City of Johannesburg

Johannesburg Water SOC Ltd

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REQUEST FOR PRICING (GOODS AND SERVICES)	Form No: JW SCM Dev MBD1 Revision No: 02 Effective Date: February 2023

RFP NUMBER:	JW RFP 14/06/2024 ALVEDA SEWER PUMP STATION	**CLOSING DATE:**	03 July 2024	**CLOSING TIME:**	14:00
DESCRIPTION:	**Rehabilitation of Alveda Sewer Pump Station for a period of twelve (12) months.**				
BRIEFING SESSION DATE AND TIME	Yes, compulsory briefing session, 27 June 2024 at 13:00	**BRIEFING SESSION VENUE**	Alveda Sewer Pump Station 9 Beech Street, Alveda Ext.2		
CIDB Grade	Mechanical works – 4 ME or higher – Active Status				
ISSUE DATE	21June 2024				

BIDDING PROCEDURE ENQUIRIES MAY BE DIRECTED TO:			
Bidding procedure enquiries must be sent to the below Official		**Technical enquiries must be directed to**	
CONTACT PERSON	Caroline Matabane	**CONTACT PERSON**	Gugulethu Quma
TELEPHONE NUMBER	011 688 1691	**TELEPHONE NUMBER**	011 689 9147
E-MAIL ADDRESS (Submissions must be made to this address)	Caroline.matabane@jwater.co.za	**E-MAIL ADDRESS**	gugulethu.quma@jwater.co.za

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SUPPLIER INFORMATION				
NAME OF BIDDER				
POSTAL ADDRESS				
STREET ADDRESS				
TELEPHONE NUMBER	**CODE**		**NUMBER**	
CELLPHONE NUMBER				
E-MAIL ADDRESS				
E-MAIL ADDRESS				
VAT REGISTRATION NUMBER			**CIDB REGISTRATION NUMBER (TO CHECK ACTIVE STATUS)**	
SUPPLIER COMPLIANCE STATUS- Tax Compliant on CSD prior award	**TAX COMPLIANCE SYSTEM PIN:**		**CENTRAL SUPPLIER DATABASE No:**	MAAA
B-BBEE VERIFICATION CERTIFICATE	[TICK APPLICABLE BOX] ☐Yes ☐No		**B-BBEE SWORN AFFIDAVIT** (EMEs OR QSEs)	[TICK APPLICABLE BOX] ☐Yes ☐No

BID SUBMISSION:

BID DOCUMENTS MUST BE DEPOSITED IN THE TENDER BOX SITUATED AT GROUND FLOOR AT JOHANNESBURG WATER HEAD OFFICE.
ADDRESS: TURBINE HALL, 65 NTEMI PILISO STREET, NEWTOWN, JOHANNESBURG, 2001

PLEASE ALLOW SUFFICIENT TIME TO ACCESS THE JOHANNESBURG WATER OFFICE IN TURBINE HALL AND DEPOSIT YOUR TENDER DOCUMENT IN THE JOHANNESBURG WATER TENDER BOX SITUATED AT RECEPTION BEFORE THE CLOSING DATE AND TIME.

- **TIME: THE BUILDING WILL OPEN 7 DAYS A WEEK FROM 06:00AM UNTIL 18:00PM** Late bids will not be accepted for consideration.
- **All pricing/quotation must be submitted by completing the attached or on the official company letterhead, signed and accompanied by the returnable documents stated below.**

☐No bids will be considered from persons in the service of the state, companies with directors who are persons in the service of the state, or close corporations with member's persons in the service of the state.

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1. SCOPE OF WORK

1.1. DESCRIPTION

The contract entails rehabilitating the Alveda Park Sewer Pump Station to restore optimal and sustainable operations by enhancing on-site security to prevent incidents of theft and vandalism, to restore vandalized/ damaged electrical and mechanical equipment to prevent sewer spillages to the environment and neighboring properties. Additionally, to modify existing pumping configuration from two stage to single stage pumping configuration and installation of a standby generator to mitigate the impact of power outages.

The appointed service provider will be expected to Rehabilitate and Modify, Supply and Installation of equipment, and Commission of the goods and services required as specified.

1.2. GENERAL

All items supplied must be as follows:

- All goods are to comply with JW standards as and with the specifications as stipulated.
- Items offered must be SANS approved where applicable as specifically stated.

1.3. SPECIFICATIONS

All goods and services tendered for must be as per JW specification.

1.4. REQUIREMENTS

The following items are expected to be supplied, delivered, installed, tested and commissioned by the appointed service provider as a turnkey project on receipt of an official order. Each line item includes material and labour costs.

Phase one (Site Establishment, and Site security)

1.4.1 Site Establishment and Preliminary and General.

1.4.1.1 Site Establishment and Preliminary and General.

1.4.1.2 Sum amount for Community Liaison Officer during the project duration.

1.4.1.3 Sum amount for security requirements during the project duration.

1.4.1.4 Removal and transportation of old equipment to Ffennell Road Depot and disposal

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of rubble at an appropriate landfill site. (Provide disposal certificate).

1.4.1.5 Safety and Environmental requirements (OHS requirements and file).

1.4.2 Site Security

1.4.2.1 Construction of guardhouse as per attached specification.

1.4.2.2 Construction of perimeter wall as per attached specification.

1.4.2.3 Supply and Install security beams and link to control room.

Phase two (Rehabilitation of Electrical and Mechanical equipment)

1.4.3 Rehabilitation of Mechanical Equipment.

1.4.3.1 Supply, delivery, and Installation of 1.5KW - 3Phase dewatering pump.

1.4.3.2 Modification of pumping configuration from two stage to single stage pump.

i. Modification of the Manifold (to fit two single stage pump sets).

ii. Modification of pump plinth (to fit two single stage pump sets).

iii. Sizing, supply, delivery, and installation of a suitable single stage pumps (two pumps sets).

iv. Sizing, supply, delivery, and installation of a suitable non-return valves (two non-return valves)

v. Sizing, supply, delivery, and installation of suitable wedge gate valves (five wedge gate valves) suitable for single stage configuration (two pumps sets).

1.4.3.3 Sizing, supply, delivery, and installation of suitable of existing overflow pipe.

1.4.4 Rehabilitation of Electrical Equipment

1.4.4.1 Modification of pumping motor configuration from two-stage to single-stage pump sets.

1.4.4.2 Supply, delivery, and installation of IE3 Electric Motors (as per JW specification B3 foot mount, top mount terminal box, 400V, IE3, 4 Pole, 1470 RPM) – suitable for the

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equivalent single-stage pump requirements.

1.4.4.3 Supply, delivery, and installation of VSD drives for the suitable motor size.

1.4.4.4 Design, supply, delivery, and installation of a Motor Control Centre (MCC) to house VSD drives, Main Incomer, Distribution Board, level controller, and marshalling cabinet.

1.4.4.5 Supply, delivery, and installation of motor cable for the two motors (4 core SWA, including cable trunking).

1.4.4.6 Supply, delivery, and installation of a Level control > Ultrasonic level controller (currently Pulsar Ultra 3 + DB 10 head).

1.4.4.7 Supply, delivery, and installation of interior and exterior lights.

Phase three (Rehabilitation of Generator, Telemetry, and Project closeout)

1.4.5 Rehabilitation of Generator

1.4.5.1 Sum amount for Rehabilitation of 150kVA Diesel Generator (at Ffennell Road Depot), including transportation to site.

1.4.5.2 Design and supply a container for generator, including attenuation of noise for residential area (below 85dB).

1.4.5.3 Design and construct a suitable concrete base for the generator.

1.4.5.4 Sum amount for power cables and changeover switch.

1.4.5.5 Installation, Testing and Commissioning of Generator.

1.4.6 Installation of Telemetry.

1.4.6.1 Sum amount for the integration of the new installation to the existing telemetry system.

1.4.7 Minor Civil and Structural works

1.4.7.1 Refurbishment, repairs and waterproofing of the roof and side walls (including painting) of the pump station building.

1.4.7.2 Sump amount for sealing of leaks between wet well (sump) and dry well.

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1.4.8 Handover and Commissioning

1.4.8.1 Testing and Commissioning of the installations

1.4.8.2 Handover and Training (Defects liability period for 12months commence)

1.4.8.3 CoC for all electrical work done.

1.4.8.4 Submission of documentation (O&M manuals, as built, safety file, closeout report).

1.5. QUANTITIES

Turnkey project for Alveda Sewer Pump Station.

1.6. DURATION OF CONTRACT

Twelve (12) months from date of signature.

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2. 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 **Rehabilitation of Alveda Sewer Pump Station** as specified in conformity with the said RFP 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 as a once off contract which will commence from the date indicated in the letter of acceptance.

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2.1 SCHEDULE OF PRICES:

The evaluation on price alteration will be conducted as follows:

2.1.1 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.

2.1.2 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 unauthenticated alteration on the total bid offer and the amount in words is not authenticated the bidders will be disqualified for the entire tender.

2.1.3. Where the tender pricing schedule or bill of quantities is requesting rates/price from bidder/s without providing a total, the following will apply:

(i) If there is an unauthenticated alteration on the unit rate/price the bidder must be disqualified.

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Tenderer to complete the below table:

Item	Description	Unit of Measure	Estimated Qty	Unit Rate- Each item offered (Excl. VAT)	Unit Rate- Each item offered (Incl. VAT.)	Total Price (Incl. VAT.) [Unit Rate- Each item offered x Estimated Qty]
1	**Site Establishment and Preliminary and General**					
1.1	Site establishment and Preliminary and General.	Sum	1	R	R	R
1.2	Sum amount for Community Liaison Officer during the project duration.	Sum	1	R	R	R
1.3	Sum amount for security requirements during the project duration.	Sum	1	R	R	R
1.4	Removal and disposal of rubble at an appropriate landfill site.	Sum	1	R	R	R
1.5	Safety and Environmental requirements (OHS requirements and file).	Sum	1	R	R	R
2	**Site Security**					
2.1	Construction of guardhouse as per attached specification.	Sum	1	R	R	R
2.2	Construction of high security fence as per attached specification.	Sum	1	R	R	R
2.3	Supply and Install security beams and link to control room.	Sum	1	R	R	R
3	**Rehabilitation of Mechanical Equipment.**					
3.1	Supply and Delivery of 1.5KW - 3Phase dewatering pump.	No	1	R	R	R
3.2	Repair the structural defects to stop leaks on the floor and walls on the drywell.	Sum	1	R	R	R
3.3	Modification of pumping configuration from two stage to single stage pump. Modification of the Manifold (two pumps sets). Modification of pump plinth (two pumps sets). Sizing and installation of a suitable single stage pumps (two pumps sets). Sizing and installation of a suitable non-return valves and wedge gate valves suitable for single stage configuration (two pumps sets).	Sum	1			
3.4	Sizing, supply, delivery, and installation of suitable of existing overflow pipe.	Sum	1	R	R	R
4	**Rehabilitation of Electrical Equipment**					
4.1	Modification of pumping motor configuration from two-stage to single-stage pump sets.	Sum	1	R	R	R
4.2	Supply, delivery, and installation of IE3 Electric Motors (as per JW specification B3 foot mount, top mount terminal box, 400V, IE3, 4 Pole, 1470 RPM) – suitable for the equivalent single-stage pump requirements.	No	2	R	R	R
4.3	Supply, delivery, and installation of VSD drives for the suitable motor size.	No	2	R	R	R

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4.4	Design, supply, delivery, and installation of a Motor Control Centre (MCC) to house VSD drives, Main Incomer, Distribution Board, level controller, and marshalling cabinet.	Sum	1	R	R	R
4.5	Supply, delivery, and installation of motor cable for the motors (2 x runs per motor) > 4 core SWA, including cable trunking.	Sum	1	R	R	R
4.6	Supply, delivery, and installation of a Level control > Ultrasonic level controller (currently Pulsar Ultra 3 + DB 10 head).	Sum	1	R	R	R
4.7	Supply, delivery, and installation of interior and exterior lights.	Sum	1	R	R	R
5	**Rehabilitation of Generator**					
5.1	Sum amount for Rehabilitation of 150kVA Diesel Generator (at Ffennell Road Depot), including transportation to site.	Sum	1	R	R	R
5.2	Design and supply a container for generator, including attenuation of noise for residential area (below 85dB).	Sum	1	R	R	R
5.3	Design and construct a suitable concrete base for the generator.	Sum	1	R	R	R
5.4	Sum amount for power cables and changeover switch.	Sum	1	R	R	R
5.5	Installation, Testing and Commissioning of Generator.	Sum	1	R	R	R
6	**Installation of Telemetry *refer to schedule attached**					
6.1	Sum amount for the integration of the new installation to the existing telemetry system.	Sum	1	R	R	R
7	**Minor Civil and Structural works**					
7.1	Refurbishment, repairs and waterproofing of the roof and side walls (including painting) of the pump station building.	Sum	1	R	R	R
7.2	Removal and delivery to Ffennell Road Depot of existing MCC cabinets and two pump sets.	Sum	1	R	R	R
8	**Handover and Commissioning of phase three installations**					
8.1	Testing and Commissioning of the installations.	Sum	1	R	R	R
8.2	Handover, Training and Submission of documentation.	Sum	1	R	R	R
8.3	Coc for all electrical work done.	Sum	1	R	R	R
	Total			R	R	R

[11] SCHEDULE: INSTALLATION OF TELEMETRY

Item	Description	Unit	Unit Price	Total
1	**Telemetry System**			
1.1	Telemetry RTU System in Perano 205 Enclosure with 24 Digital Inputs, 24 Analog Inputs and 16 Digital Outputs	1		
1.2	GE-MDS Orbit Radio	1		
1.3	Telemetry Junction Box with kniife-edge terminals, Built Up in Perano 205 Enclosure	1		
1.4	Battery Junction Box	1		
1.5	Lithium-Ion Phosphate (LiFePO4) battery 12 V 10	1		
1.6	FAT of Telemetry panel	1		
2	**Antenna System**			
2.1	Dipole Antenna	1		
2.2	LMR 400 Cable and Antenna connectors	1		
2.3	Antenna Pole Bracket	1		
2.4	Antenna Pole Aluminium	1		
2.5	Surge Protection Unit	1		
2.6	Earthing kit for Antenna and Telemetry System	1		
3	**Telemetry Access Control System**			
3.1	Industrial Passive Infrared Detector	1		
3.2	Industrial Door intruder switch for telemetry Hut	1		
3.3	TAG Reader	1		
3.5	Alarm system with 3 beams and 3 passives	1		
4	**Instrumentation**			
4.1	Radar Level Build into enclosure	1		
4.2	2 Channel Surge Arrestors	3		
4.3	Bracket for Ultrasonic sensor	1		
4.4	High and Overflow Probe System (incl control and power module)	1		
4.5	8 Pair Mylar cable, from telemetry to bottom to be used for Ultrasonic Sensor as well as High	1		
5	**OPC and SCADA Configuration**			
5.1	OPC Configuration	1		
5.2	SCADA & Reporting Configuration	1		
6	**Installation**			
6.1	Installation	1		
7	**Sundries**			
7.1	Installation Material and Sundries	1		
8	**Travelling**			
8.1	Travelling	1		
9	**Handover and Commisioning**			
9.1	Handover and Commisioning of system	1		
10	**System Documentation**			
10.1	Drawings and I/O Lists	1		
	SUB TOTAL	**Total (Excl. VAT)**		
	VAT @15%	**VAT @ 15%**		
	TOTAL	**Total (Incl. VAT)**		

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3. EVALUATION CRITERIA

3.1. Stage 1: Mandatory Evaluation

Active Status of required CIDB designation and Grade at time of evaluation.

3.2. Stage 2: Administrative Requirements

3.2.1. MBD 3.1 Firm Price(s) Purchase
3.2.2. MBD 4 form (Declaration of Interest).
3.2.3. MBD 6.1 Form (Preference points claim form).
3.2.4. MBD 8 (Declaration of Bidder's Past Supply Chain Management Practices)
3.2.5. MBD 9 (Certificate of Independent Bid Determination).

3.3. Stage 3: Functionality/Technical Evaluation Criteria

The functionality or technical evaluation criteria is as follows:

CRITERIA NO #	CRITERIA	EVIDENCE	SUB-CRITERIA/CLAUSE	MAX SCORE	SCORE
1	Tenderers experience in respect to Replacement or Installation of Pumps/ Electrical Motors	The bidder must provide reference letter (s). Where Replacement or Installation of Pumps/ Electrical Motors was carried out successfully. **NB:** The attached reference template must be completed by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with the functional criteria requirements.	**Number of Projects**	30	
			No Project		**0**
			One project		**15**
			Two or more projects		**30**
2	Tenderers experience with respect to Replacement or Installation of Electrical Drives/ MCC	The bidder must provide reference letter (s). Where Replacement or Installation of Electrical Drives/ MCC was carried out successfully. **NB:** The attached reference template must be completed by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with the functional criteria requirements.	**Number of Projects**	30	
			No projects		**0**
			One project		**15**
			Two or more projects		**30**
3	Capacity to Supply, Install and Commission Electrical Drives/ Motors/ Mechanical pumps	The bidder must provide reference letter (s). Where Supply, Installation and Commissioning of Electrical Drives/ Motor/ Mechanical pumps was carried out successfully and the contract value was R3,5 million or more. **NB:** The attached reference template must be completed by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with the functional criteria requirements.	**Total Combined Value of Contracts Completed**	40	
			Less than R3,5 million.		**0**
			R3,5 million and more but less than R4,5 million		**24**
			More than R4,5 million or more		**40**
	MINIMUM SCORE (Minimum score is required on each criteria)			**60**	
	MAXIMUM SCORE			**100**	

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3.3.1 Bidders are required to meet a minimum of 60 points on the functionality evaluation to be further evaluated on the preference points. Bidders that do not meet a minimum of 60 points will be disqualified and will not be evaluated further.

(Technical) Tenderer must meet the minimum qualify score to proceed to the preference – stage 4.

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.

3.4. **Stage 4:** The responses will be evaluated on the **80/20 preference point's principle**. 80 Points Price and 20 Points Specific Goals. Pricing schedule to be completed fully by the bidder. Bidders who fail to quote or complete the pricing schedule as per this requirement will be disqualified.
The required proof for claiming points for specific goals is as follows:

SPECIFIC GOALS – ANY ONE OR A COMBINATION OF ANY	**MEANS OF VERIFICATION THAT MUST BE SUBMITTED OR A COMBINATION THEREOF TO PROVIDE POINTS CLAIMED**
Businesses located within the boundaries of a COJ municipality. 10 Points.	• Proof of municipal account / valid lease agreement, letter from the Ward Council confirming the business address
SMME (An EME or QSE) owned by 51% or more - Black People. 10 Points.	• Valid Construction sector BBBEE Certificate issued by SANAS accredited verification agency or construction sector (Exempted Micro Enterprises) Affidavit sworn under oath.

Note: A tenderer who fails to provide proof of specific goals as required by the tender conditions may not be disqualified; however, they will only receive points for price and zero points for specific goals.

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CONTACTABLE REFERENCE

To Johannesburg Water (SOC) Ltd

I, the undersigned being duly authorized to do so, hereby furnish a reference to Johannesburg Water relative to the **Rehabilitation of Alveda Sewer Pump Station as a once-off purchase contract.**

Name of Tenderer: ……

Description of Services provided in relation to Scope of Work OR functional criteria.

……

……

……

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

Contract/Project Value: ……

Name of authorised person: ……

Signature: ……..…….. Date ……..…….....

Telephone/Mobile: ……

Email: ……

Completed on behalf (Name of Client) ……..…….....

NB: This document must be completed by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with the functional criteria requirements. A separate form must be completed for each reference as required in the evaluation criteria. 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.

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……

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……

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

Contract/Project Value: ……

Name of authorised person: ……

Signature: ……..…….. Date ……..

Telephone/Mobile: ……

Email: ……

Completed on behalf (Name of Client) ……..

NB: This document must be completed by the referee and included in the tender submission. Alternatively, the client's letterhead may be used for this purpose provided it complies with the functional criteria requirements. A separate form must be completed for each reference as required in the evaluation criteria. 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.

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4. AWARDING STRATEGY

This request for pricing will be awarded to the highest scoring bidder in terms of price and points scored for specific goals.

5. RETURNABLE DOCUMENTS

The following documents **must** be returned together with this Request for Pricing:

5.1. This request for pricing document must be completed and submitted with pricing or quotation.

5.2. Proof of points claimed for specific goal must be submitted in order to qualify for Specific Goals points.

5.3. Complete and sign the following Municipal Bidding Documents (MBD).

5.3.1. MBD 3.1 Firm Price(s) Purchase

5.3.2. MBD 4 form (Declaration of Interest).

5.3.3. MBD 6.1 Form (Preference points claim form).

5.3.4. MBD 8 (Declaration of Bidder's Past Supply Chain Management Practices)

5.3.5. MBD 9 (Certificate of Independent Bid Determination).

5.4. Latest municipal account/statement not older than three months or valid lease agreement for both the company and all active Directors.

5.5. The required documentary evidence for functionality or technical evaluation (where Applicable).

5.6. CIDB Certificate or Registration number

6. GENERAL TERMS AND CONDITIONS

Price(s) quoted must be valid for at least ninety (90) days from date of your offer.

Price(s) quoted **must** be firm for the duration of the contract and must be inclusive of VAT.

Bidders will be notified of any omitted, outstanding, missing and or incomplete administrative

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documents and will be offered a period of 3 days to complete or submit those pages i.e., Municipal Bidding Documents (MBD), authority to sign and other administrative documents that require completion and signatures. These exclude documentation on functionality, price, and preference points for specific goals.

Tenders that are received contrary to the above requirements will be disqualified after three (3) days period has lapsed.

If locality is a specific goal in MBD6.1 – the requested documentation may not be used to allocate points for specific goals.

Bidders who did not submit municipal statement of account or valid lease agreement for both the company and all active directors will be afforded a period of two (2) days to submit. In a case where the company or active Directors have municipal commitments overdue for more than 90 days they will be offered three (3) days to settle their overdue amounts or submit proof of an arrangement agreed to between that municipality and that company or Director.

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GENERAL CONDITIONS OF CONTRACT (GCC) WILL BE APPLICABLE TO THIS RFP. SHOULD THERE BE A DISCREPANCY BETWEEN THE GCC AND SPECIAL CONDITIONS OF CONTRACT (SCC), THE SCC SHALL PREVAIL.

SPECIAL CONDITIONS

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.

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 All price(s) tendered shall include the cost of all insurances, services, labour, equipment, materials, etc. and be the net price after all discounts and settlement discount have been deducted. The net price/s shall be without any extra or additional charges to JW whatsoever.

2.3 A firm price will be acceptable.

2.4 Prices must include cost of supply, delivery, installation, and commissioning as per technical specification.

3. SURETY BOND:

3.1 No surety bond shall be required in terms of this contract.

4. COMPLIANCE WITH LEGISLATION AND SPECIFICATION:

4.1 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 Regulations specified therein.

4.2 The Service Provider shall comply with all the requirements prescribed in the specification.

4.3 Equipment and Material must meet applicable SANS and issue CoC in line with SANS10142

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5. SAFETY:

5.1 Without derogation from the generality of Clause 4.1, or from any other provision of this contract, the Service Provider shall at all times during the contract, comply in all respects with the safety and other requirements of the Occupational Health and Safety Act 85 of 1993 and the regulations applicable hereunder.

6. EMPLOYMENT OF LABOUR:

6.1 The Service Provider must ensure that all relevant legislation is complied with in the employment of labour.

7. INSURANCE AND INDEMNIFICA-TION:

7.1 In addition to any insurance required to be held by the Service Provider in terms of the Contract 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. 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.

7.2 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.

7.3 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.

7.4 Copies of such insurances and indemnifications must be supplied to JW within 21 days of notification of acceptance of the tender.

8. REMEDIES, BREACH, WHOLE AGREEMENT, WAIVER, VARIATION AND INDULGENCES

8.1 If the Service Provider or any person employed or associated with him or in the case of a Company, a Director or shareholder or person also associated with such Company, either directly or indirectly gives or offers to give any gratuity, reward or commission or other bribe to any 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

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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 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

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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 Service Provider shall be required to Rehabilitate Alveda Sewer Pump Station to restore optimal and sustainable operations. The work includes supply, delivery, installation of mechanical, electrical, civil, control and instrumentation and security infrastructure.

10.2 The Service Provider shall be required to provide twelve-month maintenance plan, drawings, and related documentation as part of commissioning and handover.

11. DURATION:

11.1 The tenure of the contract shall be with effect from the date of signing the contract as a once off purchase and completion within twelve (12) months.

12. QUANTITIES

12.1 Turnkey projects for the refurbishment of Alveda Sewer Pump Station.

13. PLACE AND TIME OF DELIVERIES:

13.1 Delivery shall be made to Alveda Sewer Pump Station during normal working hours, 08h00 to 15h00 weekdays.

14.SAMPLES:

14.1 Not required for a turnkey project

15. TENDER VALIDITY:

15.1 The Tender shall be valid for a period of ninety (90) days from the date of closing of Tenders.

16. ADJUDICATION OF TENDERS:

16.1 The highest, lowest or any tender will not necessarily be accepted by JW.
JW reserves the right to adjudicate the Tender to JW's best interest and it is not necessarily intended to award the Contract to only one Service Provider.

17. ACCEPTANCE OF TENDER:

17.1 A valid and binding contract shall be concluded at the time when the Service Provider receives an official appointment letter and sign letter of acceptance at the offices of JW after the Service

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Provider where he/she will enter into a contract with JW with the term and conditions packaged in this document.

18. COMPLETENESS:

18.1 Failure by the tenderer to complete in full the required information regarding their proposal will render the tender liable to rejection on the grounds of being incomplete.

19 QUALITY AND GUARANTEE

19.1 The Service Provider shall not be relieved of his obligations with respect to the sufficiency of the materials, workmanship and quality of the goods by reason of no obligation having been taken thereto by JW's representative at the time the goods were delivered.

19.2 If at any time, as stipulated in the contract, but not exceeding twelve (12) months after delivery, JW is dissatisfied with the goods or with any part thereof on account of materials being faulty or of inferior quality of workmanship or bad design or on account of the goods not being in strict accordance with the contract specifications; the Service Provider shall immediately remedy the said defects free of cost to JW. Should the Service Provider delay remedial work in excess of the time stipulated by JW's representative, JW may have such remedial work executed at the Service Provider's expense.

19.3 The risk of all goods purchased by JW from the Service Provider under this contract shall remain with the Service Provider until such time the goods have been delivered to JW.

19.4 If any dispute arises between JW and the Service Provider in relation with the quality and guarantee of the goods, either party may give the other a notice in writing of the existence of such dispute as stipulated in Clause 9.1.

20. PENALTIES FOR FAILURE TO DELIVER

20.1 If the Service Provider fails to deliver the required quantity of product by the due date agreed upon: a penalty of 5% (five) shall be applied for the total value of that specific order where delivery conditions were not met. Alternatively, Johannesburg Water reserves the right to purchase the product elsewhere and to deduct any extra expense in excess of the tender rates so incurred from any sum due under this tender, or recover the amount from the Service Provider as debt.

20.2 No liability in terms of Clause 20.1 shall attach to the Service Provider if he shall prove to the satisfaction of the Engineer that the delivery has been delayed or become impossible due to fire, war, riot, strikes, Natural Disasters, lockout, accident or other unforeseen occurrences or circumstances beyond the Service

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Providers control, provided, however, that in all cases the Service Provider has notified Johannesburg Water in writing within 24 (Twenty-four) hours of it first coming to the Service Provider's notices, that delivery will be delayed or become impossible for the abovementioned reasons.

PART B
TERMS AND CONDITIONS FOR BIDDING

1. BID SUBMISSION:
1.1. BIDS MUST BE DELIVERED BY THE STIPULATED TIME TO THE CORRECT ADDRESS. LATE BIDS WILL NOT BE ACCEPTED FOR CONSIDERATION.
1.2. ALL BIDS MUST BE SUBMITTED ON THE OFFICIAL FORMS PROVIDED–(NOT TO BE RE-TYPED) OR ONLINE
1.3. THIS BID IS SUBJECT TO THE PREFERENTIAL PROCUREMENT POLICY FRAMEWORK ACT AND THE PREFERENTIAL PROCUREMENT REGULATIONS, 2022, THE GENERAL CONDITIONS OF CONTRACT (GCC) AND, IF APPLICABLE, ANY OTHER SPECIAL CONDITIONS OF CONTRACT.
2. TAX COMPLIANCE REQUIREMENTS
2.1 BIDDERS MUST ENSURE COMPLIANCE WITH THEIR TAX OBLIGATIONS.
2.2 BIDDERS ARE REQUIRED TO SUBMIT THEIR UNIQUE PERSONAL IDENTIFICATION NUMBER (PIN) ISSUED BY SARS TO ENABLE THE ORGAN OF STATE TO VIEW THE TAXPAYER'S PROFILE AND TAX STATUS.
2.3 APPLICATION FOR THE TAX COMPLIANCE STATUS (TCS) CERTIFICATE OR PIN MAY ALSO BE MADE VIA E-FILING. IN ORDER TO USE THIS PROVISION, TAXPAYERS WILL NEED TO REGISTER WITH SARS AS E-FILERS THROUGH THE WEBSITE WWW.SARS.GOV.ZA.
2.4 FOREIGN SUPPLIERS MUST COMPLETE THE PRE-AWARD QUESTIONNAIRE IN PART B:3.
2.5 BIDDERS MAY ALSO SUBMIT A PRINTED TCS CERTIFICATE TOGETHER WITH THE BID.
2.6 IN BIDS WHERE CONSORTIA / JOINT VENTURES / SUB-CONTRACTORS ARE INVOLVED, EACH PARTY MUST SUBMIT A SEPARATE TCS CERTIFICATE / PIN / CSD NUMBER.
2.7 WHERE NO TCS IS AVAILABLE BUT THE BIDDER IS REGISTERED ON THE CENTRAL SUPPLIER DATABASE (CSD), A CSD NUMBER MUST BE PROVIDED.
3. QUESTIONNAIRE TO BIDDING FOREIGN SUPPLIERS
3.1. IS THE ENTITY A RESIDENT OF THE REPUBLIC OF SOUTH AFRICA (RSA)? ☐ YES ☐ NO

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3.2. DOES THE ENTITY HAVE A BRANCH IN THE RSA?
☐ YES ☐ NO

3.3. DOES THE ENTITY HAVE A PERMANENT ESTABLISHMENT IN THE RSA?
☐ YES ☐ NO

3.4. DOES THE ENTITY HAVE ANY SOURCE OF INCOME IN THE RSA?
☐ YES ☐ NO

3.5. IS THE ENTITY LIABLE IN THE RSA FOR ANY FORM OF TAXATION?
☐ YES ☐ NO

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

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

SIGNATURE OF BIDDER: ……

CAPACITY UNDER WHICH THIS BID IS SIGNED: ……

DATE: ……

MBD 4

DECLARATION OF INTEREST

1. No bid will be accepted from persons in the service of the state[1].

2. Any person, having a kinship with persons in the service of the state, including a blood relationship, may make an offer or offers in terms of this invitation to bid. In view of possible allegations of favouritism, should the resulting bid, or part thereof, be awarded to persons connected with or related to persons in service of the state, it is required that the bidder or their authorised representative declare their position in relation to the evaluating/adjudicating authority.

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

3.1 Full Name of bidder or his or her representative:……..

3.2 Identity Number: …….

3.3 Position occupied in the Company (director, trustee, hareholder[2]):……..

3.4 Company Registration Number: …….

3.5 Tax Reference Number:……

3.6 VAT Registration Number: ……

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

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

3.8.1 If yes, furnish particulars. ……

……..

[1]MSCM Regulations: "in the service of the state" means to be –

(a) a member of –
  (i) any municipal council;
  (ii) any provincial legislature; or
  (iii) the national Assembly or the national Council of provinces;

(b) a member of the board of directors of any municipal entity;
(c) an official of any municipality or municipal entity;
(d) an employee of any national or provincial department, national or provincial public entity or constitutional institution within the meaning of the Public Finance Management Act, 1999 (Act No.1 of 1999);
(e) a member of the accounting authority of any national or provincial public entity; or
(f) an employee of Parliament or a provincial legislature.

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

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**

MBD 8

DECLARATION OF BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES

1 This Municipal Bidding Document must form part of all bids invited.

2 It serves as a declaration to be used by municipalities and municipal entities in ensuring that when goods and services are being procured, all reasonable steps are taken to combat the abuse of the supply chain management system.

3 The bid of any bidder may be rejected if that bidder, or any of its directors have:

a. abused the municipality's / municipal entity's supply chain management system or committed any improper conduct in relation to such system;
b. been convicted for fraud or corruption during the past five years;
c. willfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past five years; or
d. been listed in the Register for Tender Defaulters in terms of section 29 of the Prevention and Combating of Corrupt Activities Act (No 12 of 2004).

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

Item	Question	Yes	No
4.1	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 *audi alteram partem* 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 ☐	No ☐
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 ☐	No ☐
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 ☐	No ☐

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 ☐	No ☐
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 ☐	No ☐
4.7.1	If so, furnish particulars:		

CERTIFICATION

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

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

……... **……..**
Signature **Date**

……. **……..**
Position **Name of Bidder**

MBD 9

CERTIFICATE OF INDEPENDENT BID DETERMINATION

1 This Municipal Bidding Document (MBD) must form part of all bids[1] 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.

MBD 9

CERTIFICATE OF INDEPENDENT BID DETERMINATION

I, the undersigned, in submitting the accompanying bid:

_____

(Bid Number and Description)

in response to the invitation for the bid made by:

_____

(Name of Municipality / Municipal Entity)

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

I certify, on behalf of:_____that:

(Name of Bidder)

1. I have read and I understand the contents of this Certificate;
2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect;
3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder;
4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign, the bid, on behalf of the bidder;
5. For the purposes of this Certificate and the accompanying bid, I understand that the word “competitor” shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who:

    (a) has been requested to submit a bid in response to this bid invitation;
    (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and

(c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder

6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However communication between partners in a joint venture or consortium[3] 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.

MBD 9

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

MBD 3.1

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 90 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/Not 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

SIGNATURE(S)OF AUTHORIZED PERSON …….....

DATE: .....

Name of bidder.....……..

Name of authorized person (in block letters) .....……

MBD 6.1

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

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

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

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1. GENERAL CONDITIONS

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

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

1.2 The applicable preference point system for this tender is the 80/20 preference point system.

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

a) Price; and
b) Specific Goals.

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

The maximum points for this tender are allocated as follows:

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

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

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

2. DEFINITIONS

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

3. FORMULAE FOR PROCUREMENT OF GOODS AND SERVICES

3.1 POINTS AWARDED FOR PRICE

3.1.1 THE 80/20 PREFERENCE POINT SYSTEMS

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

80/20

$$Ps = 80\left(1 - \frac{Pt - P\,min}{P\,min}\right)$$

Where

Ps = Points scored for price of tender under consideration

Pt = Price of tender under consideration

Pmin = Price of lowest acceptable tender

4. POINTS AWARDED FOR SPECIFIC GOALS

4.1 In terms of Regulation 4(2); 5(2); 6(2) and 7(2) of the Preferential Procurement Regulations, preference points must be awarded for specific goals stated in the tender. For the purposes of this tender the tenderer will be allocated points based on the goals stated in Table 1 below as may be supported by proof/ documentation stated in the conditions of this tender:

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

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

The specific goals allocated points in terms of this tender	Number of points allocated (80/20 system) (To be completed by the organ of state)	Number of points claimed (80/20 system) (To be completed by the tenderer)
Businesses located within the boundaries of a COJ municipality	10	
SMME (An EME or QSE) owned by 51% or more - Black People.	10	
Total	**20**	

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

5.1 Name of company/firm……

5.2 Company registration number: ……...

5.3 TYPE OF COMPANY/ FIRM

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

[TICK APPLICABLE BOX]

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

i) The information furnished is true and correct.

ii) The preference points claimed are in accordance with the General Conditions as indicated in paragraph 1 of this form;

iii) In the event of a contract being awarded as a result of points claimed as shown in paragraphs 1.4 and 4.2, the contractor may be required to furnish documentary proof to the satisfaction of the organ of state that the claims are correct;

iv) If the specific goals have been claimed or obtained on a fraudulent basis or any of the conditions of contract have not been fulfilled, the organ of state may, in addition to any other remedy it may have –

(a) disqualify the person from the tendering process;

(b) recover costs, losses or damages it has incurred or suffered as a result of that person's conduct;

(c) cancel the contract and claim any damages which it has suffered as a result of having to make less favourable arrangements due to such cancellation;

(d) recommend that the tenderer or contractor, its shareholders and directors, or only the shareholders and directors who acted on a fraudulent basis, be restricted from obtaining business from any organ of state for a period not exceeding 10 years, after the *audi alteram partem* (hear the other side) rule has been applied; and

(e) forward the matter for criminal prosecution, if deemed necessary.

…… **SIGNATURE(S) OF TENDERER(S)** **SURNAME AND NAME**: …… **DATE:** …… **ADDRESS**: …… …… …… ……

JOHANNESBURG WATER (SOC) Ltd.

BULK WASTEWATER

PARTICULAR SPECIFICATION

E01 : ELECTRICAL MOTORS

Johannesburg Water

Johannesburg Water (SOC) Ltd.
PO Box 61542
Marshalltown
2107

Revision 4

August 2019

City of Johannesburg
Johannesburg Water (SOC) Ltd

DOCUMENT CONTROL SHEET

Document Title: **Particular Specification – E01 : Electrical Motors**

JW Reference: **BWW523C**

Document Ref. No: **E01**

DOCUMENT APPROVAL

ACTION	FUNCTION	NAME	DATE	SIGNATURE
Prepared	Senior Electrical Engineer	B Pieterse	August 2019	
Reviewed	Director	R Baard	August 2019	
Approved	Regional Maintenance Manager	T Thabeng	August 2019	

RECORD OF REVISIONS

Date	Revision	Author	Comments
4	2019-08-20	B Pieterse	Review of Electrical Standards, plus New Design Guidance
3	2014-06-03		Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance
2	2012-05-30		Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance
1	2009-05-12		Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance

PARTICULAR SPECIFICATION: VOLUME E01: ELECTRICAL MOTORS

CONTENTS

E01.1 SCOPE

This specification shall cover all electric motors to be designed, supplied installed and tested that shall drive any of the items of equipment to be supplied under the contract. This specification shall be read together with those specifying the mechanical driven equipment.

E01.2 INTERPRETATIONS

E01.2.1 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

E01.2.2 Standards

The latest edition, including all amendments to until the date of tender, of the following particular national and international specifications, publications and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof:

(a) SANS 1804-2 : Low-voltage three-phase standard motors

(b) SANS 60529 : Degrees of protection provided by enclosures (IP code)

(c) SANS 60034 : Rotating electrical machines

(d) BS 1486-2 : Heavy duty lubricating nipples

(e) SANS 60034-1 : Rotating electrical machines Part 1: Rating and performance

(f) ISO 281 : Rolling bearings - dynamic load ratings and rating life

E01.3 GENERAL REQUIREMENTS

(a) Electric motors shall be manufactured in South Africa and shall comply with the requirements of SANS 1804-2.

(b) Imported motors shall be accepted only if they form an integral part of the equipment offered. Where imported motors are offered they shall be submitted to the South African Bureau of Standards to be tested in accordance with the requirements of SANS 1804-2.

(c) The Engineer shall be provided with the appropriate certificates obtained from the South African National Standards stating that such motors do comply, prior with the installation of the motors. However, where tests reveal that motors do not comply, it shall be the responsibility of the Contractor to supply alternative motors that comply with the requirements of SANS 1804-2.

(d) Where imported motors are not normally kept in stock in South Africa, written proof shall be provided of the availability of replacement parts as well as the delivery period of the parts after placing the orders.

(e) All motors shall be standard catalogue models and shall be readily available.

(f) All motors shall where possible, be from the same manufacturer and shall have the same interchangeable frames. Variations in type and size shall, where possible, be limited to prevent stocking a variety of special spares.

(g) All motors shall be wound for direct-on-line (DOL) type of starting.

E01.4 WORKING VOLTAGE AND SUPPLY SYSTEMS

(a) The motors shall be capable of operating within ± 10% of the nominal supply voltage without risk of damage. All motors shall be suitable for operating continuously at the specified 3-phase voltage system under actual service conditions, including the ± 10% voltage tolerance, without exceeding the specified temperature rise determined by the resistance on a basic full load heat run.

(b) All motors shall be capable of operating continuously under actual service conditions at any supply frequency between 48 and 51 Hz together with any voltage between ± 5% of the nominal supply voltage.

(c) The slip-in speed of any motor at 80 percent of the nominal voltage at 50Hz shall not exceed a percentage agreed on by the engineer, and the motors shall be capable of operating at this voltage for a period of five minutes without deleterious heating.

E01.5 TEMPERATURE RISE

The temperature rise, as determined by resistance, of all motors, shall not exceed the following derated values:

Insulation class	E	B	F	H
Temperature rise (K)	50	60	80	100

E01.6 EFFICIENCY AND POWER FACTOR

(a) All motors supplied will be energy-efficient as described in SANS 60034-31: Selection of energy-efficient motors

(b) The efficiency of all motors shall be guaranteed by the contractor. Deviations from the guaranteed efficiency shall be within the limits specified in SANS 1804-2.

(c) The guaranteed efficiency of each motor size and rating shall be as determined in accordance with SANS 60034. A basic test certificate of efficiency will be accepted for a motor of identical size and rating or a basic test of efficiency shall be conducted if no certificate is available.

(d) The power factor of motors with a capacity of 20 kW or more shall not be less than 0,85 under all operating conditions.

E01.7 VIBRATION

(a) Motors shall be statically and dynamically balanced.

(b) All motors shall be checked for inadvertent vibration without load, and at full rated voltage at the manufacturer's works, and the vibration amplitude as measured shall be in accordance with SANS 60034-1.

(c) The ratio of axial to radial vibration shall not exceed 0,5.

E01.8 NOISE LEVEL

Unless specified differently all motors shall be of 'normal sound power', in compliance with SANS 60034.

E01.9 ENCLOSURE AND FRAME

(a) Each motor shall be ingress protected to the degree required by its application, and its enclosure shall be designed for the system of cooling associated therewith.

(b) Notwithstanding the requirements above, the minimum degree of protection shall be IP 55 to SANS 60529, or alternatively specified. Motors shall preferably be of the totally enclosed fan-cooled (TEFC) type.

(c) The motor cooling system must be of an aerodynamic design with minimal noise levels and superb airflow distribution over the frame with superior mechanical strength. All motor

cooling fan covers will be constructed in metal.

(d) All motors of the vertical-spindle type and exposed to the weather, shall be provided with a robust canopy of approved design by the Engineer.

E01.10 MOTOR TYPE

Motors shall be of the squirrel-cage induction type. Slip-ring induction motors or other approved types will be considered if the contractor is of the opinion that better results could be obtained by using such motors. Full electrical and mechanical details of each alternative shall be submitted with the tender documents. Alternative motors must be accepted by the Engineer in writing.

When motors are connected to VFD's with variable torque loads operated under usual service conditions, inverter-ready general-purpose motors must be supplied (IEC 60034-1)

When motors are connected to VFD's operating at extremely low speeds and/or with a constant torque load, or when operating over base speed, definite-purpose, inverter-duty motors must be supplied (IEC 60034-1).

Larger inverter-duty motors must be equipped with a constant speed auxiliary blower to provide adequate cooling at low motor operating speeds. The contractor must submit a statement from the motor supplier on the need for an auxiliary blower when omitted.

Inverter-duty motors above the 500 frame size should have both bearings insulated, and be equipped with a shaft grounding brush with a ground strap from the motor to the drive case. For frame sizes below 500, the contractor must check with the motor manufacturer regarding requirements for motor bearing insulation.

E01.11 RATING AND STARTING REQUIREMENTS

(a) Motors shall be adequately rated for the service for which they are intended, and due allowance shall be made for the temperature, altitude, climatic conditions and variations in the supply voltage. Motors shall not exceed 120% of the required capacity without prior approval from the Engineer.

(b) Not only shall motors be based on the full load requirements, but also the motor capacity and starting characteristics shall be compatible with the requirements of the driven equipment.

(c) Where motors are required to drive high inertia loads, the starting torque of the motor and the torque curve of the driven load shall be submitted to the Engineer for approval prior to manufacture. Such motors shall be capable of at least three starts per hour, with two consecutive starts from normal operating temperature, or more frequently if required by the Engineer.

(d) Motors shall be of the continuously running duty class S1 unless otherwise specified in the detailed specification or if a more onerous duty is dictated by the drive requirement.

(e) All squirrel-cage induction motors shall be suitable for direct on line starting at full voltage. Single-speed motors shall conform to SANS 60034-12, Design B characteristics unless approved by or dictated by the drive requirements.

(f) Unless otherwise approved, the 15% tolerance on locked-rotor torque permitted by SANS 60034-1 will not be accepted and shall be limited to 10%.

(g) Documentation shall include performance curves to suit the designed working conditions.

(h) When making a selection of the motor size for driven equipment, motor power shall be over-rated by a factor of thirty percent (30%) more than the demand of the driven equipment.

E01.12 BEARINGS

(a) All motors shall, wherever possible, be provided with pre-lubricated sealed bearings.

(b) Re-greasable bearings shall require only one lubrication per year. Grease lubrication of ball or roller bearings, where approved, shall be by means of hexagonal button-type grease

nipples to BS 1486- 2, Nos. 21A or 21B (industrial type).

(c) Grease-lubricated bearings shall have relief holes to ensure that the bearings have been correctly packed, which holes shall be positioned so that the excess grease can be easily removed. Cups shall be fitted to contain excess grease.

(d) Bearings shall be protected against eddy currents and shall be capable of withstanding vibrations caused by unbalanced loads.

(e) All bearings shall be designed for a minimum L_{10h}, basic life rating of 50 000 hours at the rated load and speed for the application in accordance with ISO 281.

E01.13 EARTHING

All motors shall be provided with a machined or spot-faced boss earth point, tapped to receive a bolt of not less than 10 mm in diameter for earthing purposes. This earth point must be located on one side of the motor, between the mounting feet.

A protective earth cable must be installed between the MCC earth bar and the motor earth point, sized in accordance with SANS1042-1.

Earth bonding must be installed between the motor frame and the motor support structure as well as the cable support structure.

E01.14 HEATERS AND DRAINAGE

Non-submersible motors that will be located outdoors or in a damp location such as in a drainage sump shall be provided with suitable means of drainage to prevent the accumulation of water due to condensation. They shall also be fitted with anti-condensation heaters suitable for a 220V AC supply if considered advisable by the manufacturer.

All motors shall be supplied with anti-condensation heaters (220V AC supply) to keep the motor temperature at 23°C when the motor is not operational to prevent moisture from condensing in the motor unless specified otherwise.

Heater terminal boxes shall be fitted on the motor frame and shall be of robust design, liberally sized and complete with suitable terminal block and mechanical cable gland or conduit entry.

E01.15 TERMINAL ARRANGEMENTS

(a) All motor terminal boxes must be oversized to fit a cable one size bigger than the standard cable as a minimum

(b) The terminal box must be installed with an OME supplied seal between the terminal box and the motor chassis

(c) Motor cable termination blocks must confirm to the IEC 60034-1 standard

(d) The line connections of each motor shall be brought out to a terminal box located in an approved position. In the case of two-speed motors, separate terminal boxes shall be provided for each speed.

(e) Terminal boxes shall be of the totally enclosed type designed to exclude the ingress of dust and moisture and sealed from the internal circuit of the motor, and shall be manufactured from sand-cast metal. The wall thickness of the terminal boxes and the dimension of the cable inlet shall be as specified in SANS 1804-2. The terminal box shall be so designed that the cable entry may be made in any one of four positions placed at right angles to one another.

(f) Winding termination in the motor terminal boxes shall be properly secured or fastened to avoid hot connections during operation.

(g) Terminal boxes shall be of ample size to allow the cable to be terminated in the box. Under no circumstances shall the cable be allowed to be in contact with the inside of the box or lid.

(h) Terminals shall be of a substantial design and shall be suited to receive cable lugs. Pinch-screw connections will not be accepted.

(i) The terminal arrangement shall permit the motor to be disconnected from its supply cable without damaging the cable tails and shall allow the supply cable and motor windings to be tested separately.

(j) The electrical clearance and creepage distances, with the correct cable terminations in position, shall comply with the requirements of SANS 60034.

(k) Terminal markings shall be clear and permanent. Irrespective of the direction of rotation required on the site, the connections shall be such that, when the supply leads L1 - L2 - L3 are connected to the motor terminals U - V - W respectively, the motor shall rotate in a clockwise direction when viewed from the driving end.

(l) Motors suited for only one-directional rotation, shall be clearly marked as such by an arrow fixed to the motor frame at the driving end.

(m) Before the contractor orders terminal boxes for electrical equipment, he shall supply details of the proposed boxes to the engineer for approval. These precautions are necessary to ensure that the size of the connecting blocks installed is sufficient to accommodate the cables supplied and connected by another contractor, and that sufficient space exists within the box to route cables conveniently.

E01.16 MOTOR/LOAD COUPLING

(a) Motors shall be coupled direct to the equipment to be driven by means of approved couplings and/or gearboxes unless specified differently. Refer to the relevant sections for specific specifications on transmission couplings and gearboxes. Vee-belt and chain drives will be considered only if direct coupling of the motor to the equipment is impossible or impractical.

Motors driving vee-belt or chain drives shall be fitted with heavy-duty bearings suited to the full side thrust at 120% of full load torque and short-term overloads of up to 250% of the full load torques during starting. The stiffness of the rotor shaft shall be checked to ensure that resonance and fatigue do not occur.

(b) Where applicable, the flanges of the motors and equipment shall be identical.

(c) The precision tolerance class shall apply to all flange-mounted motors with regard to concentricity, perpendicularity and shaft run-out.

E01.17 INFORMATION PLATES FOR MOTORS

In addition to the information required by SABS 948-1the following shall also be marked on the nameplates:

(a) Year of manufacture,

(b) The order number,

(c) Total mass of motor in kilogram,

(d) Diagram indicating the number, type and positions of heaters and temperature detectors if applicable,

(e) Bearing types and sizes, and

(f) Bearing grease interval or bearing replacement interval where pre-packed bearings are used.

E01.18 ADDITIONAL SPECIFICATIONS FOR TWO-SPEED MOTORS

The following additional specifications apply to all two-speed motors:

(a) Terminal markings shall be as per SANS 1804-2.

(b) The starting current shall not exceed six times the full load current of the high-speed rating.

E01.19 SUBMERSIBLE MOTORS

The following additional requirements apply specifically to all submersible motors:

All submersible motors shall be suited for submersion up to a depth of 1,5 times the depth of submersion shown on the drawings for each application, or as specified in the detail specifications.

All submersible motors shall have dynamically balanced rotors supported by maintenance-free, sealed-for-life ball bearings.

All motors shall be suitably coated to ensure the satisfactory operation of the motor under the specified class of service.

All terminal boxes shall be waterproof and suited for submersion up to the depth as specified for the motors.

An adequate length of waterproof cable, purpose-made for submersion, shall be supplied with each submersible motor. The coupling of this cable to the normal power-distribution cable, which usually is of the PVC type with steel-wire armour, shall be placed at least 1 m above the maximum water level by means of a purpose-made, weatherproof, outdoor junction box. The submerged cable shall be supported to minimize any movement of the cable, which results from turbulence caused by the operation of the equipment or the flow of the water.

Thermistor protection temperature switches shall be provided for submersible motors.

Seal monitors shall be provided for submersible motors, together with the required seal monitor relays. The cost for the seal monitor relays shall be deemed included in the rates tendered for the equipment.

E01.20 ADDITIONAL REQUIREMENTS

(a) The rotation speed of motors shall not exceed 1 500 rpm unless approved by the Engineer.

(b) Thermistor protection shall be provided for each winding of each motor. Motors rated below 22kW shall have no thermistor and heater protection devices installed on them. Motor rated 22kW and above shall have both thermistor and heater protection devices installed on them.

(c) Motors below 55kW shall be started by the DOL type method of starting. Motors including 55kW and above shall be started by the softer-starter type method of starting.

(d) A separate thermistor and heater terminal box shall be fitted on the motor frame next to the power terminal box and shall be of robust design, liberally sized and complete with suitable terminal block and mechanical cable gland or conduit entry.

(e) The minimum preferred class of insulation is Class F, derated in accordance with the relevant clause above.

E01.21 TECHNICAL DATA SHEETS

Details of all individual electric machines and equipment requiring electrical energy shall be indicated on the technical data sheet provided for in the tender Schedules (included in the technical data sheets.

E01.22 TESTING

Tests on completion (commissioning tests) shall be performed as described below in this specification.

E01.22.1 Performance Tests

(a) One motor of every type shall be tested for temperature rise and excess torque. Type test certificates on identical motors will be acceptable in lieu of these tests. Should type test certificates not be available, the first motor of each size manufactured shall be tested. All tests shall be in accordance with SANS 60034.

(b) The measurement of the temperature rise of the stator windings of motors for use on voltages up to 1 000 volts shall be by the increase in resistance method as is now permitted by SANS 60034.

E01.22.2 Routine Tests

(a) Each motor shall be tested at the manufacturer's works for light-run, locked rotor, insulation resistance, high voltage, air-gap clearances and Tan Delta on each complete stator.

(b) All tests shall be in accordance with SANS 60034.

E01.22.3 Test Certificates

(a) Four copies of all test certificates, showing the results of all tests performed, shall be supplied at a date not later than the delivery date of the motors.

(b) The test certificates shall contain power factor and efficiency figures for 125%, 100%, 75%, 50% and 25% of full load conditions as calculated from the test results.

E01.22.4 Witnessing of Tests

All type and routine tests on motors larger than 45 kW shall be witnessed by the Engineer.

E01.22.5 Testing of Terminal Box Assembly

(a) Proof shall be given to show that a prototype terminal and cable box assembly of the type being supplied on medium voltage motors has been tested under internal short-circuit conditions and that the pressure relief diaphragm ruptured protecting the case of the terminal box from serious damage. In addition, that a through fault current test was made to demonstrate that the complete assembly is capable of handling the short-circuit current without damage. The fault current for these tests shall have been 45 000 ampere for a duration of 0.25 seconds.

(b) These type tests shall have been witnessed by an independent authority.

E01.23 DRAWINGS FOR APPROVAL

The following drawings shall be submitted for approval:

(a) Dimensioned outline and foundation drawings of the motors. (Shaft diameter, shaft height and motor weight to be clearly shown).

(b) Detailed drawings of the bearing arrangement, showing all lubrication pipes, coolers and pumps.

(c) Cross-sectional dimensioned drawings of the cable boxes.

(d) Detailed drawings of the motor base plate showing full constructional details with dimensions.

(e) For motors of 250 kW and larger fully dimensioned drawings of the shaft showing all tolerances.

(f) For motors designed for voltages of 3.3 kV and above, drawings showing the end winding bracing arrangements.

E01.24 STORAGE

The contractor must ensure that the storage requirements as specified by the manufacturer are adhered to strictly so as avoid voiding of the warranty. Every effort must be taken to ensure the motor is protected against ingress of water, vermin or anything that may affect its future operation. The following are only given as guidelines, the contractor is expected to exercise due care in the storage and handling of electric motors.

(a) The motor should be store upright in its normal position, free of dust, dirt, gasses and corrosive atmospheres.

(b) Motors should be stored under roof on a concrete base, normally in a store environment. Do not remove the motor from the wooden pallet.

(c) For bigger units, which cannot be housed in a store or relevant building, shed must be built with a proper concrete floor. Do not remove the motor from the wooden pallet.

(d) Store the bigger units close to the final position within access with overhead crane or mobile crane.

(e) Do not stack any objects on top of or against the motor.

(f) Motors must be stored in places free from vibrations in order to avoid damage to the bearings.

(g) The motors space heaters/ anti condensation heaters and similar accessories must be switched on at all times to avoid condensation and corrosion within the enclosure.

(h) If painting has been damaged during transportation, it must be repainted to avoid rusting.

(i) Ensure all machined surfaces and shaft extensions are covered with grease or a rust inhibiting substance.

(j) For slip-ring motors, the brushes must be lifted to avoid condensation between contact surfaces and slip rings.

(k) Before operation all brushes and contact surfaces have to be inspected and brush seating confirmed.

(l) When any motor is kept for extended period, the shaft must be manually turned on monthly intervals.

(m) For big machines with frames greater than or equal to 400mm, the shaft should be rotated monthly at any number of turns and then put at rest at 180 degrees difference from previous stationary position.

(n) When a motor is not immediately required in operation, it should be protected against moisture, high temperature and impurities in order to avoid damage to the insulation system.

(o) If the ambient contains high humidity, periodical insulation resistance inspection is recommended during storage.

(p) The following guidelines show the approximate insulation resistance values that can be expected from a clean and dry motor at 40° Celsius ambient.

(q) Minimum insulation resistance = rated voltage (kV) + 1 (Mega ohm) using 2 times the rated voltage.

(r) These periodical measurements should be recorded and be available prior to installation.

E01.25 ERECTION AND INSTALLATION

E01.25.1 Erection

(a) When motors are erected, care shall be taken to ensure that adequate tolerance margins are made available to ensure interchangeability with replacement motors.

(b) A minimum of 10 mm of packers shall be provided under the motor frame or motor bedplate to allow for adjustments in height.

(c) Before holding-down bolts are grouted in, the motor shall be lined up and the bolts shall be properly centred in the hole of the bedplate.

(d) The bending radius of the motor supply cable should not be exceeded when installing the cable (SANS10142-1).

(e) Motor supply cables must be supported and should not hang from the terminal box/gland.

E01.25.2 Bearing Inspection

(a) The Engineer shall inspect motors having ball/roller bearings.

(b) The grease shall be examined to ensure that it is not hard.

(c) Providing that no roughness is felt when the shaft is rotated by hand and that the motor runs without undue noise or vibration, the bearings will be considered acceptable.

(d) Should the bearings fail or exhibit the symptoms of brinelling during the guarantee period,

the Contractor, free of charge, without delay, shall change them.

E01.25.3 Alignment

(a) After erection, the alignment of the half-couplings between the motor and the driven machine shall be measured. In the case of a pedestal, bearing motor the air gap clearance between the rotor and the stator shall also be measured. A record shall be kept of these figures and they shall be submitted to the Engineer for approval.

(b) A horizontal sleeve bearing or limited end-float roller bearing motor shall be run uncoupled from its load to ensure that it rotates at the axial position indicated on the shaft and that the rotor is free to move to either side of this position. Particular attention shall be paid to ensure that the free running position and the rotor end-float are in agreement with the axial movement of the flexible coupling.

E01.25.4 Drying Out

(a) The Contractor shall dry out all motors larger than 100 kW and all smaller motors which have stood in the open during rain or have been flooded or whose cold insulation resistance is below 1.5 MΩ, before they are connected to the supply. If a motor is flooded, the motor bearings shall be replaced as a matter of urgency.

(b) The method of drying the motor shall be by placing the motor in a heating oven.

Sufficient heat shall be applied to produce a temperature of 60ºC but not greater than 80ºC for a Class A or 90º C for Class B insulation systems. Insulation resistance measurements and temperature readings shall be taken regularly every half hour at the start of dry-out until the motor attains an even temperature and thereafter every hour.

The characteristic dry-out curve of insulation resistance versus temperature shall be plotted and dry-out may be considered complete four hours after the resistance readings have started to rise from the steady minimum value, providing that the winding temperatures have remained steady during this period.

(c) The Contractor shall provide all equipment and the personnel required for the drying-out operation.

(d) In the case of motor smaller than 100kW, the onus remains on the Contractor to satisfy himself that a motor is dry before it is connected to the supply.

(e) Any motor, which fails as a result of being commissioned in a damp condition, shall be repaired at the cost of the Contractor.

E01.25.5 Double Shaft Extensions

The unused shaft extensions of a double-ended shaft motor shall be covered with an approved rust preventative after the motor is commissioned.

E01.26 TESTING AND COMMISSIONING

The contractor must supply a Manufacturers Test Certificate with each motor supplied.

The contractor must do a visual inspection as well as an insulation test on each motor before installation.

The contractor must do a direction test on each motor before handing the installation over. Where equipment can be damaged when rotated in an incorrect direction, the equipment must be disconnected from the motor before the direction check is done.

All test results must recorded and submitted to the Engineer for approval. The Engineer must be informed timeously off all tests to allow witnessing.

E01.27 MEASUREMENT AND PAYMENT

No separate payment will be made for electric motors for equipment unless otherwise specified in the detail specifications. All direct and indirect costs associated with such motors shall be deemed included in the rates tendered for the equipment.

Where separate payment is required for electric motors and specified as such in the detail

specifications, the following payment items shall be applicable:

Item	**Unit**
Supply and delivery electric motors	No

The unit of measurement shall be the number of motors supplied.

The tendered rate shall include full compensation for the design, manufacture, corrosion protection, supply, handling, transport, testing and delivery of each complete motor as specified in the detail specification to ensure satisfactory operation after installation.

Separate items will be scheduled for different sizes/types of motors required.

Item	**Unit**
Installation, test and commission of electric motors	No

The unit of measurement shall be the number of motors installed.

The tendered rate shall include full compensation for the installation and coupling of the motor to the required load. The tendered rate shall include full compensation for all required installation material.

Separate items will be scheduled for different sizes/types of motors required.

JOHANNESBURG WATER (SOC) Ltd.

BULK WASTEWATER

PARTICULAR SPECIFICATION

E05 : ELECTRICAL LOW VOLTAGE POWER AND CONTROL CABLES

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Revision 5 August 2019

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PARTICULAR SPECIFICATION: VOLUME E05: ELECTRICAL LOW VOLTAGE POWER AND CONTROL CABLES

CONTENTS

E05.1 SCOPE

This specification covers the requirements with regards to the manufacture, supply, delivery, installation, testing and commissioning of power and control cables rated up to 600/1000V. The term cable shall indicate electrical conductors or carriers manufactured for supplying power for the control and supervision of multipurpose loads.

E05.1.1 Statutory Documents and Standards

Cables shall be strictly manufactured in accordance with the requirements of the latest editions of the following standards:

(a) SANS 1507	:	Electrical cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V)
(b) SANS 1411	:	Materials of insulated electric cables and flexible cords
(c) SANS 1339		Electric cables - Cross-linked polyethylene (XLPE) insulated cables for rated voltages 3,8/6,6 kV to 19/33 kV
(d) SANS 1520	:	Flexible electrical cables for use in mines
(e) SANS 10198		The selection, handling and installation of electric power cables of rating not exceeding 33 kV
(f) SANS 10142-1	:	The Wiring of Premises Part 1 – Low Voltage Installations
(g) IEC 60245	:	Rubber insulated cables
(h) IEC 60287	:	Electric cables - Calculation of the current rating
(i) IEC 60811	:	Electric and optical fibre cables - Test methods for non-metallic materials
(j) DIN VDE 0250-816	:	Cables – Wires and flexible cords for power installation – Heat-resistant silicone rubber insulated flexible cable

The Occupational Health and Safety Act (Act No. 85 of 1993)

E05.1.2 Definitions and Terminology

In general, the following definitions and terminology shall apply:

Armouring	A layer or layers of galvanized steel wires applied to the cable to provide mechanical protection or earth continuity, or both.
Bedding	A layer of extruded compound applied to the cable beneath the armouring.
Cable	A length of core or more cores assembled, that may or may not be provided with an overall mechanical covering.
Core	A single insulated conductor without protective covering.
Direction of lay	The lateral direction of inclination to the axis (either left or right) of the receding helix formed by wire or core in a cable or flexible cord.
PVC	Polyvinyl chloride
Sheath	A solid extruded protective covering applied as the exterior of a cable or a flexible cord.

E05.1.3 Particular Specifications to read in Conjunction with this Specification

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

E06: ELECTRICAL MEDIUM AND LOW VOLTAGE CABLE INSTALLATION

E05.2 GENERAL SCOPE

E05.2.1 Design and Supply

(a) Conductor sizes

The minimum conductor size for control cables shall be 2.5mm^2.

The minimum conductor size for power cables on plant equipment (excluding small power and lighting) shall be 16mm^2.

(b) Conductor material

In the case of plants with a high risk of cable theft, cables with aluminium conductors must be used where the nominal core diameter exceeding 25mm^2. This must be agreed upon in writing by the Engineer.

E05.3 CONSTRUCTION

The cable shall be constructed as follows:

E05.3.1 Conductor Material

The copper conductors shall be of plain annealed or hard draw wire in accordance with the requirements of the latest edition of SANS 1411.

The aluminium conductors shall be of plain hard drawn aluminium wire in accordance with the requirements of the latest edition of SANS 1411.

E05.3.2 Insulation

The insulation material shall comprise of PVC in accordance with the requirements of the latest edition of SANS 1411.

E05.3.3 Core Colour Identification

The cable cores colour shall be in accordance with the requirements of the latest edition of SANS 1507-3.

E05.3.4 Bedding

The bedding shall consist of a continuous PVC extruded sheath.

E05.3.5 Armour

The armouring shall consist of one layer of round galvanised steel wire in accordance with the requirements of the latest edition of SANS 1411.

E05.3.6 Sheath

The outer sheathing shall be an impermeable, halogen free, reduced smoke emission, flame retardant PVC in accordance with the latest edition of SANS 1411.

E05.4 CABLE MARKINGS

The cables shall be legibly marked in accordance with the requirements of the latest edition of SANS 1507, and shall include the following:

(a) Conductor size in square millimetres
(b) Number of cores
(c) Conductor material (copper)
(d) The specification number (SANS 1507) to which the cable has been manufactured.
(e) The year of manufacture.
(f) Nominal voltage.

E05.5 STORAGE

Cables shall be packed on reeled drums. The moisture content of wooden cable drums shall not exceed 20%.

Each end of the cable shall before being secured to the reeled drum, be sealed by an acceptable

method approved by the Engineer. The outer end shall be secured to the reel drum and the inner end shall be protected in a manner against mechanical damage.

The cable reeled drums shall be capable of taking a round spindle and be lagged with strong, closely fitted battens, at the inner and outer circumference to prevent damage to the cables. The spindle bearing plates shall be steel. The dimensions of the drum shall not exceed 1 100 mm width, 2 000 mm diameter and the spindle bearing plate shall not be less than 9 mm thick. Each drum shall be clearly marked on both sides in accordance with the latest edition of SANS 1507.

The ends of the PVC sheathed cable shall be sealed to avoid penetration of moisture. Each cable drum shall be numbered.

E05.6 CABLE SIZING AND DE-RATING

The cables shall be sized and de-rated in accordance with the requirements of the latest edition of SANS 10142-1.

E05.7 TESTING OF CABLES

E05.7.1 Testing and Commissioning

The contractor shall supply factory test certificates for each drum of cable supplied under the Contract.

After the installation is complete, the contractor and the Engineer shall inspect the installation. The Engineer must be notified in advance of the inspection dates. The contractor will keep a snag list, reflecting all items not acceptable to the Engineer. The contractor will correct the snag items as required to the Engineers approval, updating the snag list as the items are completed and signed off by the Engineer.

On completion of his work, the Contractor will issue an Electrical Certificate of Compliance (CoC). All tests deemed necessary to issue the CoC should be included. The Contractor shall make all arrangements, pay all fees and provide all equipment for these tests. The Contractor shall notify the Engineer timeously so that he may witness the tests.

Each installed cable shall be tested in accordance with:

(a) The Occupational Health and Safety Act (OHSA) 1994;
(b) SANS 1507 (Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V));

SANS 1507 Test Wave	Duration (min)	Commissioning test voltage between conductors (V)			Commissioning test voltage between conductors / earth (V)		
		300/ 500	600/ 1000	1900/ 3300	300/ 500	600/ 1000	1900/ 3300
AC (rms)	15	1000	2000	6000	1000	2000	3500
DC	15	1500	3000	9000	1500	3000	5000

This test will be conducted to the Engineers judgement. The constructer must obtain written approval from the Engineer before conducting any tests.

(a) The requirements of the Local and Supply Authorities.

E05.8 QUALITY ASSURANCE

All the cables supplied under the Scope of Works of this project shall be designed and manufactured under a quality control system, typically to ISO 9000 series. The contractor must supply current compliance certificates on the manufacturers ISO classification.

E05.9 MEASUREMENT AND PAYMENT

Measurement and payment will distinguish between supply/delivery and installation/commissioning of the cabling lengths required.

Item **Unit**

Supply and delivery of low-voltage cable..... metre

The unit of measurement shall be the length of low-voltage cable supplied. It is the responsibility of the Contractor to verify the lengths of cables required on site. The Contractor shall only supply the required length of cables required. The final quantity of installed cable lengths shall determine the final quantity to be paid of the supplied cable lengths.

The tendered rate shall include for the design, manufacture, supply and delivery of the specified cable to the site.

Separate items shall be scheduled under this payment item for each size and type of cable.

JOHANNESBURG WATER (SOC) Ltd.

BULK WASTEWATER

PARTICULAR SPECIFICATION

E08 : ELECTRICAL WIRING

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Johannesburg Water (SOC) Ltd

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PARTICULAR SPECIFICATION: VOLUME E08: ELECTRICAL WIRING

CONTENTS

E08.1 SCOPE

This specification covers the wiring requirements of electrical installations.

E08.2 STANDARDS

The latest edition, including all amendments to until the date of tender, of the following particular national and international specifications, publications and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof:

(a) SANS 10142-1 : The wiring of premises Part 1: Low-voltage installations

(b) SANS 1411-2 : Materials of insulated electric cables and flexible cords: Part 2 – Polyvinyl Chloride (PVC)

(c) SANS 1507 : Electric Cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1 900/3 300 V)

E08.3 GENERAL REQUIREMENTS

PVC insulated conductors for general wiring shall consist of high conductivity annealed copper wire strands with polyvinyl chloride insulation. The insulation shall be compounded and stabilised to comply with SANS 1411-2 as amended.

Conductors shall be finished in the required colours and shall be manufactured in accordance with SANS 1507 as amended.

Any special requirement regarding the type and size of wiring to be installed in a specific installation shall be specified.

E08.4 DRAWING OF CONDUCTORS

Wiring shall only be carried out after the wireway installation is completed, but before painting has commenced. No conductors shall be installed before the wireways have been cleaned of all debris and moisture. Wireways shall contain no sharp edges.

When conductors are drawn through conduit, care shall be taken that they are not kinked or twisted.

E08.5 WIRING METHOD

All wiring shall be carried out according to the loop-in system. When earth continuity conductors are looped between terminals of equipment, the looped conductor ends shall be twisted together and ferruled to ensure that earth continuity is maintained when the conductors are removed from a terminal.

When connecting more than one conductor in a terminal, the strands shall be securely twisted together. Under no circumstances shall strands be cut off.

E08.6 SIZE OF CONDUCTORS

The following minimum conductor sizes shall be used:

Bell circuits = 1.5 mm^2
Clock circuits = 1.5 mm^2
Lighting circuits = 1.5 mm^2
Plug circuits = 2.5 mm^2
All the above = 2.5 mm^2 earth conductor
Motor circuits = As specified

E08.7 DIFFERENT PHASES

With the exception of three-phase outlets, circuits connected to different phases shall not be present at light, switches or socket-outlet boxes.

E08.8 TESTING AND COMMISSIONING

The contractor shall supply factory test certificates for each drum of cable supplied under the Contract.

After the installation is complete, the contractor and the Engineer shall inspect the installation. The Engineer must be notified in advance of the inspection dates. The contractor will keep a snag list, reflecting all items not acceptable to the Engineer. The contractor will correct the snag items as required to the Engineers approval, updating the snag list as the items are completed and signed off by the Engineer.

On completion of his work, the Contractor will issue an Electrical Certificate of Compliance (CoC). All tests deemed necessary to issue the CoC should be included. The Contractor shall make all arrangements, pay all fees and provide all equipment for these tests. The Contractor shall notify the Engineer timeously so that he may witness the tests.

Each installed cable shall be tested in accordance with:

(a) The Occupational Health and Safety Act (OHSA) 1994;

(b) The requirements of the Local and Supply Authorities.

E08.9 MAINTENANCE INSTRUCTIONS AND GUARANTEES

E08.10 MEASUREMENT AND PAYMENT

Item	**Unit**
Supply and deliver LV conductors	m

The unit of measurement shall be the linear length of conductor supplied and delivered.

The tendered rate shall include full compensation for the supply and delivery to site of the specified conductors. Conductors will be measured linearly along the full length installed in the wireway and sufficient provision will be made in the quantities for conductor slack at outlet boxes and distribution board trays. No extra will be allowed for jointing, overlapping and wastage at connections.

Separate items shall be scheduled for each conductor size.

Item	**Unit**
Install LV conductors in conduit	m

The unit of measurement shall be the linear length of conductors installed in conduit.

The tendered rate shall include full compensation for the handling, inspection, pulling in conduit the specified number and sizes of conductors, cutting and testing of the conductors. Sufficient provision will be made for conductor slack at outlet boxes and distribution board trays to make the necessary connections to equipment.

Separate items shall be scheduled for each size of conductor.

Item	**Unit**
Install LV conductors in trunking	m

The unit of measurement shall be the linear length of conductors installed in trunking.

The tendered rate shall include full compensation for the handling, inspection, installing in trunking the specified number and sizes of conductors, the grouping of these conductors into circuits using plastic cable ties, cutting and testing of the conductors.

Separate items shall be scheduled for each size of trunking and for each size of conductor.

This rate shall furthermore include for the supply of all cable ties, clamps and other materials

necessary to ensure that the wiring conforms to the specification.

Item **Unit**

Install LV conductors in power skirting.....m

The unit of measurement shall be the linear length of conductor installed in power skirting.

The tendered rate shall include full compensation for the handling, inspection, installing in power skirting the specified number and sizes of conductors, the grouping of these conductors into circuits using plastic cable ties, cutting and testing of the conductors. Sufficient provision will be made for conductor slack at power outlets.

Separate items shall be scheduled for each type of power skirting and for each size of conductor.

This rate shall furthermore include for the supply of all cable ties, PVC sleeving for earth conductors and other materials necessary to ensure that the wiring conforms to the specification.

Item **Unit**

Install LV conductors in floor ducting .....m

The unit of measurement shall be the linear length of conductors installed in floor ducting.

The tendered rate shall include full compensation for the handling, inspection, installing in floor ducting the specified number and sizes of conductors, the grouping of these conductors into circuits using plastic cable ties, cutting and testing of the conductors. Sufficient provision will be made for conductor slack at power outlets. Were cables are exposed to the sun they shall be strapped, using stainless steel strapping.

Separate items shall be scheduled for each type of floor ducting and for each size of conductor.

This rate shall furthermore include for the supply of all cable ties, PVC sleeving for earth conductors and other materials necessary to ensure that the wiring conforms to specification.

Item **Unit**

Supply conductor terminals..... No

The unit of measurement shall be the number of conductor terminals supplied.

The tendered rate shall include full compensation for the supply and delivery to site of the specified terminals complete with mounting rail and all hardware required to fasten the terminals and mounting rail. Separate items shall be scheduled for each size of terminal.

Item **Unit**

Install conductor terminals ..... No

The unit of measurement shall be the number of conductor terminals installed.

The tendered rate shall include full compensation for the handling, inspection and installation of the specified terminals and mounting rail. Separate items shall be scheduled for each size of terminal.

Item **Unit**

Supply PVC insulated multicore cables .....m

The unit of measurement shall be the linear length of cable installed.

The tendered rate shall include full compensation for the supply and delivery of the cables. Separate items shall be scheduled for the different types and sizes of cables.

Item **Unit**

Install PVC insulated multi core cables.....m

The unit of measurement shall be the linear length of cable installed.

The tendered rate shall include full compensation for the supply and delivery of the cables. Separate items shall be scheduled for the different types and sizes of cables.

Item **Unit**

Supply and install the terminations for PVC multicore cables ..... No

The unit of measurement shall be the number of terminations installed.

The tendered rate shall include full compensation for the supply and installing of the terminations as specified.

JOHANNESBURG WATER (SOC) Ltd.

BULK WASTEWATER

PARTICULAR SPECIFICATION

E16 : ELECTRICAL UNINTERRUPTIBLE POWER SUPPLY UNIT

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PARTICULAR SPECIFICATION: VOLUME E16: ELECTRICAL UNINTERRUPTIBLE POWER SUPPLY UNIT

CONTENTS

E16.1 INTRODUCTION

This specification is for the supply and installation of Single Online Double Conversion Static Uninterrupted Power Supply Units (UPS) for use in office and industrial environments.

The UPS Unit will be used for backing up critical electrical loads, such as lighting, dedicated sockets, air conditioning in computer rooms etc.

The UPS Unit will be installed via Normal Power or via a Diesel Standby Generator.

E16.2 SCOPE

The scope of work includes the furnishing of all labour, material and services for the design, supply, manufacture, delivery to site, off load, install in position, fix on site, testing, commissioning and inspection of the equipment and installation works at the manufacturers premises and on site of an UPS Unit and its installation.

The Tenderer has to complete all required returnable schedules. Failure to comply with this request will lead to immediate disqualification.

The Tenderer will be responsible for connecting electrical cables to their own equipment that is supplied and installed under this contract. All cables will be properly glanded to the units.

E16.3 STATUTORY DOCUMENTS AND STANDARDS

E16.3.1 Standards

In addition to any client specifications and general operating procedures, the UPS Units shall comply with the requirement of the following specifications, and any amendments thereto, the SANS specification taking preference:

The equipment offered and work performed, shall comply with the requirements of the governing occupational Health and Safety act, at time of tender.

The Uninterruptible power supply system shall comply with the requirements of SANS 1474 or an International standard such as BS or DIN, and shall be produced in a factory with ISO9000 rating and the applicable quality assurance standards.

(a) SANS 60439	:	Low Voltage Switchgear and Control Gear Assemblies
(b) SANS 60529/IEC 529	:	Degrees of Protection Provided by Enclosures (IP Code)
(c) SANS 60947/IEC 947	:	Low-voltage switchgear and controlgear
(d) IEC 60146	:	General requirements and line commutated converters
(e) IEC 747	:	Semi-conductor Devices (including Thyristors)
(f) IEC 60269-4	:	Low-voltage fuses - Part 4: Supplementary requirements for fuse-links for the protection of semiconductor devices
(g) IEC 60269-5	:	Low-voltage fuses - Part 5: Guidance for the application of low-voltage fuses
(h) SANS 10142-1	:	The wiring of premises Part 1: Low-voltage installations
(i) SANS 156	:	Moulded-case circuit-breakers
(j) SANS 1195	:	Busbars
(k) SANS 61238	:	Compression and mechanical connectors for power cables for rated voltages up to 30 kV (Um = 36 kV)

E16.3.2 Particular Specifications to be read in conjunction with this specifications

The following particular specifications shall be read in conjunction with the Project Specification:

(a) E23	:	ELECTRICAL SPECIFICATION FOR COLOUR CODE
(b) G02	:	PARTICULAR SPECIFICATION FOR CORROSION PROTECTION
(c) E06	:	ELECTRICAL MEDIUM AND LOW VOLTAGE CABLE INSTALLATION
(d) E05	:	LOW VOLTAGE POWER AND CONTROL CABLE
(e) E08	:	WIRING
(f) E11	:	GENERAL EARTHING AND LIGHTNING PROTECTION

E16.4 GENERAL TECHNICAL SPECIFICATION

E16.4.1 General

(a) All Single Online Double Conversion Static UPS Units will be continuous duty single or three phase units.

(b) The UPS must be a TRUE on-line, double conversion transformer-based unit (i.e. using a transformer that is an integral part of the UPS, on the input to the UPS). Hybrids, transformerless units or units with external, separate transformers will not be acceptable.

(c) The UPS must employ PWM technology.

(d) The UPS must have battery backup for at least 30 minutes at the full rated load of the UPS.

(e) The output waveform shall be sinusoidal in form with the THD at full line load not exceeding 3%.

(f) The output voltage variation must not exceed 2%.

(g) Interference shall not exceed the limits laid down by ICASA

(h) The UPS must have a battery low voltage/DC cut-off which is not lower than 1,67 Vpc.

(i) The UPS must be accompanied by the tenderer’s proof of their ability to install, test, service, repair, etc. these devices in the field and that they have a suitable after-sales infrastructure.

(j) The UPS must be equipped with an integral static bypass switch as well as an integral manual/maintenance bypass switch.

(k) The UPS static bypass switch must be upgradable in order to be matched to the load inrush current.

(l) The tenderer must be willing and able to provide a complete factory load test, which can be witnessed by the engineer and/or client.

(m) A voltage free contact rated for 230V AC at 2 amps shall be provided in all the UPS units. This general alarm relay shall be internally wired to energise when a collective signal from all alarms is healthy. Alternatively, this relay shall de-energise when a fault occurs, raw mains is interrupted or the battery power is low.

(n) The UPS must be supplied complete with maintenance free batteries and with a capacity to run the system for 30 minutes at full load. If external battery packs are provided, the battery charger must be adequately rated to re-charge the additional batteries at the C/10 rate.

(o) The UPS system shall be suitable for operation from a 230V AC single-phase supply and must supply a nominal single phase 230 Volt, 50 Hz output.

(p) Tenderers must satisfy themselves that the UPS rating is adequate to supply all the equipment which they are offering

(q) The units shall be able to sustain an overload of 125% for one minute or 150% for ten seconds whereupon it shall switch itself off. A full short circuit shall cause the unit to switch off without sustaining damage.

(r) The UPS must be able to operate normally in an ambient service temperature of 0ºC to +35ºC and a relative humidity of 5 to 95% non-condensing at 1500 to 3000m above sea level.

(s) The rated output voltage must be user selectable from 220/230/240V.

(t) The output frequency must not vary by more than 3Hz.

(u) The UPS module shall consist of the following main components:

i. Transformer - choke input stage,
ii. Rectifier/Charger and DC link,
iii. Static Inverter,
iv. Static Bypass Switch and Manual Bypass Switch,
v. Control Panel and Mimic Panel with LCD Display,
vi. Output Isolation Transformer,

E16.4.2 UPS Rating

(a) The UPS should be able to supply a load with a power factor of 0.7 to unity. Tenderers must submit both the VA and Wattage rating of each UPS offered.

(b) The UPS efficiency must be no less than 89% from zero to full load.

(c) The UPS must be suitably rated to supply all the required equipment specified in this tender and any attached specifications and provide backup to this equipment for no less than 30 minutes at full load. Even if the equipment does not require it however, the UPS must not have a rating of less than 3kVA

E16.4.3 UPS Backup Batteries

(a) Tenderers must state the exact number of batteries that will be used.

(b) Tenderers must state the type of batteries that will be used.

(c) Tenderers must state the Ah rating of the batteries that will be used.

(d) Tenderers must state the design life of batteries that will be used (3-5years, 10 years, etc.).

E16.4.4 UPS Standards

(a) All imported UPSs must have a CE rating

(b) The UPS must have CE, LGA/GS markings.

(c) The UPS must comply with safety conformance to EN-50091-1.

(d) The UPS must have EMC conformance to EN-50091-2 and EN-61000-3-2.

E16.4.5 Module Modes of Operation

The UPS unit will operate as an online, fully automatic system in the following modes:-

(a) Normal:

i. The inverter shall continuously supply the critical load.

ii. The Rectifier/Charger shall derive power from the commercial AC source and shall supply DC power to the Inverter while simultaneously float charging the batteries.

(b) Batteries:

i. Upon failure of the commercial AC power, the critical load shall continue to be supplied by the Inverter, which shall obtain power from the batteries without any operator intervention. There shall be no interruption to the critical load upon failure or restoration of the commercial AC source.

ii. The UPS must have a battery low voltage/DC cut-off which is not lower than 1,67 Vpc.

(c) Recharge:

i. Upon restoration of the AC source, the Rectifier/Charger shall recharge the batteries and simultaneously provide power to the Inverter.

ii. This shall be an automatic function and shall cause no interruption to the critical load.

(d) Bypass:

i. No-break transfer to and from Bypass mode shall be capable of being initiated manually, without operation of the static switch.

E16.4.6 Cabinets/Enclosures

The UPS Unit and the back-up batteries must each be supplied and installed in a freestanding double front steel metal cabinet/enclosure (safety shield behind doors) on adjustable/levelling feet, all pre-powder coated. The cabinets/enclosures shall be designed for industrial and computer room applications in accordance with the environment requirements. The cabinets will have a minimum standard Ingress Protection of 20 (IP20) in office environments and a minimum Ingress Protection of 23 (IP23) in dusty conditions.

Cabinets will be provided with lockable removable doors/panels and seal protection as required. These doors/panels will be cut to accommodate the control panel displays and metering as required. Cabinets must be provided with forced air-cooling ventilation fans. Should the fans be installed on the top section, the cabinets must be fitted with drip trays.

The cabinets must ensure that cable entry and connection will be from the bottom and additional support is provided for cable glands. A dedicated wire way shall be provided within the UPS module for routing user input and output wiring.

UPS Unit plus Battery Cabinet must line up and match up in style and colour.

Service Area Requirements: The UPS module shall require no more than 1 meter of front and side service access room.

Refer to Environment Conditions – Cabinets/Enclosures must be built to suit all temperatures and humidity conditions.

Cabinets/Enclosures must be labelled with 50mm high black engraved letters on white background fixed to cabinet with screw in centre of units.

E16.4.7 Manufacturer's Field Service

(a) Field Engineering Support:

i. The UPS manufacturer shall have a countrywide field service department staffed by factory-trained field service engineers dedicated to start-up, maintenance, and repair of UPS equipment. The organization shall consist of local offices managed from a central location.

ii. Field engineers shall be deployed in key population areas to provide on-site emergency response within 24 hours 80% of the time.

iii. Location of all field service offices must be submitted with the proposal.

iv. Third-party maintenance will not be accepted.

(b) Spare Parts Support:

i. Parts be available within 24 hours.

(c) Operational Training:

i. Before leaving the site, the field service engineer shall familiarize responsible personnel with the operation of the UPS. The UPS equipment shall be available for demonstration of the modes of operation.

(d) Product Enhancement Program:

i. The UPS manufacturer shall make available feature upgrade service offerings to all users as they are developed. These products shall be proposed as a field-installable, optional kit.

E16.4.8 UPS Data Sheets (Returnable Schedule)

The tenderer must complete the data sheet below with his tender:

Technical Data Sheet: UPS

DESCRIPTION	DATA
Make/Manufacturer	
Type/Model (E.g. true on-line, double conversion)	
Transformer-based unit (Y/N?)	
Technology employed (E.g. pulse width modulation)	
Output voltage variation	
Output frequency variation	
UPS rating (VA and Watts)	
UPS efficiency from zero to full load	
Maximum harmonic distortion at full load	

Overload handling capabilities (E.g. “x”% load for “y” minutes)	
Power backup period from batteries at full rated load	
Compliance with standards rating and markings (E.g. “Yes, full compliance” or “No”.	
Tenderer to provide complete factory load test that can be witnessed by the Engineer	
Staff available for installation, testing and backup service?	
Number of batteries to be used	
Type of batteries to be used	
Ah rating of batteries	
Design life of batteries	
Local agent (Y/N)?	
Local agent contact details	
Guarantee period	

E16.5 QUALIFICATIONS

(a) The UPS manufacturer shall have a minimum of ten years’ experience in the design, manufacture and testing of solid-state UPS. A list of installed UPS of the same type as the manufacturer proposes to furnish for this application shall be supplied with the proposal.

(b) The UPS manufacturer shall have ISO 9001 certification for engineering/R&D and manufacturing facilities.

(c) If it is an imported UPS, the vendor must be the ACTUAL importer of the UPS. In other words, a middleman who cannot provide factory load tests or suitable after-sales service and backup will not be acceptable.

E16.6 GUARANTEE

The successful vendor/supplier will guarantee the installation works and equipment for a period of twelve months after first delivery was taken by the Engineer.

E16.7 TESTING AND INSPECTION:

(a) The testing and inspection procedures shall be approved prior to the commencement of manufacture.

(b) The Contractor shall assemble the complete UPS for inspection and factory testing, and present the system to the Engineer, to who it shall be demonstrated that the equipment meets the requirements of the specification.

(c) The tenderer must be willing and able to provide a complete factory load test, which can be witnessed by the engineer and/or client.

(d) The Contractor shall provide suitably qualified personnel and all necessary equipment to carry out the tests to demonstrate conformance with the specification and simulate the operation of the system in its final operating state.

(e) The Contractor shall prepare a set of completed test and inspection certificates for approval.

(f) The contractor is required to perform site acceptance tests (SAT) on the UPS witnessed by the employer and the engineer, prior to commissioning the UPS. A schedule of the checks, tests and results of the SAT must be available for signing by the engineer at the completion of the SAT.

(g) A thermal imaging record of the UPS shall be taken after the UPS has been in operation for a minimum one week under typical normal conditions and while running. The thermal imaging record will form part of the deliverable documentation together with Operation and Maintenance Manuals and delivered to the employer on completion of the works.

E16.8 PACKING AND MARKING

E16.8.1 Packing

The Contractor shall protect the equipment against scratching and damage by suitable wrapping, packing and crating of the equipment items.

E16.8.2 Marking

Each separately packed and transported piece of equipment shall be clearly marked.

E16.10 MEASUREMENT AND PAYMENT

Item	Unit
Supply and deliver UPS	No

The tendered rate shall include full compensation for the manufacture, supply, testing and delivery of the UPS incorporating all options/extras as detailed in the detail specification.

Item	Unit
Install UPS	No

The tendered rate shall include full compensation for the installation, site testing and commissioning plus the 12 months maintenance of the UPS incorporating all options/extras as detailed in the detail specification.

Item	Unit
Supply and deliver support platform/stand for UPS	No

The tendered rate shall include full compensation for the manufacture, supply, testing and delivery of the support platform/stand for UPS as detailed in the detail specification.

Item	Unit
Install support platform/stand for UPS	No

The tendered rate shall include full compensation for the installation of the support platform/stand as detailed in the detail specification.

JOHANNESBURG WATER (SOC) Ltd.

BULK WASTEWATER

PARTICULAR SPECIFICATION

E17 : ELECTRICAL VARIABLE SPEED DRIVE (VSD) UNITS

Johannesburg Water

Johannesburg Water (SOC) Ltd.
PO Box 61542
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Revision 5

August 2019

City of Johannesburg
Johannesburg Water (SOC) Ltd

DOCUMENT CONTROL SHEET

Document Title: **Particular Specification – E17 : Electrical Variable Speed Drive (VSD) Units**

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DOCUMENT APPROVAL

ACTION	FUNCTION	NAME	DATE	SIGNATURE
Prepared	Senior Electrical Engineer	B Pieterse	August 2019	
Reviewed	Director	R Baard	August 2019	
Approved	Regional Maintenance Manager	T Thabeng	August 2019	

RECORD OF REVISIONS

Date	Revision	Author	Comments
5	2019-08-20	B Pieterse	Review of Electrical Standards, plus New Design Guidance
4	2014-06-03		Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance
3	2012-05-30		Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance
2	2010-05-03		Review of Electrical Standards
1	2009-05-12		Review of Mechanical / Electrical and Control / Instrumentation Standards, plus New Design Guidance

PARTICULAR SPECIFICATION: VOLUME E17: VARIABLE SPEED DRIVES (VSD)

CONTENTS

E17.1 SCOPE

This specification shall cover all variable speed drives to be designed, supplied installed and tested that shall drive any of the items of equipment to be supplied under the contract.

E17.2 INTERPRETATIONS

E17.2.1 Abbreviations

In this Specification, the following abbreviations will apply:-

(a) VSD	:	Variable Speed Drive
(b) ANSI	:	American National Standards Institute
(c) ASTM	:	American Society for Testing and Materials
(d) BS	:	British Standards Institution
(e) SANS	:	South African National Standards

E17.2.2 Standards

The latest edition, including all amendments to until the date of tender, of the following particular national and international specifications, publications and codes of practice shall be read in conjunction with this specification and shall be deemed to form part thereof:

(a) SANS 60529	:	Degrees of Protection Provided by Enclosures (IP Code)
(b) IEC 60 664 –1	:	Degree of Pollution – no condensation permitted during operation
(c) IEC 60721-3-3	:	Classification of environmental conditions - Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use at weather protected locations
(d) BS EN 55011	:	Industrial, scientific and medical equipment — Radio-frequency disturbance characteristics — Limits and methods of measurement
(e) IEC 61800-3	:	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods

E17.2.3 Particular Specifications to be read in conjunction with this specifications

The following particular specifications shall be read in conjunction with the Project Specification:

(a) E04	:	PARTICULAR SPECIFICATION FOR MCC

E17.3 GENERAL REQUIREMENTS

(a) The VSD units shall control asynchronous motors with standard constant torque, variable standard torque or optimized torque.

(b) The VSD units shall be specifically designed to offer extensive flexibility in water and wastewater applications.

(c) The VSD units shall be provided with six programmable, isolated digital inputs (24V DC, positive or negative logic).

(d) VSD units shall have three programmable relay outputs (1 with NO/NC contacts and 2 with NO contacts)

(e) The VSD units shall be provided with 3 programmable analogue inputs (configurable as voltage (0...10 V) or current (0-20 mA/4-20 mA), 2 of them including probes (PTC, PT100, PT1000 or KTY84)).

(f) The VSD units shall have two programmable analog outputs configurable as voltage (0...10 V) or current (0-20 mA).

(g) The VSD units will have the option to extend the I/O with optional modules.

(h) The VSD shall have low-noise motor operation due to high pulse frequencies.

(i) The VSD unit shall have complete protection for motor and inverter.

(j) The VSD units shall comply with the requirements of the EU low-voltage guideline.

(k) The VSD unit shall have the CE marking.

(l) All VSD units shall have the same interface, including a control panel, I/O connections and software, regardless of power rating, voltage or enclosure (IP rating).

(m) All VSD units shall be supplied with an internal Class A filter. The requirements are fulfilled using shielded cables with maximum length of 25m.

(n) The VSD units shall be supplied with line commutating choke in line with EN61 000-3-2 Regulations “Limits for harmonic currents with device input current < =16A per phase”.

(o) The maximum permissible motor cable lengths (shielded/unshielded) for a mains voltage of 400V are 150 m/ 225 m.

(p) The VSD units shall be supplied with integrated category C3 EMC filters.

(q) The VSD units shall be supplied with graphic display terminal for parameterising the inverter, complete with mounting kits for installation in the control cabinet doors.

(r) The unit shall have complete protection for motor and inverter.

(s) The VSD units shall have the following standard communication modules Modbus/TCP, Modbus serial link.

(t) The VSD units shall have the following optional communication modules EtherNet/IP and Modbus/TCP Dual port, ProfiNet, CANopen, Profibus DP V1, DeviceNet, and BACnet MS/TP.

(u) Depending on the power rating and application, the VSD unit should be available as a wall mounted unit, a cabinet integration unit or a floor-standing unit.

(v) **Note**:
Attention shall be given to ventilation to prevent the accumulation of heat in cubicles where power electronic drives (soft starters and VSD’s) or other heat generating equipment (i.e. control transformers) are contained. Extraction ventilation fans should be installed in these cases to remove heat from the cubicle. The filtered extraction fan should be placed as high as possible in the compartment door with a filtered air inlet opening as low as possible in the compartment door. The fan and opening must be sized to ensure all generated heat is extracted from the cubicle. Natural convection cooling will not be accepted. All specific requirements from the VSD OEM must be adhered to.

E17.4 WORKING VOLTAGE AND SUPPLY SYSTEMS

Depending on the power rating and application, the following power supply alternatives shall be available:

i. Single-phase: 200...240 V
ii. Three-phase: 380...480 V

E17.5 ENVIRONMENTAL LIMITS

E17.5.1 Operating Temperature

The VSD must be able to operate in the specified operating temperature without any derating of the specified output power

i. 0... 40 °C as standard
ii. 40...50 °C with derating

E17.5.2 Relative humidity

i. 5...95% without condensing.

E17.5.3 Storage and transport temperature

i. -40…+70 °C

E17.5.4 Operating altitude:

i. 0…1,000 m without derating
ii. 1,000...2,000 m with derating of 1% per 100 m

E17.5.5 Withstand to harsh environments:

i. Chemical class 3C3 conforming to IEC/EN 60721-3-3 (1)
ii. Mechanical class 3S3 conforming to IEC/EN 60721-3-3 (1)
iii. Electronic cards with protective coating

E17.5.6 Ingress Protection:

i. IP 00 for mounting in an enclosure.
ii. IP 20/21/UL type 1 for wall mounting in a plant room and in an enclosure
iii. IP 55 for wall mounting, with protection against dust and water jets
iv. Floor-standing IP 21
v. Floor-standing IP 54, with protection against dust and water jets

E17.6 PROTECTION FUNCTIONS

The following protection functions shall be available:

(a) Under voltage
(b) Overvoltage
(c) Overload
(d) Earth faults
(e) Short-circuits
(f) Stall prevention
(g) Locked motor protection
(h) Motor over temperature
(i) Inverter over temperature parameter change protection.

PARTICULAR SPECIFICATION: HANDRAILS

Handrails

“Handrailing shall be of tubular construction in grade 304 stainless steel or galvanised mild steel as scheduled and be of an approved proprietary make.

Hand and knee rails shall be not less than 32 mm O.D. (wall thickness not less than 1,6 mm) and the height of the handrails (centre) shall be 1 000 mm above walk-way level, with knee rails located approximately midway between.

Stanchions shall be not less than 44 mm O.D. (wall thickness not less than 1,6 mm) and shall have ball type or spun and flared connectors to suit horizontal or angled handrailing as required. The base plates shall not be less than 8 mm thick.

In general, all bends in the hand and knee railing shall be 140 mm radius. Handrails shall be either side or top mounted and shall be fastened with stainless steel nuts, bolts and washers.

Spacing between stanchions shall be determined by site conditions but in no case shall it exceed 1 800 mm c/c. At bends, stanchions shall be provided on either side at a distance of 300 mm from mid-bend.

Finished handrailing shall be true to line and level and connections shall be securely fixed by means of 2 No. stainless steel pins, finished flush on each side of the joints (to the approval of the JW representative).

All ends shall have closures joining the hand and knee railing.

The rate quoted per metre shall include for the supply and installation of the handrail, knee rail, portion of a stanchion, footing, holding down bolts and nuts and shall be inclusive of all cutting, mitring, welding, grinding and waste. Stainless steel components shall be fully pickled and passivated prior to installation."

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PARTICULAR SPECIFICATION

M18: MECHANICAL CENTRIFUGAL PUMPS

Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water
4	2013-10-23	Minor updates and re-issued	J Ritchie	
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		

PARTICULAR SPECIFICATION M18: MECHANICAL CENTRIFUGAL PUMPS

CONTENTS

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 tapping’s 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 ±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 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.

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 relief 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 until 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 intension 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 guarantee 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.

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
4	2013-10-23	Minor updates and re-issued	J Ritchie	
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

CONTENTS

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. Vales 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 ASTMA 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 patter. 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 form 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 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 “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.

M20.13.5 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
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 ± 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 affects 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 nitrite 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

M21: MECHANICAL PRESSURE PIPEWORK

Rev	Date	Description	Signature: JW Wastewater Partnership	Signature: Approval from Johannesburg Water
4	2013-10-23	Minor updates and re-issued	J Ritchie	
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 M21: MECHANICAL PRESSURE PIPEWORK

CONTENTS

M21.1 SCOPE

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of pipework, pipe items, protective coatings and describes methods for laying and jointing of pipes. The Particular Specification shall be read in conjunction with the Project Specification.

M21.2 INTERPRETATIONS

M21.2.1 Definitions

For the purposes of this Specification the following definitions shall apply:-

(a) Cut Lengths

Where this term is used in the Specifications, on the Drawings or in the Schedule of Quantities it shall be taken to mean a pipe of differing length from the standard length for pipes as supplied by the manufacturer.

Cut lengths are required as closure pieces between standard pipe lengths, between the ends of a pipe fitting or between pipe fittings.

(b) Plain End

This term refers to a pipe end that has been cut, machined or finished in a manner suitable for coupling to a pipe with a similar end as specified.

M21.2.2 Abbreviations

For the purpose of this Specification the following abbreviation shall apply:-

ASTM	:	American Society for Testing and Materials
API	:	American Petroleum Institute
BS	:	British Standard
SANS	:	South African National Standards
SIS	:	Swedish Institute of Standards
uPVC	:	Unplasticised Polyvinyl Chloride
ISO	:	International Standards Organsiation
DIN	:	Deutsches Institut für Normung
HDPE	:	High Density Polyethylene
MPVC	:	Modified Polyvinyl Chloride Pipes

M21.2.3 Standards

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

SANS 10400	:	National Building Regulations
SANS 9096-1: 1994	:	Testing of welders, where applicable to the type of welding required
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 455 : Covered electrodes for the manual arc welding of carbon and carbon manganese steels

DWS 1110 : Construction of pipelines

M21.2.4 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

M21.3 CLASS DESIGNATION

Pipe classes indicated on Drawings and in the Specification should have the following meaning:-

Working Pressure (kPa)	Steel Pipes
300	
600	6
900	
1 000	10
1 200	
1 500	
1 600	16
1 800	
2 100	
2 400	
2 500	25

M21.4 MATERIALS

The type, ability and condition of the equipment and material are subject to the Engineer's approval.

Covered electrodes of mild steel or medium high tensile steel for hand welding must comply with SANS 455 and carry the SANS mark.

The Contractor must submit full particulars off all electrodes he intends using to the Engineer. All electrodes must be supplied by the Contractor and the consignment number submitted to the Engineer. Should a different consignment be used on the works, the Engineer may alter the welding procedure.

M21.4.1 Standards

M21.4.1.1 uPVC Pipes

Requirements:-

SANS 966 : uPVC Type I Pressure Pipes and Fittings for Cold Water Services
SANS 967 : Unplasticised poly(vinyl chloride) (PVC-U) soil, waste and vent pipes and pipe fittings
ISO 4422 : Pipes and fittings made of unplasticised poly (vinyl chloride) (PVC-U) for water supply – Specifications
SANS 1123 : Pipe flanges
SANS 791 : unplasticised poly(vinyl chloride) (PVC-U) sewer and drain pipes and pipe fittings
SANS ISO 4427 : Components of Unplasticised Polyvinyl Chloride (uPVC) Pressure

Pipe Systems for potable water

SABS 0112	:	The installation of polyethylene and unplasticised polyvinyl chloride pipes
BS 3505	:	Unplasticised polyvinyl chloride pressure pipes for cold potable water
DIN 8061	:	A1:1991 Unplasticised polyvinyl chloride pipes: General quality requirements and testing
ISO 1167	:	Plastic pipes for the transport of fluids: determination of the resistance to internal pressure.
ISO 1628	:	Plastics determination of viscosity number and limiting viscosity number. Part 2: PVC resins.
ISO 4422	:	Pipes and fittings made of unplasticised polyvinyl chloride for water supply specifications

125 & 140mm sizes are not recommended for uPVC pipes due to the lack of standard fitting.

M21.4.1.2 HDPE

Requirements:-

SANS ISO 4427	:	Black polyethylene pipes for the conveyance of liquids

M21.4.1.3 Mild Steel

Requirements:-

SANS 719 grade B	:	Electric welded low carbon steel pipes for aqueous fluids (large bore)
SANS 62	:	Steel pipe and pipe fittings up to 150 mm nominal bore

M21.4.1.4 Cast Iron

Requirements:-

BS 2035	:	Cast Iron flanged pipes and flanged fittings.
SANS 509	:	Malleable cast iron pipe fittings.
SANS 664	:	Cast Iron gate valves.
SANS 746	:	Cast-iron pipes and pipe fittings for use above ground in drainage installations

M21.4.1.5 Stainless Steel

Requirements:-

SANS 1044-3	:	Welding Part 3: The fusion of steel (including stainless steel): Tests for the approval of welding procedures
SANS 1044-4	:	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 10162-4	:	Structural use of Steel Part 4: The design of cold-formed stainless steel structural

M21.4.1.6 Ductile Iron

Requirements:-

SANS 1835	:	Ductile iron pipes, fittings, accessories and their joints, for use in high and low pressure systems for potable and foul water
SANS 50545	:	Ductile iron pipes, fittings, accessories and their joints for water pipelines - Requirements and test methods
SANS 50598:1994	:	Ductile iron pipes, fittings, accessories and their joints for sewerage application - Requirements and test methods

M21.4.2 Steel (Other than Galvanised)

M21.4.2.1 Manufacturing Specifications

SANS 62	:	Steel pipe and pipe fittings up to 150 mm nominal bore
SANS 719	:	Electric welded low carbon steel pipes for aqueous fluids
SANS 1123	:	Standard Specification for steel pipe flanges
BS 4504	:	Flanges and bolting for pipes, valves and fittings

M21.4.2.2 Welding Specifications

BS 1965	:	Butt-welding pipe fittings.
BS 2633	:	Metal-arc welding of steel pipe lines and pipe assemblies for carrying fluids.
BS 4504	:	Flanges and bolting for pipes, valves and fittings.
API 5L	:	Specification for line pipe.
API 5LS	:	Specification for spiral-weld line pipe.
API 1104	:	Standard for welding pipe lines and related facilities.

M21.4.2.3 Protective Coatings

SANS 763	:	Hot-dipped (galvanised) zinc coatings.
SANS 0129	:	Code of Practise for plastic tape wrapping of steel pipe lines.
SANS 1117	:	Plastic wrapping for the protection of steel pipe lines.
SANS 1130	:	Glass fibre reinforcing material for pipe wrapping.
SANS 1136	:	Cold applied bitumen primer for steel pipe line protection.
SANS 1137	:	Hot applied bitumen for steel pipe line protection.
SANS 1138	:	Cold applied coal tar primer for steel pipe line protection.
SANS 1139	:	Hot applied coal tar enamel for steel pipe line protection.
SANS 1178	:	The production of lined and coated steel pipes using bitumen or coal tar enamel.
SIS 05 59 00	:	Pictorial surface preparation standards for painting steel surfaces.

M21.5 UPVC PIPES AND FITTINGS

All manufacturers of uPVC and MPVC pipes, fittings and couplings must be quality listed by the South African Bureau of Standards to comply with SABS ISO 9002.

All exposed uPVC piping shall be protected against ultra-violet degradation by the application of two coats of white PVA paint after degreasing.

Where flanged ends are required, the end of the pipe shall be prepared with a solvent welded stub adaptor to accommodate a galvanised steel backing flange.

All sludge and polyelectrolyte pipework shall be uPVC and rated 9 bar pressure and shall adequately supported to prevent sagging.

M21.5.1 Handling

Care shall be taken when handling uPVC pipes to ensure that pipes are not dropped or mishandled. Piping in transit shall be adequately secured using straps to prevent abrasion and surface damage.

During transport, handling and storage, the Contractor shall ensure that the pipes lie on a smooth surface and are not in contact with sharp objects and are not subjected to point or linear loads.

Yield (MPa) at 28° C	Tensile Modulus (GPa) 23°C	Max Temperature	Design Stress (MPa) at 20°C	Minimum Safety factor at 50 years

55	2.7-3.0	60	10,000	2.1

M21.6 HDPE PIPING

Flange couplings shall be kept to a minimum. Where the standard length of pipe is less than the required length, butt weld or flanged connections shall be used.

HDPE stub ends and loose flange connections may be butt welded and the bead formed inside the pipe shall be removed to avoid restrictions and product build-up. All flanges and bolts shall be galvanised.

Pipe work shall be adequately supported depending upon the size and class to prevent pipe sag. Where pipework is exposed directly to the environment, provision shall be made for suitable horizontal expansion joints.

M21.6.1 Handling

Care shall be taken when handling HDPE pipes to ensure that pipes are not dropped or mishandled. Piping in transit shall be adequately secured using straps to prevent abrasion and surface damage.

During transport, handling and storage, the Contractor shall ensure that the pipes lie on a smooth surface and are not in contact with sharp objects and are not subjected to point or linear loads.

The maximum stacking height for class 6-10 pipes shall not exceed 2m. All pipes exhibiting damage shall be rejected.

Yield (MPa) at 28° C	Tensile Modulus (GPa) 23°C	Max Temperature	Design Stress (MPa) at 20°C	Minimum Safety factor at 50 years
20	0.7-0.95	80	5,0	1.3

M21.7 MILD STEEL

All mild steel pipework and fittings other than steam tubing and screwed and socketed pipe, larger than 150 mm diameter shall comply with the requirements of SABS 719 grade B and shall have a minimum wall thickness as follows:

Normal Bore mm	**Min Wall Thickness mm**
Less than 400 mm	4
400-500	5
600-700	6
750-900	8
950-1100	10
1100-1500	12
1600-1800	14

Pipework other than screwed and socketed of sizes up to and including 150 mm nominal bore, shall comply with the requirements of SABS 62. These pipes shall be heavy class with flanged joints and suitable for a minimum working pressure of 1.6 MPa.

All screwed and socketed pipes shall comply with the requirements of SABS 62 Medium class and shall be “hot dip” galvanised. Unless otherwise specified screwed and socketed pipes shall not be used for the conveyance of steam, gas and compressed air. Compressed air pipelines of diameter 25 mm or less may be screwed and socketed.

Plain ends of pipes and fittings shall be protected against damage while being transported from the factory to the site. Details of the proposed protection system shall be submitted by the Engineer for approval.

M21.8 CAST IRON PIPES

All cast iron fittings shall be factory coated internally and externally with one coat bitumen paint to BS 3416 Type II leaving a dried film thickness of not less than 25 µm.

(a) All Exposed pipes and fittings except pipes installed in potable water retaining structures. Method of corrosion protection shall be specified in the project specification.

(b) After installation paint with one further coat as per factory coat.

M21.9 STAINLESS STEEL PIPES

Stainless steel shall be ANSI Type 304L or 316L as stated in the detailed specification. Where no welding is required Type 304 or 316 may be used. Manufacturers test certificates shall be provided for each material and each stainless steel item supplied shall be clearly and permanently marked with the grade of stainless steel and cross referenced to the applicable test certificate.

Welding of stainless steel shall be carried out using welding electrodes most suitable for the material and its applications by reference to the manufacturer's recommendations. Special precautions shall be taken to ensure that the strength and corrosion resistance of the material is not impaired by prolonged heating of the welds. All welds and adjacent areas shall be cleaned and pickled to remove the area of discolouration with a nitric and hydrofluoric acid formulation as recommended by the material suppliers.

After cleaning pickling all areas shall be thoroughly washed with clean water and re-passivated thereafter with a proprietary passivating solution of 10 per cent – 20 per cent nitric acid in aqueous solution recommended by the material suppliers.

M21.10 3CR12 PIPES

Test certificates and marking shall be used for 3CR12 as per stainless steel.

All 3CR12 shall be supplied "passivated" and upon completion of fabrication welds and other areas where the passivating layer has been removed or damaged and are contamination with mild steel or discoloured shall be cleaned and pickled using nitric acid and hydrofluoric acid formulation as recommended by the material suppliers. After cleaning/pickling all areas shall be thoroughly washed with a proprietary passivating solution of 10 per cent – 20 per cent nitric acid in aqueous solution recommended by the material suppliers.

Welding of 3CR12 steel shall be carried out under controlled conditions using stainless steel 309L welding rod or similar approved and recommended by the material suppliers. All welds shall be continuous and crevice free.

Where a fabricator has shops that deal with both carbon steel and stainless/ 3CR12 fabrications these shops are to be totally separated and no grinding wheels, etc., shall be interchanged between shops.

M21.11 DUCTILE IRON PIPES

Ductile iron pipes and fittings shall comply with ISO 2531. The nominal diameters of ductile iron are 80 to 2000mm.

The pressure rating of ductile iron is K9 range, with the nominal pressure of 3200 kPa. A safety factor of 4 times the working pressure shall be used for ductile iron pipes.

An integral rubber ring socket and spigot is used for the jointing. Ductile iron pipes shall have a inner lining of alumina cement mortar.

M21.12 STEEL PIPES, SPECIALS AND FITTINGS

M21.12.1 General

Protective coatings shall be either "factory" implying coating prior to delivery from the factory to Site, or "Site" implying coating on the Site after the item has been installed.

Undercoats shall be coloured differently to ensure complete coverage with each coat.

External protections other than specified in this clause e.g. coal, tar, enamel and proprietary types of tape wrapping shall when called for in the Schedule of Quantities be carried out as specified.

M21.12.2 Materials

Materials used for spun bitumen lining and bitumen fibre glass wrapping of pipes and the method to be followed shall comply with SANS 720.

Epoxy resin paint shall be approved by the Engineer and shall not break down chemically with time or affect the potability or cause discolouration of potable water in any way and the primer used with such paints shall be zinc rich epoxy type compatible with the paint. Bitumen based aluminium paint to be to SANS 802.

Undercoat for alkyd based enamel paint to be to SANS 681 Type II, and colour to match final decorative paint. Alkyd based enamel paint to be to SANS 630 Grade I.

Zinc chromate primer to be to SANS 679 Type I.

Bitumen paint to BS 3416 (Type II where specified).

M21.12.3 Types of Protection

Pipe work and fittings will be protected in accordance with the Particular Specification G02: Corrosion Protection.

M21.13 PIPE CONSTRUCTION

M21.13.1 General

Pipes shall be tested hydraulically in accordance with SABS 719 and test certificates shall be submitted to the Engineer before the pipes leave the manufacturers workshops.

M21.13.2 Marking of Pipes

The following markings shall be legibly and indelibly marked on each pipe and coupling:-

(a) The name, trade name or registered trade mark of the manufacturer.

(b) The nominal internal diameter.

(c) The class of pipe and colour code (marked at each end).

(d) The wall thickness (for steel pipes).

(e) Length of pipe (if different from the standard length)

(f) Pipe items, specials and valves shall be legibly and indelibly marked with the item number corresponding to the item number given in the Item Lists on the Drawings, or where Item Lists are not provided, the item number in the Schedule of Quantities.

M21.13.2.1 Information to be Supplied:-

The following information shall be made available to the Engineer prior to the award of the Contract:-

(a) Make and types of pipe offered.

(b) The friction loss formula applicable to the types of pipe offered.

(c) Standard pipe length.

(d) Thickness of pipe wall.

(e) Type of coupling and degree of maximum safe deflection permissible with the coupling.

Where the Contract calls for the supply, delivery and laying of the piping, the unit rate tendered for straight pipes shall include for one complete coupling (i.e. including rubber rings, insertion, bolts, etc.) per pipe length and shall include for the protection of the coupling.

Where the Contract calls for the supply and delivery only of the piping, the unit rate tendered for straight pipes shall include for one complete coupling per pipe length together with sufficient material for protecting the coupling.

Where the Contract calls for taking delivery of and laying the piping the unit rate tendered for straight pipes shall include for the labour necessary for protecting the couplings.

M21.14 WELDED STEEL PIPES

M21.14.1 General

Welders must be successfully tested in accordance with SANS 044 Part V by a certificate institution defined by SANS 044 Part V. The Contractor is responsible for the competency certificates of the welders. The Contractor must issue each welder with such equipment so that a welder can identify his joints. A list of identification marks must be kept by the Contractor and made available to the Engineer.

Should two joints of a particular welder not withstand the prescribed test, the welder may not undertake any more welds.

Pipes shall be manufactured by an approved welding process and shall not incorporate more than one longitudinal seam for pipes up to and including 1 000 mm diameter or two longitudinal seams for pipes bigger than 1 000 mm diameter.

Pipe specials shall be manufactured strictly as shown on the Drawings and described in the Documents. Plate thickness shall be such to ensure that the maximum stress shall not be higher than for an uncut pipe in the same pipeline.

The maximum angle between butt-ends of segments for gusseted bends shall be 22½E.

M21.14.2 Pipe Ends

Pipe ends must be thoroughly cleaned of all rust, grease and protection which may affect the quality of the weld. For cut lengths the ends must be bevelled to 30E with the end of the pipe and the roof surface prepared all at the Contractor's own cost. Should laminating, splitting of ends or any other defect occur during welding, the Contractor must cut the defective areas from the pipe.

M21.14.3 Handling

Pipes shall be brought in position in such a manner that damage to the pipes is avoided. Should the pipes have a longitudinal joint, the pipes must be placed so that this joint lies in the top third of the completed line. These longitudinal joints must be staggered at 20E from each other.

M21.14.4 Clamps

Internal clamps must be used to keep the pipes in position during the welding. The root opening must be between 1,5 and 3,0 mm and the pipes may not deviate more than 1,5 mm from the concentric.

Clamps may be removed only after 50 % of the root weld has been completed in equal sections around the perimeter of the pipes.

M21.14.5 Welding

Root welding may at no place be thicker than two thirds of the pipe wall and must be without defects.

Welding must be thoroughly cleared of slag, scale and oxide before the next weld is applied. Weld joints must consist of at least two welds to ensure the specified reinforcing.

Complete penetration must be ensured by letting the weld reinforcement protrude 1,5 mm on the inside of the pipe. No other protrusions will be allowed on the inside of the pipe.

Weld joints must be built up until the weld reinforcement protrudes between 0,8 mm to 1,6 mm above the pipe. The cover weld must be 3,2 mm wider than the original groove width.

In order to avoid cracks, the second or "warm" weld must be applied immediately after the root weld has been cleaned and prior to the cooling of the pipe at the joint.

The internal weld bead on welded seams shall protrude a maximum of 1,0 mm into the barrel of the pipe. For butt-welded pipelines the weld bead shall be ground flush with the pipe body at each pipe end.

The Contractor must submit with his tender a Qualification of Welding Procedures as set out in Section 2 of API Std 1104 including a procedure specification as set out in paragraphs 2.3a, d, e, f, g, h, I, j, k, l, m, n, p, q and r of above specification. The Contractor must demonstrate that this proposed procedure will produce an acceptable pipeline. Should tests reveal that an acceptable result cannot be obtained; the Contractor shall alter his procedure and qualification so that the desired result is obtained.

No welding may take place should inclement weather including rain, sand and wind result in bad joints. If practical, shelters may be erected. The Engineer's representative will decide if the weather is suitable for welding or not.

M21.15 BONDING OF PIPELINE

It may be necessary as a result of tests to be carried out by the Employer, for the pipeline to be

bonded across couplings for electrical continuity.

The bonds shall consist of lengths of 16 mm² PVC sheathed cable secured to the pipeline by thermal welding. Each and every flexible and flanged coupling will be bonded across except in the case of valve chambers where the bonding will take place in the form of a bypass around the outside of the chamber. At flexible couplings two fastenings to the pipe (one on either side of the coupling) and one to the barrel of the coupling shall be made. The external protection of the pipe shall be made good by filling the space cleared of wrapping for the connection with bitumen as used for wrapping the pipe, such that the depth of bitumen thus applied is equal to the depth of the wrapping.

The bonding shall be carried out as soon as possible after installation of the piping and before joints are protected and backfilled. The cables shall be installed in accordance with the requirements of the supplier and to the satisfaction of the Engineer.

Bonding of pipes shall be measured per joint unit. This price shall include for supplying of materials, transporting on Site and installing bonds and making good of pipe wrapping all as described in this Clause.

M21.16 BEDDING AND SUPPORTING OF PIPEWORK

In all cases buried pipes shall be laid on a 50 mm thick bedding layer, surrounded and covered to a height 150 mm above the pipe with selected fill material complying with the requirements of standardized specification unless otherwise indicated on the Drawings or ordered by the Engineer.

Bedding material shall be to the same Specification as selected fill.

Exposed pipework shall be adequately supported on concrete pads and fastened down with approved metal straps with rag-bolts cast into the concrete or with holder bats or as indicated on the Drawings or directed by the Engineer.

M21.17 LAYING OF PIPES

Only qualified workmen shall be employed for the laying and jointing of pipes and proper tools shall be used for the execution of the works. Care shall be taken during construction that the ends of pipes are not hit against each other and pipe ends are damaged in this way.

Once a sufficient length of trench has been excavated and trimmed to the required levels and grades, the pipes shall be lifted and carefully lowered into the trench and placed on the prepared bedding layer (where gravel bedding layers are called for).

Immediately prior to laying the pipe or fitting, it shall be carefully examined both externally and internally for any damage or defect, and all foreign matter shall be removed from inside of the pipe.

Pipes shall be laid evenly on the prepared bedding layer that shall be free of hollows, bumps or other irregularities. Where any such irregularities occurring in this layer prevent the pipe barrel from bearing on the bedding layer for its full length between joint holes, the pipe shall be lifted out of the trench or moved to one side while the bedding layer is trimmed in the specified manner, and where such filling or trimming is necessary as a result of any fault or omission on the part of the Contractor responsible for excavating the trenches, the additional handling of the pipe and trimming shall be to his own cost.

A guideline shall be strung parallel to the centre-line of the pipe and at the height of the centre-line of the pipe. Alternatively the Contractor may make use of a laser beam grade indicator.

All pipes and fittings shall be laid to the true lines and levels indicated on the drawings or as instructed by the Engineer. Pipes and fittings shall be positioned concentrically correct so as to obtain a thoroughly uniform joint. Where possible pipes shall be laid by commencing at the lower end of the grade and working uphill, and in the case of spigot and socket pipes, the socket end of the pipe shall face uphill.

In order to prevent foreign matter entering pipes already laid, a properly fitting wooden or other approved type plug or cap shall be used to cover the end of the last pipe laid whenever laying of pipes is interrupted.

Under no circumstances will the Contractor be permitted to use stones, corrugated iron or cement bags to cover the open end of closed pipes.

An approved pipe "cleaner" attached to a sturdy rope and left in the mouth of the pipe already laid and jointed, shall be pulled forward through the pipeline as each successive pipe is laid. The scraper and ropes used must be of soft material, which will not damage the inner surface of the pipes.

M21.18 DAMAGED PIPES

Damaged or defective pipes or fittings may not be used but shall be placed to one side for inspection by the Engineer who will determine and decide whether the damage is of such a nature that the pipe or fitting shall be rejected or whether it is so slight that it may be repaired on the Site. The decision of the Engineer with regard to the rejection of the damaged or defective pipes and fittings shall be final. Pipes and fittings shall be replaced or repairs undertaken by the Contractor at his own cost to the full satisfaction of the Engineer. In the case of pipes and fittings provided by the Employer, the responsibility of the Contractor for the repair and replacement of damaged pipes and fittings will commence once the Contractor has taken delivery of the material from the Employer. Before taking over any material from the Employer, he shall thoroughly inspect all material and immediately report any damage or defects therein to the Engineer.

The Engineer shall have the right to order the removal of any defective or damaged pipe or fitting that has not been repaired or approved as described above, from the pipe line, irrespective of whether such pipe or fitting has been laid and joined in the pipe line or not, and the Contractor must then undertake the removal and replacement of such pipe or fitting to the complete satisfaction of the Engineer, at his own cost.

M21.19 SIGHT RAILS

In all cases pipes are to be laid to definite lines and levels and sight rails shall be erected after setting out, at changes in direction and grade and at intermediate positions such that the distance between sight rails does not exceed 50 m or as the Engineer may require.

Sight rails for bulk excavation of trenches may be temporary to suit the Contractor's requirements but for purpose of final trimming and pipe laying sight rails shall be of sturdy construction, firmly planted and have the cross-arm neatly and clearly painted black and white.

Boning rods shall be well constructed with the cross-arm painted red or other colour contrasting with the sight rail. Sight rails and boning rods shall be maintained in a clean and sound condition and shall be subject to the approval of the Engineer at all times.

M21.20 STORAGE OF PIPES AND PREFABRICATED SECTIONS

Unless specifically stated to the contrary, the Contractor shall supply, deliver and install, as shown on the Drawings and in the Schedule of Quantities, all pipes, prefabricated sections and accessories required under each particular Section of the various Sections of the Contract.

Unless the pipes, prefabricated sections and accessories are off-loaded on the side of the excavated trench, the Contractor shall stack such pipes, prefabricated sections and accessories on an approved site. The cost involved in the transport from such storage place to the section of the trench where the drain or pipe line has to be built, shall be included in the construction cost.

During transport, handling, stacking and placing, the prefabricated units shall be protected against damage.

The Engineer reserves the right to restrict the height to which pipes may be stacked. Pipes larger than 300 mm diameter may not be stacked at all.

M21.21 JOINTING OF PIPES

Only suitably qualified workmen will be permitted to lay and join pipes and suitable equipment must be used for the execution of work.

Before they are joined together, the ends of pipes and all fittings and flanges shall be inspected and cleaned.

(a) Flanged Joints

Where flanged pipework, valves, etc., are to be connected, the insertion material shall be cut to the correct size and provided with bolt holes. The insertion material shall be positioned immediately prior to the two flanges being brought together and the whole joint must then be bolted together by tightening diametrically opposite bolts in sequence.

(b) Flexible Joints (Viking Johnson Type)

The flanges must be placed in position first; one over each end of the pipe, and the rubber rings must then be inserted by pulling them over the ends of the pipes or by using special pointed plugs, the point of which has been placed in the end of the pipe. Any twists in the rubber rings must be removed by rolling the rings along the outside of the pipe and they must then be brought into position so that the distance from the end of the pipe to the ring is equal to half the length of the detachable collar. The collar shall be placed over the end of one of the pipes and the two pipe ends shall be brought together in such a way that the collar is placed centrally over the joint. The bolts must then be placed through the flanges and carefully and evenly tightened to the required torque, thus ensuring a watertight joint.

(c) Flexible Joints (Loose Collar Type)

The pipe barrel shall be thoroughly cleaned over the area to be covered by the coupling. The coupling shall be installed strictly in accordance with the manufacturer's instructions - a copy of which shall be kept by the Contractor on Site.

(d) Screwed Joints

Screw threads on pipes and in sockets shall conform to the relevant standards. Threading on Site will be subject to the approval of the Engineer. PTFE tape only shall

be used for thread sealing. Sockets shall not be over tightened and the pipes shall be screwed the same distance into the socket on either side.

(e) Spigot and Socket Joints

For spigot and socket joints the ring shall be placed around the spigot end of the pipe, perpendicular to the centre-line and as near as possible to the end. The ring shall be clean, dry and not twisted. The joint is made by pushing the pivot in the socket by means of a crowbar or block and tackle. If the pipe is inclined to creep out of the joint, it is a sign that the ring is not rolled on evenly and it must be redone.

(f) Open Joints

For open joints the pipes shall be laid close together and any gap larger than 3 mm on the inside as well as outside shall be filled completely with 3:1 cement mortar and on the outside covered with one layer of jute material soaked in the same mortar. The jute material must overlap the joint by at least 75 mm on both sides.

M21.22 COUPLING DIFFERENT TYPES OF PIPING

The following methods shall be used for connecting different types of pipe together:-

Cast iron flange adaptors or steel flange and spigot pieces to suit the types of piping shall be coupled with a flexible coupling on one end and bolted to a flange on the other end which may, in the case of steel piping, be welded or screwed on.

Where a steel pipe is to be connected to an asbestos cement pipe with a larger outside diameter, without the use of a flange adaptor to the end of steel pipe shall be furnished with a steel ring welded on or, in the case of galvanised piping, a special galvanised steel socket shall be screwed on such that the outside diameters of the pipes match and the pipes may then be joined with a flexible coupling.

M21.22.1 Making of Openings

Where drains have to be joined to existing structures or existing drains or newly constructed prefabricated box culverts in such a way that it was not possible for the Contractor to leave openings for the joining or building in of prefabricated units, such openings shall be made according to the instructions of the Engineer.

The Contractor shall supply the necessary equipment and labour to make the openings according to the dimensions and/or requirements directed by the Engineer without damaging the rest of the structure or drain. If the openings are made too large or the rest of the structures or drain is damaged in any way, the Contractor shall repair it at his own expense to the satisfaction of the Engineer.

Blasting to make openings will only be permitted in exceptional circumstances.

Where necessary, parts of the existing structure or drain shall be propped until the junction of the new drain is completed.

The prefabricated units must be built into the openings or the other drains joined thereto as directed by the Engineer and the joint shall be finished neatly so that a minimum of obstruction is caused to the flow of water. The Contractor must provide all material, tools and labour to make the new junction.

M21.22.2 Positioning of Valves and Fittings

All valves and fittings shall be correctly positioned as indicated on the Drawings, and where necessary shall be supported by concrete pads. Spindle guides and anchors shall be fixed to the brickwork or concrete and carefully adjusted to ensure correct operation of the spindle.

M21.22.3 Thrust Blocks

Unless otherwise ordered by the Engineer, concrete Class 25/19 MPa thrust blocks shall be cast as a support for bends, tees and caps and at valves. The size of the thrust will depend on the strength of the soil, the pipe diameter, the working pressure and the type of item to be supported.

All thrust blocks shall be cast against undisturbed soil and in such a manner as to leave all couplings accessible and such that the bearing area is in accordance with the table given below, which table is based on the assumption that the safe bearing capacity of the soil is at least 100 kN/m². The Engineer will determine in each case the safe bearing capacity for the soil, and the bearing area of the thrust block may then be interpolated from the table. The areas are given in square metres.

Thrust blocks and pipework supports inside buildings shall be constructed to the dimensions given on the Drawings or as directed by the Engineer after the piping and fittings are installed in position.

Note: Bearing area of thrust blocks for pipe diameters, working pressures and bends not stated in the table below, shall be interpolated from the values given.

Nominal Pipe Diameter (mm)	Working Pressure KPa	Bends				End Caps and T-pieces
		11.25º	22.50º	45.00º	90.00º	
100	300	0.010	0.020	0.035	0.065	0.045
	900	0.025	0.050	0.100	0.185	0.130
	1 500	0.045	0.085	0.165	0.305	0.215
	2 100	0.060	0.120	0.230	0.425	0.300
200	300	0.035	0.070	0.135	0.245	0.175
	900	0.107	0.200	0.395	0.725	0.515
	1 500	0.170	0.335	0.655	1.210	0.855
	2 100	0.235	0.470	0.915	1.695	1.195
300	300	0.080	0.150	0.295	0.545	0.385
	900	0.230	0.450	0.885	1.630	1.150
	1 500	0.380	0.750	1.475	2.720	1.920
	2 100	0.530	1.050	2.060	3.805	2.685
400	300	0.135	0.265	0.515	0.950	0.670
	900	0.395	0.785	1.540	2.845	2.005
	1 500	0.660	1.310	2.565	4.740	3.340
	2 100	0.920	1.895	3.590	6.635	4.675
500	300	0.210	0.420	0.820	1.510	1.065
	900	0.630	1.250	2.455	4.530	3.195
	1 500	1.050	2.085	4.085	7.550	5.325
	2 100	1.465	2.915	5.720	10.565	7.450
600	300	0.305	0.600	1.180	2.175	1.535
	900	0.905	1.800	3.530	6.521	4.600
	1 500	1.510	3.000	5.885	10.870	7.665
	2 100	2.110	4.200	8.235	15.215	10.730
800	300	0.540	1.070	2.095	3.865	2.725

Nominal Pipe Diameter (mm)	Working Pressure KPa	Bends				End Caps and T-pieces
		11.25º	22.50º	45.00º	90.00º	
	900	1.610	3.200	6.275	11.595	8.175
	1 500	2.680	5.335	10.460	19.320	13.625
	2 100	3.750	7.465	14.640	27.050	19.070
1 000	300	0.840	1.670	3.270	6.040	4.260
	900	2.510	5.000	9.805	18.110	12.770
	1 500	4.185	8.050	16.340	30.185	21.285
	2 100	5.855	11.660	22.875	42.260	29.795

M21.23 CUT PIPES AND PREFABRICATED SECTIONS

Cut pipes may only be used with the Engineer's permission and the ends shall be cut square to the length of the pipe and finished smooth and evenly so that the cut ends is not inferior to that of an uncut pipe.

The Contractor shall measure the length required for a cut length, cut the pipe, prepare the end for the required coupling and install the cut length. The cutting and end-finishing operations shall be done with special tools available for the particular type of piping such that the cut end is not inferior to the factory made end. In the case of asbestos cement piping particularly, an end cutting machine as supplied by the pipe manufacturers only, shall be used for cutting and preparing the end.

In the case of steel pipes since the ends only are truly circular, it is necessary that cut lengths be factory made and prepared. The prices tendered for cut lengths for various types, classes and diameters of piping shall include for the cutting and end finishing operations but exclude the actual pipe length used as this will be measured and paid for under the item provided for supplying and/or laying of straight pipes. The price shall however, include for one coupling as required, and for any possible wastage.

In the case of sewer pipes, cut pipes may only be used at manholes and the cut end shall wherever possible be built into the manhole. Prefabricated units may only be trimmed or cut where they join structures or other drains.

Box culvert sections may only be trimmed or cut perpendicular to the direction of flow to obtain the correct length and units of the correct skew shall be obtained from the manufacturer where the box culvert drain joins at a skew and in such cases the second last unit shall be trimmed or cut to obtain the correct length.

The ends of pipes to be built in shall be trimmed or cut to the correct skew to be finished smoothly on the inside face of the wall into which it is built.

Units shall be cut in such a way that the edges are not shattered or cracks are not caused in the concrete where the structural strength of the unit causes it to break. When it is trimmed it shall be cut or sawn to obtain the correct length and skew end.

The necessary openings for junctions shall be left when structures or drains are constructed. If the Contractor neglects to leave such openings, he shall, at his own expense, make such openings afterwards or remove the building work and reconstruct it with openings, all according to the Engineer's directions.

Units must fit neatly into the openings provided for them and must be firmly concreted or built in without any obstruction to the flow of water.

M21.23.1 Sterilizing of Pipelines

Pipelines that are to be used for potable water shall be sterilized over its complete length before it is taken into use.

The pipe shall be filled with potable water chlorinated to a concentration of 10 mg of chlorine per litre of water which shall remain with the inner surface of the pipe line for a period of not less than 24 hours. The pipeline is to be filled for sterilizing in such a manner that no shock is created or air trapped in the pipeline.

The Contractor shall at least 14 days prior to the commencement of sterilizing, submit full details of the proposed method of sterilizing the pipe line to the Engineer for his approval.

The Contractor shall provide all necessary tools, equipment and labour necessary to sterilize the pipeline. After sterilizing the pipe line the Contractor shall, at no extra cost empty the pipe lines and dispose of the water in a manner approved by the Engineer.

The Contractor may use the following products as a source of chlorine:-

(a) Chloride of Lime to SANS 295 yielding one third by weight free chlorine.

(b) Calcium Hyper Chloride to SANS 295 yielding 70% by weight free chlorine.

(c) Chlorine gas applied by chlorinator.

The unit rates tendered under the items in the Schedule of Quantities for sterilizing pipe lines shall include for all materials (including water) and labour necessary and shall also include for all arrangements the Contractor may have to make in order to obtain water and fill the pipe line.

M21.23.2 Route Markers

In certain instances concrete pipe route markers may be required. Such markers shall be detailed fully in the Project Specification.

M21.23.3 Protective Layers on Pipes and Fittings

Unless otherwise indicated on the Drawings or stated in the Schedule of Quantities, pipes, specials and fittings shall be protected as shown here-under. Note that preparation of metal surfaces shall be done as specified for steel and other metal work.

PVC, Polythene, galvanised and Chromed Piping

Pipes and fittings manufactured from the above materials shall receive no treatment except as follows:-

(a) Exposed galvanised steel piping shall be thoroughly cleaned and coated with one layer of etching primer, one coat zinc chromate primer and finishing coats as for exposed steel piping when called for in the Schedule of Quantities.

(b) The exposed threads and where galvanising has been damaged shall be thoroughly cleaned and all traces of oil removed with an appropriate solvent. One coat of zinc chromate primer to SANS 679 Type 1 followed by one undercoat to SANS 681 Type II to a total dried film thickness of 50 µm shall be brush applied to all surfaces.

(c) Buried galvanised steel piping shall, when called for in the Schedule of Quantities, be protected by wrapping with pressure sensitive tape or butyl rubber laminated tape.

(d) Identification bands shall be painted on exposed PVC, Polythene and chromed piping in accordance with instructions of the Engineer.

M21.23.4 Flexible and Flanged Couplings

The couplings shall first be cleaned by removing all loose scale, rust, extraneous matter such as mud, by means of wire brushing and removing possible excess water by wiping with a dry cloth.

After cleaning, the whole of the coupling shall be well primed with a paste of saturated petroleum hydrocarbons (petrolatum), insert fillers and passivating agents, leaving a thin film on flanges and sleeves and a liberal amount around the bolt heads, narrow cavities, etc. A mastic plats of petrolatum, insert fillers and mineral fibres shall then be applied to cover all the bolt heads on the outside of the flanges (also between flanges to give approximate 5 mm cover over the sleeve). The mastic shall then be moulded up to, but not to completely cover the bolts and flanges.

A glass fibre, felt coated tape saturated with petrolatum with insert siliceous fillers shall then be applied circumferentially, starting and finishing on top of the coupling, care being taken to form the tape well into the angle between the flange and the pipe. Care shall be taken to smooth the tape down and ensure conformability to the underlying mastic. The tape should be "fed" onto the coupling and not stretched.

Two complete turns of 0,15 mm thick polyethylene sheeting shall be applied over the coupling. The sheeting shall be wide enough to cover the entire coupling and overlap by 150 mm on top of the coupling. The sheeting shall be secured onto the pipe barrel each side of the coupling by means of self adhesive tape overlapping 25 mm on the pipe barrel and 75 mm on itself.

The tendered unit rate for wrapped couplings shall include all materials, labour, transport, etc. to complete the protection of the coupling in any position along the pipeline.

M21.24 COLOUR CODES

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

M21.25 TOLERANCES

Pipes shall be laid to the lines, grades and levels as specified on the Drawings

(a) Vertical deviation from the straight line between two consecutive levels shall not be more than the value of "d" as calculated from the following formula :-

$$d = 5 + \frac{L_{1/2}\ D_{1/2}\ S_{1/2}}{60}$$

Where : d = tolerance in millimetre
L = length of pipe between control point in millimetre
D = nominal pipe diameter in millimetre
S = slope of pipe taken as the difference in level of control points in millimetre divided by L

(b) The horizontal deviation from the specified direction and line between two consecutive control points shall not be more than the maximum vertical deviation as calculated under (a) above.

Pipe items and specials shall be manufactured to the dimensions as specified in the pipe lists or shown on the Drawings

Maximum allowable deviation from the specified dimensions shall be as follows:-

(a) Straight pipes and tapers :-

Length (mm)	Tolerance (face to face) (mm)
Up to 1 800	± 16
1 800 to 2 700	± 24
2 700 to 3 600	± 32
Longer than 3 600	± 40

(b) Bends and Tees :-

Diameter (mm)	Tolerance (centre to face) (mm)
Up to 300	16
300 to 600	24
600 to 1 200	40

M21.26 TESTING

M21.26.1 Steel Pipes and Pipe Fittings

M21.26.1.1 *Testing and Inspection at Manufacturer's Works*

Where factory inspection and supervision of tests are required by the Engineer, such tests and inspections shall be carried out at the manufacturer's works at the expense of the Contractor who shall provide free of charge all necessary testing facilities, labour, instruments, etc. that may be required.

An independent inspector such as the SABS may be appointed to act on behalf of the Engineer. Fees payable to such an inspector, however, will not be to the account of the Contractor.

M21.26.2 Non-Destructive Tests

(a) Visual Inspection

All pipes and pipe specials shall be visually examined, shall be free of defects, such as cracks, laminations and arc burns and shall comply fully with the dimensions as specified.

A penetrant dye shall be used for the visual inspection of welding.

(b) Ultrasonic Inspection

All longitudinal or spiral welds on straight steel pipes shall be checked ultrasonically with approved equipment capable of continuous and uninterrupted inspection of weld seam - all in accordance with API 5L.

(c) Radiographic Inspection

As an alternative to (b) above, 20% of all longitudinal or spiral welds on straight pipe, and up to 100% of all butt-welds on straight pipes and up to 100% of all welds for pipe specials shall be checked radio graphically in accordance with API 5L.

(d) Hydrostatic Testing

All pipes and pipe specials shall be subjected to hydrostatic testing at a test pressure determined from the following formula:-

$$P = \frac{1500\ Yt}{D}$$

Where P = Hydrostatic test pressure in kPa
Y = Minimum Yield stress of material in Mpa
t = Nominal wall thickness in mm
D = Nominal outside diameter in mm

All leaks on sweating shall be considered as defects.

(e) Visual Inspection of Linings and Coatings

Linings shall have a smooth glossy finish, free from ripples, runs, pinholes, bubbles, laminations, disbanding, fraying or other blemishes.

Coatings shall be free of crazing, laminations, disbanding, pinholes, craters, bridging across and weld beads, or any sign of physical damage and shall have an acceptable smooth finish.

(f) Holiday Testing of Linings and Coatings

The entire lining and coating of each pipe shall be tested by the Contractor to the Engineer's satisfaction with an approved holiday detector fitted with the following heads:

(i) For epoxy linings and coatings - with a wet sponge detector head.
(ii) For bitumen or coal tar linings and coatings - with a copper bristle search head.
(iii) For wrapped coatings - with a rolling ring detector around the pipe.

(g) Thickness of Linings and Coatings

The thickness of linings and coatings shall be measured by means of a magnetic or eddy current instrument suitable for measuring non-metallic films on curved magnetic surfaces.

(h) Delamination Test and Disbonded Areas

Refer to SANS 1178 Clauses 7.2.3 and 7.2.4.

M21.26.3 Destructive Tests

Destructive tests on steel pipes and specials shall be carried out in accordance with SANS 719 and SANS 1178.

M21.26.4 Testing and Inspection on Site

M21.26.4.1 Site Welding

The Contractor must appoint an inspector from a certified institution in accordance with SANS 044 Part V at his own cost. An incompetent inspector must be replaced by a competent person. A copy of all inspection reports must be provided at no cost to the Engineer.

Inspection and test of welds must be carried out in accordance with API Std 1104 chapter 5 and the standard required must be according to chapter 6. All results must be tabulated.

Radio graphical tests in accordance with chapter 8 of above specification must be carried out. The numbers of welds of each welder that must be tested are: the first three joints, then every third joint to a total of 6 joints and then one out of every 10 joints. Should one joint fail the prescribed tests, the above procedure must be repeated starting from the before last joint.

The Contractor must keep a complete record of the position of every radio graphical tested joint and provide a copy at no cost to the Engineer.

All joints, which fail the prescribed test of API Std 1104, must be repaired in accordance with chapter 7 of above specification.

M21.26.4.2 Linings and Coatings

Linings and coatings shall be visually inspected on Site prior and after installation for any sign of physical damage.

All repairs to linings and coatings undertaken on Site shall be to the Engineer's approval who also reserves the right to order pipes and pipe specials to be returned to the factory for repairs to linings and coatings.

For bitumen linings and coatings the following procedure shall be followed:-

Weld spatters must be removed and steel surfaces must be wire brushed to ST 3 of SIS 0559 and all dust must be removed. Damaged bitumen primers, bitumen and lime layers must be scraped and/or brushed until steel or good bitumen is reached to a point at least 100 mm from the point of repair.

Bitumen primer must be cold applied to steel and exposed bitumen surfaces and left to dry for at least 4 hours but not more than 4 days.

For the repair of linings bitumen applied hot in an acceptable manner shall be used.

One layer of warm bitumen to a thickness of 1.5 mm followed by two layers bitumen saturated glass fibre cloth applied by means of a warm iron to ensure complete affixion and bitumen saturation must be applied as wrapping. Above must be followed by one layer of 1 mm thick warm applied bitumen on one layer of white lime over the joint area. The thickness of the wrapping must be at least a thick as the original and edges must fit to the original protection.

Bitumen must be heated in closed kettles to a maximum of 235EC. Local overheating must be prevented by stirring.

M21.26.4.3 Hydrostatic Testing of Pipe Line

Pipe joints shall in general be left exposed until the pipeline has been successfully tested and passed by the Engineer. All open excavations at joints shall be adequately and safely protected. Should the Engineer order any joints to be backfilled prior to testing, the responsibility for re-exposing the joints for the purpose of repair of leaks after testing shall be entirely the Contractor's own and he shall not be entitled to extra payment for such work.

The Contractor shall provide and maintain in good condition the equipment necessary to carry out the test. Where temporary pumping equipment is used for testing, the equipment shall consist of a force pump with the suction end in a suitable container of water, and connected to the pipe line by means of high pressure hosing in good condition and/or piping and all the necessary flanges, connections, couplings, etc. and a pressure gauge suitably calibrated and in good condition. The equipment and method of assembly for testing shall be subject to the approval of the Engineer.

The entire pipe line or portion of the pipe line between closed valves and/or blank flanges mat be tested at any one time provided that no section of the pipe line is subject to a higher pressure than one and a half times the working pressure for the particular class of pipe and fitting.

Prior to commencing the test the Contractor may, if he so desires, keep the pipeline full of water for as long a period as he considers necessary. The Contractor shall, at least 14 days prior to the first test being carried out, submit full details of the procedure he intends to follow, to the Engineer for approval.

For the purpose of the test the pipeline shall be filled with water in such a manner that no shock

is created or air trapped in the portion to be tested.

Once the pipe line is completely full of water, the pressure shall be brought up to one and a half times the maximum working pressure for all parts of the portion of pipe line under test as the water level in the container at the suction end of the pump noted. The initial application of the test pressure shall be done in the presence of the Engineer.

The pressure shall be maintained at the test level for 4 hours.

The quantity of water which has to be added to the container at the suction end of the pump during the 4 hours that the pipe line is under test in order to bring the water level back to the initial level at the start of the test, shall be carefully recorded. No water may be added to the container except in the presence of the Engineer.

Should the quantity of water thus added not exceed the following limit, the pipeline shall be deemed to be successfully tested.

Limit of leakage permitted over 4 hours:-

(a) For pipeline with flexible joints

50 ml per 10 mm of pipe diameter per 1 000 m of pipe length per 10 m maximum test head for the portion of pipeline tested. All joints must be inspected while the test is in progress to ensure that there are no visible leaks.

(b) For pipeline with welded joints

10 ml per 10 mm pipe diameter per 1 000 m of pipe length per 10 m maximum test head for the portion of pipeline tested. Should the leakage be more than 3 l/km of pipe tested, the Contractor must prove that no single leak exceeds 0,2 l in 4 hours.

M21.26.5 Other Pipe Materials

Visual inspections and hydrostatic tests shall be carried out on Site as described for steel pipes. Factory inspections and tests shall be as specified in the relevant SANS Specification for the pipe material concerned.

M21.27 MEASUREMENT AND PAYMENT

Payment under scheduled items shall be made per complete pipework system 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 drawings and instructions for anything not specifically mentioned but obviously required for the proper installation to enable the system as described 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

C3.3.1.3 PD BUILDING WORK

C3.3.1.3.1 PD 01 SCOPE

This is a Particular Specification and covers the various construction activities associated with the erection of buildings which form part of this Contract.

Building work shall be carried out in accordance with the National Building Regulations, SANS 10400, the applicable clauses of the SANS Standardized Specifications and the information contained in this Specification.

Work appurtenant to the erection of buildings such as earthworks, concrete work, structural steelwork, etc. shall be carried out as specified in the appropriate Standardized Specifications and will be measured and paid for under those Specifications.

C3.3.1.3.2 PD 02 BRICKWORK, PLASTER WORK AND FLOOR SCREEDS

C3.3.1.3.2.1 PD 02.1 MATERIALS

(a) Bricks

Bricks shall comply with SANS 227 and shall be of the class scheduled or shown on the drawings.

Satisfactory proof of the load-bearing capacity of the bricks offered shall be submitted before deliveries are made to the site.

Air bricks shall be well-burnt terracotta and shall be free from cracks and blemishes and lined with copper mosquito gauze.

Three samples of each type of brick shall be submitted to the Engineer for approval. All subsequent deliveries shall be of a standard equal to or better than that of the approved samples.

(b) Cement

Cement shall comply with the requirements of SANS 50197 and shall be stored under cover. The use of Portland blast-furnace cement (PBFC) which complies with the requirements of SANS 50197 will only be allowed if approved by the Engineer.

(c) Aggregate

Fine aggregate shall consist of natural sand, or crushed rock or gravel, and shall be hard, clean and free from adherent coatings or other deleterious matter. Sand for plaster and mortar shall comply with the requirements of SANS 1090, whereas the aggregates for normal and granolithic floor screeds shall comply with the requirements of BS 1199 and BS 1201 respectively.

(d) Water

Water shall be clean and free from clay, silt, oil, acid, alkali, organic or other matter which would impair the required strength and durability of the mortar, plaster, or floor screed.

(e) Wall ties

Wall ties shall be of the galvanized, crimped, single-wire type, 3,5 mm in diameter, and shall comply with the requirements of SANS 28.

(f) Damp-proof sheeting

Damp-proof sheeting shall comply with SANS 248, type FV for fibre felt, or SANS 952, type B for embossed polyethylene sheeting.

C3.3.1.3.2.2 PD 02.2 CONSTRUCTION OF BRICKWORK

(a) Cement mortar

Cement mortar shall, unless otherwise specified, consist of one-part Portland cement to four parts sand (1:4) by volume for normal brickwork and one-part Portland cement to three parts sand (1:3) by volume for reinforced brickwork. The ingredients for cement mortar shall be measured in proper gauge boxes on a boarded platform and thoroughly mixed. Alternatively, mixing may be by means of an approved mechanical batch mixer. Only when the dry ingredients have been thoroughly mixed and a mixture of uniform colour has been obtained may the water be added in sufficient quantity to obtain mortar with the required consistency.

Cement mortar shall be used within two hours of adding water to the mix and shall not be used after two hours or if it has begun to set. Mortar shall be turned over frequently to prevent it from setting until it is used.

(b) Brickwork

Dimensions of all the brickwork shall be set out and built as shown on the drawings. Bricks shall be kept wet before laying and the top of brickwork shall be wetted before any further bricks are laid. Bricks shall be well buttered with mortar before being laid and all joints shall be thoroughly flushed up as the work proceeds. All joints to face brickwork shall be neatly made and key-drawn with a 6 mm key.

Brickwork shall be carried up in a uniform manner with no portion being raised more than 1 m above an adjacent portion. All perpends, quoins, etc., shall be kept strictly true and square and the whole properly bonded together.

Brickwork shall be built in stretcher bond or english bond as shown on the Drawings, and bats shall not be used except where required for the bond. All joints shall be 10 mm wide and four courses shall measure 340 mm.

Brickwork for cavity walls and solid walls built in stretcher bond shall be tied with wall ties placed not more than one metre apart in every third course and shall be staggered vertically. At openings, the ties shall be positioned not more than 300 mm apart along the periphery of the opening and 150 mm from the opening.

Face brickwork shall be kept perfectly clean and rubbing down of the brickwork shall not be allowed. Scaffold boards shall be turned back during heavy rain to avoid splashing. Soiled brickwork shall be cleaned at the Contractor's expense, and the cleaning method shall be approved by the Engineer.

(c) Reinforced brickwork

Brickwork over door and window openings shall be reinforced with steel rods, welded, or expanded mesh, etc. Reinforcement shall be placed in each course of brickwork for a minimum of four (4) courses or as shown on the drawings. Reinforced brickwork shall continue at least 300 mm on each side of the openings.

Brick lintels shall be built upon rigid temporary supports left in position for not less than seven (7) days after bricklaying. Prestressed concrete lintels may be used where approved by the Engineer.

(d) Key for plaster

Joints of all brickwork receiving plaster shall be raked out, or the brick surfaces shall otherwise be prepared with an acrylic slurry or any other approved bonding agent.

(e) Damp-proofing

A damp-proof course shall be laid over the full width of all the walls at a minimum height of 150 mm above the final ground level or wherever else it may be required, and it shall be lapped for at least 150 mm at angles and joints. A damp-proof course shall also be laid and stepped up under all external sills.

(f) General

Rough and fair cutting shall be performed as required, and the brickwork shall be fitted around any steel work. Face brickwork shall be carefully cut and fitted to suit fittings.

Chases shall be left or formed for edges of concrete floors, staircases, etc. Chases shall also be provided wherever they may be required for pipes, conduits, switch boxes, distribution boards, and the like. Joints shall be raked out for flashings.

C3.3.1.3.2.3 PD 02.3 PLASTER WORK

(a) Plaster coats

A plastered finish shall consist of a single coat, comprising one application of a 1:6 cement sand mixture with a wood or steel-float finish.

(b) Thickness

The total thickness of the plaster finish shall be 13 mm minimum and 20 mm maximum.

(c) Workmanship

All plaster work shall be finished smooth and ready to receive paint. Plaster shall be flush with the faces of all switch and plug boxes, the interiors of which shall be kept free from plaster. Plastered surfaces shall be plumb, and jambs and reveals shall be formed square.

The plasterer shall cut out and make good all cracks, blisters and other defects and leave the plaster work, on completion, in a state which is acceptable to the Engineer.

C3.3.1.3.2.4 PD 02.4 FLOOR SCREEDS

Floor screeds shall have a mix proportion by mass consisting of one (1) part Portland cement and three (3) parts (1:3) fine aggregate. A minimum amount of water is to be used, but it shall be sufficient to allow adequate compaction.

Screeds shall be laid on clean hardened bases in panels not exceeding 14 m² and shall be steel-trowelled to a true and smooth finish. In monolithic construction, the panels shall not exceed 30 m². Joints in screeds shall coincide as nearly as possible with joints in the bases. The thickness of screeds shall be as shown on the drawings or as directed by the Engineer.

The entire screed surface shall be free from loose or raised particles of aggregate, trowel marks or any irregularities, humps or depressions exceeding 5 mm when measured from a 3 m long straight edge.

Screeds shall be cured for three (3) to seven (7) days as may be directed by the Engineer and shall be protected from damage.

No moisture-sensitive floor finish shall be laid on screeds unless a reliable moisture test shows that the screed is sufficiently dry to receive the covering.

C3.3.1.3.3 PD 03 DOORS AND WINDOWS

C3.3.1.3.3.1 PD 03.1 MATERIALS

(a) General

All steel and iron work shall be delivered clean and free from rust, pitting or other defects. Shop primings shall be applied before delivery and shall consist of a coat of red oxide paint, or any other approved anti-rust paint on all surfaces.

Unless otherwise specified, all materials shall conform at least to the appropriate SANS or BS standards where such standards apply to ironmongery, or steel, cast iron and any other related materials.

(b) Pressed-steel door frames

Pressed-steel door frames shall comply with SANS 1129 and shall be manufactured from 1,6 mm thick mild-steel sheeting, pressed to the required shapes, properly mitred, welded and reinforced, with all welding neatly cleaned off.

Frames shall be of the widths required to suit the thickness of the walls into which they are built and shall be fitted with suitable tie bars and braces at the bottom. Three lugs to be built into the brickwork shall be provided on each jamb.

Rebates in frames and transoms for doors shall be of the widths required to suit the thicknesses of the doors and shall be fitted with a pair of approved steel butt hinges set flush into recesses in the frames. 4,5 mm thick reinforcing plates shall be welded to the backs of the frames at hinge positions.

Heads of frames over double doors shall be drilled where required to form keeps for bolts and shall be fitted with one rubber buffer for each leaf of the door.

Frames for single doors shall be fitted with approved chromium striking plates and an adjustable striking-plate keeper boxed in at the back of the frame by a welded-on sheet-metal box. The frames shall be fitted with a minimum of two rubber buffers.

Frames shall be protected against twisting and damage during transit and erection.

(c) Pressed-steel doors

Pressed-steel doors shall be manufactured from 1,6 mm thick steel plate. The doors shall be of standard design, pressed to shape with 40 mm reveals all round. The doors shall be strengthened with full-length vertical V-shaped or other approved sectional strengthening ribs projecting to the outer face. Two horizontal stiffening rails shall also be welded to the inner face of the doors.

A door shall be hung on a pair of 100 mm long steel butt hinges with loose pins. The leaves of the hinges shall be welded to both the door and the door frame, and a 1,6 mm thick steel plate shall be welded to the inner face of the door to protect the lock.

One leaf of double doors shall be fitted at the top and bottom with approved 150 mm cast brass barrel bolts in an approved manner and the other leaf shall be fitted with a lock, the striking plate of which shall be fixed to the first leaf.

Where indicated on the drawings, doors shall be fitted with louvred ventilation grills of approved design, backed with insect and vermin-proof gauze screening.

(d) Steel window frames

All steel window frames shall comply with SANS 727 and shall be of the types and sizes shown on the drawings.

Standard industrial types of steel window frame shall be constructed from rolled mild-steel industrial sections, 35 mm wide by 3 mm thick, with opening sections constructed from standard residential sections, 25 mm wide by 3 mm thick, welded at angles and properly jointed at intersections.

Window frames shall be formed perfectly flat, truly square, and properly jointed at all angles, and the opening portion shall fit properly on all faces and shall open and close freely.

Glazing bars shall be continuous with jointed intersections, the ends being neatly tenoned into the frame and securely welded in position.

Frames shall be fitted with standard fixing lugs.

Opening sections shall open as indicated on the drawings and shall be fitted with steel hinges with brass pins. Pivots shall be fitted with bronze ring centres.

Side hung or top hung opening sections shall be fitted with brass handles and friction stays. Bottom hung sections shall be fitted with friction pivots and spring catches.

Weather bar drips shall be attached to the fixed frames for the complete width of the window at the head of outward opening sections.

Composite windows shall preferably be delivered to the Site fully assembled, complete with mullions and transoms.

(e) Door-locks and handles

All door-locks shall comply with the requirements of SANS 4 and shall be of approved industrial-type manufacture and pattern. All locks shall be supplied with two keys. Keys shall be distinctly numbered with consecutive numbers and each key shall be stamped with the same number as that of the lock which it controls. No two locks in any one building may have the same key.

External doors shall be fitted with four-lever heavy-duty mortice locks, which shall be master-keyed.

All locks shall be properly installed, and, after completion, striker plates shall be adjusted, and the locks serviced.

Doorhandles shall be of cast zinc of approved manufacture and pattern.

(f) Miscellaneous fittings

All retaining devices for doors and windows as well as fittings such as coat hooks, retaining hooks, etc. shall be of solid brass. All fittings shall be secured by screws or set screws of the same material and finish as the fitting.

Fittings to be fixed to plastered walls, masonry or floors shall be fixed direct by means of patent plastic or fibre plugs fitted into drilled holes.

Doorstops shall be provided at every door and shall be 40 mm diameter rubber stops.

(g) Aluminium windows and doors

Aluminium extrusions shall be of 6063-T6 alloy and temper. Aluminium sheet and strips shall be of 1200-H4 alloy and temper.

Joints in all aluminium members shall be formed in an approved manner so that the joints are practically invisible. Screw heads, pins, rivets, etc shall be concealed as far as possible. 300 Series stainless steel screws and bolts shall be used for jointing and fixing aluminium work.

The surfaces of all aluminium which are in contact with other materials when fixed shall be suitably insulated with a non-absorbent insulating material to prevent corrosion. All aluminium work shall be suitably protected against damage, deterioration or discolouration caused by mortar droppings, paint, etc by taping with removable tape, covering with temporary casings or by covering with motor oil.

Aluminium described as “anodized” shall be treated with Grade 25 coating thickness for exterior use or Grade 15 for interior use as specified, to the required finish. All alloys to be anodized shall be suited to anodizing.

These specifications shall apply to aluminium windows, doors, etc in all respects in so far as they are applicable. Aluminium windows and doors shall be manufactured from extruded aluminium members of 6063T6, 6261-T6 or 6082-T6 alloy and temper.

Ancillary members such as sills, flashings, infill panels and the like formed from flat sheet material shall be of an appropriate alloy selected from 1200, 3004 or 5251 complying with BS 1470 of a temper suitable for the method of forming and a composition suitable for anodizing or painting as required.

Windows, doors, etc shall be of an approved standard system, manufactured by an approved firm experienced in this type of work, and shall meet with the minimum recommended performance requirements as set out by the Association of Architectural Aluminium Manufacturers of South Africa (AAAMSA) in the latest edition of the Selection Guide.

The fittings for all opening sashes shall be substantial and, unless otherwise described, shall be of high quality aluminium alloy finished to match the windows, doors, etc on which they occur. Samples of all fittings shall be supplied to the Principal Agent for approval.

Top, side and bottom hung opening sashes shall be hung on two aluminium hinges with 300 Series stainless steel pins, nylon bushes and stainless-steel washers. Side hung sashes shall have fasteners and sliding stays, top hung sashes shall have peg stays and bottom hung sashes shall have spring catches and concealed arms.

Projected out sashes shall have aluminium fasteners and concealed arms of a non-corrosive material compatible with aluminium.

The frames which are to be built into openings in brickwork shall be fitted with the manufacturer’s standard type fixing lugs, not less than 20 x 3 x 150mm long, screwed to frame and placed one near each corner and intermediately not more than 450mm apart to sides, top and bottom and where fixed to concrete reveals, wood sub-frames or to preformed openings in brickwork shall have countersunk holes for screws, one near each corner and intermediately not more than 450mm apart to sides, top and bottom.

Where so described, openings and sashes of windows and doors shall be fitted with approved channel section aluminium glazing beads sufficient in size and profile to suit the method of glazing employed, finished to match the windows, doors, etc and neatly mitred. Screws where necessary shall be of aluminium or 300 Series stainless steel and have pan or raised heads finished to match the beads

Windows, doors, etc described as “anodized” shall be treated with Grade 25 coating thickness. Windows, doors, etc described as “factory painted” shall have an

electrostatically applied oven baked polyester paint coating not less than 25 micrometres thick

Aluminium windows, doors, etc shall include glass as described, fixing in position, sealing and protection against damage, deterioration or discolouration by taping with removable tape or covering with temporary casings or motor oil and removing same on completion

C3.3.1.3.3.2 PD 03.2 INSTALLATION OF DOORS AND WINDOWS

All built-in door and window frames shall be set straight, plumb, and level, and shall operate to the satisfaction of the Engineer after fixing has been completed.

Fittings shall be either removed, or wrapped and protected from damage, until all rough trades have been completed.

C3.3.1.3.4 PD 04 GLAZING

C3.3.1.3.4.1 PD 04.1 MATERIALS

(a) Glass

Glass shall comply with the requirements of CKS 55. The quality of all window glass shall be such that surface deterioration will not develop after glazing.

All glass shall be free from bubbles, waviness, scratches, stains, or other imperfections.

Unless otherwise specified, sheet glass for glazing shall be flat-drawn clear glass of ordinary glazing quality and of the thicknesses indicated below:

For panes not exceeding 0,75 m² in area	3 mm
For panes exceeding 0,75 m² but not exceeding 1,5 m² in area	4 mm

(b) Putty

All putty shall comply with the requirements of SANS 680.

Putty shall not be too hard or soft or caked when used and shall dry evenly without crazing or cracking.

Defective putty shall be cut out and replaced by the Contractor at his own expense, and any broken glass shall also be so replaced and putty so repainted.

C3.3.1.3.4.2 PD 04.2 GLAZING

Glass shall be cut in panes to suit all glazed openings with sufficient clearance all round to prevent cracking by expansion, contraction, or vibration.

In all cases the glass shall be well bedded and back-puttied and installed as specified in SANS Code of Practice 10137.
All putty shall be carefully trimmed, cleaned off and neatly finished off straight with smooth surfaces and sharp mitres. A paint primer shall be applied as soon as the putty has dried out sufficiently to prevent shrinkage cracks from forming.

The entire glazing operation shall be cleaned before the premises are handed over for occupation.

C3.3.1.3.5 PD 05 CARPENTRY AND JOINERY

C3.3.1.3.5.1 PD 05.1 GENERAL

(a) Materials

All timber used for structural purposes shall be of merchantable grade and shall comply with the requirements of SANS 1783-1 and SANS 1783-2. Structural timber shall be carefully selected and of the best quality, free from large or dead knots, shakes, waney edges or other defects. Purlins and brandering shall comply with the requirements of SABS 1783-4. Finger-jointed structural timber shall comply with the requirements of SANS 10096 and laminated timber with the requirements of SABS 1460.

Hardwoods and softwoods for joinery shall comply with SANS 1099 and SANS 1783-3 respectively and suitable species shall be used for the various purposes.

Unless otherwise specified, all materials shall conform to the appropriate SANS or BS Specification where such standards exist for nails, screws, bolts, adhesives, etc.

(b) Preservative treatment

All structural timber shall be given a preservative treatment suitable for the duty for which the timber is intended in accordance with SANS 10005, and no untreated timber shall be used. The preservative treatment shall not impair the final finish. The timber shall be impregnated throughout. When surface coating is specified, the compounds applied on the surfaces of the timber shall form an unbroken film.

(c) Priming

The jointing surfaces of all joints exposed to the weather and built-in portions of frames shall be thickly primed except where adhesives are specified.

Carpentry and joinery items which are prepared for painting by the manufacturer, shall be knotted and primed before being dispatched to the Site.

Primed surfaces shall be touched up where necessary during the progress of the work or where site adjustments have been made.

C3.3.1.3.5.2 PD 05.2 CARPENTRY WORK

(a) Scope of work

Carpentry work shall be carried out in a manner consistent with good workmanship and in compliance with the drawings.

The carpenter shall perform all cutting away and making good in attendance upon all other trades and he shall provide and maintain temporary coverings required for the protection of any finished work that might be damaged if left unprotected during the progress of the work.

(b) Dimensions

Unwrought timber shall be as sawn and shall be to the dimensions and within the tolerances specified in the relevant SANS Standard Specifications mentioned in subclause PD 05.1(a).

(c) Jointing

Unless otherwise specified, all joints shall be secured by means of a suitable type and a sufficient number of approved connectors. All joints shall be carefully made in such a way that they will not impair the strength and stiffness of the beams or members.

(d) Timber roof construction

The plates, joists, rafters, purlins, brandering and other pieces used for the construction of the roof and trusses shall be of the dimensions, spacing and construction as shown on the drawings.

All the joints in the framework shall be of the most appropriate type, accurately formed and adequately secured with fasteners as specified.

C3.3.1.3.5.3 PD 05.3 JOINERY WORK

(a) Scope of work

Joinery work shall consist of the manufacture, delivery to the site, and fixing in the buildings, of all joinery shown on the drawings.

Except where a special finish is specified, the Contractor shall have all stairs, landings, doors, shelves, and other joinery work cleaned and scrubbed down and shall leave all his work in a good order to the satisfaction of the Engineer.

(b) Dimensions

All wrought timber shall be sawn, planed, drilled, or otherwise machined or worked to the correct sizes and shapes shown on the drawings.

Reasonable tolerances shall be provided at all connections between joinery works and the building structure to compensate adequately for any irregularities, settlements, or any other movements.

(c) Manufacture

The joiner shall perform all the necessary mortising, tenoning, grooving, matching, tonguing, housing, rebating and all the other works necessary for correct jointing. He shall also provide all metal plates, screws, nails, and other fixings that may be necessary for doing the specified joinery work properly.

(d) Joints

Where joints are not specifically indicated, they shall be the recognised forms of joints for each position. The joints shall be so made as to comply with Part 2 of BS 1186.

(e) Doors and frames

Door frames, linings, panel doors, framed, ledged and braced doors, flush doors, sliding doors, etc. shall be supplied or made by the joiner and shall be installed, fitted, or hung as detailed on the drawings.

All timber shall be wrought and prepared for oiling, staining, varnishing, or painting.
(f) Skirtings, cornices, etc.

Skirtings, cornices, etc. shall not be installed until after the wall coverings have been applied, the flooring laid and ceilings installed, unless otherwise specified.

(g) In-situ joinery

In-situ joinery work shall not be executed until after all floor, wall and ceiling surfaces have been formed or constructed, unless otherwise instructed.

(h) Ceilings

Ceilings shall consist of plaster board or fibre-cement panels as shown on the drawings and shall be nailed to the brandering or suspended from the roof structure. The panels shall be separated by exposed tees and insulated with a 50 mm thick fibreglass wool blanket where shown on the drawings.

C3.3.1.3.6 PD 06 ROOF SHEETING AND ACCESSORIES

Roof sheeting and accessories shall comply with and will be measured and paid for under SANS 1200 HC.

C3.3.1.3.7 PD 07 ELECTRICAL WORK

The electrical wiring of buildings shall be carried out by registered and licensed electricians in accordance with the requirements of SANS 10142-1 and the regulations of the Employer.

The electrician shall work in close co-operation with the Contractor to ensure that all conduits, switchboards, plug boxes and switch boxes are installed in their correct position.

The work shall be carried out in accordance with the drawings and to the satisfaction of the Engineer and the local authority.

C3.3.1.3.8 PD 08 PLUMBING

C3.3.1.3.8.1 PD 08.1 MATERIALS

(a) General

All materials shall be of the best quality and shall be approved by the Engineer before installation. Cracked, chipped, dented, or faulty items or materials shall be replaced at the Contractor's expense. Glazed ceramic sanitary ware shall comply with the requirements of SANS 497 and all other materials shall comply with the standards as specified, scheduled, or shown on the Drawings.

(b) Water closet (WC) suites

WC suites shall consist of a white glazed vitreous china closet with an S or P trap and seat lugs, a 14 litre low-level matching flat-bottomed flushing cistern placed and fixed on the closet, or a suspended enameled cast-iron cistern with the flush pipe connected to the flushing rim of the closet with rubber cone joints, and a solid heavy-duty plastic seat with cover, hinges and buffers.

(c) Urinals

Urinals shall be of the type detailed or scheduled, of white glazed vitreous china, wall mounted, with an automatic or a manual flushing system, and chromium-plated fittings.

(d) Wash-hand-basins

Wash-hand-basins shall be of white glazed vitreous china or enameled cast iron, wall mounted on a pair of cast-iron brackets, and fitted with chromium-plated fittings consisting of two taps, outlet and chain, and supplied with a plug and an anti-siphon trap.

(e) Sinks

Sinks shall comply with the requirements of SANS 242 and shall be complete with cabinet, chromium-plated outlet, anti-siphon trap, plug, chain and two bib taps or one mixer tap, all as detailed or as scheduled.

(f) Pipes and tubing

Cast-iron and steel pipes used in plumbing work shall comply with the requirements of SANS 746 and SANS 62 respectively. Copper tubing shall comply with the requirements of SANS 460 and malleable cast-iron fittings with SANS 14.

C3.3.1.3.8.2 PD 08.2 CONSTRUCTION

Plumbing shall be carried out strictly in accordance with the Drawings and with the National Building Regulations, with specific reference to Government Notice R1875 dated 31 August 1979.

Steel pipes and their malleable cast-iron fittings shall be joined with red lead and hemp, lead pipes shall have wiped soldered joints, and cast-iron pipes shall be joined by caulking with hemp and metallic lead.

Soil pipes from WCs shall have an internal diameter of at least 100 mm and shall be fitted with a pan connector and an access bend (or an access junction where a vent pipe is used), and carried through walls and into the ground for connection to the sewer. Vent pipes shall be fitted with approved balloon gratings.

Waste pipes from basins and sinks shall have an internal diameter of at least 32 mm and shall discharge into gulleys. Bends for waste pipes shall incorporate cleaning eyes.

Cisterns, basins and sinks shall be connected to the pipe system with 12 mm diameter copper service pipes, and chromium-plated stopcocks shall be installed for isolation and maintenance purposes.

C3.3.1.3.9 PD 09 PAINTING

C3.3.1.3.9.1 PD 09.1 GENERAL

No paint shall be applied to any surface containing traces of dust, grit, grease, oil, loose rust, mill scale or corrosion products of any kind or to any surface that is not free from moisture. Where necessary, surfaces shall be thoroughly washed to remove all traces of soluble salts and/or corrosive air-borne contaminants prior to painting, and the surfaces shall be dried and painted immediately thereafter.

Welding shall be completed in so far as it is possible before painting commences, but in cases where welding can be done only at a later stage, no paint shall be applied to within 75 mm of the proposed weld position unless otherwise specified. Welds and adjacent parent metal shall be abrasive blasted and/or ground and all contaminants such as flux shall be removed prior to painting.

Surfaces of members which are to rest on concrete or other floors or which will be otherwise inaccessible after erection shall receive the full paint system prior to erection.

Damaged paint areas on metal surfaces shall be cleaned, rust spots removed where applicable and the surrounding paint which is still intact shall be feathered for a distance of 20 mm beyond the damaged area. Spot priming and repair shall consist of all the coats previously applied and shall overlap the damaged area.

Damaged galvanised areas shall be cleaned and any rust spots and any flakes of the coating surrounding the damaged area removed. The coating shall then be restored by zinc spraying or soldering, or painting with a zinc-rich paint, as may be approved by the Engineer.

Where the shop coat is allowed to age for a few months before the final painting is done, light sanding or rubbing with steel wool or scrubbing with clean water using a bristle brush shall be carried out.

Steel to be embedded in concrete shall not be painted below 50 mm from the final level of the concrete.

Each priming coat and each undercoat of paint shall be inspected and approved by the Engineer before any subsequent undercoat or finishing coat is applied.

All finishing colours shall be as shown on the drawings, or as directed by the Engineer.

C3.3.1.3.9.2 PD 09.2 MATERIALS

Paints shall comply with the requirements of the appropriate specifications below:

- Painting of Structural Steel - EN ISO 12944
- Painting of Buildings - BS 6150
- Undercoats and Finishing Coats - BS 7664

The Contractor shall furnish the Engineer with the following information and details regarding the paints and decorative materials for the painting system he proposes to use, for written approval:

(i) The name of the manufacturer and trade name

(ii) The brand, type or grade of paint and the appropriate Specification

(iii) Manufacturer's data sheets, colour references, instructions for use, including surface preparation, sealers, primers, undercoats, finishing coats, coat thicknesses and curing periods, which shall all be considered as being part of these Specifications if approved by the Engineer

(iv) Safeguards to protect the applied paint from damage until the work is accepted by the Engineer

(v) The shelf or pot life of materials, if applicable

(vi) An undertaking that the proposed paint system is suitable for its intended use and that the various coats of paint are compatible with one another

Where proprietary brands are used, the manufacturer's priming and all subsequent coats of paint suitable for that particular brand shall be employed in accordance with the manufacturer's instructions.

No other materials of a similar nature and quality or from another manufacturer may be used instead of those approved, unless written permission to do so has been obtained from the Engineer.

All materials shall be brought onto the site in containers sealed by the manufacturer. Paints of a different quality, type, brand or colour shall not be mixed, or thinned and shall not be adulterated in any way, but shall be used as supplied by the manufacturer. Any mixing or tinting required shall be carried out by the manufacturer.

Tinting of paint on the site by the Contractor will only be allowed with the written permission of the manufacturer and the Engineer.

C3.3.1.3.9.3 PD 09.3 INSPECTION AND PRELIMINARY WORK

Before commencing paintwork, the Contractor shall carefully inspect the surfaces to be painted to satisfy himself that the surfaces are in a satisfactory or acceptable condition to receive the paint system specified.

All metal fittings and fastenings shall be removed where applicable before the preparatory processes are commenced. On completion, the metal fittings and fastenings shall be cleaned and refitted in position.

C3.3.1.3.9.4 PD 09.4 WORKMANSHIP AND FINISHES

Paint may be applied by spray, brush or roller depending on the materials used, the surface to be painted, and the manufacturer's instructions.

Every coat of paint, irrespective of the method of application, shall be adequately and permanently keyed or bonded to the base material or previously applied coat, and shall be evenly distributed, continuous, free from sags, runs, brush marks, pin holes or other imperfections, and shall dry to a smooth finish.

An approved water trap and air-regulating valve shall be furnished and installed on all equipment used in spray painting.

Before painting the interiors of buildings they shall be cleaned and the floors shall be washed and kept free from dust during the progress of the interior work.

The Contractor shall protect all nearby surfaces against disfigurement by spatters, splashes and smirches of paint or paint materials. The Contractor shall be responsible for any damage by paint or dirt caused by his operations to vehicles or property or injury to persons and he will be required to provide protective measures to prevent any such damage or injury and make good, where required, at his own expense.

If passing traffic creates dust which may harm or spoil the appearance of external painted surfaces, the Contractor shall sprinkle the adjacent areas with water, at his own cost, for a sufficient distance on each side of the location where painting is being done.

Undercoats shall be tinted by the manufacturer to distinguish between successive coats.

The final coats or finishing coats of paint shall be applied after all the other work in the vicinity has been completed.

The painter shall keep some of the final paint in reserve in the event of his having to make good any patching which may be required as a result of damage or unforeseen circumstances.

Upon completion, the Contractor shall, in the case of buildings, clean all glass, remove all paint spots from walls, floors and fittings, and leave the premises clean and fit for occupation.

All inflammable materials, comprising solvents, thinners, wiping cloths, etc., shall be placed in tightly closed containers and properly disposed of.

C3.3.1.3.9.5 PD 09.5 PAINTING OF PLASTER, CONCRETE OR BRICK SURFACES

(a) Surface preparation

Surfaces for painting shall be prepared by sandpapering, scraping or wire-brushing to remove loose material, dust, laitance, scum or other deleterious materials or high spots. Defective areas shall be cut out where necessary and made good with an approved non-shrink filler. Cracks shall be cut out, suitably keyed, and given a coat of an approved bonding agent before the filler is applied. All patches shall be rubbed down to an even surface. Surfaces shall be washed and allowed to dry.

Surfaces shall be treated with neutralising liquid for walls, and if the surface is coarse or textured, either one full coat of pigmented wall sealer or one full filler coat shall be applied in addition to the neutralising liquid.

(b) Paint application

Prior to the emulsion paint being applied, the surface shall be sealed with an approved clear sealer and primed with an undercoat diluted to 50%. Emulsion paint (PVA or acrylic) shall then be applied in two finishing coats.

Egg-shell finish (alkyd oil-based), oil gloss paint or enamel gloss paint shall be applied as follows: one coat of universal undercoat shall be applied and it shall be followed by one coat of a mixture comprising 50% of the undercoat and 50% of the paint to be used for the finishing coat. A finishing coat of semi-gloss egg-shell, or oil gloss paint or enamel gloss paint shall then be applied.

C3.3.1.3.9.6 PD 09.6 PAINTING OF WOODWORK

(a) Surface preparation

The surfaces shall be cleaned, sandpapered and rubbed down to a smooth, even face before painting. The moisture content of the timber shall not be more than 20% at the time when the first coat is applied. All cracks, shakes or scars shall be filled flush with a filler approved by the Engineer before painting. The surface shall then be washed with cleaner and allowed to dry.

(b) Primer application

One coat of an approved wood primer shall be applied.

After open-grained timber has been prepared and primed, the grain shall be stopped and filled with synthetic filler and rubbed down with water paper.

All new woodwork shall be properly primed on all surfaces and edges before being fixed in position. All woodwork not previously painted shall be given a prime coat, well brushed in.

(c) Paint application

One coat of universal undercoat shall be applied followed by one coat of a mixture of 50% of the undercoat and 50% of the paint to be used for the finishing coat. A finishing coat of oil gloss paint or enamel gloss paint or semi-gloss egg-shell (alkyd oil-based) paint shall then be applied.

(d) Varnish finish

Two coats of gloss varnish or egg-shell varnish shall be prepared, stopped and applied.

C3.3.1.3.9.7 PD 09.7 PAINTING OF METAL SURFACES

(a) General

Wherever possible, all painting shall be done at the manufacturer's works, but where this is not feasible, the Engineer may permit the application of the undercoat and finishing coats to be carried out on the Site, in which case a prime coat shall be applied at the manufacturer's works prior to the members being dispatched to the Works.

(b) Surface preparation

The preparation of metal surfaces shall comply with SANS Code of Practice 10064 and shall receive the greatest care to ensure rust-free conditions prior to the paint system being applied.

All surfaces shall be prepared by removing loose paint, rust, plaster, scale, dust, dirt, grease, etc. and by repairing or patching defective paint surfaces before painting or repainting. Damaged shop-primed surfaces shall be thoroughly cleaned of rust and patched with a prime coat.

(c) Paint application

(i) Iron and steel work

All iron and steel work shall be properly primed with a red-lead-based primer where steel work is likely to be exposed to the elements for longer than 30 days. Zinc-chromate primer may be used where overpainting will be completed within 30 days of priming. Metal-etch wash primers may be used under dry conditions where overpainting will be completed within 24 hours of priming. The dry-film thickness of the prime coat shall not be less than 0,300 mm.

After priming, one coat of universal undercoat shall be applied. If necessary, the undercoat shall be tinted to a shade just lighter than the desired finish with approved liquid stainers. The dry-film thickness shall not be less than 0,250 mm.

The two finishing coats shall either be of alkyd resin-based synthetic enamel, gloss or matt oil paint, or as specified elsewhere. The dry-film thickness shall not be less than 0,250 mm per coat.

When mating surfaces are brought together, both surfaces shall have been given the full treatment specified, but where this cannot be done, each surface shall be given a copious coating of primer and the surfaces drawn together while the paint is still wet.

The portion of structural steel members to be buried in soil, and all bases to a height of 500 mm shall be given two coats of an epoxy-tar primer instead of the zinc-chromate primer specified for other surfaces.

The surfaces of steel and cast-iron articles, such as floor gratings, grids and manhole covers, shall, after a thorough brushing to remove loose rust, be painted with two coats of epoxy-tar paint, each at least 0,230 mm thick.

(ii) Galvanized iron and steel

All traces of protective coating shall be removed with galvanized iron cleaner, and two coats of calcium plumbate primer shall be applied. One coat of tinted universal undercoat and two finishing coats of alkyd resin-based synthetic enamel gloss paint shall be applied.

(iii) Non-ferrous metals

Surfaces of aluminium, copper, etc. shall be prepared and cleaned, and one coat of self-etch zinc-chromate wash primer shall be applied. One coat of universal tinted undercoat and two finishing coats of enamel gloss paint shall then be applied. Where non-ferrous metals are not to be painted, the surfaces shall be cleaned, polished and two coats of lacquer applied.

C3.3.1.3.9.8 PD 09.8 PAINTING OF FLOOR SCREEDS

Where chemicals could cause damage to floors, such floors shall be painted with an approved epoxy paint. The type of paint to be used will be shown on the drawings and will depend on the types of chemical that are used.

The preparation of such floor screeds for painting and the subsequent application of paints shall be carried out strictly in accordance with the manufacturer's instructions.

C3.3.1.3.9.9 PD 09.9 PAINT THICKNESS

Unless otherwise specified, all coats of paint, whether prime coat, undercoat or finishing coat, shall have a dry-film thickness of not less than 0,200 mm, irrespective of the method of application.

C3.3.1.3.9.10 PD 09.10 INSPECTION

The Contractor shall provide the necessary equipment to establish whether the primers, undercoats and finishing coats have been applied to the correct thickness according to the correct applications. The Engineer may take samples of the paints during painting operations for testing and quality control.

C3.3.1.3.10 PD 10 MEASUREMENT AND PAYMENT

C3.3.1.3.10.1 PD 10.01 Brickwork:

(a) (Thickness, type, and class indicated) ……Unit: m²

(b) Etc. for other thicknesses, types and classes

The unit of measurement shall be the square metre of each type of brickwork built, calculated from the leading dimensions of the brickwork. Areas of pipes, etc. built into brickwork shall not be included in the areas measured. At corners and intersections common to more than one brick wall, the areas shall be measured only once.

The tendered rates shall include full compensation for the construction of the brickwork complete as specified, including pointing, the building-in of conduits, beams, lintels, pipe sleeves, doors, windows, the raking-out of joints, damp-proof course, brickforce reinforced as specified, etc.

C3.3.1.3.10.2 PD 10.02 Plaster work:

(a) (Thickness of plaster and finish indicated) ……. Unit: m²

(b) Etc. for other thicknesses and finishes

The unit of measurement shall be the square metre of each type of coat completed as specified.

The tendered rates shall include full compensation for the construction of the plaster work, including supplying all materials, mixing, applying, finishing, forming reveals, joints, narrow widths, rounded angles, V-joints, etc. complete as specified.

C3.3.1.3.10.3 PD 10.03 Floor screeds:

(a) (Description and thickness indicated) ……Unit: m²

(b) Etc. for other thicknesses

The unit of measurement shall be the square metre of floor screed laid, as specified, on floors, steps or areas shown on the drawings or as designated by the Engineer.

The tendered rates shall include full compensation for constructing the floor screeds, including supplying all materials, mixing, laying, finishing, and forming nosings, reedings, skirtings, etc.

C3.3.1.3.10.4 PD 10.04 Doors and windows:

(a) (Type and size indicated) ……Unit: number

(b) Etc. for other types and sizes

The unit of measurement shall be the number of doors and windows installed complete as specified.

The tendered rates shall include full compensation for manufacturing and installing steel doors, powder-coated aluminium windows, and frames complete with hinges, handles, industrial-type locks, barrel bolts, retaining devices, door stops, stays and any other work necessary to complete the work as specified or as shown on the drawings. The tendered rate for windows shall also include full compensation for glazing, window sills as specified, and damp-proof sheeting.

C3.3.1.3.10.5 PD 10.05 Structural timber:

(a) Plates (sizes indicated) ...……Unit: m

(b) Beams (sizes indicated) ...……Unit: m

(c) Joists (sizes indicated).…….……. Unit: m

(d) Rafters (sizes indicated) ……..……...Unit: m

(e) Purlins (sizes indicated) ……..……Unit: m

(f) Roof trusses complete (drawing number indicated) ……..……Unit: number

(g) Roof truss system complete (drawing number indicated) ……. Unit: Sum

The unit of measurement shall be the metre of individual types of timber element or the number of complete trusses installed.

The tendered rates shall include full compensation for supplying all materials and manufacturing, cutting, wasting, jointing and installing the timber as shown on the drawings.

C3.3.1.3.10.6 PD 10.06 Ceilings:

(a) Plaster-board ceiling (type and thickness indicated):

(i) Fixed ceiling……..Unit : m²

(ii) Suspended ceiling……Unit: m²

(b) Fibre-cement ceiling (thickness indicated):

(i) Fixed ceiling……..Unit : m²

(ii) Suspended ceiling……Unit: m²

The unit of measurement shall be the square metre of fixed or suspended ceiling installed complete as scheduled.

The tendered rates shall also include full compensation for the construction of the ceilings, including the exposed tees, insulation blanket and brandering as specified, as well as the suspension system where applicable.

C3.3.1.3.10.7 PD 10.07 Joinery:

(a) Items measured by number:

(i) Doors (type and size indicated)…….Unit: number

(ii) Etc. for other items measured by number

(b) Items measured by length:

(i) Skirtings (type and size indicated)……...Unit: m

(ii) Etc. for other items measured by length

The units of measurement shall be the metre of each type and/or size of joinery item specified.

The tendered rates shall include full compensation for supplying all materials, and manufacturing, cutting, wasting, fixing and installing the joinery items.

C3.3.1.3.10.8 PD 10.08 Miscellaneous work:

(a) Paintwork…… …Unit: sum

(b) Plumbing…… Unit: sum

(c) Electrical work……Unit: sum

The tendered sums shall include full compensation for the supply of all materials, for transport, storage, all equipment and labour, all temporary work and safety precautions, replacement of defective work, protection of completed work and clean-up after completion.

C3.3.1.3.10.9 PD 10.09 Miscellaneous items:

(a) Items measured by number:

(i) (Description of item)……Unit: number

(ii) Etc.

(b) Items measured by length:

(i) (Description of item)……Unit: metre (m)

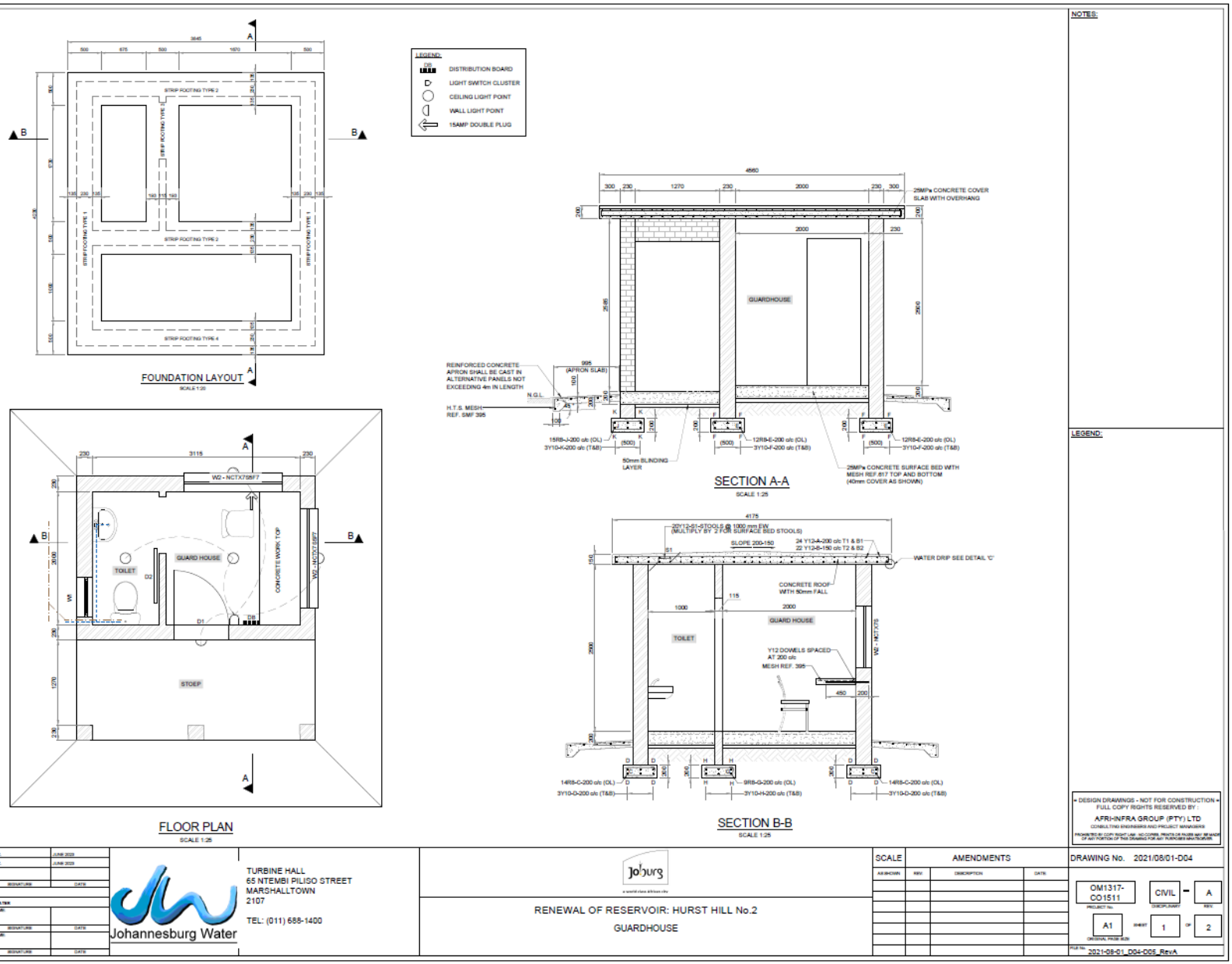
(ii) Etc.

(c) Items measured by area:

(i) (Description of item)……..Unit: square metre (m²)
(ii) Etc.

The unit of measurement shall be the number, linear metre and square metre as applicable to each item.

The tendered rates shall include full compensation for all labour, plant, equipment, transport, etc., manufacturing or providing and installing each item complete as scheduled and shown on the drawings, and shall include all corrosion protection where applicable
.


FOUNDATION LAYOUT
SCALE 1:20
LEGEND:
DISTRIBUTION BOARD
LIGHT SWITCH CLUSTER
CEILING LIGHT POINT
WALL LIGHT POINT
15AMP DOUBLE PLUG
SECTION A-A
SCALE 1:25
REINFORCED CONCRETE APRON SHALL BE CAST IN ALTERNATIVE PANELS NOT EXCEEDING 4m IN LENGTH
25MPa CONCRETE COVER SLAB WITH OVERHANG
GUARDHOUSE
50mm BLINDING LAYER
25MPa CONCRETE SURFACE BED WITH MESH REF.817 TOP AND BOTTOM (40mm COVER AS SHOWN)
FLOOR PLAN
SCALE 1:25
TOILET
GUARD HOUSE
STOEP
CONCRETE WORK TOP
SECTION B-B
SCALE 1:25
CONCRETE ROOF WITH 50mm FALL
WATER DRIP SEE DETAIL 'C'
Y12 DOWELS SPACED AT 200 c/c
MESH REF. 395
NOTES:
LEGEND:
- DESIGN DRAWINGS - NOT FOR CONSTRUCTION -
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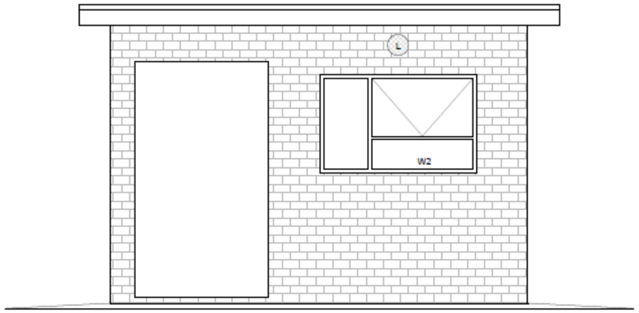
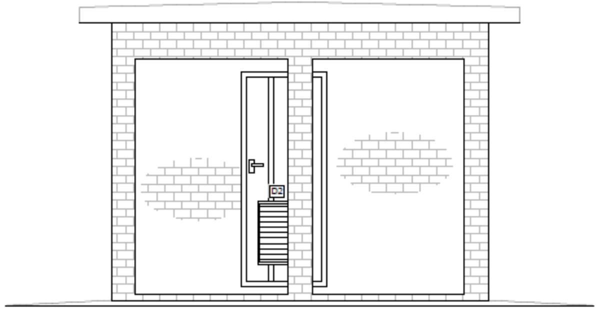
RENEWAL OF RESERVOIR: HURST HILL No.2
GUARDHOUSE
SCALE
AMENDMENTS
DRAWING No. 2021/08/01-D04
OM1317-CO1511
CIVIL
A
A1
1
2
2021-08-01_D04-D05_RevA

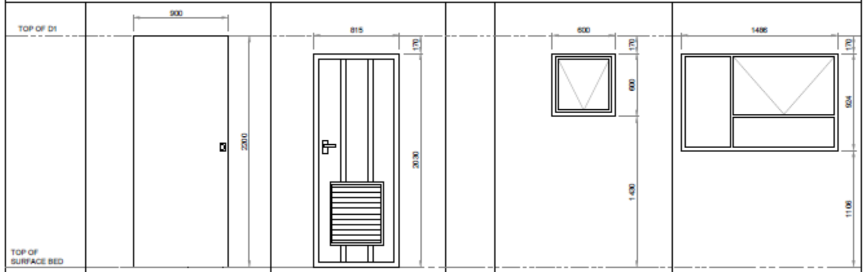


ELEVATION A
SCALE 1:20



ELEVATION B
SCALE 1:20

WINDOW & DOOR SCHEDULE



MARK & (NO. OF)	D1 (1 NO. OF)	D2 (1 NO. OF)	TYPE	W1 (1 NO. OF)	W2 - NCTX7S5F7 (2 NO. OF)
DOOR	900 mm WIDE x 2200 mm HIGH SEMI SOLID DOOR WITH 3.2 mm HARDWOOD VENEER COVERING ON BOTH SIDES AND CONCEALED HARDWOOD VERTICAL EDGE STRIP HUNG TO SLIDING GEAR	815 WIDE x 2030 mm HIGH TRANSFORMER TYPE AV LOUVRE DOOR, WITH HEAVY BRASS PINTLE HINGES	WINDOW FRAME	600 WIDE x 600 mm HIGH RESIDENTIAL STEEL FRAME INCLUDING Ø12 mm M.S. BURGLAR PROOFING ON FULL FACE OF WINDOW.	1486 WIDE x 924 mm HIGH RESIDENTIAL STEEL FRAME INCLUDING Ø12 mm M.S. BURGLAR PROOFING ON FULL FACE OF WINDOW.
DOOR FINISH	TWO COATS OF WATERPROOF VANISH (OR SIMILAR) ON BOTH SIDES	CLEAN PREPARE AND APPLY ONE COAT UNIVERSAL UNDERCOAT AND TWO COATS OF STANDARD COLOUR ENAMEL PAINT.	GLASS	4mm TEXTURED GLASS	4mm CLEAR GLASS GLAZED TO SPEC.
FRAME	SLIDING DOOR GEAR	1.8mm PRESSED METAL FRAME FOR 230 mm WALL. THE FRAME SHOULD BE DOUBLE REBATE.	FITTINGS	APPROVED STANDARD FITTINGS INCLUDING ALL NECESSARY LOCKING AND HANGING DEVICES.	APPROVED STANDARD FITTINGS INCLUDING ALL NECESSARY LOCKING AND HANGING DEVICES.
FRAME FINISH	N/A	ONE COAT UNIVERSAL UNDERCOAT AND 2 COATS GLOSS ENAMEL STANDARD COLOUR	FINISH	ONE UNDERCOAT AND TWO COATS POLYURETHANE ENAMEL. COLOUR AS PER CLIENT.	ONE UNDERCOAT AND TWO COATS POLYURETHANE ENAMEL. COLOUR AS PER CLIENT.
IRONMONGERY	N/A	FOUR LEVER MORTICE LOCKSET. HOLDING OPEN LATCH.			

FINISHING SCHEDULE

WALLS:

1. EXTERNAL WALLS PATTERN TO BE STRETCHER BOND.
2. INTERNAL WALLS TO HAVE 12 mm SMOOTH PLASTER. PREPARE, PRIME AND APPLY TWO COATS OF WHITE EMULSION PAINT.

FLOOR:

1. FLOOR TO HAVE A SMOOTH STEEL FLOATED FINISH.

ROOF:

1. ON THE SOFFIT OF THE CONCRETE ROOF, PREPARE, PRIME AND APPLY TWO COATS OF WHITE EMULSION PAINT.

GUARDHOUSE

MEMBER	NO. OF	BARS PER MEMBER	DIA	LENGTH	TOTAL NO.	BAR MARK	BENDING					
							SC	A	B	C	D	E/r
Roof Reinforcement	1	48	Y12	4290	48	A	38	100	4090	100		
	1	44	Y12	4680	44	B	38	100	4480	100		
	1	40	Y12	1060	40	81	83	400	110	250	250	
Strip Footing Type 1	2	14	R8	1280	28	C	60	120	420			
	2	6	Y10	4150	12	D	20	4150				
Strip Footing Type 2	2	13	R8	1280	26	E	60	120	420			
	2	6	Y10	3760	12	F	20	3760				
Strip Footing Type 3	1	9	R8	1280	9	N	60	120	420			
	1	6	Y10	2650	6	P	20	2650				
Strip Footing Type 4	1	15	R8	1280	15	Q	60	120	420			
	1	8	Y10	3760	8	R	20	3760				
	8	10	12	16	20	25	32	40	TOT	Date	2019/07/24	
R	39								39	Det. By	S.K.R	
Y		87	403						490	Total	2017/08/07-R-D10	
Total	39	87	403						530	Rev.	1	

NOTES:

LEGEND:

AFI CONSULT
Plan • Design • Implement
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DESIGNED	K.C.	JUNE 2020
DRAWN	K.C.	JUNE 2020
CHECKED AND APPROVED BY:	SIGNATURE	DATE
ECSA REG. No.		
FOR JOHANNESBURG WATER		
CHECKED AND APPROVED BY: IPAM DEPARTMENT	NAME: / SIGNATURE	DATE
CHECKED AND APPROVED BY: OPERATIONS DEPARTMENT	NAME: / SIGNATURE	DATE

Johannesburg Water

TURBINE HALL
65 NTEMBI PILISO STREET
MARSHALLTOWN
2107

TEL: (011) 688-1400

Joburg

RENEWAL OF RESERVOIR: HURST HILL No.2

GUARDHOUSE

SCALE: AS SHOWN

AMENDMENTS

REV.	DESCRIPTION	DATE

DRAWING No. 2021/08/01-D05

PROJECT No.	DISCIPLINARY	REV.
OM1317-CO1511	CIVIL	A

ORIGINAL PAGE SIZE: A1 SHEET 2 OF 2

FILE No. 2021-08-01_D04-D05_RevA