the public. The Register can be perused on the National Treasury website

24. Antidumping and countervailing duties and rights

24.1 When, after the date of bid, provisional payments are required, or anti-dumping or countervailing duties are imposed, or the amount of a provisional payment or anti-dumping or countervailing right is increased in respect of any dumped or subsidized import, the State is not liable for any amount so required or imposed, or for the amount of any such increase. When, after the said date, such a provisional payment is no longer required or any such anti-dumping or countervailing right is abolished, or where the amount of such provisional payment or any such right is reduced, any such favourable difference shall on demand be paid forthwith by the supplier to the purchaser or the purchaser may deduct such amounts from moneys (if any) which may otherwise be due to the supplier in regard to goods or services which he delivered or rendered, or is to deliver or render in terms of the contract or any other contract or any other amount which may be due to him.

25. Force Majeure

25.1 Notwithstanding the provisions of GCC Clauses 22 and 23, the supplier shall not be liable for forfeiture of its performance security, damages, or termination for default if and to the extent that his delay in performance or other failure to perform his obligations under the contract is the result of an event of force majeure.

25.2 If a force majeure situation arises, the supplier shall promptly notify the purchaser in writing of such condition and the cause thereof. Unless otherwise directed by the

purchaser in writing, the supplier shall continue to perform its obligations under the contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the force majeure event.

26. Termination for insolvency

26.1 The purchaser may at any time terminate the contract by giving written notice to the supplier if the supplier becomes bankrupt or otherwise insolvent. In this event, termination will be without compensation to the supplier, provided that such termination will not prejudice or affect any right of action or remedy, which has accrued or will accrue thereafter to the purchaser.

27. Settlement of Disputes

27.1 If any dispute or difference of any kind whatsoever arises between the purchaser and the supplier in connection with or arising out of the contract, the parties shall make every effort to resolve amicably such dispute or difference by mutual consultation.

27.2 If, after thirty (30) days, the parties have failed to resolve their dispute or difference by such mutual consultation, then either the purchaser or the supplier may give notice to the other party of his intention to commence with mediation. No mediation in respect of this matter may be commenced unless such notice is given to the other party.

27.3 Should it not be possible to settle a dispute by means of mediation, it may be settled in a South African court of law.

27.4 Notwithstanding any reference to mediation and/or court proceedings herein,
(a) the parties shall continue to perform their respective obligations under the contract unless they otherwise agree; and

(b) the purchaser shall pay the supplier any monies due the supplier for goods delivered and / or services rendered according to the prescripts of the contract.

28. Limitation of Liability

28.1 Except in cases of criminal negligence or wilful misconduct, and in the case of infringement pursuant to Clause 6;

(a) the supplier shall not be liable to the purchaser, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the supplier to pay penalties and/or damages to the purchaser; and

(b) the aggregate liability of the supplier to the purchaser, whether under the contract, in tort or otherwise, shall not exceed the total contract price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment.

29. Governing language

29.1 The contract shall be written in English. All correspondence and other documents pertaining to the contract that is exchanged by the parties shall also be written in English.

30. Applicable law

30.1 The contract shall be interpreted in accordance with South African laws, unless otherwise specified.

31. Notices 31.1 Every written acceptance of a bid shall be posted to the supplier concerned by registered or certified mail and any other notice to him shall be posted by

ordinary mail to the address furnished in his bid or to the address notified later by him in writing and such posting shall be deemed to be proper service of such notice.

31.2 The time mentioned in the contract documents for performing any act after such aforesaid notice has been given, shall be reckoned from the date of posting of such notice.

32. Taxes and duties

32.1 A foreign supplier shall be entirely responsible for all taxes, stamp duties, license fees, and other such levies imposed outside the purchaser's country.

32.2 A local supplier shall be entirely responsible for all taxes, duties, license fees, etc., incurred until delivery of the contracted goods to the purchaser.

32.3 No contract shall be concluded with any bidder whose tax matters are not in order. Prior to the award of a bid SARS must have certified that the tax matters of the preferred bidder are in order.

32.4 No contract shall be concluded with any bidder whose municipal rates and taxes and municipal services charges are in arrears.

33. Transfer of contracts

33.1 The contractor shall not abandon, transfer, cede assign or sublet a contract or part thereof without the written permission of the purchaser

34. Amendment of contracts

34.1 No agreement to amend or vary a contract or order or the conditions, stipulations or provisions thereof shall be valid and of any force unless such agreement to amend or vary is entered into in writing and signed by the contracting parties. Any waiver of the requirement that the agreement to amend or vary shall be in writing, shall also be in writing.

35. Prohibition of restrictive practices

35.1 In terms of section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, an agreement between, or concerted practice by, firms, or a decision by an association of firms, is prohibited if it is between parties in a horizontal relationship and if a bidder(s) is / are or a contractor(s) was / were involved in collusive bidding.

35.2 If a bidder(s) or contractor(s) based on reasonable grounds or evidence obtained by the purchaser has / have engaged in the restrictive practice referred to above, the purchaser may refer the matter to the Competition Commission for investigation and possible imposition of administrative penalties as contemplated in section 59 of the Competition Act No 89 Of 1998.

35.3 If a bidder(s) or contractor(s) has / have been found guilty by the Competition Commission of the restrictive practice referred to above, the purchaser may, in addition and without prejudice to any other remedy provided for, invalidate the bid(s) for such item(s) offered, and / or terminate the contract in whole or part, and / or restrict the bidder(s) or contractor(s) from conducting business with the public sector for a period not exceeding ten (10) years and / or claim damages from the bidder(s) or contractor(s) concerned.

BANKING DETAILS FOR ELECTRONIC FUNDS TRANSFER

Requirements

- All fields below must be completed and only **the completed original authorised form will be accepted**. (Faxed and emailed copies are not accepted).
- This form must be accompanied by an original **cancelled cheque** or an **original signed and stamped letter from your bank** (date must be not older than 3 months). Alternatively this form can be stamped by your bank.

Supplier Name	
Contact Person	
Email Address	
Telephone Number	
Fax Number	

Bank Information

Name of Payee (Must be the same as your supplier name)	
Name of Bank	
Account Number	
Branch Code -(to be confirmed with your bank for EFT payments)	
Branch Name	
Reference (if applicable)	

In the event my tender is successful, I hereby authorise Johannesburg Water SOC Ltd, to make all payments by EFT into the above bank account and I have attached the required documents as requested. I have the authority to provide and authorise the above information on behalf of the corporation/organization/payee.

Authorised representative of supplier

Name & Surname: _____ Date: _____

Signature : _____ Designation _____