

TENDER DOCUMENT

TENDER No: D 29 OF 2025/2026

EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF AKKERKLOOF DAM PUMPSTATION

CONTRACTOR NAME	
ADDRESS OF CONTRACTOR	
TELEPHONE NO	
EMAIL ADDRESS	
CONTRACT AMOUNT	
COMPLETION PERIOD	2 weeks
GENERAL CONDITIONS OF	FIDIC FIRST EDITION 1999
CIDB Grading	2ME
CSD Supplier number	
CSD Unique reference number	



Knysna

Municipality || Munisipaliteit || uMasipala

inclusive || innovative || inspired

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PART T1: TENDER DATA

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T1.1 Tender Notice

EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF AKKERKLOOF DAM PUMPSTATION

Knysna Local Municipality hereby invites suitably qualified and experienced contractors to submit tenders for the Emergency Bulk Water Supply Project – Knysna Refurbishment of Akkerkloof Dam Pumpstation.

PROJECT DESCRIPTION

The works comprise, but are not limited to the Refurbishment of the Akkerkloof Dam Pumpstation, including:

- replacement of all bearings and seals on centrifugal pumps,
- replacing all bearings on motors,
- checking of Motor Control Centre and ensuring automatic operation,
- checking that telemetry is operational and allows remote switching on and off of pumps,
- cleaning of Pumpstation and removing sand and soil on outside of Pumpstation to a low enough level to avoid surface water from entering the Pumpstation building,
- fixing of White Location Sportsfield wastewater pumpstation to avoid wastewater stream that has to be crossed to reach the Pumpstation.

CONTRACT DETAILS

Conditions of Contract: FIDIC 1999, FIRST EDITION

Contract Type: Re-measurement

Contract Duration: 2 weeks from commencement date

Closing date: 25 February 2026 at 12:00pm

Defects Liability Period: 12 months

This is an emergency project and time is of the essence.

The Municipality reserves the right to appoint more than one contractor.

TENDER ELIGIBILITY

Tenderers must:

- Be tax compliant with SARS
- Have demonstrable experience in refurbishment of water pumpstations
- Be suitably equipped with machines and tools
- Be equipped with suitable vehicles to reach Pumpstation
- Competent Pump Technician
- Comply with the Occupational Health and Safety Act and Construction Regulations, 2014

Technical enquiries relating to the tender documents may be addressed via email to: Pieter Erasmus, george@zutari.com and Supply Chain related queries may be addressed to: Mzwanele Mato, e-mail mmato@knysna.gov.za .

Bidders must have a minimum CIDB Designation of **2 ME or higher**.

The closing time for submission of bids is **12:00 on Wednesday, 25 February 2026**. Bids must be sealed in an envelope clearly marked with the bid number and title given above and placed in the **bid box at the Supply Chain Management Unit, Finance Building, Queen Street, Knysna**, on or before the mentioned time and latest date. Telephonic, facsimile, e-mail, and late bids will not be accepted. Bids must remain valid for a period of **180** days after the closing date of the bid. Notwithstanding the period of validity of bids as set out in the bid documents, the Municipality reserve the right to request validity extension.

Bids will be opened on the same day at the Supply Chain Management Section at 12h00. Late or unmarked bids will not be considered.

Bids may only be submitted on the bid documentation that is issued. Bidders are required to submit an original of their tender document together with a copy of their tender document and soft copy in a USB. (The original tender document must be clearly marked "Original", and the copy of the tender document must be clearly marked "Copy").

The evaluation of this bid will be subjected to functionality scoring. Tenderers must achieve a minimum overall functionality score of **35 out of 50 points** for functionality in order to be evaluated further on price and preference points system. The functionality criteria and weighting are set out in the tender document.

Bids will be evaluated according to the **80/20** preference points system. The bids are subject to the Council Supply Chain Management Policy, Preferential Procurement Policy Framework Act, 2000, and the Preferential Procurement Regulations 2022 as amended

The Municipality reserves the right to withdraw any invitation to bid and/or re-advertise or to reject any bid or to accept a part of it. The Municipality does not bind itself to accept the lowest bid or to award a contract to the Bidder scoring the highest number of points.

NO BIDS WILL BE CONSIDERED FROM PERSONS IN THE SERVICE OF THE STATE AS DEFINED IN THE MUNICIPAL SUPPLY CHAIN MANAGEMENT REGULATIONS (GOVERNMENT GAZETTE NO 40553 DATED 20 JANUARY 2017).

Further requirements for sealing, addressing, delivery, opening, and assessment of bids are stated in the Tender Document.

**DR. RICHARD MARTIN
ACTING MUNICIPAL MANAGER
CLYDE STREET
KNYSNA
6570**

FUNCTIONAILITY

The tenderers are required to score a minimum functionality scoring of **35 out of 50 points** to qualify for further evaluation on price and preference. Tenderers scoring less than **35 points** will be regarded as non-responsive and will not be evaluated further. The Employer reserves the right to verify any information submitted in support of functionality claims. Failure to substantiate information may result in a reduction of the functionality score or disqualification.

ELIGIBILITY CRITERIA	
Compulsory Criteria (Failure to meet compulsory criteria will lead to bidder being eliminated)	COMPLY: YES/NO
Plant and Equipment, 1 Ton Bakkie and Pump Lifting Equipment	Yes/No
Ability to establish site within 2 days for receipt of Appointment Letter and Form of Offer & Acceptance	Yes/No
Successful submission of acceptable Qualifications & CV of Contracts Manager	Yes/No
METHODOLOGY: The tenderer must submit a basic methodology off the process to carry out the work. The methodology shall indicate the sequence of events and timeframes to successfully carry out the work.	Yes/No
Contract Organogram: The tenderer must submit a basic organogram for the contract of the personnel he intends using. The organogram should show administrative and other support staff plus team structure. NB: Attach organogram of the key personnel who will be appointed for this contract ONLY.	Yes/No

- Key Personal – 30 points
- Previous experience – 20 points

CITERIA	DESCRIPTION	SCORING	TENDERERS SCORE
1. Key Personal Experience			
Pump Technician (minimum; fitter)	15 and more year's relevant experience	15	
	10-14 years relevant experience	10	
	6-9 years relevant experience	5	
	Less than 5 years' experience	0	
Health and Safety Officer	10 and more year's relevant experience	15	
	5-9 years relevant experience	10	
	3-4 years' experience	5	
	Less than 2 years	0	
2. Previous Company Experience			
	9-10 projects	20	

Completion of projects of a similar nature Refurbishment/servicing of pumpstations) in the past 10 years (water pump station projects) The value of the project must be above the value of R500 000 .	6-8 projects	15	
	3-5 projects	10	
	1-2 projects	5	
	0-projects	0	
MAXIMUM POINTS OBTAINABLE		50	

CONDITIONS

- **The Municipality reserves the right to appoint more than one contractor.**
- Points will be scored based on **80/20** (Price/preference)
- The estimate project duration is 2 weeks.

T1.2: TENDER DATA

T1.2.1 General

The Conditions of Tender are the Standard Conditions of Tender as contained in Annexure F of SANS 294 - Construction Procurement Processes, Methods and Procedures. The Standard Conditions of Tender for procurements make several references to the Tender Data for details that apply specifically to this tender. The Tender Data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the Standard Conditions of Tender for procurement other than disposals. Each item of data given below is cross-referenced to the Standard Conditions of Tender to which it mainly applies.

Clause (SANS 294 Annex. F)	Applicable to this tender
F.1.1	The Employer is the Knysna Local Municipality
F.1.2	The Tender Document consists of the following: <u>TENDER</u> T1: Tendering Procedures T1.1: Tender Notice and Invitation to Tender T1.2: Tender Data T1.3: Preferential Procurement Policy T2: Returnable Documents T2.1: List of Returnable Documents T2.2: Returnable schedules <u>CONTRACT</u> C1.1: Form of Offer and Acceptance C1.2: Contract Data C1.3: Occupational health and Safety Mandatory Agreement Part 2: Pricing Data C2.1: Pricing Instructions C2.2: Bill of Quantities C2.3: Summary Part 3: Scope of Work C3.1: Description of the Works C3.2: Procurement C3.4: Construction C3.5: Site Information C3.6: Environmental Management plan C3.7: Annexures – Photos

Clause (SANS 294 Annex. F)	Applicable to this tender
F.1.4	The Employer's Agent's address for receipt of communications and notices is: Address (Physical): Knysna Municipality 5 Clyde Street Ground Floor Finance Building Supply Chain Section Knysna 6570
F.2.1	A tender offer may only be submitted if the tenderer satisfies the following: • The tenderers key personnel meet the minimum requirements • The tenderer scores a minimum of 35 out of 50 for functionality.
F.2.7	Compulsory Briefing: None
F.2.13	Parts of each tender offer communicated on paper shall be submitted as originals only.
F.2.13/F.2.15	The Employer's address for delivery of tender offers and identification details to be shown on each tender offer package are: Location of tender box: The Knysna Local Municipality Physical Address: 5 Clyde Street, Knysna Identification Details: <u>TENDER</u> The Knysna Local Municipality Tender No. T 29 OF 2025/2026 EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF AKKERKLOOF DAM PUMPSTATION TENDERER'S NAME:
F.2.13/F.2.15/F.3.5	A two-envelope procedure will not be followed.
F.2.15	Closing date and time for the submission of tender offer is: 17 February 2026 at 12:00pm
F.2.15	Telephonic, telegraphic, telex, facsimile or e-mailed tender offers will not be accepted
F.2.16	The tender offer validity period is 180 days from the tender closing date

Clause (SANS 294 Annex. F)	Applicable to this tender
F.2.18	Tenderers shall, when requested by the Employer, or the Employer's Representative to do so, submit the names of all management and supervisory staff that will be employed to supervise the labour-intensive portion of the Works, together with satisfactory evidence that such persons satisfy the eligibility requirements.
F.3.4	The time and location for the opening of the tender offers are: At the offices of Knysna Local Municipality directly after tender closing.
F3.7	Add the following clause: Accept that failure to submit certificates stated in the Tender Data and failure to complete in full the tender document, shall result in the tender regarded as non-responsive
F.3.11.5	The procedure for evaluation of responsive tender offers is Method 2 of Standards for Uniformity in Construction Procurement: However, bids will have to pass the functionality criteria prior to having their bids evaluated for price and preference. The quality criteria and maximum score in respect of each of the criteria are as follows: - Key Personal – 30 points - Previous experience – 20 points
F.3.11.6.2	The value of the weighting factor W_1 is 80. Formula 2 shall apply.
F.3.17	Two paper copies of the Signed Contract are to be provided by the Employer.

TI.3: MUNICIPAL BID DOCUMENTS

MBD1

KNYSNA MUNICIPALITY TENDER NOTICE AND INVITATION TO BID DETAILS OF TENDERER				
NAME OF BIDDER:				
TRADING AS (if different from above):				
PHYSICAL ADDRESS:				
	City/Town		Code	
POSTAL ADDRESS:				
	City/Town		Code	
CONTACT PERSON:				
ENTERPRISE REGISTRATION NUMBER:		CIDB CRS NUMBER:		
TCS PIN		FACSIMILE NUMBER:		
E-MAIL ADDRESS:				
TELEPHONE NUMBER:		CELLPHONE NUMBER:		
HAS TAX COMPLIANCE STATUS PIN BEEN ATTACHED?			YES	NO
HAS AN ORIGINAL OR CERTIFIED COPY OF A B-BBEE STATUS LEVEL VERIFICATION CERTIFICATE BEEN SUBMITTED? (MBD 6.1)			YES	NO
HAS THE DECLARATION BEEN COMPLETED AND CURRENT, ORIGINAL OR CERTIFIED MUNICIPAL ACCOUNTS BEEN ATTACHED? (MBD 15)			YES	NO
DECLARATION				
I am duly authorised to represent the tenderer for the purpose of this tender and hereby tender to supply all or any of the goods and/or render all or any of the services described in the attached document to the Knysna Municipality on the terms and conditions stipulated in this tender document and in accordance with the specification stipulated in the tender document.				
NAME (PRINT)		SIGNATURE		
CAPACITY		DATE		

KNYSNA MUNICIPALITY	
TAX CLEARANCE CERTIFICATE REQUIREMENTS	
It is a condition of tender that the taxes of the successful bidder must be in order, or that satisfactory arrangements have been made with South African Revenue Service (SARS) to meet the bidder's tax obligations before an award may be considered.	
1.	In order to meet this requirement, bidders are required to complete in full the form TCC 001 "Application for a Tax Clearance Certificate" and submit it to any SARS branch office nationally. The Tax Clearance Certificate Requirements are also applicable to foreign bidders / individuals who wish to submit bids.
2.	Copies of the TCC 001 "Application for a Tax Clearance Certificate" form are available from any SARS branch office nationally or on the website www.sars.gov.za .
3.	SARS will then furnish the bidder with a Tax Clearance Certificate that will be valid for a period of 1 (one) year from the date of approval.
4.	The original Tax Clearance Certificate must be submitted together with the bid. Failure to submit the original and valid Tax Clearance Certificate will result in the invalidation of the bid. Certified copies of the Tax Clearance Certificate will not be acceptable.
5.	In bids where Consortia / Joint Ventures / Sub-contractors are involved; each party must submit a separate Tax Clearance Certificate.
6.	Applications for Tax Clearance Certificates 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 .

KNYSNA MUNICIPALITY	
DECLARATION OF INTEREST	
1.	No bid will be accepted from persons in the service of the state*.
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 the 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 / her representative:
3.2.	Identity number:
3.3.	Position occupied in the Company (director, trustee, shareholder 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 (where applicable) 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.

3.9.	Have you been in the service of the state for the past twelve months?	YES / NO	
3.9.1.	If so, 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 so, state particulars.		
3.11.	Are you aware of any relationship (family, friend, other) between the bidder and any person 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 so, state particulars.		
3.12.	Are any of the company's directors, managers, principal shareholders or stakeholders in service of the state?	YES / NO	
3.12.1.	If so, state particulars.		
3.13.	Is 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 so, 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 so, furnish particulars.		
4.	Full details of directors / trustees / members / shareholders:		
COMPLETION OF THE FOLLOWING INFORMATION IS <u>COMPULSORY</u>:			
Full Name	Identity Number	Individual Tax Number for each Director	State Employee Number
CERTIFICATION			
I CERTIFY THAT THE INFORMATION FURNISHED ON THIS DECLARATION FORM IS CORRECT. I ACCEPT THAT THE STATE MAY ACT AGAINST ME SHOULD THIS DECLARATION PROVE TO BE FALSE.			
NAME OF ENTERPRISE			

CAPACITY		DATE	
NAME (PRINT)		SIGNATURE	

¹MSCM Regulations: "in the service of the state" means to be -

a)	a member of – (i) any municipal council; (ii) any provincial legislature; or (iii) the National Assembly or the National Council of Provinces;
b)	a member of the board of directors of any municipal entity;
c)	an official or 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 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 exercise control over the company.

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

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

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

1. GENERAL CONDITIONS

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

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

1.2 **To be completed by the organ of state**

(delete whichever is not applicable for this tender).

- a) The applicable preference point system for this tender is the **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	
SPECIFIC GOALS	
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 OR 90/10 PREFERENCE POINT SYSTEMS

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

80/20	or	90/10
$Ps = 80 \left(1 - \frac{Pt - P_{min}}{P_{min}} \right) \text{ or } Ps = 90 \left(1 - \frac{Pt - P_{min}}{P_{min}} \right)$		

Where

Ps = Points scored for price of tender under consideration

Pt = Price of tender under consideration

Pmin = Price of lowest acceptable tender

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

3.2.1. POINTS AWARDED FOR PRICE

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

80/20	or	90/10
$Ps = 80 \left(1 + \frac{Pt - P_{max}}{P_{max}} \right) \text{ or } Ps = 90 \left(1 + \frac{Pt - P_{max}}{P_{max}} \right)$		

Where

P_s = Points scored for price of tender under consideration

P_t = Price of tender under consideration

P_{max} = Price of highest acceptable tender

4. POINTS AWARDED FOR SPECIFIC GOALS

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

4.2. In cases where organs of state intend to use Regulation 3(2) of the Regulations, which states that, if it is unclear whether the 80/20 or 90/10 preference point system applies, an organ of state must, in the tender documents, stipulate in the case of—

- (a) an invitation for tender for income-generating contracts, that either the 80/20 or 90/10 preference point system will apply and that the highest acceptable tender will be used to determine the applicable preference point system; or
- (b) any other invitation for tender, that either the 80/20 or 90/10 preference point system will apply and that the lowest acceptable tender will be used to determine the applicable preference point system,

then the organ of state must indicate the points allocated for specific goals for both the 90/10 and 80/20 preference point system.

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

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

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

NB: BBBEE Contribution Status Level will be applied in order to allocate preference points. The 80/20 preference points system is applicable in this tender.

The specific goals allocated points in terms of this tender	Number of points allocated (90/10 system) (To be completed by the organ of state)	Number of points allocated (80/20 system) (To be completed by the organ of state)	Number of points claimed (90/10 system) (To be completed by the tenderer)	Number of points claimed (80/20 system) (To be completed by the tenderer)

DECLARATION WITH REGARD TO COMPANY/FIRM

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

4.4. Company registration number:
.....

4.5. TYPE OF COMPANY/ FIRM

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

[TICK APPLICABLE BOX]

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

- i) The information furnished is true and correct;
- ii) The preference points claimed are in accordance with the General Conditions

as indicated in paragraph 1 of this form;

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

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

KNYSNA MUNICIPALITY			
DECLARATION OF BIDDER'S PAST SUPPLY CHAIN MANAGEMENT PRACTICES			
1.	This Municipal Bidding Document 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.		
2.	The bid of any bidder may be rejected if that bidder, or any of its directors have:		
2.1.	abused the municipality's / municipal entity's supply chain management system or committed any improper conduct in relation to such system;		
2.2.	been convicted for fraud or corruption during the past five years;		
2.3.	willfully neglected, reneged on or failed to comply with any government, municipal or other public sector contract during the past five years; or		
2.4.	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).		
3.	In order to give effect to the above, the following questionnaire must be completed and submitted with the bid.		
3.1.	Is the bidder or any of its directors listed on the National Treasury's Database of Restricted Suppliers as companies or persons prohibited from doing business with the public sector? (Companies or persons who are listed on this Database were informed in writing of this restriction by the Accounting Officer/Authority of the institution that imposed the restriction after the <i>audi alteram partem</i> rule was applied).	Yes / No	
3.2.	If so, furnish particulars:		
3.3.	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	
3.4.	If so, furnish particulars:		
3.5.	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	
3.6.	If so, furnish particulars:		
3.7.	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	
3.8.	If so, furnish particulars:		
3.9.	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	
3.10.	If so, furnish particulars:		

4.	CERTIFICATION		
I, 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.			
NAME OF ENTERPRISE			
CAPACITY		DATE	
NAME (PRINT)		SIGNATURE	
WITNESS 1		WITNESS 2	

KNYSNA MUNICIPALITY	
CERTIFICATE OF INDEPENDENT BID DETERMINATION	
1.	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 <i>per se</i> prohibition meaning that it cannot be justified under any grounds.
2.	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.
3.	This Municipal Bidding Document 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.
4.	In order to give effect to the above, the following Certificate of Bid Determination must be completed and submitted with the bid:
CERTIFICATE OF INDEPENDENT BID DETERMINATION	
I, the undersigned, in submitting the accompanying bid:	
Bid Number	T 29 of 2025/26
Description:	EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF AKKERKLOOF DAM PUMPSTATION
in response to the invitation for the bid ISSUED by the Knysna Municipality , do hereby make the following statements that I certify to be true and complete in every respect:	
certify, on behalf of (Name of Bidder):	
That: 1. I have read and I understand the contents of this Certificate; 2. I understand that the accompanying bid will be disqualified if this Certificate is found not to be true and complete in every respect; 3. I am authorized by the bidder to sign this Certificate, and to submit the accompanying bid, on behalf of the bidder; 4. Each person whose signature appears on the accompanying bid has been authorized by the bidder to determine the terms of, and to sign, the bid, on behalf of the bidder; 5. For the purposes of this Certificate and the accompanying bid, I understand that the word “competitor” shall include any individual or organization, other than the bidder, whether or not affiliated with the bidder, who: (a) has been requested to submit a bid in response to this bid invitation; (b) could potentially submit a bid in response to this bid invitation, based on their qualifications, abilities or experience; and (c) provides the same goods and services as the bidder and/or is in the same line of business as the bidder 6. The bidder has arrived at the accompanying bid independently from, and without consultation, communication, agreement or arrangement with any competitor. However, communication between partners in a joint venture or consortium³ will not be construed as collusive bidding. 7. In particular, without limiting the generality of paragraphs 6 above, there has been no consultation, communication, agreement or arrangement with any competitor regarding: a) prices;	

b) geographical area where product or service will be rendered (market allocation) c) methods, factors or formulas used to calculate prices; d) the intention or decision to submit or not to submit, a bid; e) the submission of a bid which does not meet the specifications and conditions of the bid; or f) bidding with the intention not to win the bid.			
8. In addition, there have been no consultations, communications, agreements or arrangements with any competitor regarding the quality, quantity, specifications and conditions or delivery particulars of the products or services to which this bid invitation relates.			
9. The terms of the accompanying bid have not been, and will not be, disclosed by the bidder, directly or indirectly, to any competitor, prior to the date and time of the official bid opening or of the awarding of the contract.			
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.			
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.			
NAME (PRINT)		SIGNATURE	
CAPACITY		DATE	
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.			
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.			

KNYSNA MUNICIPALITY

CERTIFICATE FOR PAYMENT OF MUNICIPAL SERVICES

(To be signed in the presence of a Commissioner of Oaths)

I, the undersigned, in submitting the accompanying bid, declare that I am duly authorised to act on behalf of:

(name of the enterprise)

I hereby acknowledge that according to SCM Regulation 38(1)(d)(i), the Municipality may reject the tender of the tenderer if any municipal rates and taxes or municipal service charges owed by the Tenderer or any of its directors/members/partners to the Knysna Municipality, or to any other municipality or municipal entity, are in arrears for more than 3 (three) months.

To the best of my personal knowledge, neither the firm nor any director/member/partner of said firm is in arrears on any of its municipal accounts with any municipality in the Republic of South Africa, for a period longer than 3 (three) months.

If the value of the transaction is expected to exceed R10 million (VAT included) I certify that the bidder has no undisputed commitments for municipal services towards any **Municipality** in respect of which payment is overdue for more than 30 days;

PHYSICAL BUSINESS ADDRESS(ES) OF THE TENDERER

MUNICIPAL ACCOUNT NUMBER

FURTHER DETAILS OF THE BIDDER'S Director / Shareholder / Partners, etc.:

Director / Shareholder / partner	Physical address of the Business	Municipal Account number(s)	Physical residential address of the Director / shareholder / partner	Municipal Account number(s)

NB: Please attach certified copy(ies) of ID document(s)

NB: Please attach copy(ies) of Municipal Accounts

Number of sheets appended by the tenderer to this schedule (If nil, enter NIL)

Therefore hereby agrees and authorises the Knysna Municipality to deduct the full amount outstanding by the Tenderer or any of its directors/members/partners from any payment due to the tenderer; and

I further hereby certify that the information set out in this schedule and/or attachment(s) hereto is true and correct. The Tenderer acknowledges that failure to properly and truthfully complete this schedule may result in the tender being disqualified, and/or in the event that the tenderer is successful, the cancellation of the contract.

NAME OF ENTERPRISE			
NAME (PRINT)			
CAPACITY			
SIGNATURE		DATE:	

COMMISSIONER OF OATHS Signed and sworn to before me at _____, on this _____ day of ____ 20_____ by the Deponent, who has acknowledged that he/she knows and understands the contents of this Affidavit, it is true and correct to the best of his/her knowledge and that he/she has no objection to taking the prescribed oath, and that the prescribed oath will be binding on his/her conscience. COMMISSIONER OF OATHS: - Position: _____ Address: _____ Tel: _____	Apply official stamp of authority on this page:
--	--

Version 3.0

PART T2: RETURNABLE DOCUMENTS

- T2.1 List of Returnable Documents**
- T2.2 Returnable Schedules**

T2.1: LIST OF RETURNABLE SCHEDULES

The following documents are to be completed and returned to form part of the Contract. Failure to submit any of the returnable schedules required – then you will be deemed nonresponsive.

No	Part of the Contract	Returnable Name	Tick if completed and submitted
1. RETURNABLE SCHEDULES TO FORM PART OF THE CONTRACT			
1M	YES	Schedule of Construction Equipment	
1N	YES	"Tax Compliant Status" & SARS certificate	
1O	YES	VAT Registration Certificate (If Applicable)	
1P	Optional	Proof of Registration with the Construction Industry Development Board (in the applicable category or higher)	
1Q	YES	Letter of good standing	
1R	YES	Proof of banking details	
1S	YES	Declaration Concerning Fulfilment of the Construction Regulations, 2014	
2B	YES	Schedule of Key Personnel / Competent persons assigned to the Contract	
2C	YES	Schedule of Proposed Subcontractors	
2D	YES	Preliminary Program of the Works	
2E	YES	Contract Organogram	
2F	YES	Schedule of experience	
2G	YES	Methodology	
2. OTHER DOCUMENTS AND AFFIDAVITS THAT WILL BE INCORPORATED INTO THE CONTRACT			
C 1.1:	YES	Form of Offer and Acceptance	
C 1.2:	YES	Contract Data	
C 1.3:	YES	Occupational Health and Safety Mandatory Agreement	
C 1.4	YES	Form of performance security (Pro Forma)	
C 1.5	YES	Insurance Broker's Warranty	
C 2.1:	YES	Pricing Instructions	

No	Part of the Contract	Returnable Name	Tick if completed and submitted
C 2.2:	YES	Bill of Quantities	
C 2.3:	YES	Summary of Prices	

T2.2: RETURNABLE SCHEDULES

1M: SCHEDULE OF PLANT AND EQUIPMENT

The following are lists of major items of relevant equipment that I / we presently and will have available for this contract if my / our tender is accepted. **Proof of Ownership of 1 Ton a bakkie must be provided. Copy of current Inatis Disk must be provided. Failure to provide Inatis Disk will lead to zero points scored.**

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

DESCRIPTION (<i>type, size, capacity etc</i>)	QUANTITY	YEAR OF MANUFACTURE

Attach additional pages if more space is required.

Please note it is a tender requirement for the contractor to have suitable equipment available and owned to refurbish the Pumpstation

Proof of ownership of plant to be provided for functionality points to be claimed. Leased equipment will not contribute to functionality points.

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

DESCRIPTION (<i>type, size, capacity etc</i>)	QUANTITY	HOW ACQUIRED	
		HIRE/BUY	SOURCE

Attach additional pages if more space is required.

The Tenderer undertakes to bring onto site without additional cost to the Employer any additional plant not listed but which may be necessary to complete the contract within the specified contract period.

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

Signed: Date:
.....

Name: Position:
.....

Tenderer:

1N: SARS TAX CLEARANCE

Tenderers must ensure that they are up to date with their payments of taxes.

The tenderer must submit a “tax compliant” status in respect of his/her company, close corporation, or partnership as well as a SARS tax clearance certificate or pin certificate. In the case of a joint venture between two or more firms, the tenderer shall attach the SARS documents for each of the joint venture partners.

10: VAT REGISTRATION CERTIFICATE (IF APPLICABLE)

NOTE: REQUIRED INFORMATION TO BE SUBMITTED IN THE ATTACHMENT DOCUMENT UNDER SECTION 10

1Q: WORKMENS COMPENSATION: LETTER OF GOOD STANDING

(Tenderer's Details):

.....
.....
.....
.....
(Date).....

**LETTER OF GOOD STANDING
COMPENSATION FOR OCCUPATIONAL INJURIES & DISEASES ACT, 1993**

ATTENTION:.....

Dear Sirs

In terms of Section.....of the Act, we confirm that, for the period ending
.....

(Tenderer's
Details).....
.....

carrying on the business of

are insured with the Company under Policy Number.....

and their standing with the Compensation Fund is.....

The Compensation Commissioner's Reference Number being.....

Yours Faithfully

.....

A letter of current Good Standing received from Workmen's Compensation may be submitted with the tender.

1R: Proof of Banking Details

NOTE: Tenderer to provide proof of banking details on banking letter head and stamped by the bank.

1S: DECLARATION CONCERNING FULFILMENT OF THE CONSTRUCTION REGULATIONS, 2014

In terms of the Construction Regulations, 2014 (hereinafter referred to as the Regulations), promulgated on 07 February 2014 in terms of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) the Employer shall not appoint a contractor to perform construction work unless the Contractor can satisfy the Employer that his/her firm has the necessary competencies and resources to carry out the work safely and has allowed adequately in his/her tender for the due fulfilment of all the applicable requirements of the Act and the Regulations.

Tenderers shall answer the questions below:

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

(Tick)

YES	
NO	

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

Own resources, competent in terms of the Regulations (refer to 3 below)	
Own resources, still to be hired and/or trained (until competency is achieved)	
Specialist subcontract resources (competent) – Specify:	

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

.....

.....

.....

.....

.....
.....

.....
.....

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

.....
.....

.....
.....

.....
.....

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

.....
.....

.....
.....

.....
.....

.....
.....

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

YES	
NO	

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

1. ID NO:
.....

(Name in Print):

2.
.....

ID

NO:

(Name in Print):

2B: KEY PERSONNEL / COMPETANT PERSONS ASSIGNED TO THE CONTRACT

Curriculum vitae (CV) must be submitted for each of the key personnel proposed in the table below. **The CV must specifically include the proof of qualifications, years of experience (only relevant to the Job Description)**, relevant courses completed at the required NQF level, and experience in construction contracts of a similar value or higher and nature. Contactable referees must also be provided.

In order for the company to be evaluated for Functionality the Contracts Manager must meet the minimum NQF qualification level, failing which the bid will be deemed to be non-responsive.

In order for points to be awarded for the Pump Technician and the Health and Safety Officer, only experience gained after obtaining the minimum qualifications will be considered.

NOTE: REQUIRED INFORMATION TO BE SUBMITTED IN THE ATTACHMENT DOCUMENT UNDER SECTION 2B

Job Description	Full Name	Qualification	Years of Post Qualification Experience
Contracts Manager / Director – NQF Level 6 (Zero points towards functionality)			
Pump Technician – NQF Level 3 (15 points towards Functionality)			
Health and Safety Officer – NQF Level 5 (15 points towards Functionality)			

*To be filled in by Tenderer

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

Signed: Date:
.....

Name: Position:
.....

Tenderer:

2C: SCHEDULE OF PROPOSED SUBCONTRACTORS

We notify you that it is our intention to employ the following subcontractors to work on the contract.

Sub-contracting of the core activity (refurbishment and drilling) is not allowed.

If we are awarded the contract, we agree that this notification does not change the requirement for us to submit the names of proposed subcontractors in accordance with requirements in the contract for such appointments. If there are no such requirements in the contract, then your written acceptance of this list shall be binding between us.

NOTE: ADDITIONAL INFORMATION TO BE SUBMITTED IN THE ATTACHMENT DOCUMENT UNDER SECTION 2C

No.	Name and address of proposed subcontractor	Nature and extent of work	Previous experience with subcontractor
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

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

Signed: Date:
.....

Name: Position:
.....

Tenderer:

2D: PRELIMINARY PROGRAMME OF WORKS

The tenderer must submit a basic Preliminary Programme for the execution of the works.

The programme shall indicate daily activities, progress rates, milestones, etc. The programme will be binding upon acceptance of offer. Bidders should apply due caution in compiling the programme.

Failure to submit the preliminary programme may result in the tender being rejected.

2F: SCHEDULE OF EXPERIENCE

Contractor to submit a schedule of experience detailing experience of works of a similar nature which involves refurbishment/servicing of pumpstations in the last 10 years. The schedule is to include contactable references, value of previous contract, and appointment letters and letter of completion are to be provided.

No.	Date	Project	Description of services	Contract value	Contact

Please note to be eligible Contractor shall own the necessary plant and equipment to carry out the refurbishment.

NOTE: REQUIRED INFORMATION TO BE SUBMITTED IN THE ATTACHMENT DOCUMENT UNDER SECTION 2F

CONTRACT PART C1: AGREEMENT AND CONTRACT DATA
--

CONTENTS

C1.1	Form of Offer and Acceptance
C1.2	Contract Data (Part 1 and 2)
C1.3	Occupational Health and Safety Mandatory Agreement

C1.1: FORM OF OFFER AND ACCEPTANCE

1 OFFER

The employer, identified in the acceptance signature block, has solicited offers to enter into a contract for the procurement of: **TENDER NO. T 29 OF 2025/26 EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF AKKERKLOOF DAM PUMPSTATION.**

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

By the representative of the tenderer, deemed to be duly authorized, signing this part of this form of offer and acceptance, the tenderer offers to perform all of the obligations and liabilities of the Contractor under the contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the Conditions of Contract identified in the Contract Data.

THE OFFERED TOTAL OF THE PRICES INCLUSIVE OF VALUE-ADDED TAX IS:

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

..... Rand (in words); R..... (in figures)

This offer may be accepted by the employer by signing the acceptance part of this form of offer and acceptance and returning one copy of this document to the tenderer before the end of the period of validity stated in the tender data, whereupon the tenderer becomes the party named as the contractor in terms of the conditions of contract identified in the contract data.

Signature(s) of authorized agents:

Name(s) (in block letters) :

Capacity of authorized agents:

for and on behalf of the Tenderer

(Name and address of organization)

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

(Name)

.. (Signature)

Date:

ACCEPTANCE

By signing this part of this form of offer and acceptance, the employer identified below accepts the tenderer's offer. In consideration thereof, the employer shall pay the contractor the amount due in accordance with the conditions of contract identified in the contract data. Acceptance of the tenderer's offer shall form an agreement between the employer and the tenderer upon the terms and conditions contained in this agreement and in the contract that is the subject of this agreement.

The terms of the contract are contained in:

Part C1: Agreements and contract data (which includes this agreement)

Part C2: Pricing data

Part C3: Scope of work

Part C4: Site Information

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

Deviations from and amendments to the documents listed in the tender data and any addenda thereto, as listed in the returnable schedules as well as any changes to the terms of the offer agreed by the tenderer and the employer during this process of offer and acceptance, are contained in the schedule of deviations attached to and forming part of this agreement. No amendments to or deviations from said documents are valid unless contained in this schedule.

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

Notwithstanding anything contained herein, this agreement comes into effect on the date when the tenderer receives one fully completed original copy of this document, including the schedule of deviations (if any). Unless the tenderer (now contractor), within five (5) working days of the date of such receipt, notifies the employer in writing of any reason why he cannot accept the contents of this agreement, this agreement shall constitute a binding contract between the parties.

For and on behalf of the Employer:

Signature(s) of authorized agent(s)

.....Date:

Name(s)

Capacity

for the **Employer:** (Name and address of organization)

Witness:.....(Full name)
..... (signature)

Date:

2 SCHEDULE OF DEVIATIONS

Notes:

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

1. Subject
Details
2. Subject
Details
3. Subject
Details
4. Subject
Details
5. Subject
Details
6. Subject
Details
7. Subject
Details
8. Subject
Details

By the duly authorized representatives signing this schedule of deviations, the employer and the tenderer agree to and accept the foregoing schedule of deviations as the only deviations from and amendments to the documents listed in the tender data and addenda thereto as listed in the returnable schedules, as well as any confirmation, clarification, or changes to the terms of the offer agreed by the tenderer and the employer during this process of offer and acceptance.

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

the tenderer of a completed signed copy of this Agreement shall have any meaning or effect in the contract between the parties arising from this agreement.

For and on behalf of the
Tenderer.....
.....
(Name and address of organization)

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

.....
(Signature)

Date:

For and on behalf of the Employer:

Signature(s) of authorized agent(s) Date:
.....

Name(s):

Capacity:

for the **Employer:**
(Name and address of organization)

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

.....
(Signature)

Date:

PART 1: CONTRACT DATA PROVIDED BY THE EMPLOYER

General Conditions of Contract

The General Conditions of Contract are the **Conditions of Contract for Plant and Design-Build for electrical and mechanical plant, and for building and engineering works, designed by the contractor, First Edition 1999** published by Federation Internationale des Ingenieurs-Conseils (FIDIC).

Particular Conditions of Contract

The Particular Conditions of Contract are as numbered and set out below. These Clauses are the only variations from and/or additions to the clauses of the General Conditions of Contract. The variables are listed after these clauses in the form of an Appendix to the Tender.

1.1 Definitions

1.1.1 The Contract

In Sub-Clause 1.1.1.6, delete “lists and schedules of payments and/or prices” and substitute “lists, Bills of Quantities and schedules of payments and/or prices”.

In Sub-Clause 1.1.2.3, delete “in the Letter of Tender” and substitute “in the Appendix to the Tender and whose offer has been”.

Delete the text of Sub-Clause 1.1.3.9 and substitute:

“ “day” means a calendar day and where a specific number of days is allowed in the Contract for the performance of any act or is stipulated for the extinction of any right or the duration of any event or circumstance, the special non-working days and the days falling within the year end break as stated in the Appendix to Tender and the day from which the period concerned is stated to commence shall be excluded from the calculation of the number of days concerned. “Year” means 365 days.”.

Add to Sub-Clause 1.1:

“1.1.7 Terms that may be used elsewhere in other portions of the document

1.1.7.1 “Certificate of Completion” is synonymous with “Taking-over Certificate”.

1.1.7.2 “Defects Liability Period” is synonymous with “Defects Notification Period”.

1.1.7.3 “Performance Bond”, “Guarantee” and Deed of Suretyship” are synonymous with “Performance Security”.

1.1.7.5 “Final Approval Certificate” is synonymous with “Performance Certificate”.

- 1.1.7.6 “Contract Price Adjustment Factor” is synonymous with “table of adjustment data” as used in Sub-Clause 13.8 *[Adjustments for Changes in Cost]*.
- 1.1.7.7 “Contract Data” means the General Conditions and the “Particular Conditions”.
- 1.1.7.8 “Offer” is synonymous with “Tender”.
- 1.1.7.9 “Form of Offer” is synonymous with “Letter of Tender”.
- 1.1.7.10 “Scope of Work” is synonymous with “Employer’s Requirements”.
- 1.1.7.11 “Site Agent” is synonymous with “Contractor’s Representative”.
- 1.1.7.12 “Plant” is synonymous with “Contractor’s Equipment” where the context so indicates.

1.5 Priority of Documents

Delete Sub-Clause 1.5 and substitute:

“The documents forming the Contract are to be taken as mutually explanatory of one another. If an ambiguity or discrepancy is found, the priority shall be such as may be accorded by the governing law. The Engineer has authority to issue any instruction which he considers necessary to resolve an ambiguity or discrepancy”.

1.6 Contract Agreement

Delete Sub-Clause 1.6 and substitute:

“The Parties shall enter into a Contract Agreement after the Contractor is called upon to do so by the Employer. The Agreement shall be the fully completed Form of Offer and the fully completed Acceptance and Schedule of Deviations (if any) sent under cover of the Employer’s Letter of Acceptance”.

2.1 Right of Access to the Site

In Sub-Clause 2.1, the first paragraph, delete “Performance Security has” and substitute “Performance Security and/or proof of third party insurance have”.

3.1 Engineer’s Duties and Authority

In Sub-Clause 3.1, the third paragraph, delete “Particular Conditions” and substitute “Appendix to the Tender”.

3.2 Delegation by the Engineer

In Sub-Clause 3.2, the first paragraph, after “resident engineer” insert “Engineer’s representative”.

4.2 Performance Security

In Sub-Clause 4.2, at the end, add:

“If the Performance Security is in the form of a bank guarantee, it shall be issued either (a) by a bank located in the Country, or (b) directly by a foreign bank acceptable to the Employer. If the Performance Security is not in the form of a bank guarantee, it shall be furnished by a financial entity registered, or licensed to do business, in the Country”.

4.5 Nominated Subcontractors

In Sub-Clause 4.5, delete “means a Subcontractor” and substitute “means a subcontractor named in the Contract and/or a Subcontractor”.

4.6 Co-operation

See also any requirements with regard to co-operation in Part C3: Scope of Work.

4.9 Quality Assurance

In Sub-Clause 4.9, the first paragraph, delete “The system shall be in accordance with the details stated in the Contract”.

See also any requirements with regard to Quality Assurance in Part C3: Scope of Work.

4.10 Site Data

In Sub-Clause 4.10, the first paragraph, after the first sentence, add “The relevant data referred to in the previous sentence shall be the data provided in the Employer’s Requirements”.

4.12 Unforeseeable Physical Conditions

In Sub-Clause 4.12, the sixth paragraph, delete “(ii)” and substitute “(b)”.

4.21 Progress Reports

Delete the text of Sub-Clause 4.21 and substitute “Progress reports shall be prepared and submitted as specified in the Employer’s Requirements”.

5.1 General Design Obligations

In Sub-Clause 5.1, the first paragraph, delete the sentence “Unless otherwise stated in the Contract,” and substitute:

“The Contractor shall ensure that all design work to be undertaken by the Contractor or on behalf of the Contractor is undertaken by registered professionals. If required by the Engineer”.

5.2 Contractor’s Documents

In Sub-Clause 5.2, the sixth paragraph, delete subparagraph (a)(iii).

6.7 Health and Safety

In Sub-Clause 6.7, the first paragraph, delete reference to “medical staff” and “ambulance service” and add: “The Contractor shall display in a prominent position(s) the telephone numbers of an appropriate medical practitioner and ambulance service”.

In Sub-Clause 6.7, the second paragraph, delete “accident prevention officer” and substitute “Safety Officer in terms of the Occupational Health and Safety Act (Act No 85 of 1993)”.

In Sub-Clause 6.7, add at the end “See also the specification dealing with Occupational Health and Safety, if any”.

8.3 Programme

In Sub-Clause 8.3, insert the following before the first paragraph: “The sequence of the Works shall be as follows:

- a) Design the Works and submit the designs to the Engineer for approval.
- b) Manufacture, purchase, install, test and commission the Works.
- c) Operate the Works for the duration of the Trial Operation Period prior to issue of the Taking-Over Certificate.”

In Sub-Clause 8.3, the first paragraph, delete “within 28 days” and substitute “within the time stated in the Appendix to Tender”.

In Sub-Clause 8.3, add the following after the last paragraph: “The Contractor’s Programme will not take priority over any contractual condition in consideration of claims for additional compensation”.

See also any requirements with regard to Programme in Part C3: Scope of Work.

8.4 Commencement Delays and Supervision

In Sub-Clause 8.7 (c) add “the number of working days quoted below shall be regarded as a fair estimate of the delays to be anticipated and allowed for under normal climatic conditions where normal weather conditions prevents or disrupts critical work:

January	2
February	2
March	2
April	2
May	1
June	2
July	2
August	2
September	2
October	3
November	4
December	2

Claims for delays for abnormal climatic conditions shall be accompanied by substantiating facts and evidence, which shall be submitted timeously as each day a half-day delay is experienced.

8.7 Delay Damages

In Sub-Clause 8.7, delete all references to “delay damages” and “damages” and substitute “penalties”.

Notwithstanding, the client shall levy a penalty fee of **R 5000** per day for every calendar day the contractor has failed to complete the scheduled works.

9.1 Contractor’s Obligations

In Sub-Clause 9.1, the third paragraph, subparagraph (c), after “trial operation” insert “(if a trial operation is required in terms of the Appendix to the Tender or the Employer’s Requirements and for the period stated therein)”.

10.1 Taking Over of the Works and Sections

In Sub-Clause 10.1;

- (i) in the first paragraph, delete “or is deemed to have been issued”, and*
- (ii) delete the last paragraph.*

10.2 Taking Over of Parts of the Works

In Sub-Clause 10.2, the second paragraph, subparagraph (a), delete “it is used” and substitute “the trial operation ends”.

10.3 Interference with Tests on Completion

In Sub-Clause 10.3, delete the first and second paragraphs.

11.3 Extension of Defects Notification Period

In Sub-Clause 11.3, the first paragraph, delete the last sentence.

13.8 Adjustment for Changes in Cost

In Sub-Clause 13.8, the third paragraph, delete from “The formulae shall be of the following ...” up to and including the fourth paragraph and substitute:

“Contract Price Adjustment

Contract Price Adjustment is not applicable. Rate of Exchange items shall be dealt with as follows:

Imported Equipment

A Permissible Adjustment

The SEIFSA Index adjustment shall not apply to the value of any materials, good, plant or equipment imported from outside the Republic of South Africa, but contract

price adjustments for variations in such prices will be permitted in respect of the following variables only:

Variations in rates of exchange as detailed in Sub-Clause E.

ii) Variations in customs surcharge and customs duty as detailed in Sub-Clause C.

All other fluctuations in the cost of imported materials, goods, plant and equipment shall be for the Contractor's account including any change in the cost of freight rates, marine insurance rates, wharfage, dock dues, landing charges, local cartage, agency charges, disbursement fees, delivery release orders, documentation, postage and petties and so forth.

B Values of Imported Materials, Goods, Plant and Equipment

- i) The value of materials, goods, plant, and equipment imported from outside of South Africa shall be as listed in the Schedule of Imported Equipment and shall be deducted from the total values to be adjusted by the SEIFSA Index adjustment.
- ii) The value of imported materials, goods, plant or equipment referred to in (i) above shall be the quotation value in foreign currency converted to South African Rand by using the spot selling rate quoted by the Employer's main banker on the Base Date, to which shall be added any Customs Surcharge and Customs Duty applicable at that date.

C Variations in Customs Surcharge and Customs Duty

i) Any increase or decrease in the Rand value between the amounts of Customs Surcharge and Customs Duty inserted in the Schedule of Imported Equipment and those amounts actually paid to the Customs and Excise Authorities, which are due to changes in the percentage rates applicable or to the foreign exchange rate used by the authorities, shall be adjusted accordingly.

D Special Requirements for Price Adjustment Claims on Imported Equipment

All claims for price adjustments shall be supported by documentary evidence such as audited statements, proof of payment, receipted vouchers and other relevant information as required to the satisfaction of the Engineer, all presented in a clear and concise manner. Failure to render the information and statements as required will result in the rejection of claims for price adjustment.

Documentary evidence shall include documents showing the cost to the contractor of all imported materials, goods, plant and equipment, including Banker's debit notes and Bills of Entry, in respect of each and every consignment.

E Variations in Rates of Exchange

Adjustment for variations in rates of exchange referred to in Sub-Clause A(i) above shall be based on the following:

- i) The Contractor shall within five working days from the date of placing a firm order on an overseas supplier, cover or recover forward by way of a contract with a bank which is an authorised foreign exchange dealer, the foreign exchange component of the cost of any imported plant or equipment listed in the Schedule of Imported Equipment.

- ii) When the Contractor so obtains forward cover he shall immediately notify the Employer of the rate obtained and furnish the Employer with a copy of the foreign exchange contract note as soon as possible thereafter.
- iii) Providing Sub-Clause E(i) and (ii) above are fully complied with the value in Rand inserted in the Schedule of Imported Equipment, Column (C) above shall be recalculated using the forward cover rate obtained, and any increase or decrease in the Rand value shall be adjusted accordingly.”

14.3 Application for Interim Payment Certificates

In Sub-Clause 14.3,

(i) delete subparagraph (a) and substitute:

“(a) the estimated contract value of the Works executed as determined from the Bill of Quantities up to the end of the month (including Variations but excluding items described in subparagraphs (b) to (g) below.”, *and*

(ii) delete subparagraph (e).

14.5 Plant and Materials intended for the Works

Delete Sub-Clause 14.5.

14.6 Issue of Interim Payment Certificates

In Sub-Clause 14.6, the first paragraph, delete “within 28 days” and substitute “within the time stated in the Appendix to Tender”.

14.7 Payment

In Sub-Clause 14.7, the first paragraph, sub-paragraphs (b) and (c), delete “within 56 days” and substitute “within the time stated in the Appendix to Tender”.

14.13 Issue of Final Payment Certificate

In Sub-Clause 14.13, the first paragraph, delete “within 28 days” and substitute “within the time stated in the Appendix to Tender”.

14.15 Currencies of Payment

In Sub-Clause 14.15, subparagraph (b) delete “damages” and substitute “penalties”.

15.2 Termination by Employer

In Sub-Clause 15.2, the first paragraph;

(i) in subparagraph (a), after “Sub-Clause 4.2 [Performance Security]” add “or fails to comply with Sub-Clause 18.1 [General Requirements for Insurance] and the Employer elects not to effect the relevant insurances”, and

(ii) after subparagraph (f) add:

“(g) the Contractor committed a corrupt or fraudulent act in relation to the Contract, or

(h) an official or other role player committed any corrupt or fraudulent act that benefited the Contractor.”.

In Sub-Clause 15.2, the second paragraph, the second sentence, delete “(e) or (f)” and substitute (e), (f), (g) or (h)”.

17.3 Employer’s Risks

In Sub-Clause 17.3, delete subparagraph (a) to (h) and substitute:

- “(a) War, invasion, act of foreign enemies, hostilities or warlike operations (whether war be declared or not) or civil war,
- (b) Insurrection. Rebellion or revolution,
- (c) Mutiny, military rising, military or usurped power, martial law or state of siege, or any other event or cause which determines the proclamation or maintenance of martial law or state of siege,
- (d) Any event which, at closing date of tenders, is defined as a risk in terms of insurance offered by the South African Special Risks Insurance Association,
- (e) Any occurrence for which a fund has been established in terms of the War Damage Insurance and Compensation Act, as amended,
- (f) The impact of meteorites,
- (g) Pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds,
- (h) Ionising radiation or contamination by radioactivity from any nuclear fuel or from nuclear waste from combustion of nuclear fuels,
- (i) The use of or occupation by the Employer or his employees or agents or other contractors (not employed by the Contractor) of any part of the Works,
- (j) The design, specification or instruction of the Engineer, Employer or any of their employees or agents, or defects in the materials supplied by the Employer for incorporation in the Works,
- (k) The confiscation, commandeering, nationalisation, requisition or destruction of or damage to property by an order of government, or any public or local authority,
- (l) The fact that the value of materials, as supplied by the Employer for incorporation in the Works, exceeds the value thereof as specified by or on behalf of the Employer at the time of delivery thereof by the Employer”.

18.1 General Requirements for Insurances

In Sub-Clause 18.1, add:

“Save as otherwise provided in the Contract, nothing herein contained shall oblige the Contractor to effect any insurance which is not generally obtainable from a registered insurer in South Africa.

The insurances shall be effected with an insurance company registered in South Africa.

The Contractor shall be liable for payment of the deductibles in respect of each claim settlement in terms of the policies effected by the Contractor.

If required, the Contractor shall provide proof to the Engineer that the Contractor is in good standing with respect to duties, taxes, levies and contributions required in terms of legislation applicable to the work in this Contract”.

18.2 Insurance for Works and Contractor’s Equipment

In Sub-Clause 18.2, add:

- ”(f) which are to be effected and maintained by the Contractor and endorsed to note the interests of the Employer are:
- (i) transit insurance en route to Site, including whilst in temporary storage (and intended for incorporation in the Contract),
 - (ii) professional indemnity insurance; including professional indemnity insurance of the registered professionals who carry out design work on behalf of the Contractor to adequately cover their liability for professional negligence. Proof of such insurance shall be submitted to the Engineer on demand, and
 - (iii) where the Contract involves manufacturing and/or fabrication of the Works or part thereof at premises other than the Site, the Contractor shall satisfy the Employer that all materials and equipment for incorporation in the Works are adequately insured during manufacture and/or fabrication. In the event of the Employer having an insurable interest in such Works during manufacture or fabrication then such interest shall be noted by endorsement to the Contractor’s policies of insurance”.

18.3 Insurance against Injury to Persons and Damage to Property

In Sub-Clause 18.3, in the second paragraph, delete the sentence “if an amount is not stated shall not apply.” and substitute “If so indicated as “not applicable” in the Appendix to Tender, this Sub-Clause shall not apply”.

18.4 Insurance of Contractor’s Personnel

In Sub-Clause 18.4, add “The insurance shall be in terms of the provisions of the Compensation for Occupational Injuries and Diseases Act (Act No 130 of 1993)”.

Add the following new Sub-Clause:

18.5 Special Risks Insurance

If required in terms of the Appendix to the Tender, the Contractor shall effect and maintain, in the joint names of the Employer and the Contractor a Coupon Policy for Special Risks Insurance issued by the South African Special Risks Insurance Association”.

20 Claims, Disputes and Arbitration

Delete Sub-Clauses 20.2 to 20.8 and substitute:

20.2 Notice of Disagreement

In respect of any matter not required to be dealt with in terms of Sub-Clauses 20.1 [Contractor’s Claims] or 20.8 [Special Disputes], the Contractor shall have the right

by written notice with supporting particulars to the Engineer to require him to consider any disagreement which he raises with the Engineer provided that the said written notice shall be given within 28 days after the cause of disagreement has arisen.

20.3 Engineer to Rule on Disagreements

The Engineer shall, within 28 days after the Contractor has delivered his disagreement, give effect to Sub-Clause 3.5 *[Determinations]* and give his ruling on the disagreement in writing to the Employer and the Contractor, referring specially to this Sub-Clause.

20.4 Dispute Notice

The Contractor and the Employer, hereinafter referred to as "the parties" shall have the right to dispute any ruling given by the Engineer in terms of Sub-Clause 20.1 *[Contractor's Claims]* or Sub-Clause 20.3 *[Engineer to Rule on Disagreements]*;

Provided that, unless the Contractor or the Employer shall, within 28 days after his receipt of a ruling, give written notice (hereinafter referred to as a "Dispute Notice") to the Engineer, referring to this Sub-Clause, with a copy to the other party, disputing the validity or correctness of the whole or a specified part of the ruling, he shall have no further right to dispute that ruling or the part thereof not disputed in the said notice.

If the Engineer fails to give his ruling according to Sub-Clause 20.1 *[Contractor's Claims]* or Sub-Clause 20.3 *[Engineer to Rule on Disagreements]*, the Contractor shall have the right to submit his claim or disagreement as a Dispute Notice within 28 days after the ruling should have been given. If the Contractor fails to do this within 28 days, the Employer shall be discharged from all liability in connection with the claim or disagreement.

All further references herein to a ruling shall relate to the ruling, or part thereof, set out in the Dispute Notice, as varied or added to by agreement between the Contractor and the Engineer or by the Mediator's opinion or the Adjudicator's decision to the extent that it has become binding in terms of paragraph 8 of Sub-Clauses 20.5 *[Mediation]* or Sub-Clause 20.6 *[Arbitration]*.

If either party shall have given notice in compliance with this Sub-Clause 20.2, the dispute shall be referred immediately to mediation.

Notwithstanding that the parties may, in respect of a ruling, have given a Dispute Notice, the ruling shall be of full force and carried into effect unless and until otherwise agreed by both parties in terms of paragraph 8 of Sub-Clause 20.5 *[Mediation]* or as determined in an arbitration award.

20.5 Mediation

The mediation shall be conducted by a Mediator selected by agreement between the parties or, failing such agreement within 7 days after a written request by either party for such agreement, nominated on the application of either party by the President for the time being of the South African Institute of Mechanical Engineering or the South African Institution of Civil Engineering, as appropriate.

Neither party shall be entitled to be represented at any hearing before or at any meeting or in any discussion with the Mediator except by:

- a) The party himself, if a natural person,
- b) A partner in the case of a partnership,
- c) A chief executive officer or an executive director in the case of a company,
- d) A member in the case of a close corporation,
- e) The Engineer,
- f) A bona fide employee of the party concerned,
- g) A professional engineer appointed for the purpose by the party concerned.

Such limitation shall not be construed as preventing any person from giving evidence as a witness.

The Mediator shall, as he deems fit, follow formal or informal procedure and receive evidence or submissions orally or in writing, sworn or unsworn, at joint meetings with the parties or separately or from any person whom he considers can assist in the formulation of his opinion;

Provided that:

- a) Each party shall be given reasonable opportunities of presenting evidence or submissions and of responding to evidence or submissions of the other party, and
- b) Each party shall be given full details of any evidence or submissions received by the Mediator from the other party or any other person otherwise than at a meeting where both parties are present or represented.

The Mediator shall have the power to propose to the parties compromise settlements of or agreements in disposal of the whole or portion of the dispute.

The Mediator shall, as soon as reasonably practical, give to each of the parties his written opinion on the dispute, setting out the facts and the provisions of the Contract on which the opinion is based and recording the details of any agreement reached between the parties during the mediation.

The Mediator's opinion shall become binding on the parties only to the extent that it is correctly recorded as being agreed by the parties in the Mediator's written opinion or otherwise as recorded as being agreed in writing by both parties subsequent to the receipt of the Mediator's opinion.

The dispute on any matter still unresolved after the application of the provisions of the above paragraph shall be resolved by arbitration.

Save for reference to any portion of the Mediator's opinion which has become binding in terms of paragraph 8 of this Sub-Clause, no reference shall be made by or on behalf of either party, in any proceedings subsequent to mediation, to the Mediator's opinion, or to the fact that any particular evidence was given, or to any submission, statement or admission made in the course of the mediation.

Irrespective of the nature of the Mediator's opinion:

- a) Each party shall bear his own costs arising from the mediation, and

- b) The parties shall in equal shares pay the Mediator the amount of his expenses and the amount of his fee based on a scale of fees as agreed between the Mediator and the parties before the commencement of the mediation.

20.6 Arbitration

If a dispute is still unresolved as provided in paragraph 9 of Sub-Clause 20.5 [*Mediation*] or the dispute is one to which Sub-Clause 58.8 [*Special Disputes*] refers:

The matter shall be referred to a single Arbitrator to be agreed on between the parties or, failing such agreement within 28 days after delivery to the parties of the Mediator's opinion, or the Adjudicator's decision, nominated on the application of either party by the President for the time being of the South African Institute of Mechanical Engineering or the South African Institution of Civil Engineering, as appropriate, and any such reference shall be deemed to be a submission to the arbitration of a single arbitrator in terms of the Arbitration Act (Act No 42 of 1965, as amended), or any legislation passed in substitution therefore;

In the absence of any other agreed procedure, the arbitration shall take place in accordance with the Rules for the Conduct of Arbitrations issued by the Association of Arbitrators (Southern Africa) which are current at the time of the referral to arbitration;

The Arbitrator shall, in his award, set out the facts and the provisions of the Contract on which his award is based.

20.7 Common Provisions

Nothing herein contained shall deprive the Contractor of the right to institute immediate Court proceedings in respect of failure by the Employer to pay the amount of a payment certificate on its due date or to refund any amount of retention money on its due date for refund.

No ruling or decision given by the Engineer in accordance with the provisions of the Contract shall disqualify him from being called as a witness and giving evidence before the Arbitrator or the Court on any matter whatsoever relevant to the dispute concerned.

The Arbitrator and the Court shall have full power to open up, review and revise any ruling, decision, order, instruction, certificate or valuation of the Engineer relevant to the matter in dispute and neither party shall be limited in such proceedings before such Arbitrator or Court to the evidence or arguments put before the Engineer for the purpose of obtaining his ruling.

The following provisions shall apply in respect of the appointment of a mediator or arbitrator in terms of this Clause:

- a) If, for any reason, the person appointed fails to assume or to continue in the office concerned, the provisions of this Clause shall apply with the necessary changes in the appointment of a successor, and

- b) In making his nomination in terms of the first paragraph of Sub-Clause 20.5 *[Mediation]* or the last paragraph of Sub-Clause 20.6 *[Arbitration]*, the President for the time being of the South African Institution of Civil Engineers shall, at his own discretion, act in consultation with the Presidents for the time being of the South African Association of Consulting Engineers and the South African Federation of Civil Engineering Contractors, and
- c) the President required to make a nomination in terms of this Clause shall have a direct or indirect interest in the subject matter of the dispute, the nomination shall be made by the next senior officer of the body concerned who has no such interest.

20.8 Special Disputes

Notwithstanding anything elsewhere provided in this Clause, any dispute between the Contractor and the Employer:

- a) Not relating to a ruling, decision, order, instruction or certificate by the Engineer, or
- b) Arising after the completion of the Contract or, if a Defects Notification Period is provided, after the termination of that period

shall be determined, without the application of the provisions of Sub-Clause 20.4 *[Dispute Notice]* and Sub-Clauses 20.5 *[Mediation]*, by arbitration and which may be initiated by either party, in which event the provisions of Sub-Clauses 20.6 *[Arbitration]* and 20.7 *Common Provisions]* shall apply.

20.9 Continuing Validity of Sub-Clauses 20.4 to 20.8

Sub-Clauses 20.4 to 20.8 is a separate, divisible agreement from the rest of the Contract and shall remain valid and applicable notwithstanding that the Works may have been completed or that the rest of the Contract may be void or voidable or may have been cancelled for any reason.”.

APPENDIX TO TENDER PART 1 - DATA PROVIDED BY THE EMPLOYER

Item	Sub-Clause	Entry
The Employer is:	1.1.2.2 & 1.3	Knysna Municipality Charmonay Bezuidenhout E-mail: cybezuidenhout@knysna.gov.za
The Employer's address for receipt of communications is:		Tel: 044 - 302 6300 Postal Address: P O Box 21, KNYSNA, 6530 Physical Address: Clyde Street 5, KNYSNA
The Engineer is:	1.1.2.4 & 1.3	Zutari (Pty) Ltd represented by an employee duly authorized thereto.
The Engineer's address for receipt of communications is:		Tel: 044 805 5400 Fax: 044 873 5843 e-mail: george@zutari.com Address: Suite 201, 2 nd floor, Bloemhof Building, 65 York Street, GEORGE, 6529
Time for completion of the whole of the Works including the Trial Operation Period:	1.1.3.3	As indicated by Tenderer on Contract data C1.2 * Inclusive of special non-working days
Defects Notification Period	1.1.3.7	365 days
Special non-working days	1.1.3.9	Public holidays, election days for local government and national elections (whenever applicable) and the year-end break periods defined as follows: • 11 December 2026 to 11 January 2027, inclusive
Electronic transmission systems	1.3	Formal signed correspondence may be scan copied in PDF format and issued via email messaging for information (the originals sent as per method of formal communication). All other correspondence may be affected directly by email messaging.
Governing Law	1.4	South African law
Ruling language	1.4	English
Language for communications	1.4	English
Time for access to the Site	2.1	2 Days

Item	Sub-Clause	Entry
Approval of Employer required for:	3.1	Not applicable
Amount of Performance Security	4.2	10% of the Accepted Contract Amount, in the currency of the Contract. To be provided within 7 days.
Period for notifying unforeseeable errors, faults and defects in the Employer's Requirements	5.1	21 days
Normal working hours	6.5	08:00 to 17:00 on days other than locally recognised days of rest and special non-working days
Locally recognised days of rest	6.5	Saturdays and Sundays
Adjustments for Changes in Cost; Table(s) of adjustment data	13.8	As in Part 2 and Item 8 of Part C1.2
Time for submission of programme	8.3	Within 2 days of receipt of notice under 8.1
Amount of Delay Damages	8.7	R 1 500 per day
Period of Trial Operation	9.1	28 days
Commencement of Work	8.1	Within 1 day from Acceptance
Variation procedure	13.3	The scope of the work may be increased by up to 20% or be cut down/ not awarded depending on funds without the Contractor adjusting any rates
Advance payment	14.2	Not applicable
Percentage of retention	14.3 (c)	10% Retention. Retention money guarantee not permitted.
Limit of Retention Money	14.3 (c)	10% of the Accepted Contract Amount
Percentage advance on materials	14.5.c (ii)	80% of value of material
Time for Engineer to issue interim payment certificates to Employer	14.6	Within 7 days of receipt by the Engineer of Contractor's statement
Minimum amount of Interim Payment Certificates	14.6	n/a
Time for payment of interim payment certificates	14.7(b)	Within 35 days of receipt by the Engineer of Contractor's statement

Item	Sub-Clause	Entry
Time for Engineer to issue Final Payment Certificate	14.13	Within 14 days of receipt by the Engineer of final statement
Time for payment of final payment certificates	14.7 (c)	Within 28 days of receipt by the Employer of Final Payment Certificate
Currency of payments	14.15	South African Rand
Periods for submission of insurance: a) evidence of insurance b) relevant policies	18.1	2 days 2 days
Maximum amount of deductibles for insurance of the Employer's risks	18.2(d)	R5 000-00
Minimum amount of Professional Indemnity Insurance	18.2(f) (ii)	R1 000 000-00
Minimum amount of third party insurance	18.3	R5 000 000-00
Special Risks coupon policy	18.5	Required
Disputes	20.2	Disputes shall be adjudicated by a three (3) member Dispute Adjudication Board

C1.2: CONTRACT DATA: PART 2: DATA PROVIDED BY THE CONTRACTOR

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

Clause	
1.1.2.3	The legal name of the contractor The contractor's address for receipt of communications and notices is: Telephone: facsimile: E-mail: Cell phone: Address (postal): address (physical):
13.5 (b)	The percentage allowances to cover all overhead charges for provisional sums is :.....%
1.1.3.3	Time for completion of the whole of the works including the trial operational period:weeks (Specified 2 weeks)
13.8	Adjustments for changes in cost : tables of adjustment data (for imported equipment) The value of equipment imported from outside South Africa shall be adjusted in accordance with the "Schedule of Imported Equipment" in Part C2.3

C1.3: OCCUPATIONAL HEALTH AND SAFETY MANDATORY AGREEMENT

(To be filled out by the successful Tenderer)

ARTICLE OF AGREEMENT IN TERMS OF SECTION 37(2) OF THE OCCUPATIONAL SAFETY ACT, 1993 BETWEEN

EMPLOYER

(Hereinafter referred to as the "EMPLOYER")

AND

.....
Herein represented by..... in his/her capacity as
..... duly authorised by virtue of a resolution
dated....., Attached hereto Annexure A, of the said
.....
.....

..... (herein after referred to as the
"CONTRACTOR")
.....
.....

WHEREAS the CONTRACTOR is the mandatory of the EMPLOYER as contemplated
in an agreement in respect of
.....
.....
.....
.....

..... Contract
number

AND WHEREAS section 37 of the Occupational Health and Safety act, 1993 (Act 85
of 1993, hereinafter referred to as the "ACT"), imposes certain powers and duties upon
the EMPLOYER.

AND WHEREAS the parties have agreed to enter into an agreement in terms of
section 37(2) of the ACT. **NOW THEREFORE** the parties agree as follows:

- (a) The CONTRACTOR undertakes to acquaint the appropriate officials and employees of the CONTRACTOR with all relevant provisions of the ACT and the regulations promulgated in terms thereof.
- (b) The CONTRACTOR undertakes that all relevant duties, obligations, and prohibitions imposed in terms of the ACT and Regulations will be fully complied with, provided that should the EMPLOYER prescribe certain arrangements and procedures, that same shall be observed and adhered to by the CONTRACTOR, his officials, and employees. The CONTRACTOR shall bear the onus of acquainting himself/herself/itself with such arrangements and procedures.
- (c) The CONTRACTOR hereby accepts sole liability for such due compliance with the relevant duties, obligations, prohibitions, arrangements, and procedure, if any, imposed by the ACT and Regulations and the EMPLOYER expressly absolves the EMPLOYER from itself being obliged to comply with any of the aforesaid duties, obligations, prohibitions, arrangements, and procedure as the case may be.
- (c) The CONTRACTOR agrees that any duly authorised officials of the EMPLOYER shall be entitled, although not obliged, to take such steps as may be necessary to ensure that the CONTRACTOR has complied with the undertakings as more fully set out in paragraphs 1 and 2 above, which steps may include, but shall not be limited to, the right to inspect any appropriate site or premises occupied by the CONTRACTOR, or to inspect any appropriate records held by the CONTRACTOR or to take such steps it may deem necessary to remedy the default of the CONTRACTOR at the cost of the CONTRACTOR.
- (d) The CONTRACTOR shall be obliged to report forthwith to the EMPLOYER any investigations, complaint or criminal charge which may arise as a consequence of the provisions of the ACT and Regulations, pursuant to work performed in terms of this agreement, and shall, on written demand, provide full details in writing of such an investigation, complaint or criminal charge as the case may be.

Signature(s) of authorized agents:

Name(s) (in block letters)

Capacity of authorized agents:

For and on behalf of the Tenderer

.....

(Name and address of organization)

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

.....

 (Signature)

Date:

For and on behalf of the Employer:

Signature(s) of authorized agent(s) Date:
.....

Name(s)

Capacity

for the **Employer:**

.....
.....

(Name and address of organization)

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

(Name)

.....
.....

Date:

(Signature)

C1.4: FORM OF PERFORMANCE SECURITY (PRO FORMA)

Brief description of Contract: EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF AKKERKLOOF DAM PUMPSTATION

Name and address of Beneficiary: KNYSNA MUNICIPALITY, 5 CLYDE STREET, FINANCE BUILDING, KNYSNA, 6570 (whom the Contract defines as the Employer).

We have been informed that
(hereinafter called the "Principal") is your Contractor under such Contract, which requires him to obtain a Performance Security.

At the request of the Principal, we (name of bank/financial entity)
hereby irrevocably undertake to pay you, the Beneficiary/Employer, any sum or sums not exceeding in total the amount of (the "guaranteed amount") upon receipt by us of your demand in writing and your written statement stating:

- (a) that the Principal is in breach of his obligation(s) under the Contract, and
- (b) the respect in which the Principal is in breach.

Any demand for payment must contain your authorised representative's signature. The demand and statement must be received by us at this office on or before (the date 70 days after the expected expiry of the Defects Notification Period for the Works) (the "expiry date"), when this guarantee shall expire and shall be returned to us.

We have been informed that the Beneficiary may require the Principal to extend this guarantee if the Performance Certificate under the Contract has not been issued by the date 28 days prior to such expiry date. We undertake to pay you such guaranteed amount upon receipt by us, within such period of 28 days, of your demand in writing and your written statement that the Performance Certificate has not been issued, for reasons attributable to the Principal, and that this guarantee has not been extended.

This guarantee shall be governed by South African Law and shall be subject to the Uniform Rules for Demand Guarantees, published as number 458 by the International Chamber of Commerce, except as stated above.

We hereby choose our address for the serving of all notices for all purposes arising hereof as:

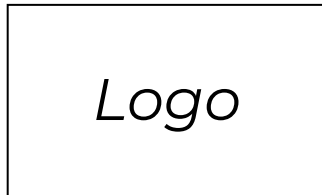
.....
.....
.....
.....

.....
.....
Date

Signature(s)
.....

C1.5: INSURANCE BROKER'S WARRANTY

Pro Forma



Letterhead of Contractor's Insurance Broker

KNYSNA MUNICIPALITY

Directorate: Technical Services
5 Clyde Street, Finance Building
Knysna, 6570

Dear Sir

CONTRACT NO.: **Tender No :29 OF 2025/26**

CONTRACT TITLE: **EMERGENCY BULK WATER SUPPLY PROJECT – KNYNSNA
REFURBISHMENT OF AKKERKLOOF DAM PUMPSTATION**

NAME OF CONTRACTOR:.....

I, the undersigned, do hereby confirm and warrant that all the insurances required in terms of the abovementioned contract have been issued and/or in the case of blanket/umbrella policies, have been endorsed to reflect the interests of the George Municipality with regard to the abovementioned contract, and that all the insurances and endorsements, etc., are all in accordance with the requirements of the contract.

I furthermore confirm that all premiums in the above regard have been paid.

Yours faithfully

Signed:

For:

**EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF
AKKERKLOOF DAM PUMPSTATION
TENDER NO: 29 OF 2025/26**

PRICING DATA: (PART C2)

C2.1	Pricing Instructions	Yellow
C2.2	Bill of Quantities	Yellow
C2.3	Schedule of Import Equipment	Yellow

**EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF
AKKERKLOOF DAM PUMPSTATION
TENDER NO: 29 OF 2025/26**

PRICING INSTRUCTIONS: (PART C2.1)
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- 1 The Tender Data, the Contract Data, the Scope of the Work and the Site Information are to be read in conjunction with the Bill of Quantities.
- 2 The Bill of Quantities comprises items covering the Contractor's profit and costs of general liabilities and of provision of temporary and permanent Works.
- 3 Except that they shall not include Value Added Tax (VAT), the prices and rates to be inserted in the Bill of Quantities are to be the full inclusive prices to the Employer for the work described under each item. Such prices shall cover all costs and expenses that may be required in and for the construction of the work described and shall cover the cost of all general risks, liabilities, and obligations set forth or implied in the documents on which the tender is based. Provision is made in the Summary to the Bill of Quantities for VAT to be added.
- 4 A price or rate is to be entered against each item in the Bill of Quantities, whether the quantities are stated or not. An item against which no price is entered will be considered to have a price or rate of R0,00.
- 5 The Tenderer must price and extend each item, total each page and carry the total of each section in the Bill of Quantities to the Summary page.
- 6 Where an item(s) has been provided for the tenderer to price any further work considered necessary by the tenderer, the tenderer must provide full details of what has been allowed for under that item(s). Where such item(s) are not priced, it will be held that the priced items adequately cover the cost of carrying out the required work.
- 7 Descriptions in the Bill of Quantities are abbreviated and must be read in conjunction with the measurement and payment clauses below and the applicable Specifications.
- 8 Contract price adjustment to allow for variations in the rate of exchange for imported equipment shall be dealt with in terms of Sub-clause 13.8 of the General Conditions of Contract on the basis of the rates inserted by the tenderer in the **Schedule of Imported Equipment** in Part C2.4. Note that the values of imported equipment to be inserted in this schedule will not be used for the adjudication process and will vary from the tenderer's prices inserted in the Bill of Quantities.
- 9 If any change in design is contemplated during the course of the Contract, the Contractor will be required to provide the Engineer with a detailed breakdown of the contract price involved with a similarly detailed breakdown of the suggested revised price together with supporting quotations and other relevant documentation to satisfy the Engineer that the revised price is built up in a similar manner to the original contract price.

MEASUREMENT AND PAYMENT

PI1 General

Payment for particular items billed in the Bill of Quantities shall conform to the payment instructions in the Contract Data and Scope of Work as amended by the following:

- a) The tendered rates or sums shall cover the costs of compliance with all requirements of the Contract Data and the Scope of Work not billed separately.
- b) The tendered rates or sums shall cover the costs of anything not specially mentioned but which an experienced contractor can reasonably foresee as being required, (e.g. all ancillaries, including all bolts, fastenings and brackets, safety guards and any work or material or equipment required for the proper installation of such apparatus and equipment, piping, valves, gauges, instruments, either severally or collectively in complete working order), to enable the Works to be installed and to pass the tests on completion and to 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 in the Bill of Quantities.
- c) With reference to Sub-Clause 14.3 of the General Conditions of Contract the Contractor will not be entitled to any payment until the required number of copies of the Progress Statement have been submitted by him to the Engineer. The Statement shall contain an invoice of all items as billed in the Bill of Quantities and reflect the progress made on each item. If a pro forma is enclosed in the Contract Documents the Contractor's Progress Statement shall conform to it. If there is no pro forma in the document the form of the Progress Statement used by the Contract will be subject to the approval of the Engineer.

PI2 General Requirements and Conditions

Unit: Sum

Where provision is made in the Bill of Quantities for General Requirements and Conditions, the sum(s) tendered shall cover the cost of all responsibilities specified in the Scope of Work together with all responsibilities in terms of the Contract Data. In interim certificates, payment for General Requirements and Conditions will be made, unless otherwise provided for, as a percentage of the tendered lump sum(s) pro rata to the value of work certified for payment.

Where no provision is made in the Bill of Quantities for General Requirements and Conditions the rates tendered for the scheduled items shall cover the cost of all responsibilities specified in the Scope of Work together with all responsibilities in terms of the Contract Data.

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PI3 Design

Unit Sum

The tendered sum shall cover the cost of the design of the Works, and the provision of the Contractor's documents in accordance with Clause 5 of the GCC and related requirements in terms of the Scope of Work.

PI4 Supply (or supplying)

Unit:No or Sum

The tendered rate or sum shall cover the cost of the supply of the goods, testing as specified and as required by Act No. 85, provision of test certificates certifying compliance of the goods with SANS, IEC, ISO or BS standards, corrosion protection, if designated and not scheduled separately, and supply of all special tools and keys specified. The tendered rate shall include the cost of witness testing by the Engineer where this is required in terms of the Scope of Work.

Payment for supply of the relevant equipment will not be affected until the draft copies of the related sections of the Operation and Maintenance Manuals have been submitted.

PI5 Delivery

Unit:No or Sum

The tendered rate or sum shall cover the cost of delivery of the goods and offloading at the delivery point stated in the Scope of Work or at the Site.

Where a rate or sum has been tendered for delivery of goods which are then stored, the Engineer at his sole discretion may certify an amount for partial or full payment of the relevant item, if in the Engineer's opinion such a payment is justified by reason of the transportation of such goods to their place of storage.

PI6 Installation

Unit:No or Sum

The tendered rate or sum shall cover the cost of all necessary site-oriented activities such as handling at the Site, storing, sorting, erecting, all painting, pre-commissioning tests (unless scheduled separately), including all costs of transport of personnel and their erection gear to Site, and the cost of all materials. Where pipes are required to pass through walls of structures constructed by others, and where openings have been provided for this purpose, the installation sum shall include for building/grouting the pipe into the wall and finishing to match the surrounding structure. Where items of equipment are to be grouted in (such as for anchors and pump set base plates), the installation sum shall include for such work.

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PI7 Pre-commissioning tests (where scheduled separately)

Unit:No or Sum

The tendered rate or sum shall cover the cost of pre-commissioning tests, including all costs of transport to and from Site, and Site accommodation of personnel and their gear.

PI8 Commissioning tests (where scheduled separately)

Unit:No or Sum

The tendered rate or sum shall cover the cost of commissioning tests, including putting the whole of the Works into operation, and including all costs of transport to and from the Site, and Site accommodation of personnel and their gear. The cost of process chemicals required for production of any product of the Works (such as coagulants and chlorine), shall be borne by the Employer.

PI9 Trial operation (where scheduled separately)

Unit:No or Sum

The tendered rate or sum shall cover the cost of trial operation tests, including all costs of transport to and from the Site, and Site accommodation of personnel and their gear. The cost of process chemicals required for production of any product of the Works (such as coagulants and chlorine), shall be borne by the Employer.

PI10 Servicing visits

Unit: Sum or No of Visits

The tendered rate or sum shall exclude the cost of providing lubricants but shall cover the cost of any servicing visits and operations specified.

Payment of 95% of the tendered amount will become due monthly on a pro rata basis or after each visit, as the case may be. The remaining 5% will be regarded as Retention Money and paid at the end of the Defects Notification Period.

PI11 Corrosion Protection and Painting

Unit:No or Sum

Where a separate item is included in the Bill of Quantities the tendered rate shall cover the cost of surface preparation, supply and application of the corrosion protection material, site repairs to paintwork, the provision of inspection equipment and the cost of the Contractors quality surveillance and his independent inspectorate.

Where a separate item is not included in the Bill of Quantities the total cost of corrosion protection as specified above shall be included in the cost of supply of the item.

The cost of the Employer's or Engineer's inspection shall be borne by the Employer.

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PI12 Spares

Unit:Prime Cost Sum

The cost of special tools and keys shall be covered by the tendered rate or price for the supply of the relevant equipment (see PI4). Payment for standard spanners and cabinet(s) will be made out of the Prime Cost Sum allowed in the Bill of Quantities for such items. The Contractor's profit, administration and delivery charges will be paid at the tendered percentage of the actual purchase price of the goods.

Payment for spares will be made at the price tendered in the Spares Schedule which price shall cover the cost of supply, crating and labelling where applicable, and delivery to the Site of the relevant items.

PI13 Miscellaneous items

Unit:No or Sum or as stated in the schedule

Where a miscellaneous item or operation is scheduled that does not match the specific measurement and payment categories in PI2 to PI12 above, the rate for such items shall cover all the costs required to execute and complete the work as specified and/or as described in the Bill of Quantities, including equipment, materials, labour, plant, and the costs related to the categories of PI1 to PI11 above

**EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF
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C2.2: BILL OF QUANTITIES

BILL M1:	GENERAL REQUIREMENTS AND CONDITIONS
BILL M2:	INLET WORKS: MECHANICAL FRONT RAKED BAR SCREENS
BULK SUMMARY:	MECHANICAL WORK
SUMMARY OF BILLS	

DISCLAIMER

This electronic file is made available for the convenience of prospective tenderers and no responsibility is accepted by the Engineer or the Employer for the accuracy of the data in this file or for any discrepancy between the data in this file and the Bill of Quantities bound into the relevant tender document. Tenderers or others using the information in this file do so at their own risk. This file and the data therein, including any hard copy produced from this file are the copyright of Zutari (Pty) Ltd. This file will not be amended to take account of any Notice(s) to

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AFWYSING

Hierdie elektroniese lêer word vir die gerief van voornemende tenderaars beskikbaar gestel en geen verantwoordelikheid word deur die Ingenieur of die Werkgewer aanvaar nie vir die akkuraatheid van die data in hierdie lêer of enige teenstrydigheid tussen die data in hierdie lêer en die Hoeveelheidslys ingebind in die betrokke tender dokument. Tenderaars en ander gebruik die inligting in hierdie lêer op eie risiko. Hierdie lêer en data daarin, asook enige herprodusering van hierdie lêer, is kopiereg van Zutari (Edms) Bpk. Hierdie lêer sal nie aangepas word om enige Kennisgewing(s) aan Tenderaars in ag te neem

Nieteenstaande die beskikbaarstelling van hierdie elektroniese lêer, mag tenders nie in elektroniese vorm of as 'n drukstuk van hierdie elektroniese lêer ingedien word nie. Die vereistes van die Tendervoorwaardes van die betrokke tender dokument moet ten strengste nagekom word.

Item	Description	Unit	Quantity	Rate	Amount
	BILL M1 GENERAL REQUIREMENTS AND CONDITIONS Allow for all costs and expenses in connection with the following items:				
1	Providing Performance Security	Sum	1		
2	Providing Insurances	Sum	1		
3	Detailed design of the Works and Submission of Contractor's Documents (in accordance with general conditions of contract and specifications)	Sum	1		
4	Contractors Establishment on Site and Destablishment from site				
4	Establishment of Contractor's camp, including security and ablution facilities	Sum	1		
5	Destablishment of Contractor's camp, including security and ablution facilities	Sum	1		
6	Provision of water, electricity and other services	Sum	1		
7	General expenses incurred in complying with the requirements of T1.2 Tender Data, not included above	Sum	1		
8	General expenses incurred in complying with the requirements of C1.2 Contract Data, not included above	Sum	1		
	Health and Safety				
9	Compliance with the requirements of the Occupational Health and Safety Act 1993 and Construction Regulations 2014, including appointment of Construction Supervisor and Competent Person (in terms of Part C3.6, Occupational Health and Safety Specification)	Sum	1		
10	Provision of and adherence to a Health and Safety Plan (in terms of Part C3.6, Occupational Health and Safety Specification)	Sum	1		
11	Compliance with the Health and Safety Specification in the Scope of Work	Sum	1		
12	Liaison, co-ordination and chairing of meetings in respect of Health and Safety requirements	Sum	1		
Amount Carried forward / ...					R

Item	Description	Unit	Quantity	Rate	Amount
Amount Brought forward / ...					R
	Quality Management				
13	Quality management plan and quality assurance system	Sum	1		
14	Provisional Sums				
14.1	Clean Pumpstation, remove sand and soil to accommodate storm water	Provisional Sum			R200,000.00
14.2	Contractor's charges and profit on Item 14.1 (Contractor to fill in % and extend)	%	R200,000.00		
14.3	Repair sportsfield wastewater pumpstation				R50,000.00
14.4	Contractor's charges and profit on Item 14.3 (Contractor to fill in % and extend)		R50,000.00		
14.5	Check Motor Control Centre and repair and ensure that telemetry is operational and allows remote switching on and off of pumps as well as automatic operation of pumps.	%	R120,000.00		R120,000.00
15	Other Other general expenses in curred in complying with the requirements of the Scope of Work not included above (Specify)	%	R100,000.00		
					
					
					
					
					
TOTAL AMOUNT OF BILL M1 CARRIED TO SUMMARY OF MECHANICAL WORK					R

Item No	Short Description	Unit	Quantity	Rate	Amount
	BILL M2 MECHANICAL AND ELECTRICAL				
	Supply of equipment:				
1	Oil and grease for pumps and motors	Sum	1		
2	Seals and bearings for motors and pumps. (2 Motors, 2 Pumps)	Sum	1		
3	Flender coupling boats (2)	Sum	1		
4	Protective covers for couplings (2)	Sum	1		
	Interim storage including insurances etc of:	1 month	1		
5	All equipment to be supplied	Sum	1		
	Delivery of equipment to site				
6	Delivery of all equipment to site	Sum	1		
	Installation of equipment				
7	All equipment	Sum	1		
	Testing				
8	Testing of all equipment	Sum	1		
	Commissioning				
9	Commision all equipment	Sum	1		
10	Trial operating period	Sum	1		
	<u>Other:</u> All other items not included above but which are nevertheless necessary to meet the Scope of Work and/or are required for the proper, safe and effective operation of the plant (Specify)				
TOTAL AMOUNT OF BILL M3 CARRIED TO SUMMARY OF MECHANICAL WORK					R

Bill of Quantities

SUMMARY OF MECHANICAL WORKS		
BILL	DESCRIPTION	AMOUNT
M1	GENERAL REQUIREMENTS AND CONDITIONS	
M2	MECHANICAL AND ELECTRICAL	
SUB-TOTAL CARRIED FORWARD TO SUMMARY OF BILLS		R

SUMMARY OF BILLS		
BILL NO	DESCRIPTION	AMOUNT
	SUMMARY OF BILL OF QUANTITIES	R
TOTAL OF PRICED ITEMS		R
ADD CONTINGENCIES: The tenderer shall add 10% of the total of Schedule of Quantities for Contingencies. The sum provided here for contingencies is under the sole control of the Engineer and may be deducted in whole or in part if not required		
SUB-TOTAL		R
PLUS ALLOWANCE FOR FOREIGN EXCHANGE ADJUSTMENT (5%)		R
NET TOTAL OF TENDER		R
ADD 15% VALUE ADDED TAX		R
GROSS TOTAL OF TENDER		R

EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF AKKERKLOOF DAM PUMPSTATION
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C2.3 SCHEDULE OF IMPORTED EQUIPMENT

VALUES OF IMPORTED EQUIPMENT as per Item 8 of C2.1: Pricing Assumptions					CUSTOMS DUTY		SURCHARGE		Total in Rand of (C) + (D) + (E) included in Bill of Quantities Item
Bill of Quantities Item	Description of Equipment	Value in Foreign Currency	Rate of Exchange	Value in Rand (A) X (B)	%	Rand	%	Rand	
		(A)	(B)	(C)		(D)		(E)	(F)

**EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF
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PART C3: SCOPE OF WORK

- C3.1 Project Data**
- C3.2 Mechanical Specifications**
- C3.3 Mechanical Standard Specifications**
- C3.4 Annexures**

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PART C3.1: PROJECT DATA

PD1 DESCRIPTION OF THE WORKS

PD1.1 EMPLOYER'S OBJECTIVES

PD1.2 SCOPE OF WORKS (SEE ALSO PSM 1.2)

PD1.3 LOCATION OF THE WORKS AND ACCESS

PD1.4 GENERAL CONDITIONS

PD1.5 GROUND CONDITIONS

PD1.6 CONTRACTOR'S CAMP ESTABLISHMENT

PD1.7 SECURITY

PD1.8 POWER, WATER AND OTHER SERVICES

PD1.9 LIFTING FACILITIES

PD1.10 RAIL FACILITIES

PD1.11 TELEPHONE FACILITIES

PD1.12 DISPOSAL SITES

PD1.13 ABLUTION FACILITIES

PD1.14 MAINTAINING AND CLEANING OF THE SITE

PD1.15 SANITARY CONDITIONS

PD1.16 ADJACENT PROPERTIES, EXISTING STRUCTURES AND SERVICES

PD1.17 DEALING WITH WATER

PD1.18 SAFEGUARDING OF EXCAVATIONS

PD1.19 EXISTING SERVICES

PD1.20 FACILITIES FOR THE ENGINEER

PD2 APPROVALS AND INSPECTIONS

PD3 PROCUREMENT

PD3.1 PREFERENTIAL PROCUREMENT PROCEDURES

PD3.1.1 REQUIREMENTS

PD3.2 SUBCONTRACTING

PD3.2.2 SUBCONTRACTING PROCEDURES

PD3.2.3 PROVISIONAL SUMS

PD3.2.1 SCOPE OF MANDATORY SUBCONTRACT WORKS

PD3.2.2 SUBCONTRACTING PROCEDURES

PD3.2.3 PROVISIONAL SUMS

PD4 MANAGEMENT

PD4.1 PROGRAMMING AND PLANNING

PD4.1.1 GENERAL ALLOWANCES

PD4.1.2 EXTENSION OF TIME RESULTING FROM ABNORMAL RAINFALL (SEE
ALSO C1.2 CONTRACT DATA 8.4)

**EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF
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- PD4.1.3 REVIEW OF PROGRESS
- PD4.2 CONTRACTOR'S RESPONSIBILITY IN TERMS OF THE OHS ACT
- PD4.3 WORKS NOT TO INTERFERE
- PD4.4 UNAUTHORISED PERSONS
- PD4.5 ELECTRONIC PAYMENTS
- PD4.6 HEALTH AND SAFETY
 - PD4.6.1 HEALTH AND SAFETY REQUIREMENTS AND PROCEDURES
 - PD4.6.2 HEALTH AND SAFETY PLAN
 - PD4.6.3 PROTECTION OF THE PUBLIC AND EMPLOYER'S STAFF
 - PD4.6.4 HEALTH AND SAFETY SPECIALIST
- PD4.7 ENVIRONMENTAL MANAGEMENT
 - PD4.7.1 NEATNESS OF THE SITE
 - PD4.7.2 ACCOMMODATION OF TRAFFIC ON PUBLIC ROADS OCCUPIED BY THE CONTRACTOR
 - PD4.7.3 OTHER CONTRACTORS ON SITE
- PD5 CONSTRUCTION
 - PD5.1 APPLICABLE STANDARDISED SPECIFICATIONS
 - PD5.2 SITE-RELATED ITEMS
 - PD5.2.1 SERVICES AND FACILITIES
 - PD5.2.2 PERMITS AND WAYLEAVES
 - PD5.2.3 FEATURES REQUIRING SPECIAL ATTENTION
 - PD5.2.4 SITE USAGE
 - PD5.2.6 TECHNICAL MEETINGS
 - PD5.2.5 OTHER CONTRACTORS
 - PD5.2.7 SITE MEETINGS
 - PD5.2.8 FLOODING AND SURFACE WATER
- PD6 OPERATION OF SYSTEM
 - PD6.1 CONTROL PHILOSOPHY
 - PD6.2 SEQUENCE OF OPERATION
- PD7 MANAGEMENT
 - PD7.1 MEETINGS
 - PD7.2 PLANNING, PROGRAMMING AND REPORTING
 - PD7.2.1 GENERAL
 - PD7.2.2 PROGRAMMING RESTRICTIONS
 - PD7.2.3 PROGRESS REPORTING
 - PD7.2.4 DOCUMENT FORMAT
 - PD7.2.5 CORROSION PROTECTION
 - PD7.3 SEQUENCE OF THE WORKS
 - PD7.4 RIGHT OF ACCESS TO SITE
 - PD7.5 COOPERATION WITH THE EMPLOYER
 - PD7.6 METHODS AND PROCEDURES

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PD7.6.1 PROGRAMMING RESTRICTIONS
PD7.6.2 QUALITY ASSURANCE SYSTEM
PD7.7 MONTHLY LABOUR RETURNS
PD8 PROCUREMENT
PD8.1 PREFERENTIAL PROCUREMENT PROCEDURES
PD9. ENGINEERING : DESIGN OF THE WORKS
PD10 ENGINEERING : CONTRACT'S DOCUMENTS

PD1 DESCRIPTION OF THE WORKS

PD1.1 Employer's objectives

The Akkerkloof Dam Pumpstation pumps water from the Balancing Dam to the Akkerkloof Dam. The Pumpstation is situated adjacent to the Balancing Dam. The pumps suction manifold is connected to the Balancing Dam outlet pipe.

Two centrifugal pumps are used to pump the raw river water to the Akkerkloof Dam.

The Knysna Municipality wishes to refurbish the pumpstation by replacing the seals and bearings on the centrifugal pumps and motors. Provisional sums have also been allowed to clean the Pumpstation and remove soil around the building to accommodate stormwater, to check the Motor Control Centre and ensure operation of the telemetry system to be able to remotely stop and start the pumps as well as to ensure automatic operation of the pumps. A third provisional sum has also been allowed to repair the sportsfield wastewater pumpstation that overflows across the access road to the Pumpstation.

PD1.2 SCOPE OF WORKS (See also PSM 1.2)

The Mechanical scope to be included in this Mechanical and Electrical Contract comprises the design, supply, delivery, installation, testing and commissioning of:

- a) Oil and grease for pumps and motors.
- b) Supply and installation of seals and bearings for pumps and motors.
- c) Supply and installation of new boots for couplings.
- d) Supply and installation of protective covers for couplings.
- e) Accommodate various Provisional Sum items i.e.
 - Clean Pumpstation and remove soil around building to accommodate stormwater.
 - Check Motor Control Centre and repair and ensure automatic operation as well as that telemetry is operational and allows remote switching on and off of pumps.
 - Repair White Location Sportsfield waste water pumpstation to stop waste water flow across access road to Pumpstation

This description of the Mechanical and Electrical Works is not necessarily complete and the above list shall not limit the work to be carried out under this Contract.

Further to the above, the scope also includes:

- Training of Employer's staff in operation and maintenance
- Trial Operation period
- Upholding during the Defects Notification Period.

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PD1.3 Location of the works and access

The site is located at the Akkerkloof Dam Pumpstation adjacent to the Balancing Dam. The works are accessible by means of internal streets and access road to the Works. The pump station may be active while the work is carried out. The last section is a steep access path that requires 4 x 4 vehicles.

The Contractor shall at all times provide safe access to Municipal staff that may visit the site.

Any restrictions to access etc. shall be arranged between the Contractor and the Municipal officials responsible for the Pumpstation.

PD1.4 General CONDITIONS

The following site conditions shall be taken into consideration in the design and selection of the plant and equipment:

Altitude above sea level	: 159 msl
Maximum Temperature	: 38°C
Minimum Temperature	: 2°C
Corrosion Conditions	: Moderate
Lightning	: Common

PD1.5 Ground Conditions

The existing ground Conditions at the Pumpstation is typical gravel and clayey material.

PD1.6 Contractor's Camp Establishment

The Contractor shall arrange accommodation for personnel off-Site.

The Contractor shall supply and maintain adequate and suitable protection for the storage of materials that might deteriorate if exposed to the weather.

On completion of the Works, or when the facilities provided by the Contractor are no longer required, the Contractor shall remove these facilities and clear away all indications of their presence.

PD1.7 Security

The Contractor may be exposed to criminal actions, including theft and vandalism, and shall make the necessary security arrangements for the duration of the Contract.

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One person from an independent security company accepted by the Engineer shall be employed full-time on site for the duration of the Contract. The Contractor shall provide details of the security company for approval prior to access to Site.

PD1.8 Power, Water and Other Services

The Contractor shall make arrangements for providing water, electrical supply and other services required for the Works and shall pay all charges related to the supply of such services, including any installation charges.

The provision of these services shall include for all activities related to the Works up to the issue of the Performance Certificate.

PD1.9 LIFTING FACILITIES

The Contractor shall make his own arrangement for lifting facilities.

PD1.10 Rail Facilities

The nearest goods handling station is in George.

PD1.11 Telephone Facilities

The Contractor shall be responsible for arranging telephone needs for his site staff.

PD1.12 Disposal Sites

The Contractor shall dispose of unwanted material off Site, if so, caused by the Contractor's activities at a disposal site accepted by the Engineer and shall be responsible for all associated charges.

PD1.13 Ablution Facilities

The Contractor shall provide and maintain adequate ablution facilities for staff.

The Contractor shall be responsible for the safe storage, treatment and disposal of wastewater, either by on site treatment methods and/or by disposal off the Site.

Wastewater shall not be discharged to the local environment at any time during the Contract.

PD1.14 Maintaining and Cleaning of The Site

The Contractor shall maintain the Site in a clean, tidy and orderly condition to the approval of the Engineer.

The Contractor shall make good any damage resulting from the Contractor's activities on Site.

PD1.15 Sanitary Conditions

The Contractor shall ensure that sanitary conditions prevail throughout the Site and that all workers are aware of and comply with this requirement.

Unhygienic habits and any behaviour that may cause contamination of any part of the Works or the surrounding areas are strictly prohibited.

PD1.16 Adjacent Properties, Existing Structures and Services

The Contractor shall not cause damage to the existing fences and structures and shall not trespass or encroach on to any adjacent property.

Care shall be taken by the Contractor to avoid dust.

The Contractor shall take steps to protect the existing services on and in the vicinity of the Site against damage which may arise as a result of operations on Site. The Contractor shall bear the cost of the repair of damage as a result of the Contractor's operations on Site.

PD1.17 Dealing with Water

The Contractor shall deal with water on the Site so that the Works are kept sufficiently dry for their proper execution. The Contractor shall:

- a) Prevent flooding of the Works and by the Works.
- b) Keep all completed Works properly drained.
- c) Not inhibit surface drainage.
- d) Manage and dispose of water; which shall include for by-pass arrangements, temporary pumping equipment, etc, and for dealing with all possible flows whether or not the existing flow path is being interfered with during construction.

PD1.18 Safeguarding of Excavations

Where excavations are required, these shall be safeguarded in accordance with the relevant safety specifications.

PD1.19 Existing Services

There are existing services and Contractor shall locate all services before any work commences.

PD1.20 Facilities for the Engineer

Not used.

PD2 APPROVALS AND INSPECTIONS

PD2.1 Approvals before Manufacturing and Inspections (Not Applicable)

All drawings which are to be submitted in terms of the Contract shall be approved in principle by the Engineer before any manufacturing or inspection of manufactured or supplied items

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commences. Refer to Clause 5 of the FIDIC Conditions of Contract for further information in this regard.

PD2..2 Quality Control Plans

Quality Control Plans (QCP's) of all manufactured items shall be submitted to the Engineer for approval prior to the start of any manufacturing. The Engineer shall review these QCP's and identify any hold points which he deems necessary for the specific item of equipment. The necessary hold points identified by the Engineer shall be taken into consideration and failure to adhere to any hold points shall constitute a failure of approval and any costs incurred in this regard shall be borne by the Contractor.

PD2..3 Inspections (Not Applicable)

Inspections will be done in accordance with sub-clause 7.4 of the Conditions of Contract. The Contractor shall arrange timeously with the Engineer for any inspections, at least 5 working days in advance. The inspections carried out by the Engineer shall not absolve the Contractor from his responsibilities with regards to the correctness of any of the Works.

PD3 PROCUREMENT

PD3.1 Preferential procurement procedures

PD3.1.1 Requirements

All requirements for preferential procurement shall be as specified in Section T2.2 of this document.

PD3.2 Subcontracting

PD3.2.1 Scope of voluntary subcontract works

The Contractor may subcontract portions of the Works included in the Contract. Clause 4.4 of the Conditions of Contract makes provision for subcontracting.

Subcontract work provides opportunities for small or specialist businesses and can also be used to secure contract participation goal credits for HDI participation or other specific goals, where applicable. In the interests of all parties, the Contractor shall enter into a written subcontract agreement with each Subcontractor.

Where participation credits are claimed by the Contractor in respect of subcontractors, suppliers, manufacturers and/or service providers, the Contractor shall provide evidence that the sub-contractors, suppliers, manufacturers and/or service providers are based locally.

Notwithstanding the above, contract participation goal credits may not be claimed for work undertaken in respect of provisional sums and prime cost items.

PD3.2.2 Subcontracting procedures

All proposed subcontractors should be noted in Section T2.2 and will be approved by the Employer prior to the award of the contract.

PD3.2.3 Provisional Sums

Where Provisional Sums have been included in the Bill of Quantities and the work is to be done by a sub-contractor, the procedure to be followed is:

- Where monetary allowances for provisional sums or prime costs items have been allowed and the monetary allowance is less than R300 000, the Contractor shall invite three quotations from suitably qualified subcontractors, etc. for the required scope of works. The selection of the Subcontractors, etc. shall be approved by the Engineer.
- Where monetary allowances for provisional sums or prime cost items have been allowed and the monetary allowance is greater than R300 000, an open tender process will have to be followed in respect of a subcontractor for this work, unless otherwise advised and approved by the Employer. In such cases the tender will be issued by the Engineer on behalf of the Contractor.

The quotes shall include full technical descriptions as well as a breakdown of prices, which shall be submitted to the Engineer for approval.

PD4 MANAGEMENT

PD4.1 Programming and Planning

The Construction Programme to be submitted to the Engineer, within 2 days from the commencement date, by the Contractor and shall meet the following requirements:

- (a) Be in the form of a bar chart.
- (b) Clearly indicate the start and end dates and duration of all construction activities and identify the critical path.
- (c) Take full cognisance of all the Contractor's risks and obligations in terms of the Contract.
- (d) Indicate key dates in respect of work to be carried out by others.
- (e) Indicate key dates in respect of information to be provided by the Engineer and/or others.

The said Programme and all revisions thereto shall also be provided to the Engineers in electronic digital format using the MS PROJECT software.

The programme shall be updated weekly during the contract period. In addition to the above, a weekly cash flow forecast shall also be submitted to the Engineer.

The following key dates shall apply:

- (a) It is anticipated that the Contract will be awarded within 6 weeks of the tender closing date.

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- (b) It is anticipated that the instruction for Commencement of the Works will be within 1 day of the Commencement date as per Clause 8.1 of the General Conditions of Contract.
- (c) The Contractor shall complete the entire Works within the period stated in C1.2: Contract Data
- (d) The date for completion of the whole of the works excluding the Trial Operation Period is to be indicated by the Contractor.

PD4.1.1 General Allowances

When drawing up his programme, the Contractor shall, take into consideration and make allowance for, inter alia:

- a) expected weather conditions and their effects,
- b) known physical conditions or artificial obstructions,
- c) searching for, dealing with and carrying out alterations to the existing services,
- d) the accommodation of public access and traffic,
- e) the provision and implementation of the health and safety plan in terms of the Construction Regulations, 2014 of the Occupational Health and Safety Act, and

PD4.1.2 Extension of time resulting from abnormal rainfall (See also C1.2 Contract Data 8.4)

Extension of time will only be considered for rainfall or saturated conditions that will influence the quality of work and will be calculated in accordance with the following method:

- a) The Contractor shall, in his programme, allow for the anticipated number of working days on which work could be delayed - as given in the Schedule below.
- b) Extension of time will be calculated for each calendar month or part thereof over the full period for the completion of the Work, plus any approved extension thereof, as follows:
 - i) A delay caused by abnormal rainfall will only be accepted for extension of time if, in the opinion of the Engineer, it delays an item or items which lie on the critical path determined by the Contractor's programme. Only delays on working days will be considered.
 - ii) Abnormal rainfall will be considered to be days, as approved, on which rain delayed operations, less the anticipated number of days given in the Schedule below.
 - iii) The net extension of time determined for each month, which may be negative, shall accumulate algebraically to determine the net number days for extension of time due to abnormal rainfall, but a negative total at the end of the construction period will not be taken into account.
 - iv) Where a portion of a month is involved, a pro rata number of days shall be calculated.

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SCHEDULE

Anticipated number of working days on which work could be delayed as a result of rainfall and saturated conditions.

Month	Days	Month	Days
January	2	July	2
February	2	August	2
March	2	September	2
April	2	October	3
May	1	November	4
June	2	December	2

PD4.1.3 Review of progress

The Contractor shall review his progress each month and should progress lag behind the latest accepted programme, by more than 2 weeks, he shall submit a revised programme and method statement of how he proposes to make up the lost time. If, in the opinion of the Engineer, such revised programme will not make up the lost time, the Engineer shall have the right to request the Contractor to reorganize his work in a manner which will ensure an acceptable programme. Claims for additional payment to meet any costs incurred due to such re-organization will not be accepted.

PD4.2 Contractor's Responsibility In Terms Of The OHS ACT

The Contractor shall be responsible for complying with the Occupational Health and Safety Act, Act 85 of 1993, and specifically the Construction Regulations.

The Contractor is referred to Part T1.2 Tender Data and the Health and Safety Specification (see PD4.6) in this regard.

PD4.3 Works Not To Interfere

The Contractor is to take cognizance of the fact that the proposed site for the Works is the Akkerkloof Raw Water Pump Station and shall ensure that the Works do not affect operations of the aforementioned facilities.

PD4.4 Unauthorised Persons

The Contractor shall keep unauthorized persons from the Works at all times.

PD4.5 Electronic Payments

The Contractor shall provide his banking details to enable electronic payments to be made.

PD4.6 Health And Safety

PD4.6.1 Health and safety requirements and procedures

- a) In terms of the provisions of Section 37(2) of the Occupational Health and Safety Amendment Act, 1993 (Act 85 of 1993), hereinafter referred to as the Act, the following arrangements and procedures shall apply between the

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Contractor and the Employer to ensure compliance by the Contractor with the provisions of the Act:

- (i) The Contractor undertakes to acquaint the appropriate officials and employees of the Contractor with all relevant provisions of the Act and the Regulations promulgated in terms of the Act.
- (ii) The Contractor undertakes that all relevant duties, obligations and prohibitions imposed in terms of the Act and Regulations on the Contractor will be fully complied with.
- (iii) The Contractor accepts sole liability for such due compliance with the relevant duties, obligations and prohibitions imposed by the Act and Regulations and expressly absolves the Employer from himself being obliged to comply with any of the aforesaid duties, obligations and prohibitions, with the exception of such duties, obligations and prohibitions expressly assigned to the Employer in terms of the Act and its associated Regulations.
- (iv) The Contractor agrees that any duly authorised officials of the Employer shall be entitled, although not obliged, to take such steps as may be necessary to monitor that the Contractor has conformed to his undertakings as described in paragraphs (i) and (ii) above, which steps may include, but will not be limited to, the right to inspect any appropriate site or premises occupied by the Contractor, or any appropriate records or safety plans held by the Contractor.
- (v) The Contractor shall be obliged to report forthwith to the Employer and Engineer any investigation, complaint or criminal charge which may arise as a consequence of the provisions of the Act and Regulations, pursuant to work performed in terms of this Contract, and shall, on written demand, provide full details in writing, to the Employer and Engineer, of such investigation, complaint or criminal charge.
- (vi) The Contractor shall furthermore, in compliance with Constructional Regulations 2014 acquaint himself with the requirements of the Employer's health and safety specification as laid down in regulation and prepare a suitably and sufficiently documented health and safety

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plan for approval by the Employer or his assigned agent. The Contractor's health and safety plan and risk assessment shall be submitted for approval, to the Employer or his agent, within 14 days of the Commencement Date and shall be implemented and maintained from the commencement of the Works.

The Contractor shall at all times be responsible for full compliance with the approved plan as well as with the Construction Regulations and no extension of time will be considered for delays due to non-compliance with the abovementioned plan or regulations.

- (vii) The Employer, or his assigned agent, reserves the right to conduct periodic audits, as contemplated in the Construction Regulations 2014, to monitor that the Contractor is compliant in respect of his obligations. Failure by the Contractor to comply with the requirements of these Regulations shall entitle the Engineer, at the request of the Employer or his agent, to suspend all or any part of the Works, with no recourse whatsoever by the Contractor for any damages incurred as a result of such suspension, until such time that the Employer or his agents are satisfied that the issues in which the Contractor has been in default have been rectified.
- (viii) The proposed type of work, materials to be used and potential hazards likely to be encountered on this Contract are detailed in the PD4 and PD5: Construction, the Bill of Quantities, the Drawings, and in the Employers' health and safety specification, which is contained in the Particular Specifications.

Payment items are included in the Bill of Quantities to cover the Contractor's cost for compliance with the OHS Act and the abovementioned regulations.

PD4.6.2 Health and Safety Plan

Without limiting his obligations and liabilities in terms of the Construction Regulations, 2014 of the OHS Act, the Contractor, in his Health and Safety Plan to be submitted in terms of the Contract Data, shall inter alia deal with the safety provisions he will set up in respect of the aspects specified in the Specifications and given in the Construction Health and Safety Plan included in the Annexures.

The Health and Safety Plan shall be neatly set out in a lever-arch type file, with labelled dividers for each section.

A copy of the approved Health and Safety Plan shall be kept on Site and made available upon request.

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The Contractor shall, on receipt of notification of award of the Contract, submit a Health and Safety Plan tailored for the execution of the work under the Contract. The Contractor's Health and Safety Plan shall be submitted to the Employer for acceptance. The Contractor shall not receive possession of the Site before the Employer has approved the Health and Safety Plan in writing. Time lost as a result of the Contractor's failure to submit the safety plan timeously, shall not be used as a reason to claim for extension of time or standing time and related costs. The Health and Safety Plan shall at least cover the following:

- e) a proper risk assessment of the Works, risk items, work methods and procedures in terms of Regulations 9 to 30 of the Construction Regulations.
- f) identification of potential hazards and unsafe working conditions as described in the Client Baseline Risk Assessment drawn by the Client's Occupational Health and Safety Agent. See Annexures.
- g) provision of a safe working environment and equipment.
- h) statements of methods to ensure the health and safety of Sub-Contractors, employees and visitors to the site, including safety training in hazards and risk areas (Regulation 7).
- i) monitoring health and safety on the site of works on a regular basis and keeping of records and registers as provided for in the Construction Regulations.
- j) details of the key personnel to be appointed for the work on Site in terms of Regulation 8 and other applicable regulations.
- k) details of methods to ensure that the Health and Safety Plan will be carried out effectively in accordance with the Construction Regulations.

NOTE:

Cost of complying with OHS Act and Regulations

The Contractor's tender shall be deemed to include all costs for conforming to the requirements of the Act, the Regulations and the Employer's Health and Safety Specification as applicable to this Contract as given in the Annexures.

Should the Contractor fail to comply with the provisions of the Regulations, the Contractor will be liable for penalties as provided in the Regulations and in the Employer's Health and Safety Specification.

PD4.6.3 Protection of the public and Employer's staff

The Contractor shall at all times ensure that his operations do not endanger any member of the public, or the Employer's staff.

Open excavations and other hazardous conditions on site shall be barricaded and precautions shall be taken to protect the public from the same in terms of the OHS Act.

As the Works are adjacent to a running river, the Contractor shall take special precautions to prevent access to any danger areas on the Works, e.g. by temporary barricades, notices and/or fencing.

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The Contractor shall direct, control, facilitate and safeguard all pedestrian traffic during construction of the Works, provide all notices, and arrange for watching and lighting in accordance with the requirements of the relevant authorities.

PD4.6.4 Health and safety specialist

The contractor shall employ a health and safety specialist, with suitable and proven qualifications, either on full-time or part-time basis, for the duration of the Contract. This specialist shall assist with the preparation of the health and safety plan, shall provide on-going training for all construction staff (at least 1 hour per week whilst work on site is in progress, in the form of weekly tool-box talks), and shall assist with the upkeep of the health and safety plan and associated regular inspections etc.

The requirement for a weekly presence on Site necessitates that the Health and Safety Specialist be based locally, at least for the period while the Contractor is working on Site (i.e. during delivery, installation, testing and commissioning).

PD4.6.5 Weekly Health and Safety reports

The health and safety specialist required in terms of PD4.6.4 shall submit a report to the Engineer at the monthly site meetings, detailing the state of health and safety on the site over the last month, new risk assessments added, potential new risks, new precautions taken, and summarising the results of various inspections required in terms of the health and safety plan, etc. If this report is not submitted at each monthly site meeting, the Engineer shall impose a fine of R5000.00 on the Contractor, in each instance.

PD4.7 Environmental Management

The Contractor will be responsible for managing his activities so that damage to the environment is minimised, as per the specifications contained within Particular Specification PSEM.

PD4.7.1 Neatness of the site

The general neatness and tidiness of the area of the Akkerkloof Raw Water Pump Station is of particular concern. The Contractor shall, therefore, on a day-to-day basis, keep the area of the Works in a condition acceptable to the Engineer.

PD4.7.2 Accommodation of traffic on public roads occupied by the contractor

The Contractor will initiate such process as to make the road safe for official use.

PD4.7.3 Other contractors on site

Other Contractors may make use of the site other than this contract.

PD4.8 Subcontractors

The Contractor is responsible for work carried out on his behalf by subcontractors. The Engineer will not liaise directly with such subcontractors, and all problems relating to payments, programming, workmanship, etc, shall be the concern of the Contractor and the subcontractor, and the Engineer will not be involved.

PD5 CONSTRUCTION

PD5.1 Applicable Standardised Specifications

For the purpose of this Contract the following relevant Standard Specifications not bound into this document shall apply:

- SANS standards
- BS standards
- ISO standards

It shall be the responsibility of the Contractor to obtain, at his own expense, the most recent copies of the relevant editions of the documents referred to above.

PD5.2 Site-Related Items

PD5.2.1 Services and Facilities

A specific area in close proximity to or on the Site of the Works will be made available by the Employer to the Contractor for the Contractor's site establishment. The specific area for the Contractor's site establishment will be identified to the Contractor by the Engineer and the Contractor shall have sole use of such area, free of charge, for the duration of the Contract. The Contractor shall use this area only for the purposes of erecting his site offices, workshops, stores and other facilities required for the execution of the Contract. The Contractor shall not use the area nor allow it to be used for any purposes not directly associated with the execution of the Contract. No housing shall be allowed on the Site.

The Contractor shall be responsible for arranging, at his own cost, for the provision of all services he may require in the area, as well as elsewhere on the Site. These services shall include, but not be limited to, water, electricity, sanitation and security.

Should the Contractor deem the area made available by the Employer to be inadequate or unsuitable for the Contractor's particular needs, then the Contractor shall be at liberty to make his own arrangements with the owners of other sites which he considers are better suited to his needs; provided always that the use by the Contractor of any area other than that made available to him by the Employer shall be subject to the prior written approval of the Engineer, which approval shall not be unreasonably withheld; and provided further that the Contractor shall have no claim against the Employer in respect of any costs incurred by him, either directly or indirectly in consequence of utilising any area other than that made available to him by the Employer, and which costs exceed those costs allowed for by the Contractor in his Tender.

PD5.2.2 Permits and wayleaves

The Contractor shall be responsible to obtain all wayleaves required under the Contract.

PD5.2.3 Features requiring special attention

(a) Site maintenance

During progress of the work and upon completion thereof, the Site of the Works shall be kept and left in a clean and orderly condition. The Contractor shall store materials and equipment for which he is responsible in an orderly manner, and shall keep the Site free from debris and obstructions.

(b) Employment of local labour

It is the intention that this Contract should make maximum use of the local labour force that is presently under-employed. To this end the Contractor shall limit the utilisation on the Contract of non-local employees to that of key personnel only and to employ and train local labour to the extent necessary for the execution and completion of this Contract.

(c) Subcontractors

All matters pertaining to subcontractors (including Nominated Subcontractors) and the work executed by them shall be dealt with directly between the Engineer and the Contractor in the context of all subcontract work being an integral part of the Works for which the Contractor is responsible.

The Engineer will not liaise directly with any subcontractors nor will he issue instructions concerning the subcontract works directly to any subcontractor.

All matters arising from the subcontract agreements shall be dealt with directly between the Contractor and the subcontractors and the Engineer will not become involved

PD5.2.4 Site Usage

Access to site shall be limited to the Contractor and his personnel. The Contractor shall be responsible to control unauthorized entry to the site and shall inform the Engineer of any breach of such rules. The site shall be managed and used for its intended purpose.

PD5.2.5 Other Contractors

Other contractors may be engaged by the Employer and will be present on site during the period of the contract.

The Contractor shall arrange or adjust as necessary, the sequence of its work so as not to delay the programmes of the existing and new contractors. The programmes of the existing contractors are available at the offices of the Engineer for perusal.

PD5.2.6 Technical Meetings

Weekly technical meetings shall be held on an ad-hoc basis as required either by the Engineer or the Contractor.

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The Contractor shall arrange for the Contractor's Representative as well as the Designer and Director to be present at these meetings as and when required.

The Engineer will make notes of the decisions taken and distribute these to the Contractor's Representative within two days after the meeting.

PD5.2.7 Site Meetings

Site meetings shall be held weekly. The Contractor shall arrange for the Contractor's Representative to be present at these meetings.

The Engineer will take minutes of these meetings and distribute these to all relevant parties at least one day prior to the next site meeting.

PD5.2.8 Flooding and Surface Water

The Site is adjacent to a natural water course. The Contractor shall be responsible to ensure that equipment and material is stored above flood level and adequately insured in case of loss of damage due to flooding. Site and access road is on an incline and Contractor shall ensure that all precautionary measures have been taken to prevent accidents and incidents due to slippery or slope related conditions.

PD6 OPERATION OF SYSTEM

PD6.1 CONTROL PHILOSOPHY

When the Balancing Dam level reaches 70% (Adjustable) the duty Pumpset must start and switch off when the Balancing Dam level reaches 60%. (Adjustable) There are two pumpsets. One Duty and one Standby. The pumps can also be switched on/ and off remotely by telemetry.

PD6.2 SEQUENCE AND MODE OF OPERATION

The Akkerkloof Pumpstation can operate in two modes namely Automatic Mode and Manual Mode.

Automatic Mode : Duty pumps switches on when Balancing Dam level reaches 70% (Adjustable) and switches off when Balancing Dam level drops to 60% (Adjustable). Duty pump and stand-by pump switches at each cycle.

Manual Mode : The Duty pump can be started or stopped remotely by means of the telemetry.

PD7 MANAGEMENT

PD7.1 MEETINGS

The Contractor shall attend the following meetings during the Contract:

- a) An inaugural Site Meeting on Site or as called by the Engineer.

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- b) Weekly Site Meetings, on Site or as called by the Engineer, from the order to commence the Works until the issue of the Taking-Over Certificate.
- c) Ad hoc technical meetings called by the Engineer – at a venue in Knysna.,
- d) Site meetings during the Defects Notification Period called by the Engineer.

PD7.2 PLANNING, PROGRAMMING AND REPORTING

PD7.2.1 General

Planning and programming of the works is addressed in the Contract Data. The Contractor shall maintain an updated programme and shall submit this to the Engineer whenever changes are required.

PD7.2.2 Programming Restrictions

The Contractor shall take into account and allow for being on Site whilst operations are on-going.

The Contractor shall liaise with the Employer's staff on Site to ensure safe working conditions and to programme work to minimise disruption of any nature. Disagreements shall be referred to the Engineer for decision.

PD7.2.3 Progress Reporting

The Contractor shall submit a written progress report to the Engineer before each site meeting.

PD7.2.4 Document format

Programmes shall be submitted in Microsoft Project format in hardcopy and softcopy.

PD7.2.5 Corrosion Protection

The Contractor shall provide adequate internal supervision to ensure that the requirements of the corrosion protection specifications are adhered to.

In addition, during any of the corrosion protection activities specified, there shall be a senior supervisor available to accept instructions from the Engineer (or an Engineer's Representative, e.g. an appointed inspection authority). Such a person must maintain qualifications of a supervisor/technician with reasonable experience.

PD7.3 SEQUENCE OF THE WORKS

Not used.

PD7.4 RIGHT OF ACCESS TO SITE

The right of access to Site is specified in the FIDIC General Conditions and the Particular Conditions.

PD7.5 COOPERATION WITH THE EMPLOYER

The Contractor shall ensure that:

- a) The Contractor's site staff cooperate with the Employer's staff.
- b) The Employer's rules and requirements for operations are adhered to.
- c) Site staff are familiar with and comply with the Employer's emergency procedures.
- d) Activities of the Site staff do not adversely affect the health and safety of the Employer's staff once the Works is put into operation.

PD7.6 METHODS AND PROCEDURES

PD7.6.1 Programming Restrictions

The Contractor shall prepare a quality management plan to be followed during the Contract.

The quality management plan shall:

- a) clearly indicate the methods, programmes, procedures and other methods that the Contractor intends using to ensure compliance of materials and workmanship with the requirements of the Contract.
- b) include calibration certification of measuring equipment to be used.

PD7.6.2 Quality Assurance System

The Contractor shall institute a quality assurance and shall provide experienced personnel as well as all the necessary transport, instruments and equipment, to ensure adequate supervision and positive control of the works at all times.

In addition, during any of the corrosion protection activities specified, there shall be a senior supervisor on Site to accept instructions from the Engineer (or an Engineer's representative; e.g. an appointed inspection authority).

PD7.7 MONTHLY LABOUR RETURNS

Monthly labour returns of all casual labourers, if used, shall be submitted with the monthly measurement certificates.

PD8 PROCUREMENT

PD8.1 Preferential Procurement Procedures

The Contractor shall comply with the Employer's preferential procurement requirements as stated and with the Employer's Preferential Procurement Policy / Supply Chain

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Management System as stated in document. The Employer reserves a right to alter tender conditions where deemed necessary to ensure a quick turnaround time of project completion. The employer may also deviate from the normal procurement processes to obtain a quick turnaround time for implementation of the project.

PD9 ENGINEERING : DESIGN OF THE WORKS

PD9.1 GENERAL

This clause is additional to Clause 5 of the FIDIC General Conditions. Where conflict exists, the General Conditions take precedence.

PD9.2 DESIGN RESPONSIBILITIES

The design responsibilities are as follows:

Design Process	Responsibility
Concept	Employer responsible
Engineering and layout to tender stage	Employer responsible
Detailed design of the Works, including control system.	Contractor responsible for designing the Works in accordance with the Employer's requirements, including the tender drawings.

The Works shall be designed to function safely and effectively in conjunction with the infrastructure provided by others for this project. Where components of the Works are incorporated into structures provided by others, these components shall be designed accordingly.

PD9.3 DRAWINGS PREPARED BY THE EMPLOYER

The Contractor's design shall be based on the tender drawings, the existing structures and any existing equipment installations and the Contractor shall ensure that the design can be satisfactorily accommodated.

The Contractor shall accommodate actual dimensions and details measured on Site. Any inconsistencies, including any conflict between the Engineer's drawings and the actual dimensions measured on site, shall immediately be drawn to the attention of the Engineer, in writing.

D10 ENGINEERING : CONTRACT’S DOCUMENTS

PD10.1 INTRODUCTION

Clause 5 of the FIDIC General Conditions requires the Contractor to submit the Contractor’s Documents to the Engineer for review.

In accordance with the requirements of the General Conditions, the Contractor shall also provide further documents that may be required by the Engineer.

PD10.2 CONTRACTOR'S NOTICE

In accordance with FIDIC General Condition 5.2, each submission of Contractor's Documents shall include a Contractor's Notice stating that they are ready for the Engineer's review.

In accordance with FIDIC General Condition 4.9, the Contractor shall sign each drawing submitted in order to indicate approval of it.

The Contractor's Notice shall include a register of all current Contractor's documents.

PD10.3 REQUIREMENT FOR G.A DRAWINGS & EQUIPMENT

General arrangement drawings and equipment drawings submitted shall comply with the following:

- Drawings shall be prepared in accordance with the latest issue of SANS 10111 or an equivalent standard.
- Designs shall be represented by two dimensional drawings in first or third angle orthogonal projection.
- General Arrangement drawings shall be to A1 size or larger and shall incorporate the following:
 - one plan view and two elevation views. Sectional views shall also be provided where this is necessary for clarity.
 - item list which includes the equipment make, model, rating, duty, material of construction and quantity.
 - pipework and pipe supports.
 - layout dimensions.
 - a descriptive drawing title.
- Drawings shall be to scale, with both the scale and the drawing being large enough to clearly show all relevant components of the plant and equipment.
- Requirements for civil and building details to be provided by others shall be specifically noted.
- Three hard copies and an electronic copy of all drawings shall be provided.

PD10.4 CONTRACTOR'S DOCUMENTS TO BE SUBMITTED

PD10.4.1 Introduction

The Contractor's Documents to be submitted are listed in the sub-clauses below.

PD10.4.2 General Arrangement Drawings (Not Applicable)

- General Arrangement Drawings of the proposed designs.

PD10.4.3 Operation and Control (Not Applicable)

- A written description of the control system. This shall include at least as much detail as appears in the specification.
- MFD or PFD (mechanical flow diagram or process flow diagram).
- Motor and instrumentation list.
- Functional Design Specification with contents as per *electrical specifications*.
- Control panel layouts.
- P&ID (Piping and instrumentation diagram).

PD10.4.4 Equipment

- Equipment list; including every item of electronic, electrical and mechanical equipment (e.g. pump, motor, switchgear, cabling, PLC, HMI, flow meter) to be provided on the Contract shall be listed. The equipment make, model, duty, application and quantity shall be listed.
- Equipment certified drawings.
- Data sheets (brochures, manufacturer's pamphlets, catalogues) for equipment giving performance, sizing, physical and general technical data for all equipment.
- All equipment design and sizing calculations.
- All equipment inspection and testing reports.
- All equipment design drawings.

PD10.4.5 Corrosion Protection

- Technical data sheets for all coatings proposed.
- Blast material.
- Pickling and passivating products.

PD10.4.6 LV Installation

- Cable route layout and cable support systems drawings.
- Design and drawings.
- Junction box location drawings.

PD10.4.7 LV Switchgear and Control Gear Assemblies

- Switchboard Design (Wiring Schematics, Cubicle component Layouts, Door Layouts, Bus bar arrangement), General Arrangement Drawings, room requirement drawings
- Local control panels location drawings
- Type Test Certificates (as applicable)
- In-house FAT Test Report

PD10.4.8 Electronic Variable Speed Driven Motors (Not Applicable)

- Confirmation that the motors comply with the requirements as stated in SANS 60034-25 for the application.
- Motor manufacturer's written confirmation that the motor is suitable for drive by the VFC make and model to be provided, including confirmation that the motor's voltage withstand capability is sufficient for the voltage stresses at the motor terminals.
- Guaranteed VFC harmonic performance including sample output wave forms with harmonic distortion levels at 40, 45 and 50 Hz for the VFC for the load.
- Guaranteed VFC dip ride through capability curve.
- Copy of VFC type test certificate (this is required if type tests have been carried out on the model).

PD10.4.9 PLC, SCADA and Telemetry System (Not Applicable)

- PLC and SCADA design documentation.
- PLC Design (Control architecture, Wiring Schematics, Panel internal arrangement Layouts, Component List) and data sheets.
- In-house hardware and software FAT Test Report.
- UPS and PSU design calculations, data sheets and drawings.
- Telemetry radio / path design, control network drawing, panel drawing and design.
- Control room and server room layout.

PD10.4.10 Instrumentation (Not Applicable)

- Instrumentation list with the make, model, range, set points and units of all proposed items.
- Design, data sheets and drawings.

- Hook-up & Loop Drawings.
- Instrument location and instrument junction box location drawings.
- Mounting bracket drawings and details.

PD10.4.11 Operation and Maintenance Manual (Clause 5.7 FIDIC General Conditions) (Not Applicable)

- Contents List for Manual.
- Two draft copies of the Operation and Maintenance Manual shall be submitted. The Contractor shall correct and re-submit the Manual until it is accepted by the Engineer.
- Six copies of the accepted Operation and Maintenance Manual in accordance with ZUT 0002.

PD10.4.12 Training (Not Applicable)

- Training Schedule.
- Operator Training Manual (this may be identical to the operator's Training Manual specified in ZUT 0002).

PD10.4.13 HAZOP (Not Applicable)

- Not used.

PD10.4.14 General Items (Not Applicable)

- Design drawings of lifting equipment which indicate the loads exerted by lifting equipment on structures as well as the vertical and horizontal limits of the crane hook bowl.
- Marked up drawings of the building and civil structures which indicate the dimensions of the Contractor's requirements for items such as plinths, pockets, trenches, ducts, penetrations, conduits, etc. as well as any loads and forces involved.
- Equipment plinth design drawings and calculations if required.
- Signage design.

PD10.4.15 Administrative

- Quality Assurance Plans for the Works.

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- Quality Control Procedures (QCPs) for all items to be fabricated and coated, showing hold points for inspection by the Engineer.
- Contractor's Health and Safety Plan.
- Commissioning plan/schedule.

PD10.4.16 Tests on Completion

- Report containing the records of commissioning tests undertaken and the results of these, demonstrating that the Works have passed the commissioning tests. If applicable, the report shall include the SCADA system commissioning procedure and schedule of alarm messages.
- Training logs and weekly reports detailing the plant performance, problems and equipment failures during the Trial Operation Period.
- At the end of the Trial Operation Period, an overall report.

C3.2: MECHANICAL SPECIFICATIONS
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PSM 1 SCOPE

PSM 1.1 GENERAL

PSM 1.2 WORK INCLUDED IN THIS CONTRACT

PSM 1.3 CIVIL WORK

PSM 1.4 DESIGN PRINCIPLES TO BE COMPLIED WITH

PSM 1.4.1 GENERAL

PSM 1.4.2 SAFETY - OHS ACT (SEE ALSO PD4.6.2)

PSM 1.4.3 SAFETY - GENERAL

PSM 1.4.4 DESIGN PRINCIPLES

PSM 1.4.5 FAIL SAFE OPERATION AND PROTECTIONS

PSM 1.4.6 MOVING PARTS

PSM 1.4.7 ARRANGEMENT AND MOUNTING

PSM 1.4.8 PREVENTION OF CORROSION

PSM 1.5 CONTROL

PSM 1.5.1 GENERAL

PSM 1.5.2 EQUIPMENT

PSM 2 GENERAL MECHANICAL REQUIREMENTS (ZUT 0001)

PSM 2.1 SPECIFICATIONS

PSM 2.2 AMENDMENTS, ADDITIONS AND DETAILED REQUIREMENTS

PSM 3 GENERAL CORROSION PROTECTION FOR PIPELINES, WATER AND
WASTEWATER (SPE-JJ- 0003)

PSM 3.1 SPECIFICATION

PSM 3.2.1 REQUIREMENTS (CLAUSE 4)

PSM 3.2.2 INSPECTION OF EQUIPMENT (CLAUSE 6.5) (NOT APPLICABLE)

PSM 1 SCOPE

This clause specifies the Works for this Contract.

PSM 1.1 GENERAL

The Akkerkloof Dam Pumpstation is an existing, pump station that pumps raw water from the Balancing Dam to the Akkerkloof Dam.

The PumpStation can deliver 45 l/s of water to the Akkerkloof Dam.

PSM 1.2 WORK INCLUDED IN THIS CONTRACT (See Also PD1.2)

See PD 1.2.

PSM 1.3 CIVIL WORK

All civil related work unless otherwise specified in this document will also form part of the scope of the appointed Contractor.

PSM 1.4 DESIGN PRINCIPLES TO BE COMPLIED WITH

PSM 1.4.1 General

FIDIC General Condition 5 states that the Contractor shall be responsible for the design of the Works and that the design shall be prepared by engineers or other professionals.

PSM 1.4.2 Safety - OHS Act (See Also PD4.6.2)

In addition to safety requirements during the construction of the Works on Site, the Contractor is responsible for ensuring that all of the equipment supplied and the complete installation comply with the Occupational Health and Safety Act, Act 85 of 1993 and the regulations promulgated thereunder.

Installations which do not comply shall be corrected by the Contractor at no cost to Employer.

PSM 1.4.3 Safety - General

Safety shall be an all-important and overriding consideration and proper attention shall be paid to this aspect at the design stage. Installations which do not comply with the OHS Act shall be corrected by the Contractor at no cost to the Employer.

Equipment which is potentially dangerous shall be designed in accordance with a relevant South African or international Standard.

Hazards must be avoided or guarded to the satisfaction of the Engineer. Nip points shall be guarded. Sharp corners shall be rounded off. Items such as operating handles, supports and protrusions shall be kept clear of access ways or marked accordingly.

The Contractor shall be responsible for covering all unsafe gaps and openings left in structures after installation.

Each motor driven device shall be provided with an emergency stop station in an appropriate position.

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Trip wires shall be provided along the accessible side/s of moving conveyor belts, chains, etc. irrespective of operating speed and in addition to any guards provided. These shall stop the driving motor when pulled.

PSM 1.4.4 Design Principles (Where Applicable)

Mechanical engineering design shall ensure safety, robust construction, reliability, durability, prevention of avoidable corrosion, neatness as well as ease of maintenance and operation.

Design shall, as applicable, be based on:

- (a) the full range of duties which can be reasonably anticipated;
- (b) the maximum pressure or vacuum which can be produced by pumps, blowers and compressors under all conditions including blocked or closed inlet and outlet circuits;
- (c) conservative service and safety factors based on approved standards or laid down in the printed specifications of reputable and approved manufacturers;
- (d) Twenty four hour per day operation (unless specified otherwise).
- (e) a minimum life of 100 000 hours for large items of equipment before repair or major part replacement;
- (f) Prevention of serious damage from normal operational problems such as blockages, blinding, jamming, malfunction and, as far as is practical,
- (g) mal-operation (assuming that these occurrences cannot be avoided by good design).
- (h) the power and torque transmitted by the driver system under full load and stalled conditions;
- (i) machines with non-overloading characteristics shall be selected wherever possible; e.g.: motors shall be sized so that they cannot be overloaded by the driven machine:

PSM 1.4.5 Fail Safe Operation and Protections (Where Applicable)

Where damage can occur from normal operational or other foreseeable problems, plant, equipment and systems must be designed to be fail safe; i.e. must have built in redundant elements, or be fail-to-safe; i.e. must return to a safe condition where no further damage can be done in the event of a failure, malfunction, mal-operation, overload and, as far as practical, misuse. All reasonable and economically justifiable protections to prevent or limit damage to plant and equipment, particularly in high- risk situations, must be incorporated.

Protections shall:

- (a) be directed at the source of the problem, limit forces to safe levels and act quickly enough to prevent damage (electrical thermal type overloads are inadequate);
- (b) stop or prevent from starting all equipment at risk;
- (c) activate an alarm with a labelled indicator on the control panel whenever a

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protection operates;

- (d) operate reliably after long inactive periods exposed to corrosive and dirty conditions.

Contractors shall highlight equipment limitations which can be exceeded during operation and cannot be guarded against.

PSM 1.4.6 Moving Parts (Where Applicable)

The following general requirements apply not only to machines but to all equipment with moving parts such as headstocks, extension spindles, swivelling davits, heavy duty hinges, pivots and the like:

- (a) All rotating or swivelling shafts, pins and the like, shall be adequately supported, guided and restrained by lubricated or self-lubricating bearings, collars and/or bushes.
- (b) Swivelling joints on linkages and the like shall be of the "universal" or fork and rod type with bearings or bushes fitted to the eyes or forks.
- (c) Abrasion resistant materials and slow speed operation shall be used for abrasive applications. The river water shall be regarded as abrasive.
- (d) All applications associated with raw water shall be regarded as corrosive and materials of construction shall be selected to suit.
- (e) Susceptibility to fatigue failure shall be minimised by proper design and manufacturing procedures. Sharp changes in section and welding shall be avoided in components subject to fluctuating stress.
- (f) The locking of nuts and pins in position shall be done to the approval of the Engineer.
- (g) Wearing parts shall be designed for ease of removal and replacement.

PSM 1.4.7 Arrangement and Mounting (Where Applicable)

The arrangement and general design shall take the following requirements into consideration:

- (a) Lifting eyes, lugs, hooks, etc., shall be provided on heavy or large items to facilitate handling.
- (b) Castings or fabrications shall have machined pads for seating and be mounted on either soleplates or baseplates as appropriate.
- (c) Where accurate alignment is required, positioning pins and/or jacking screws shall be provided.
- (d) The needs of operation and maintenance including neatness, access, working space, safety, cleaning, adjustment, handling, assembly, alignment, disassembly, removal, etc.
- (e) With plant and equipment to be mounted on or against concrete or brick structures built by others, provision shall be made for adjustment in the mechanical design. Any special accuracy requirements must be specified on the Contractor's Documents.

PSM 1.4.8 Prevention of Corrosion

The Contractor shall review all designs from a corrosion protection point of view. Any details which might have a negative effect on the corrosion protection and the future application of coatings are to be brought to the Engineer's attention for a ruling prior to commencement of work.

All items shall be designed to minimise corrosion in the environment in which they will be exposed. Particular emphasis shall be placed on accessibility for surface preparation and the application of coatings. The detailed requirements for corrosion protection are dealt with elsewhere in this document.

Mastics, sealants, insertion rubber or suitable gasket material shall be used to seal unavoidable crevices such as bolted connections; e.g. under guardrail feet.

The design of articles shall ensure that surfaces of corrodible materials, such as carbon steel, shall be accessible for initial coating and for maintenance. The use of back-to-back angles, partially open box sections or inaccessible stiffeners shall be avoided. Fabrication openings shall be of sufficient size to enable fettling, blast cleaning, painting, pickling and passivation and particular attention shall be paid to the fabrication and inspection requirements for internal weld surfaces in pipework.

PSM 1.5 CONTROL

PSM 1.5.1 General

Control systems shall comply with the requirements as detailed throughout the specifications.

PSM 1.5.2 Equipment

Equipment control and system control is specified in the equipment clauses.

PSM 2 GENERAL MECHANICAL REQUIREMENTS (ZUT 0001)

PSM 2.1 Specifications

The Works shall comply with ZUT 0001 for the following general requirements:

- Materials
- Castings
- Fabrication of steels
- Welding
- Installation
- Civil and building works
- Pipework supports
- Steel pipework
- Plastic pipework
- Electric motors

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- Base frames.
- Machine guards
- Shaft couplings
- Belt drives
- Gearboxes
- Bearings
- Lubrication
- Gauges
- Instrumentation
- Guard rails
- Grid flooring
- Fasteners
- Machine vibration
- Noise control
- Thermal lagging
- Spares
- Signage

The amendments, additions to ZUT 0001 and the detailed requirements applicable to this contract are contained hereunder.

PSM 2.2 Amendments, Additions and Detailed Requirements

Civil and Building Works (Clause 9)

Clause 9.2 Civil and building. Work will be done on an existing pump station. Any further civil and building work will be done by Contractor or sub-contractor. A provisional sum has been allowed for in the Bill of Quantities.

PSM 3 GENERAL CORROSION PROTECTION FOR PIPELINES, WATER AND WASTEWATER (SPE-JJ-0003)

PSM 3.1 SPECIFICATION

Corrosion protection shall comply with Aur 0003.

The amendments and additions to Aur 0003 and the detailed requirements applicable to this contract are contained hereunder.

PSM 3.2 AMENDMENTS, ADDITIONS AND DETAILS REQUIREMENTS

PSM 3.2.1 Requirements (Clause 4)

Environmental conditions are classified as “severely corrosive”

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Pipework specials, bolts nuts and washers, clamps, supports etc. shall be 316 L Stainless Steel. Corrosion protection on all pumps, motors, duckfoots, etc. shall be suitable for the stated environmental conditions.

Coupling covers shall be minimum 2mm thick plate hot dipped galvanised.

All stainless steel items shall be pickled and passivated.

PSM 3.2.2 Inspection of Equipment (Clause 6.5) (Not Applicable)

The Contractor shall propose an independent inspectorate for approval by the Engineer, who will inspect the various items at all the necessary stages of fabrication when the Engineer is not available.

Inspections shall generally be carried out after fabrication.

C3.3: MECHANICAL SPECIFICATIONS
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SPECIFICATION ZUT 0001 GENERAL MECHANICAL REQUIREMENTS

SPECIFICATION SPE-JJ-0003 GENERAL CORROSION PROTECTION

SPECIFICATION: ZUT 0001

GENERAL MECHANICAL REQUIREMENTS

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1. SCOPE

Zut 0001 specifies general technical requirements for contracts in which the Contractor is responsible for the detailed design.

2. NORMATIVE REFERENCES

The following form part of the Contract Document:

- Amendments, Additions and Detailed Requirements (Zut 0001).

- Zut 0003: General Corrosion Protection for Pipelines, Water and Waste Water Works.
- Zut 7001: Design and Manufacture of Medium Pressure Steel Specials.
- Zut 7023: Pipe Couplings and Flange Adaptors.
- Zut 7024: Pipe Anchors.

- SANS 200
- SANS 719
- SANS 936/7
- SANS 989/992
- SANS 1034
- SANS 1062
- SANS 1123
- SANS 1186
- SANS 1200H
- SANS 1465
- SANS 1700
- SANS 3834
- SANS 4427
- SANS 9606
- SANS 10104
- SANS 10160
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- SANS 10108
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- SANS 50025
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- SANS/ISO 4427

- BS 1400
- BS 1452
- BS 1490
- BS 2035
- BS 2789
- BS 3100
- BS 3790
- BS 4515
- BS 4872
- BS 7854
- BS EN 681
- BS EN 1092
- BS EN 1591
- BS EN ISO 23936
- DIN 17 445
- ISO 4184
- ISO 10816

Equipment, materials and operational methods shall comply with the latest edition of relevant national and/or international standards.

3. MATERIALS

3.1 GENERALLY

All materials used in the manufacture and construction of plant and equipment shall be new and unused. The Contractor shall ensure that the materials are selected in accordance with the best engineering practice to suit the working conditions and corrosive environments.

3.2 STEEL

Structural steel shall comply with the requirements of SANS 50025 for grade S 355 JR or for grade S 355 JO.

3.3 STAINLESS STEEL

3.3.1 General

The grade of stainless steel to be used shall be as specified. Rolled material shall be supplied with a matt, annealed and pickled or otherwise de-scaled surface finish.

Where grades EN Grade 1.4401 (316) and EN Grade 1.4301 (304) are specified, these shall be taken synonymously with the low carbon grades for welding.

If stainless steel is to be coated, it shall be suitably abrasive blasted to ensure adherence of the prime coat.

3.3.2 Certification

The Contractor shall provide spectroscopic analyses of stainless steel materials. The analysis shall be undertaken by a local materials laboratory and shall be submitted to the Engineer.

Stainless steel supplied shall be clearly and permanently marked with the grade of stainless steel and cross referenced to the applicable test certificate.

3.4 3CR12

This is the titanium stabilised, 12 % chrome steel. It shall be supplied with an annealed and pickled finish.

If 3CR12 is to be coated, it shall be suitably abrasive blasted to ensure adherence of the prime coat.

3.5 PLASTICS

Thermoplastics and fibre reinforced polymers shall be UV resistant, have adequate tensile strength and high impact strength and generally suit the application.

PVC is regarded as too brittle and shall not be used unless called for in this Specification or accepted in writing by the Engineer before supply.

3.6 ELASTOMERS

The Contractor shall select elastomeric materials to be used for common duties as follows:

- Nitrile (NBR) shall be used if oil is present. PTFE or silicone shall be used if the working temperature is above 80 degrees Centigrade.
- EPDM may be used if oil is not present. PTFE or silicone shall be used if the working temperature is above 110 degrees Centigrade.

4. CASTINGS

Castings shall comply with the relevant South African or international standard for the material used, including the following:

Grey Cast Iron	SANS 1034; BS 1452
S. G. Iron	SANS 936/7; BS 2789
Steel (General Purpose)	SANS 1465; BS 3100
Aluminium	SANS 989/992; BS 1490
Stainless Steel	DIN 17 445
Copper and Copper Alloy	SANS 200; BS 1400

Castings shall be clean and sound and shall be neatly fettled and dressed. Surfaces shall be smooth and irregularities caused by mould washaways, and the presence of porosity, inclusions and sharp edges will not be tolerated. Areas under bolt heads, nuts and washers, shall be machined or spot faced to ensure a flat and smooth pressure bearing area, and sufficient space shall be provided for the use of ring or socket spanners.

All pressure retaining castings shall be hydrostatically tested to not less than 1,5 times the maximum working pressure after machining and shall be pressure tight.

No repairs shall be undertaken to castings without the written permission of the Engineer. Cast iron castings shall not be welded.

Castings shall be heat treated to provide optimum corrosion resistance and toughness combined with reasonable machinability. In particular stainless steel castings shall be heat treated so as to ensure that all carbides are in solution, to ensure optimum grain size, and to provide maximum corrosion resistance.

The Contractor shall provide a test certificate for each casting or batch of castings, except for those made of grey cast iron, giving details of the material analysis, the heat treatment and any mechanical tests carried out.

5. FABRICATION OF CARBON STEEL & STAINLESS STEEL

5.1 GENERAL

Steelwork shall generally be constructed, fabricated and erected in accordance with the applicable requirements of SANS 1200 H.

Welding shall comply with the clause "Welding".

Sharp edges, pits, inclusions, weld spatter, undercuts, indentations or other surface defects are not acceptable.

Edges shall be rounded to a radius of at least 2 mm.

Designs shall avoid inaccessible pockets and hollows.

Sharp edges on items fabricated from thin sheets will not be acceptable and sharp edges shall preferably be avoided by good design.

Inspection of fabrications shall generally be done after fabrication is complete.

5.2 CARBON STEELS

Structural steelwork shall be of grade S 355 JR or of grade S 355 JO in accordance with SANS 50025.

The requirements of the Hot Dip Galvaniser's Association of South Africa shall be complied with if the item is to be hot-dip galvanised. Designs shall provide proper access for safe and complete entry of the molten zinc into open spaces so that subsequent drilling at the galvaniser's yard is avoided.

Surfaces to be coated shall be accessible by blast and spray equipment. Inaccessible pockets, such as bad weld profile as well as hollow structures, are unacceptable and the angle of impact of blast material and sprayed coatings shall not be less than 45 degrees. Edges shall be rounded for safety reasons and also to be suitable for the coating system to be applied.

5.3 AUSTENITIC STAINLESS STEELS

Fabrication of austenitic stainless steels shall comply with the recommendations in the "Pocket Guide" issued by Columbus Stainless. Compliance with publications from equivalent authorities will be acceptable.

Stainless steel fabricators shall use permanently dedicated storage and fabrication areas and shall use machines, tools and handling equipment which are suited and permanently dedicated to this type of material.

Fabrications shall be pickled and passivated over their full surface to achieve an even colour. If grinding is required before pickling, the final grinding shall be done with a fine disc in order to remove coarse grinding marks.

5.4 3CR12

Fabrication of 3CR12 shall comply with the requirements for austenitic stainless steels except that the recommendations for Utility Ferritics in the "Pocket Guide" issued by Columbus Stainless shall be used. Compliance with publications from equivalent authorities will be acceptable.

5.5 HIGHLY ALLOYED STAINLESS STEELS

Fabrication of duplex, super austenitic and other highly alloyed stainless steels shall follow the metal producer's own guidelines.

Welding of duplex stainless steel pipework shall be in accordance with BS 4515 Part 2 or equivalent.

6. WELDING

6.1 STANDARDS

Welding shall be in accordance with SANS 15614-1 or with other equivalent standards acceptable to the SAIW.

Welders shall be experienced artisans approved in accordance with BS 4872 or equivalent.

The Contractor shall ensure that all structural welding, including all welding of pipework, is done in accordance with a welding procedure specification (WPS). The welding supervisor shall ensure compliance with the WPS. The document shall be available for scrutiny at all times.

6.2 PREPARATION

Wire brush and de-grease both surfaces to at least 30 mm from the weld.

Cleaning of stainless steel shall utilise non-chlorinated fluids only.

6.3 CONTINUOUS WELDING AND ELIMINATION OF CREVICES

Welding shall be continuous on all sides of any joint. Designs which do not allow this shall be re-designed.

Crevice, including those arising from welding on one side only, shall be eliminated. This requirement applies to the welding of all metals and welding procedure shall be designed to prevent unacceptable deformation.

Welds which are only accessible from one side shall be prepared so that the root run provides an acceptable profile and prevents the formation of crevice. Pipework shall be designed so that such welds can be inspected and, where applicable, pickled and passivated.

In special cases only, non-continuous welding might be accepted in writing by the Engineer. The resulting crevice shall be sealed with a two part solvent free epoxy which can be applied at thicknesses of up to 600 µm and above such as Sigmaline 523 or Corrocoat Zip E or Sigmacover 1000 or equivalent.

6.4 WELD APPEARANCE

Welding shall be free of blowholes, projections, pinholes, splatter and undercuts and all welding flux, weld spatter and other sharp imperfections shall be removed. Weld beads with a surface irregularity exceeding 3 mm or with sharp crests having a radius under 2 mm shall be ground.

6.5 SITE WELDING

Site welding shall be kept to a minimum and shall only be undertaken with the acceptance of the Engineer.

6.6 WELDING OF STAINLESS STEEL AND 3CR12 – ADDITIONAL REQUIREMENTS

Fabrication of austenitic stainless steels and 3CR12 shall comply with good practice and as described in the recommendations in the publications issued by Columbus Stainless. Compliance with publications from equivalent authorities will be acceptable.

Stainless steels to be welded shall be of the low carbon grade; e.g. 1.4306 rather than 1.4301 and 1.4404 rather than 1.4401.

The welding rods used shall be the most suitable for the metal and purpose.

Only welders experienced with welding stainless materials shall be used.

Welds which are accessible from only one side shall be executed in a manner to prevent heat tint or shall be post-weld treated in order to remove all traces of heat tint.

Type 309 stainless steel welding rods shall be used for welding 3CR12 unless otherwise accepted in writing. 3CR12 shall be welded as recommended by Columbus Stainless.

All possible steps shall be taken to ensure maximum corrosion resistance and strength of the welds and welded material. Special care shall be taken to avoid prolonged heating. Welds shall be passivated. Discolouration and steel contamination must be removed by pickling or electro cleaning as accepted by the Engineer but should rather be avoided by taking the appropriate measures.

6.7 INSPECTIONS

The Contractor shall arrange for all fabrications to be inspected by the Engineer prior to transport from the fabrication workshop.

7. CORROSION PROTECTION

7.1 GENERAL

Unless stated otherwise in the contract document, corrosion protection shall be suitable for the high corrosivity category (C4 of SANS 12944-2).

Corrosion protection shall comply with Zut 0003.

Corrosion protection systems used shall be suitable for an expected item life of at least 30 years in the environment for which they are designed. Corrosion protection for items which are buried or cast into concrete shall be designed for a life of 70 years.

7.2 SYSTEMS

The Contractor shall propose corrosion protection systems to the Engineer for review.

The preferred system for structural steelwork and gantries is hot-dip galvanised carbon steel.

The preferred system for cranes is hot metal zinc spray and seal.

The preferred system for pipework internals is a solids containing barrier coating with a dry film thickness of not less than 800 microns.

The preferred system for guard rails, grid flooring, trench covers, stairways and ladders is hot-dip galvanised carbon steel (unless stainless steel is called for in the project specifications).

The preferred system for clarifier bridges and other carbon steel structures above water bodies is epoxy coated 3CR12 or hot-dip galvanised and painted carbon steel or hot metal zinc sprayed and sealed carbon steel.

Hot-dip galvanised surfaces to be painted shall be sweep blasted with air pressure less than 2,5 bar and a nozzle distance of at least 500 mm.

7.3 STAINLESS STEEL

Where specified, stainless steel pipework which is in contact with pipework or valves of other materials shall be provided with an internal coat to provide an electrical barrier between the stainless steel and the fluid. Stainless steel valves, strainers and other items of equipment shall be similarly coated if specified.

The surface shall be blasted in order to achieve an acceptable profile for the coating material.

A coating such as 70 microns of Sigmacover 280 or equivalent is acceptable. The coat shall extend over flange faces.

8. INSTALLATION

8.1 GENERAL

The Works shall comply with the following:

- a) When erected and installed, the plant and equipment shall be of neat and workmanlike appearance, solidly and evenly supported, true to line, level, plumb and in proper working order.
- b) There shall be no visible movement of static components.
- c) The Contractor shall provide all anchor bolts, supports, hangers, brackets, etc. required for the support and fixing of equipment.
- d) The Contractor is responsible for grouting work associated with the equipment and pipework to be provided in terms of the Contract.
- e) No more than three shims at each position shall be used in the alignment of equipment. Machined spacers shall be prepared where necessary. Shims and spacers shall be of a corrosion resistant material such as stainless steel.
- f) Corrosion protection requirements shall be carefully attended to and the requirements of Zut 0003 must be noted. All mating faces must be coated before and sealed after assembly.
- g) A small amount of a nickel based, anti-seize compound shall be applied along the full length of fastener threads before the nut is threaded on.
- h) Crevices which are formed by bolting between two metal surfaces shall, prior to final fastening, be filled with a suitable formable packing, Denso tape or equivalent, or with a suitable mastic or sealant.

8.2 ALIGNMENT OF SHAFTS

Shafts for drives with an output above 150 kW shall be aligned to the driven shaft as follows:

- a) Final alignment shall be done after installation and before commissioning and shall be checked in the presence of and to the approval of the Engineer. Alignment shall be sufficiently accurate to ensure that no pre-load is placed on the shaft coupling.
- b) Each motor shall be aligned to its pump by alignment specialists using laser aligning equipment with real time computer display. This shall be done after the pipework is bolted to the pump.

9. CIVIL AND BUILDING WORKS

9.1 GENERAL DUTIES

The Contractor shall be responsible for grouting pipework required to pass through walls, for all equipment grouting work, anchoring of equipment and closing of apertures associated with equipment to be provided in terms of this Contract.

The Contractor's Documents shall indicate the civil and building details required to accommodate the equipment installation; subject to and in accordance with any details shown on the drawings provided by the Employer. These details shall include plinths, foundation blocks, rebates, pockets, sleeve ducts, holes, thrust blocks, anchor fasteners and openings/box-outs for pipework passing through walls.

The Contractor shall inspect and check the related structures constructed by others for accuracy and suitability of construction and for conformance with the Contractor's documents before commencing installation and construction. No payments shall be allowed for additional costs to the Contractor resulting from a failure to check such works timeously or a failure to provide the related information in Contractor's Documents timeously.

9.2 CIVIL CONTRACTOR'S WORK

The main civil and building works will be completed by others and will be mostly completed when the Contractor is granted access to the Site.

9.3 PUDDLE PIPES

The Contractor shall install the puddle pipes required by the design into concrete structures. For this purpose, the Contractor shall provide the details of box-outs required in the structure to the Engineer. Puddle flanges shall be of the same dimensions as standard flanges and the box-out shall be designed accordingly and with allowance for civil tolerances of ± 40 mm.

Concrete structures will generally be constructed by others and, if required, it will be tested for water tightness by the Engineer before handover to the Contractor by temporary closure of the box-outs.

Upon receiving access to the Site, the Contractor shall install the pipework and shall grout the puddle pipes into the structure using a suitable non-shrink grout to the approval of the Engineer. The Contractor shall provide a water tight installation and shall be responsible for rectifying any leakage at the puddle pipe.

9.4 BASEFRAMES, PIPE ANCHORS, ETC.

The design requirements for baseframes and pipework anchors are specified elsewhere in Zut 0001.

The Contractor shall be responsible for grouting of baseframes, pipe anchors, plinths, etc. required for installation of the equipment and this includes any metallic structure which is mounted onto a concrete surface.

The method proposed for anchoring baseframes and for securing pipe anchors, etc., to concrete shall be submitted to the Engineer for approval and shall incorporate the details of the grout proposed. The material used for the primary grouting of the anchors shall be a non-shrink, cementitious grout such as ABE DuragROUT 1000, or equivalent. ABE Epidermix 324, or equivalent, is acceptable if an epoxy grout is required.

The secondary grout shall be applied only after each anchor fastener has been tested for integrity. The design and grouting shall eliminate collection points for water or dirt.

If called for by the Engineer, the initial grouting shall be overseen by the grout supplier's technical representative.

10. PUMP SUCTION & DISCHARGE PIPEWORK**10.1 PUMP SUCTION PIPEWORK**

Pump suction pipework shall comply with good hydraulic design so that the flow at each pump inlet has a steady, uniform pattern.

Suction side pipework shall have a pressure rating which is greater than the operating pressure of the pumping system.

Air leaks shall be prevented.

Two mechanical couplings shall be provided on each pump's suction pipework. A single rubber tyre type coupling is acceptable for pump inlets of DN 100 and smaller.

The pipe connected to the pump inlet shall be a straight pipe of the same diameter as the pump inlet and shall have a length of at least five times its diameter. The remainder of the pipework shall preferably be sized so that the flow speed is no higher than 1,5 m/s.

The configuration of the suction manifold shall ensure equal flow to each pump, regardless of the number of pumps operating. The speed of flow in the suction manifold and into each pump branch shall be as low as feasible. Suction manifold tee offs shall be of swept tee formation if the nominal speed of flow in the pump's branch pipe is 0,7 metres per second or higher. The suction manifold tee offs may be a normal tee formation for lower flow speeds.

Pipework shall be level or shall slope upwards toward the pump. High points shall be avoided where the flow speed is below one metre per second.

The Contractor shall provide bell mouths for pump suction pipework drawing water from open sumps. The bell mouth shall be flanged on one end and shall be of glass reinforced plastic, EN Grade 1.4401 (316) stainless steel or of cast iron. Bell mouth openings shall be mounted between 0,3D and 0,5D above the sump floor ("D" is the pipe diameter). All bell mouths in a single sump shall be mounted at the same height. The flow speed through the pipe shall be approximately 1,7 metres per second.

An access hatch shall be provided upstream of each screen and/or flow straightener. The hatch shall incorporate an inner surface which is streamlined to match the pipe curvature.

10.2 PUMP DISCHARGE PIPEWORK

Two mechanical couplings or one rubber tyre type coupling shall be provided on each pump's discharge pipework.

11. PIPEWORK FOR FLOW METER CHAMBER

One flange adaptor shall be provided upstream of the flow meter and one flange adaptor shall be provided downstream of the meter.

The pipework shall also make allowance for one isolation valve upstream of the flow meter.

12. STEEL PIPEWORK

12.1 INTRODUCTION

This clause specifies requirements for carbon steel and stainless steel pipework.

12.2 INSPECTION AND TESTING

Prior to the start of welding, the Contractor shall perform the following:

- a) Obtain acceptance of quality control documentation from the Employer's Representative.
- b) Provide certification of the chemical composition of the pipe steel; including heat treatment.
- c) Confirm that the welder(s) has passed the qualification tests as specified in Clauses 6.1 to 6.7 of API Standard 1104. An equivalent standard, such as SANS 9606, is acceptable.
- d) Provide the welding procedure specification (WPS); which shall comply with SANS 15609.

Quality of welding shall comply with SANS 3834. Where dispute arises regarding acceptance of welds, the requirements of SANS 10167 shall be used. All failures shall be reported to the Engineer who shall determine the rectification procedure.

The Contractor shall perform the following:

- a) Visually inspect pipework.
- b) 100 % dye penetrant testing of all welds.
- c) X-Ray test the first five butt welds by any individual welder.
- d) X-Ray 10 % of welds. This percentage might be reduced by the Engineer if welds are found to be in order during initial testing. On discovery of defective welds, however, the Engineer may call for X-Ray examination of all welds until it is shown that the necessary standard is being maintained. Repairs of welded joints will be permitted and the repair procedure and performance of repairs shall be in accordance with Section 10 of API Specification 5L.
- e) Arrange for the Engineer to inspect the pipework after fabrication but before any corrosion protection.
- f) Measure paint thickness.
- g) Pressure test pipelines.
- h) Provide inspection and test reports

12.3 CONSTRUCTION, MATERIALS AND CONFIGURATION

12.3.1 Overall Configuration

Steel pipework shall be joined using bolted flanges. Steel pipework smaller than DN 150 may be of threaded rather than of flanged construction.

Pipework shall be anchored to withstand forces. It shall be supported above floor level on pipe anchors or shall be wall mounted and shall not be installed at the floor level.

Gravity lines shall have a minimum downward slope in the direction of flow of one percent.

Pipework shall be configured and shall be provided with couplings and/or bends to allow easy dismantling and disassembly without damage to the pipework or pipe anchors.

The Contractor's design shall accommodate thermal and structural movement and shall isolate structures from vibration.

Provision shall be made for draining all sections of pipework and for venting high points. Stainless steel ball valves shall be provided at each point.

Bends shall preferably be of the long radius type. 90 degree "lobster back bends" shall have a minimum of five segments and the pipe welded to each flange shall be perpendicular to its flange.

Convergences shall preferably be of swept tee configuration.

The full internal surface of welds shall be accessible for inspection and this might require that bends, tees and bifurcations are short.

Pipework shall be sized so that the speed of flow of fluids containing solids which could settle does not drop below 0,8 metres per second during operation.

12.3.2 Pipe

Carbon steel pipework shall be fabricated from welded carbon steel pipes complying with SANS 719.

Austenitic stainless steel and 3CR12 pipes shall be to ASTM A312, ANSI B36.19 or ANSI B36.10 or equivalent. Duplex stainless steel pipes shall be fabricated in an automated production pipe facility using mechanised welding procedures; i.e. they shall not be fabricated by the Contractor from plate.

12.3.3 Flanges

Flanges shall comply with SANS 1123 or BS EN 1092. Flange sizes and pressure ranges greater than provided in these standards shall be designed in accordance with an equivalent flange in ASME B16.47 and shall meet the jointing requirements of BS EN 1591. Flanges which are required to match existing flanges may deviate from these requirements.

Pipework of PN 25 and above shall have raised face flanges.

Flange drilling shall be "off centre" unless required to match an existing flange which is drilled otherwise.

The jointing material used on flange joints shall be of a suitable rubber or compressed mineral fibre at least 3 mm thick complying with BS EN 681 or BS EN ISO 23936, as applicable. Gaskets shall be full face. Properly designed O-ring seals are also acceptable.

Carbon steel flanges shall be chamfered on their outside edges, on their inside edges and on both sides of each bolt hole in order to provide a suitable surface for the corrosion protection coating to be applied. Stainless steel flanges shall be chamfered on their outside edges.

12.3.4 Manufacture

The manufacture of pipe specials shall comply with Zut 7001.

Welding shall be in accordance with SANS 15614-1. Welding shall achieve full penetration. Crevices are not acceptable. Both internal and external weld surfaces shall have a neat profile.

Fabrication shall comply with the quality requirements for fabrications specified elsewhere in Zut 0001.

12.3.5 Corrosion Protection

Corrosion protection shall comply with Zut 0003.

12.3.6 Pipe Couplings, Alignment & Flexibility

Pipe couplings shall be provided where misalignment or dismantling must be allowed for and also for possible pipe movement from settlement or other cause. The coupling shall have the same or higher pressure rating than the pipework in which it is installed.

Thrust restraints on couplings shall only be provided where these are essential.

Pipe couplings shall comply with Zut 7023.

12.3.7 Reducers

Reducers shall have a maximum total angle of divergence of 10 degrees.

The tapered pipe shall not be welded directly to the flanges; i.e. a short, perpendicular, cylindrical length of pipe shall be provided between the tapered pipe and each flange.

12.3.8 Nozzles/Sockets

Nozzles shall be provided for the installation of gauges, transmitters, drain pipes, cooling water take-offs, air release valves, etc.

In carbon steel pipework, nozzles shall be designed so that the pipework corrosion prevention system can be correctly applied. A nozzle shall consist of a flanged, welded tee-off of at least 100 mm diameter, coated internally and provided with a non-corrosive blank flange, e.g. EN Grade 1.4401 (316) stainless steel. The blank flange shall be provided with tapped holes, or similar, suitable for the installation.

Stainless steel pipework shall be provided with stainless steel sockets which are welded into the pipework with no crevices either externally or internally.

Nozzles on the suction side of pumps shall be designed and positioned to cause minimum interference to the flow.

Nozzles for pressure gauges and sensors shall be positioned for steady, uniform flow.

12.3.9 Flow Velocity

Air flow speeds in pipework smaller than DN 150 shall be approximately 10 m/s and shall not exceed 20 m/s. Air flow speeds in larger pipework shall be approximately 20 m/s and shall not exceed 25 m/s.

Where the pipe diameter is not specified elsewhere, the design flow velocities for water shall be as follows:

DESIGN FLOW VELOCITY [m/s]				
	<i>flow = 0 - 2,5 l/s</i>	<i>flow = 2,5 - 15 l/s</i>	<i>flow = 15 - 100 l/s</i>	<i>flow = 100 - 500 l/s</i>
grit free	< 0,75	< 1,25	< 1,5	< 2
solids containing	0,8 – 1,5	0,8 – 1,5	1 – 1,75	1 – 2

12.3.10 Site Work

Pipework shall be neatly installed, straight to line and level and adequately supported.

The Contractor shall make allowance for the misalignment of pipework to which the Contractor's pipework is to be connected.

12.3.11 Sludge Pipework

Sludge pipework shall be provided with a rodding eye, or similar, at bends to provide access for cleaning.

Sludge discharge pipework shall have a minimum slope of one percent downwards in the direction of flow.

12.3.12 Puddle Pipework

Puddle pipes to be cast into concrete shall be of EN Grade 1.4401 (316) stainless steel or shall be of a grade of stainless steel with a higher Pitting Resistance Equivalence Number than EN Grade 1.4401 (316).

Puddle pipes shall be a straight length, flanged both ends and with a puddle flange. Puddle pipe length shall be as short as feasible but adequate clearance shall be provided for inserting flange bolts and for valve handwheels and/or actuators.

The puddle flange shall be of the same diameter as a normal flange and shall be positioned in the central plane of the concrete. It shall be of the same material as the puddle pipe. Puddle flanges shall have a plate thickness of at least half the thickness of the standard flange but with a minimum of 10 mm. They shall be fully welded on both sides.

External surfaces which are not encased in concrete shall receive the full corrosion protection system. The coating shall extend about 50 mm into the concrete but the area in contact with the concrete shall otherwise be uncoated. This uncoated area shall be abrasive blasted to promote bonding with the concrete.

The Contractor shall submit a method statement for the grouting process and shall not cast the puddle pipe into the concrete structure until the Engineer has accepted this statement.

12.3.13 Marine Pipework

Pipework containing sea water or brine shall comply with the following:

- a) Shall be of EN Grade 1.4410 (2507) super duplex stainless steel.
- b) One bolted hatch shall be provided upstream of each valve. The hatch shall be DN 150 or larger.

13. PLASTIC PIPEWORK

Polyethylene or Polypropylene pipes shall comply with SANS/ISO 4427 and SANS 15874 respectively and shall carry the SABS mark.

PVC pipework is not acceptable for applications involving vibration or shock, including hydraulic shock.

An operating life of 50 years shall be designed for and appropriate de-rating factors shall be applied to suit the application. The class of pipe selected shall be suitable for at least 1,5 times the actual maximum operating pressure.

Plastic pipework installed externally shall be provided with protection against ultraviolet light.

Tappings, for example for gauges, shall be provided with welded, external doubler plates. The plates shall have a thickness at least equal to the wall thickness of the pipe.

Welding of thermoplastic pipework shall comply with SANS 10268.

14. CAST IRON PIPEWORK

Cast iron pipes and fittings shall comply with BS 2035 (Class D) and shall be pressure tested in accordance with Clause 12 of that Standard. The requirements of the Standard's Clause 6 regarding freedom from defects and casting appearance and Clauses 8, 9 and 10 regarding casting accuracy will be strictly applied.

Cast iron pipework shall comply with the requirements of the clause "Castings".

15. PIPEWORK ANCHORS

Anchors for steel pipework and for plastic pipework shall comply with Zut 7024.

16. ELECTRIC MOTORS SMALLER THAN 30 KW

16.1 PREAMBLE

Induction motors smaller than 30 kW shall comply with this clause.

16.2 GENERAL REQUIREMENTS

Motors shall be rated for operation on a 3-phase, 4-wire, 400/230 Volt, 50 Hz, AC supply.

Motors shall be squirrel cage motors in accordance with SANS 60034. Cooling shall be IC 0141 (similar to "tefc") and the motors shall be suitable for a damp environment. Ingress protection shall be IP 55 or higher.

Motors shall be suitable for both "continuous running duty", Duty Class S1, and "intermittent periodic duty", Duty Class S3. Windings shall be insulated with Class F material (100 °C rise capability) with a designed Class B temperature rise (80 °C). The motors shall be suitable for 6 starts per hour, two of which shall be consecutive.

A stainless steel rating plate shall be secured to the frame with stainless steel fasteners. This shall include the motor's lubrication details. If the manufacturer's nameplate does not comply with these requirements, the Contractor shall provide additional nameplates.

Motors above 30 kg shall be provided with lifting eyes or lugs.

16.3 PERFORMANCE REQUIREMENTS

Motors shall perform in accordance with the requirements of the specified mechanical equipment but the rated power of the motor shall, nevertheless, not be less than 20 % in excess of the designed power requirement of the driven equipment (the Engineer might waive this latter requirement if the motor forms part of a factory packaged unit).

Motors shall be designed to provide their rated power output at an ambient temperature of up to 40 °C and at an altitude of at least 1 500 masl.

16.4 OPERATION AND CONTROL

Protection against both starting overload and running overload shall be provided.

16.5 VFC DRIVEN MOTORS

The Contractor shall submit correspondence from the motor manufacturer/designer which confirms that the motor is designed for supply from the particular make and model of variable frequency converter to be provided in the application without shortening of the motor's lifespan.

Unless of the submersible or immersible type, VFC driven motors shall be cooled by a separate, constant speed fan (this requirement will be waived if the Contractor provides documentation confirming that the drive and motor design can operate in the application, with shaft-mounted fan, without exceeding its designed temperature rise).

Motors shall incorporate protection against damage to the bearings from induced currents.

16.6 BEARINGS

Bearings shall be of the rolling element type (i.e. ball or roller) and may be either oil or grease lubricated.

Grease lubricated bearings shall be re-greasable during motor operation. They shall be provided with stainless steel grease nipples and shall be suited for external applications. A port for relief against over-greasing shall be provided. Greasing points shall be provided with stainless steel extension tubes where access is restricted.

L-10 design life shall not be less than 100 000 hours.

Bearings shall comply with the clause "Bearings" in Zut 0001.

16.7 CORROSION PROTECTION

Motors shall be provided with a corrosion protection system which is suitable for the high corrosivity category, C4, of SANS 12944-2.

The fan cowl shall preferably be of cast iron or of stainless steel. For internal applications, plastic fan cowls are acceptable. Carbon steel cowls are acceptable if hot-dip galvanised. Painted carbon steel cowls are not acceptable.

16.8 HAZARDOUS LOCATIONS

If the specification calls for a motor to suit a hazardous location in terms of SANS 10108, then suitable motors complying with SANS 60034-5 or SANS 61241, as appropriate, shall be supplied.

The relevant SANS certificates, clearly indicating the location classification in which the machine may be operated, shall be submitted to the Engineer before delivery of the motors.

Each motor shall be clearly and permanently marked with the applicable certificate number.

16.9 SAFETY

Rotating parts shall be guarded as required by legislation.

17. ELECTRIC MOTORS OF 30 KW AND LARGER

17.1 PREAMBLE

Cage and slipring induction motors of 30 kW and above, with the exception of 3,3 kV, 6,6 kV, 11 kV and 15 kV motors, shall comply with this clause.

3,3 kV, 6,6 kV, 11 kV and 15 kV motors shall comply with the specification for MV motors.

17.2 GENERAL REQUIREMENTS

Motors shall be in accordance with SANS 60034.

The type of motor and starter to be provided by the Contractor shall be determined by the requirements of the application specified and by any starting limitations specified. In the absence of such specifications, a squirrel cage motor shall be provided. If a special motor is required to obtain special starting characteristics and/or variable speed, this shall be to a standard at least equal to this specification and shall incorporate all aspects of electrical protection.

Motors with a rating below 1 000 kW shall be squirrel cage motors with cooling to IC 0141 (similar to "tefc"). Ingress protection shall be IP 55 or higher.

Motors with a rating above 1 000 kW shall be squirrel cage motors of CACA configuration with an ingress protection rating of at least IP 55 and shall be provided with oil lubricated sleeve bearings.

Motors shall be suitable for both "continuous running duty", Duty Class S1, and "intermittent periodic duty", Duty Class S3. Windings shall be insulated with Class F material (100 °C rise capability) with a designed Class B temperature rise (80 °C). The motors shall be suitable for 6 starts per hour, two of which shall be consecutive.

Wound rotor motors shall have a separate enclosure for the slip-ring assembly to ensure that dust from the slip ring followers does not enter the motor. The enclosure shall have the same ingress protection as the main motor enclosure but shall have covers for direct access. The rings shall preferably be of stainless steel.

Motors shall be structurally suitable for DOL starting regardless of the specified starting system.

The frame and end covers shall locate on a spigotted register to ensure concentricity and parallelism.

Motors shall be provided with lifting eyes or lugs.

An earth terminal shall be provided on the frame.

Access shall be provided to the winding neutral point.

All monitored motor parameters; e.g. bearing temperature, winding temperature, current, etc.; shall be appropriately indicated.

Motors shall be of the reduced noise level type.

At least one internal cooling circuit fan shall be provided for frame sizes 355 and larger.

Motors of size 75 kW and above shall be fitted with "pocket" heaters. These shall be arranged to switch on when the motor stops operating and switch off when the motor starts operating.

A stainless steel rating plate shall be secured to the frame with stainless steel fasteners. This shall include the machine's lubrication details. If the manufacturer's nameplate does not comply with these requirements, the Contractor shall provide additional nameplates.

Measured vibration severity at the bearings shall meet the requirements of Zone A or Zone B of ISO 10816.

When motors are transported, care shall be taken to prevent damage to bearings.

17.3 PERFORMANCE REQUIREMENTS

Motors shall perform in accordance with the requirements of the specified mechanical equipment but the rated power of the motor shall, nevertheless, not be less than 15 % in excess of the designed power requirement of the driven equipment.

Motors shall be designed to provide this rated power output at an ambient temperature of up to 40 °C and at an altitude of at least 1 500 masl.

Motors shall reach full operating speed within 5 seconds unless driven by electronic soft start or variable speed drive.

Protection against both starting and running overload shall be provided.

17.4 400 VOLT MOTORS

400 Volt motors shall be designed to operate on a 3-phase, 4-wire, 400/230 volt, 50 Hz, AC supply.

17.5 TEFC MOTORS

The fan cowl shall preferably be of cast iron or of stainless steel. For internal applications, plastic fan cowls are acceptable. Carbon steel cowls are acceptable if hot-dip galvanised. Painted carbon steel cowls are not acceptable.

If it is specified that the motor shall produce low sound output, the fan cowl shall be provided with internal damping.

17.6 CACA MOTORS

The heat exchanger shall be provided with lifting eyes or lugs.

Silencers shall be provided for cooling air inlets and outlets.

Rotors shall be dynamically balanced.

Ports shall be provided for air gap measurement at the drive end and at the non-drive end.

Vertical jacking shall be provided at each holding down point.

17.7 VFC DRIVEN MOTORS

Motors fed by frequency converters shall comply with the following:

- Motors shall be rated to allow for additional harmonic losses in accordance with SANS 60034-17. The voltage stress withstand capability of the motor shall be checked against the converter supplier's specification. The stress due to converter operation shall be lower than the repetitive voltage stress withstand capability of the motor winding insulation system.
- Motors shall incorporate an insulated bearing and an earthing brush (or other approved protection against damage to the bearings from induced currents).
- Motors, unless submersible or immersible, shall be cooled by auxiliary constant speed motor driven fans.

The Contractor shall submit the following to the Engineer.

- Confirmation that the motors comply with the requirements of SANS 60034-25 for the application.
- Motor manufacturer's written confirmation that the motor is suitable for drive by the VFC make and model to be provided, including confirmation that the motor's voltage withstand capability is sufficient for the voltage stresses that will occur at the motor terminals.
- Guaranteed VFC harmonic performance including sample output wave forms with harmonic distortion levels at 40, 45 and 50 Hz for the VFC for the load.
- Guaranteed VFC dip ride through capability curve.
- Copy of VFC type test certificate (this is required if type tests have been carried out on the model).

17.8 BEARINGS

Bearings shall comply with the clause "Bearings" in Zut 0001.

Grease lubricated rolling element bearings shall be re-greasable during motor operation. They shall be provided with stainless steel grease nipples and shall be suitable for external applications. A port for relief against over-greasing shall be provided. Greasing points shall be provided with stainless steel extension tubes where access is restricted.

Bearings for motors of 250 kW and above shall be provided with temperature measurement, indication and alarm.

Bearings for motors in belt drive applications shall be of the rolling element type; i.e. shall not be slide bearings.

17.9 INSTRUMENTATION

Motors of 30 kW and up to (but not including) 150 kW shall be provided with thermistors embedded in the windings of each phase. The thermistor tails shall be "brought out" to separate terminals mounted near the motor winding terminal block.

Motors rated at 150 kW and above shall be provided with PT 100 type RTDs. Two RTDs shall be provided per phase winding. All six shall be incorporated into the control system; three to provide monitoring and three to provide high temperature trip functions.

17.10 CORROSION PROTECTION

Motors shall be provided with a corrosion protection system which is suitable for the high corrosivity category, C4, of SANS 12944-2.

17.11 HAZARDOUS LOCATIONS

If the specification calls for a motor to suit a hazardous location in terms of SANS 10108, then suitable motors complying with SANS 60034-5 or SANS 61241, as appropriate, shall be supplied.

The relevant SANS certificates, clearly indicating the location classification in which the machine may be operated, shall be submitted to the Engineer before delivery of the motors.

Each motor shall be clearly and permanently marked with the applicable certificate number.

17.12 SAFETY

Rotating parts shall be guarded as required by legislation.

18. PLINTHS & BASEFRAMES - PERMANENTLY MOUNTED EQUIPMENT

18.1 GENERAL

Permanently mounted rotating equipment shall be mounted on a metal baseframe and shall not be mounted directly onto concrete plinths.

The Contractor shall provide the baseframe, anchor fasteners, grouting, chemical anchor, etc. and is responsible for all installation work, including anchoring of the baseframe to the plinth.

The concrete plinth shall be designed by the Contractor for the application.

Equipment up to 1 000 kW shall be mounted on common baseframes. Separate baseframes may be provided for equipment above 1 000 kW and such base frames shall be grouted within (encapsulated in) their concrete plinths.

Equipment shall be secured to baseframes with both flat washers and spring washers (or another locking mechanism) of adequate size. Through bolts shall be used; i.e. a nut shall be used to secure the bolt.

The Contractor shall submit the baseframe workshop drawings to the Engineer for acceptance.

18.2 PLINTHS

The Contractor shall take into account all dynamic and static forces in the design of the reinforced concrete plinth and shall submit the design calculations and drawings to the Engineer for acceptance. The calculations shall confirm that the equipment's enforcing vibration will cause no resonant condition. If the plinth rests directly on soil, the calculations shall demonstrate that the design is suitable for the ground conditions. The design shall ensure that all forces, including the motor breakdown torque (or equivalent force if the driver is not a motor) and the torque experienced at power failure, will be properly withstood.

Plinths shall comply with all of the following:

- Plinth shall be of reinforced concrete.
- Plinth mass shall be greater than 4,5 times the sum of the masses of the driver and the driven equipment.
- Width of plinth shall be greater than the height between the shaft centreline and the bottom of the plinth.
- Height of plinth shall be greater than one fifth of the width.
- Height of plinth shall be greater than one tenth of the length.

- Plinths for rotating equipment above 130 kW shall be isolated from the surrounding floor and other machinery plinths (this requirement does not apply to machinery which is isolated from the floor by proprietary anti-vibration mounts).

18.3 SOLEPLATES

Sole plates; i.e. plate supports for equipment feet which are individually anchored into the concrete plinth; are acceptable as baseframes for equipment above 1 000 kW. They shall be grouted within (encapsulated in) their concrete plinths.

The soleplates to a depth of 50 mm within the concrete plinth/grout shall be of EN Grade 1.4401 (316) stainless steel or better for corrosion resistance. Carbon steel is acceptable for portions of the soleplates with concrete cover of 50 mm or more.

The soleplate's structure shall be designed so that air will not be captured under it during grouting.

18.4 BASEFRAMES

18.4.1 Dimensions

Baseframes shall have dimensions which comply with the larger of the following:

- The main frame members shall have a height of at least 0,095 times the length of the baseframe.
- The main frame members shall have a height of at least 0,18 times the width of the baseframe.

Baseframes fabricated from members which are cold formed from plate shall also comply with the following:

- The plate thickness shall have a thickness greater than 0.0037 times the length of the baseframe (but with a minimum of 4,5 mm).

18.4.2 Materials

Baseframes shall be fabricated from carbon steels complying with SANS 50025 for grade S 355 JR or S 355 JO or from 3CR12 or from EN Grade 1.4162 (LDX 2101) stainless steel.

18.4.3 Mounting Pads

The baseframe shall incorporate machined mounting pads for each equipment foot. The thickness of the mounting pads before machining shall be at least 1,25 times the diameter of the holding down bolts. The pads shall be drilled for inserting through-bolts (i.e. not machine screws in threaded holes) and access to the underside shall be provided.

Machining of the top surfaces of mounting pads shall be done after fabrication, stress relieving and hot-dip galvanizing, if applicable, are complete. In the period between machining and installation of the equipment, the machined surface shall be protected against corrosion by a removable coating. After installation, a non-hardening compound, Valvoline Tectyl Multipurpose 506 or equivalent, shall be liberally applied to exposed machined surfaces and to the crevices formed at the foot of the equipment.

18.4.4 Jacking Points

Baseframes shall be provided with robust jacking points for alignment of the motor to the driven equipment.

Jacking screws shall be hot dip galvanised.

18.4.5 Fabrication

Fabrication and welding shall comply with the requirements elsewhere in Zut 0001.

The Contractor shall arrange for the Engineer to inspect the fabrication of the baseframe before corrosion protection.

18.4.6 Corrosion Protection

18.4.6.1 General

The design of the baseplate shall take into account all practical aspects of the corrosion protection system; for example:

- accessibility for surface preparation and coating.
- hidden surfaces are not acceptable.
- inaccessible pockets and hollow spaces which cannot be accessed by blast and spray equipment shall be avoided or shall be welded closed;.
- structures to be hot dip galvanised shall provide proper access for safe and complete entry and exit of the molten zinc.

Baseframe designs shall prevent pooling of water. They shall be grout filled and/or shall be provided with large drain holes in all side members (before corrosion protection).

Holes in the baseframe and welded lugs for mounting of conduits, etc. are acceptable on condition that these are provided prior to galvanising or prior to pickling and passivation, whichever is applicable. They shall preferably be positioned near the neutral axis of steel sections.

18.4.6.2 Carbon Steel Baseframes

Carbon steel baseframes shall be hot-dip galvanized in accordance with Zut 0003.

Baseframes which are drilled, welded or ground after galvanising will be rejected. Machine milling of mounting pads, with subsequent protection against corrosion as specified, is acceptable.

18.4.6.3 Stainless Steel and 3CR12 Baseframes

3CR12 shall be coated with a suitable system complying with Zut 0003.

EN Grade 1.4162 (LDX 2101) stainless steel and other stainless steels need not be coated.

18.4.7 Anchor Fasteners

18.4.7.1 Requirements for All Baseframes

Baseframe anchor fasteners shall be of EN Grade 1.4401 (316), or better.

Fasteners shall comply with the requirements for fasteners elsewhere in this specification.

The baseframe and plinth shall form a structural unit (i.e. the baseframe and plinth shall vibrate as a unit) and, to achieve this, the baseframe anchors must transfer force into the concrete (i.e. it is not acceptable to provide a levelling nut below the baseframe as the anchor will not be properly pre-stressed into the plinth).

Anchor fasteners shall be provided with both a lock washer and a flat washer of adequate size.

18.4.7.2 Additional Requirements for Pump Baseframes

Baseframe anchor fastener size for pump installations shall be in accordance with the table below.

Pump Inlet Size	Minimum Fastener Size
DN 50	M10
DN 100	M12
DN 200	M12
DN 300	M16
DN 400	M20
DN 500	M24
DN 600 and larger	M30

The number of baseframe anchors for pump installations shall be in accordance with the table below.

Pump Inlet Size	Minimum Fasteners (No.)
DN 50	6
DN 50 to DN 150	8
Above DN 150	10, or more.

18.4.8 Installation

Not more than three shims may be used at any point and these shall be of a corrosion resistant material.

Concrete surfaces under baseframes shall be scabbled before the baseframe is placed and shall be clean. Dust shall be removed from the surface by compressed air immediately before grouting.

Baseframes shall be grouted in a manner which will eliminate collection points for water or dirt.

The material used for grouting shall be a non-shrink, cementitious grout (ABE Duragrout 1000, or equivalent).

Final equipment alignment shall be done after grouting has been completed.

19. SKID MOUNTED EQUIPMENT

Skid baseframes shall comply with the design requirements for anchored baseframes. They shall be single fabricated units.

The baseframe shall be provided with four jacking points and four lifting points.

Equipment shall be secured to the baseframe on anti-vibration mounts.

Skid baseframes shall be placed on anti-vibration rubber mats, "Tico pad" or equivalent. These shall provide a gap between the skid and the concrete in order to prevent pooling of liquids (in addition to vibration isolation). The elastomeric materials shall be resistant to oil.

20. MACHINE GUARDS

Guards shall comply in all respects with the Occupational Health and Safety Act of 1993 as amended.

Guards are required to cover all moving or revolving components of machinery and shall prevent a person from touching any moving protrusion. Guards which do not adequately cover moving protrusions such as keys, lock nuts, lock washers, setscrews, etc., or irregularities such as keyways, will under no circumstances be accepted.

Guards shall be neatly and rigidly constructed and fixed and shall not vibrate or cause noise during operation.

Where expanded metal or similar mesh is used, the mesh opening shall not permit a circular object 10 mm or larger to penetrate. Mesh shall not be used for chain guards but on belt drives the side of the guard most conveniently sited for inspection shall be constructed of expanded metal or similar. Mesh should similarly be used in other situations where inspection or ventilation is required.

Allowance must be made for adjustment where adjustment will be required such as on belt guards.

It shall be possible to remove guards easily for maintenance purposes.

Guards shall preferably be fabricated of EN Grade 1.4401 (316) stainless steel (uncoated) but may also be hot-dip galvanized, hot metal zinc-sprayed or hot metal aluminium-sprayed carbon steel, coated to Specification in all these cases. Fasteners shall be M10 or larger and shall be of EN Grade 1.4401 (316) stainless steel.

21. SHAFT COUPLINGS

Shaft couplings shall be selected to reduce transmission of misalignment forces and of torsional oscillations between the driving and the driven machine. The service factor for electric motor drives shall be at least 1,5; for electric motors on variable frequency converter drives shall be at least 2 and for internal combustion engine drives shall be at least 2,5.

Couplings shall preferably be of the rubber tyre or rubber compression type, keyed to the shafts. Elastomeric elements shall be urethane based.

The design shall respect the requirements of the machine bearings in order to counter thrust forces and limit axial movement.

Flexible metallic elements shall be of stainless steel. Couplings shall not require lubrication.

Spacer couplings shall be used where required for disassembly of the equipment. It shall be possible to dismantle the coupling without having to move either the driver or the driven equipment.

Coupling guards shall comply with the requirements of the OHS Act and shall be to the approval of the Engineer.

After installation, shaft alignment shall be checked by the Contractor in the presence of the Engineer or a person delegated by him. Alignment shall be accurate and to the approval of the Engineer.

22. BELT DRIVES

Belt drives shall be designed to suit the power rating of the motor using service factors appropriate to the driving and driven machinery. Drives shall be designed, manufactured and installed in accordance with BS 3790 and ISO 4184 or equivalent, utilizing taperlock pulleys with taperlocks keyed to the shaft.

Where alternative pulley diameters can be selected, preference must be given to the larger pulley diameters to minimize the belt loading on bearings.

The bearing arrangements of driving and driven machinery shall be designed to cope with the loads imposed by belt drives. Rolling element bearings shall be designed for an L-10 life exceeding 100 000 hours.

Belt drives shall incorporate lay shafts where necessary. Lay shafts shall be supported by bearings mounted in bearing housings which are adequately sealed and fitted with grease nipples. Bearing units incorporating open, shielded bearings are not acceptable.

Belt driven machinery shall be equipped with rolling element bearings; i.e. shall not be equipped with slide bearings.

23. DRIVEN GEARBOXES

23.1 GENERAL

Driven gearboxes shall be supplied with environmental protection to IP 55 or higher.

The gearbox ratings shall be provided for an ambient temperature of 40 degrees Centigrade.

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

23.2 SERVICE FACTOR

23.2.1 Motor Driven Gearboxes

The service factor to be used for the design of gearboxes in uniform load duty shall be at least 1,25 for electric motor driven applications. A minimum service factor of 1,5 shall be used for moderate shock applications and a minimum service factor of 2 shall be used for heavy shock applications.

23.2.2 Engine driven gearboxes

The service factor to be used for engine driven gearboxes shall not be less than 2.

23.3 DESIGN REQUIREMENTS

Gears shall be case hardened, profile ground and lapped, helical and spiral bevel gears.

The gearbox housing shall be of rigid cast construction preferably split in the horizontal plane.

Unless close coupled, each gearbox shall be mounted on machined sole plates fitted with jacking screws to assist with alignment.

Rolling element bearings shall be designed for an L-10 life in excess of 100 000 hours.

A breather designed to prevent moisture from entering shall be fitted.

23.4 LUBRICATION

Oil-bath gearboxes shall have suitable oil level indicators or dipsticks which indicate the allowable levels. Inaccessible oil drain points shall be provided with extensions so that the oil can be easily drained. The drain line shall be of EN Grade 1.4401 (316) stainless steel and shall be fitted with a ball valve and square head plug.

Grease lubrication points shall be easily accessible. Grease nipples shall be of stainless steel.

23.5 OIL CHANGE

The Contractor shall drain and replace oil in all gearboxes during the Defects Notification Period.

23.6 CORROSION PROTECTION

Gearbox external surfaces shall be provided with a coating suitable for the high corrosivity category (C4 of SANS 12944-2) and the dry film thickness shall not be less than 200 micron.

24. MANUAL GEARBOXES

An over-torque limiting device shall be incorporated.

Grease lubrication points shall be easily accessible. Grease nipples shall be of stainless steel.

A breather designed to prevent moisture from entering shall be fitted.

25. BEARINGS

25.1 BEARING CHOICE

Bearing design shall suit the requirements of the equipment and the installation.

Greased lubricated bearings are acceptable for units with power ratings up to 100 kW but oil lubricated bearings are preferred for larger machines.

Units with power ratings above 1 000 kW shall be provided with slide bearings (oil film type). Slide bearings are also preferred for units with high speed shafts and for high temperature applications.

25.2 OPERATIONAL REQUIREMENTS

Bearing designs shall ensure safe shut down without damage following electrical supply failure.

Bearing designs for variable speed drive applications shall be suitable for the full expected speed range.

25.3 SEALS

Bearings shall be provided with seals to prevent the ingress of water and solids.

25.4 ROLLING ELEMENT BEARINGS

For shaft sizes above 50 mm, the bearing shall be selected for an L-10 bearing life of at least 100 000 hours. This may be reduced if the equipment is expected to operate for less than 3 000 hours in a normal year.

Grease lubricated rolling element bearings shall be provided with relief against over greasing.

Oil lubricated rolling element bearings shall be provided with an oil ring.

25.5 SLIDE BEARINGS

Slide bearings (“plain bearings”, “oil-film bearings” or “sleeve bearings”) which are oil lubricated shall have lubrication by oil ring, by rotating dish or by pumped feed or by a combination of these.

Lubrication shall be active during normal run down and during power failure and the design shall ensure that the bearing is not damaged.

Loss of pressure in pumped lubrication systems shall lead to shut down of the machinery.

Small diameter bushes shall preferably be self-lubricated sintered metal or of engineering polymer with suitable lubrication.

25.6 MOTOR BEARINGS

Motor bearings shall be provided with protection against stray currents which cause damage to the bearing.

25.7 THERMAL ALARMS

Thermal alarms on bearing systems shall be set in accordance with the equipment manufacturer’s instructions.

Alarm settings done on Site shall be set after at least 24 hours of operation have occurred.

If high temperature protection is specified for a bearing, the Contractor shall note the equilibrium temperature reached after 30 minutes of normal operation and shall also note the ambient temperature. The high level trip temperature shall then be calculated as follows:

$$T_{\text{trip}} = T_{\text{equilibrium}} + (40^{\circ}\text{C} - T_{\text{ambient}}) + 10^{\circ}\text{C}.$$

(This assumes that the bearing is operating correctly.)

25.8 BELT DRIVEN EQUIPMENT

Belt driven machinery and belt drive motors shall be equipped with rolling element bearings; i.e. shall not be equipped with slide bearings.

26. LUBRICATION

26.1 TYPE

Grease lubrication is generally acceptable where design parameters are not severe. Oil lubrication shall be provided where the design parameters are more severe.

Lubrication systems shall be designed to exclude dirt and moisture. Air vents on the oil reservoir shall incorporate filters. Drain facilities shall always be provided.

26.2 GREASE LUBRICATION

Where a grease point is not easily accessible, a grease line shall be piped to an easily accessible position for manual greasing. Each grease point shall be provided with its own grease point and pipework.

A distributor shall be provided where motorised lubrication is provided to more than one destination. The distributor shall be a positive displacement device which ensures equal, successive lubrication to all destinations. Only one distributor shall be used for each lubrication pump; i.e. distributors shall not be cascaded.

Pipework for grease distribution shall be of stainless steel.

26.3 OIL LUBRICATION

Where oil lubrication is provided, the Contractor is responsible for the initial oil fill and the first oil change, including flushing, draining and filling, after an initial run in period not exceeding 3 months

Oil level indicators shall be provided for visual checking. Drain valves, including EN Grade 1.4401 (316) fittings where necessary to permit convenient draining, and plugged at the end, shall be provided for oil reservoirs exceeding 1,5 litre capacity. Drains shall be from the lowest point and syphon type drains are unacceptable.

26.4 SUBMERGED BEARING HOUSINGS

Submerged bearing housings shall be grease lubricated by motorised lubrication. The seals shall be arranged to avoid overgreasing of the bearing. These requirements apply to the bottom bearings of equipment such as Archimedes screw pumps but do not apply to equipment such as submersible pumps in which the bearing housing is contained within the pumpset housing.

27. GAUGES

27.1 CONSTRUCTION

Gauges shall be of industrial construction. The case and bezel shall be of stainless steel unless this material is unsuitable for the application.

Pressure, vacuum or compound gauges shall comply with SANS 1062 and shall bear the Standards mark. Gauges shall be of Accuracy class 1.6 and Durability grade A.

The gauge reading shall indicate gauge pressure unless absolute pressure measurement has been called for.

Gauges shall have a scale diameter of not less than 100 mm.

Calibration shall be in mWC (metres Water Column). The units of measurement shall be clearly marked on the dial.

The scale shall be chosen so that the operating pressure is not less than half full scale reading. In addition, the full scale reading for a gauge on the discharge of a centrifugal pump shall be higher than the pump's shut-off head.

Wherever applicable, gauges shall be clearly strip marked in green to indicate the normal operating range and in red to indicate the non-permissible range of values.

Gauges shall be suitable for continuous operation and shall be glycerine filled on all pump applications and where fluctuations in pressure may cause damage.

Scale markings shall be radial, plain, straight, black lines on a white background and shall be spaced so that one scale division represents approximately 1,5 % of the maximum scale value in values of 1, 2 or 5 multiplied by any power of 10 to suit the maximum operating rating. On circular gauges the scale shall be concentric and the maximum and minimum scale values shall be near the bottom of the gauge, with the scale symmetrically disposed about the vertical centre line of

the gauge. The tip of the pointer shall be of the knife edge type extending across the scale divisions and shall be as close as practical to the dial.

27.2 INSTALLATION

Gauges shall not be mounted directly on equipment subject to vibration.

Gauges for pipework larger than DN 250 shall be remotely mounted and isolating valves shall be provided at each end of the connecting pipework.

Gauges shall be mounted vertically and in such a position that they can be easily read from floor level.

Nozzles/sockets for gauges shall be provided in accordance with the clause "Steel Pipework; DN 150 and Larger".

Pressure gauges shall be fitted with an isolating and an air bleed valve. Valves shall be stainless steel ball valves with stainless steel operating levers.

Gauges for sludges and other liquids which contain solids shall have their nozzles on the side of the parent pipe. The configuration shall allow easy cleaning of the passageways.

Gauges used on wastewater, sludge, chemical, solids conveying or other applications where blockage or corrosion of the gauge is possible shall be fitted with a diaphragm type chemical seal, both being liquid filled. The portion of the seal in contact with the process liquid shall be of a suitable non-corroding material.

When used on steam lines a siphon shall be fitted between the steam line and the gauge which shall be filled with water before it is put into service.

27.3 CALIBRATION

The Contractor shall calibrate all instrumentation prior to commissioning and shall submit the calibration certificates to the Engineer.

28. ELECTRONIC INSTRUMENTATION

Environmental protection of electronic instrumentation shall be as follows:

- a) Instrumentation and associated displays and transmitters which are either located inside or located outside and above ground level shall have IP 55, or higher, rating.
- b) Instrumentation and associated displays and transmitters which are located in underground chambers shall have IP 68 environmental protection. The instrument shall be mounted in an enclosure which shall provide physical protection and shall be self-draining.
- c) Instruments and associated displays and transmitters which are located outside buildings shall be mounted in enclosures. Enclosures shall be of polycarbonate construction with transparent front, Fibox EK or equivalent. The complete enclosure installation shall have an IP 55 rating or higher. The enclosure size shall be chosen to provide a clearance of at least 100 mm all around the instrument.

Instruments and their cabling shall be protected so that electromagnetic interference does not affect their operation and signal transmission.

Instruments shall have permanently affixed nameplates.

The Contractor shall calibrate all instrumentation prior to commissioning and shall submit the calibration certificates to the Engineer. Calibration certificates shall be included in the Manual.

29. GUARD RAILS

29.1 GENERAL

Legislated requirements call for guard railing to be provided in positions where the vertical change in level is 1 000 mm or greater.

Guard railing shall comply with SANS 10104 and shall be designed for access for maintenance purposes.

29.2 OPERATIONAL REQUIREMENTS

Guard railing shall be designed to resist, without any damage and without excessive deflection, the loadings in Category E in Table 7 in Clause 9.4 of SANS 10160 2:2011, Edition 1.1, namely:

- a) a force of 1 000 Newtons in any direction (concentrated over a length of 100 mm).
- b) a distributed horizontal force of 1 000 Newtons per metre applied along the top rail.

29.3 DESIGN REQUIREMENTS

Guard railing shall be designed to resist the loadings set out in SANS 10160.

Hand and knee rails shall have an outside diameter of not less than 33 mm and a wall thickness of not less than 2,5 mm and a maximum span of 1 500 mm (greater spans will be acceptable if heavier tube dimensions are used).

Tubular stanchions shall have a wall thickness of at least 3,0 mm.

On platforms, walkways, landings or around dangerous areas the vertical height, measured from the top of the hand rail to the floor or surface, shall be at least 1 000 mm.

On stairways and fixed ladders the rails shall be parallel to the strings, and the vertical height, measured from the top of the hand rail to the nosing of the tread, shall be at least 900 mm.

No opening between rails shall allow the passage of a ball of diameter 600 mm.

Stanchions and rails shall be smoothly finished and free from sharp corners, edges and projections which may injure persons or damage clothing. Stanchion bases shall have the corners rounded or sheared off.

Welded guard rail installations are preferred. Installations which incorporate bolted sections shall be secure and tight under loading. "Pop" rivetted installations will not be acceptable. Joints shall be smoothly finished, without shoulders.

Railings shall be ended off with positively fixed closure bends. At corners, short radius bends with stanchions on both ends shall be employed or, alternatively, stanchions specifically designed for such a position shall be employed. No sharp ends will be permitted.

Stanchions shall generally be base-mounted to suit the arrangement requirements and shall be of solid or welded construction.

Stanchions which are hollow shall be self-draining.

Stanchion feet which are attached to metallic surfaces shall have minimum dimensions of 150 mm X 60 mm X 8 mm. Two fasteners, of minimum size M16, shall be used to secure each

foot. Neatly fitting packing, Denso tape or equivalent, shall be fitted under stanchion feet to prevent the formation of crevices.

Stanchion feet which are attached to non-metallic surfaces shall have minimum dimensions of 150 mm X 150 mm X 10 mm. In instances where the horizontal surface to which the foot is to be fastened is less than 150 mm wide, the foot shall be designed to be seated on at least two surfaces. Four fasteners, of minimum size M16, shall be used to anchor the foot. Non-shrink, cementitious grout shall be applied under the foot prior to final tightening of nuts.

Toe plates shall be provided. These shall extend to 150 mm above the walkway level.

29.4 ADDITIONAL DESIGN REQUIREMENTS FOR GUARD RAILING IN PUBLIC PLACES

The requirements for guard railing at equipment installations shall also apply for guard railing for public places. The following specific requirements shall also be complied with:

- a) The structural design shall be done in accordance with the requirements of SANS 10104.
- b) No opening in guard railing installed in public places shall allow the passage of a ball of 100 mm diameter.

29.5 CARBON STEEL GUARD RAILS

Fabrication and welding shall comply with the clauses "Fabrication of Carbon Steel and Stainless Steel" and "Welding".

The guard rails shall be hot-dip galvanised. Designs shall provide proper access for safe and complete entry of the zinc into open spaces so that subsequent drilling at the galvaniser's yard is avoided.

If the guard rails are welded or cut after hot-dip galvanising, they shall be returned to the galvaniser for re-galvanising.

29.6 STAINLESS STEEL AND 3CR12 GUARD RAILS

Fabrication and welding shall comply with the clauses "Fabrication of Carbon Steel and Stainless Steel" and "Welding".

29.7 FASTENERS

All anchor fasteners, including nuts and washers shall be of EN Grade 1.4401 (316) stainless steel.

Fastener diameter shall not be less than M12.

30. GRID FLOORING

The depth of bearer bars in metal grid flooring shall not be less than 30 mm with a bearer bar pitch of not greater than 40 mm.

The bearer bars shall be across the shorter span.

Panels shall be set level and fixed to angle frames to prevent rocking.

Cut-outs in grid flooring for pipes, valve spindles, etc. are to be fully banded. The edges of removable grid access covers must also be fully banded. Corrosion protection shall only be done after welding of banding has been completed.

Unless another material such as stainless steel is specified, grid flooring and frames shall be of carbon steel, hot-dip galvanized after fabrication. If hot-dip galvanising is not suitable, a glass flake resin, such as Power Blast's Vitaglass or equivalent which is applied by dipping the flooring in catalysed resin, is acceptable. Painted coatings are not acceptable as corrosion protection.

Where grid flooring rests on painted surfaces, strips of rubber insertion material shall be secured under the grid to protect the paint.

The fixing clip set (saddle clamp and locking plate) shall be of hot-dip galvanised steel or stainless steel. Fasteners shall be of EN Grade 1.4401 (316), or better.

GRP grid flooring is not acceptable.

31. FASTENERS

31.1 STANDARDS

Bolts and nuts shall be hexagon head type complying with SANS 1700 with threads of the coarse pitch series.

31.2 LOADING/STRESS

Fasteners shall be loaded in accordance with their design and shall not be loaded as columns and/or in bending. In particular, anchor fasteners shall only be loaded in tension and sideways forces shall be transferred to the concrete structure in which they are anchored.

31.3 MATERIALS

M12 fasteners and smaller shall be of EN Grade 1.4401 (316) or better.

Fasteners in corrosive areas shall be of EN Grade 1.4401 (316) or better. Corrosive areas shall be taken to include any moist or wet area such as in and above settling tanks, in or in the vicinity of open channels, where a continuous spray can be expected and all areas in the vicinity of a wastewater treatment works or wastewater sump.

Fasteners larger than M12 which are in non-corrosive areas shall, except when specified otherwise, be hot-dip galvanized.

Plated fasteners are not acceptable.

31.4 HIGH TENSILE BOLTS

Where high tensile bolts are required by the design, they shall be hot-dip galvanized and painted. The bolt holes and crevices shall be filled and sealed prior to painting.

31.5 ANCHOR FASTENERS

Anchor fasteners shall be of EN Grade 1.4401 (316), or better.

Anchor fasteners for water retaining structures and for brickwork shall be of the chemical anchor fastening type. Other anchors may be of the expanding type or chemical anchor type.

Where hook bolts are used, these shall be supplied and grouted by the Contractor into pockets which will be provided in the concrete structure in accordance with the information to be supplied by the Contractor. The grouting products shall be used strictly in accordance with the manufacturer's instructions.

Where machinery is anchored by studs or bolts which extend through the supporting structure and is therefore fastened down with the use of nuts from both sides, the studs or bolts, together with associated washers and brackets, shall also be of EN Grade 1.4401 (316), or better.

Anchors shall be tensioned when their nuts are tightened; i.e. it is not acceptable to use a second nut below the baseplate to position it; and the holding down force shall be loaded into the concrete structure rather than the baseplate being held between two nuts.

Submerged anchors shall be secured with chemical anchor designed for submersion.

31.6 MATERIAL COMPATIBILITY

Fastener material shall always be of equal or better corrosion resistance than the items being fastened, e.g. EN Grade 1.4401 (316) bolts must be used to fasten together EN Grade 1.4401 stainless steel flanges and fabrications.

31.7 WASHERS

Flat washers shall be provided under nuts and setscrew heads.

Flat washers shall be provided under bolt heads on painted surfaces.

Flat washers shall be provided under bolt heads where the bolt is positioned in a slot.

Spring washers shall be used on fasteners subject to vibration (other approved locking arrangements will also be acceptable on proprietary equipment).

Anchor bolts for machinery shall each be provided with a flat washer and a spring washer (other locking arrangements are not acceptable).

Washers shall be of the same material as the fasteners.

Flat washers exhibiting visual deformation shall be replaced by thicker washers.

31.8 ANTI-SEIZE COMPOUND

Before assembly, stainless steel threads shall be treated with a nickel-based, anti-seize/corrosion protection compound such as Chesterton 725 : Nickel Anti-Seize Compound, or equivalent. Copper based compounds are not acceptable.

A small amount of the compound shall be applied along the full length of the exposed thread before fastening. Excessive compound visible on the thread after the nut has been applied is unacceptable and indicates that the compound has not been used correctly.

31.9 THREAD PROJECTION

Bolt threads shall project no less than 1 thread and no more than 8 threads from the head of the nuts when fixed. Longer projections will only be allowed if the Contractor can show that bolts of a more suitable length are not manufactured.

31.10 CORROSION PROTECTION

After installation, the exposed surfaces of fasteners not of stainless steel shall be coated as for the items being fastened.

"Self-tapping" fasteners are not acceptable.

If the use of Allen head or similar fasteners has been accepted by the Engineer, the recessed heads shall be filled with a suitable non-hardening sealing compound.

32. MACHINE VIBRATION

The mechanical vibration of machines measured at all important points such as bearings shall be lower than that specified as "good" for that class of machine in BS 7854 (ISO 10816).

Reciprocating machines shall be designed and installed so that the machine vibrations are isolated from the floor structure. Vibration isolation mountings which will eliminate not less than 90 % of the vibrations transmitted by the equipment shall be provided between the baseframe and the concrete plinth. When mounted on the vibration isolators, distortion of the baseframe shall be negligible in comparison with the permissible and acceptable misalignment of the equipment mounted thereon.

Shafts shall be designed so that the critical speed is outside the operating speed range.

33. NOISE CONTROL**33.1 GENERAL**

Noise emitted by equipment shall be kept to a minimum and shall not exceed the noise levels specified in these documents.

33.2 NOISE LEVELS

The sound power of any equipment shall not exceed 89 dB(A) (referred to 10^{-12} Watts) unless specifically accepted by the Engineer. This is approximately equivalent to a sound pressure level of 81 dB(A) at a radius of one metre from the acoustical centre assuming uniform hemispherical propagation in a free field on a hard floor. In certain instances, a lower noise level may be called for.

Where the Contractor is unable to restrict the noise level of the machines to the maximum specified by the appropriate selection of suitable equipment; e.g. by selecting slow speed or silent type machines, quiet type cooling fans, suitable silencers, etc.; the Contractor shall inform the Engineer so that appropriate steps can be taken to counteract the effects of noise.

33.3 ACOUSTIC TREATMENT

Standard acoustic enclosures shall be provided where called for.

Acoustic treatment of high noise sources shall be provided where this can be done without greatly interfering with operation or maintenance.

If acoustic lagging of pipework or ducting is specified, this shall consist of pre-formed rockwool encapsulated in stainless steel sheet metal. Alternatively, a 100 mm thick layer of rockwool having a density of 60 kg/m^3 , suitably fixed in place and reinforced to prevent collapse, and covered with 25 mm thick asbestos free plaster having a density of $1\,000 \text{ kg/m}^3$ (I.P. Insultex AF720, or equivalent). The outer surface shall be finished off with scrim cloth before being painted.

It is not normally necessary to lag flow meters and cast iron valves on acoustically lagged pipelines.

Components which can move, such as those associated with expansion bellows or mechanical couplings, shall be enclosed by an effective acoustic enclosure designed to prevent sound transmission but able to cope with movement without damage.

33.4 MEASUREMENT

Noise levels will be verified by taking impulse weighted Leq readings in dBA over ten minutes at the specified positions. Readings so achieved shall not exceed the specified level by more than 2 dBA. Should the noise exceed the specified level or should the level be in dispute, the Contractor will be responsible for obtaining certified sound pressure levels across the full octave band mid-frequency range in order to establish the precise A weighted level.

34. THERMAL LAGGING

Thermal insulation shall only be carried out after successful pressure testing of the equipment.

The efficiency of the insulation system shall exceed 90 % and the insulation cold face temperature shall not exceed 40 °C.

Pipe insulation shall consist of pre formed insulation material having a thermal conductivity of approximately 0,040 W/m °K at 60 °C. The insulation material shall not have any corrosive effect on the pipework and, in particular, it must be noted that fibreglass may not be used on stainless steel.

Inside buildings, or in other protected areas, pipe insulation shall be supplied with a canvas covering having a 50 mm lap at one end and along the longitudinal seam. The laps shall be sealed using a suitable lagging adhesive. On bends the insulation material shall be neatly mitred and covered with canvas. At all flanges the insulation shall be closed off. Flanges, couplings, tees and valves shall be insulated using a removable canvas blanket or jacket fastened in place with brass hooks and eyes.

All insulation shall be coated with a suitable sealer and then painted in accordance with the colour code. The manufacturer shall advise regarding the paint types and system to be used.

Outside buildings or in other exposed areas pipe insulation shall be fixed in position using three bands per section or a suitable adhesive and then clad with aluminium. All longitudinal and circumferential joints shall incorporate a 50 mm lap with each edge grooved. The longitudinal joints shall be positioned in the "twenty past" position with the lap and groove downwards. All ends next to couplings or flanges shall be closed off and sealed before fitting muff type insulation and cladding over the couplings and flanges. All bends, tees and other fittings shall also be insulated and clad but valves need not be insulated. All joints shall be primed and sealed using a silicone or other appropriate sealer and the contractor shall generally ensure that the lagging is weatherproof with particular attention being paid to all joints and pipework anchor points.

With large exposed items such as vessels mounted outside, a suitable system incorporating a 20 mm thick, smooth layer of weatherproof, reinforced plaster covered with a scrim cloth and overcoated with at least two coats of fibre reinforced resin sealer shall be acceptable.

35. SPARES

Spares which are specified as part of the Works shall be packed individually in wooden boxes with the lids unattached. Each box shall be labelled with the Contract number, manufacturer, contents, relevant part/model numbers and the supplier's address. The boxes shall be brought to Site and the lids shall be secured to the boxes immediately after the Engineer has accepted the spares and the packaging.

36. SIGNAGE

36.1 GENERAL

All signs as specified below shall be installed prior to commissioning.

36.2 OPERATING INSTRUCTIONS

Operating instructions shall be framed and shall be attached to the wall in the control room using brass screws. The frame shall be of wood or aluminium with a glass front and hardboard backing. They shall include the following:

- a) Start up, Shut down and Operating instructions shall be comprehensive and shall indicate actions to be taken in the case of all alarm conditions. These shall be written from the point of view of the plant operator.
- b) A layout drawing of the equipment installation.
- c) A process flow diagram.
- d) A P&ID.

36.3 SAFETY

Safety signs shall be suitably framed or encapsulated. Symbolic signs shall comply with SANS 1186. The wording of the signs shall be accepted by the Engineer prior to final printing. They shall be provided by the Contractor in appropriate places on the walls of the plant room and shall include the following:

- a) All statutory and special safety warning instructions.
- b) Course of action during/after electrical shock.
- c) Any operating restrictions for equipment.
- d) Operating instructions in cases of plant trip and electrical supply failure.
- e) Spares list.

General specification

General Corrosion Protection

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1 Scope

This Specification covers the painting and corrosion protection of plant, equipment in pump stations and water and wastewater treatment works and pipelines exposed to environments with variable corrosive tendencies.

Interpretations and variations of this Specification are set out in the Amendments of this Specification.

2 Normative References

2.1 Supporting Specifications

Where this Specification is required for a project, the following specifications shall, inter alia, form part of the Contract Document:

- (a) Amendments to this Specification;

Equipment, materials and operational methods shall comply with the latest edition of the relevant SANS, ISO, AS, BS, DIN or equivalent American Standard as shown in Annexure A.

3 Definitions and Abbreviations

3.1 Definitions

In this Specification the following shall have the meaning given:

- (a) **Coat:** A single uniform film of corrosion protection material applied to a substrate for corrosion protection purposes.
- (b) **Layer:** A uniform protective film of corrosion protection material applied to plant, equipment and piping in a specified manner consisting out of multiple coats.
- (c) **System:** A corrosion protection coating or lining consisting of multiple coats and/or layers, the type of coat, the number of coats and their thickness, the method of application and the requirements of the complete system.
- (d) **Coating:** A system on the outside of plant, equipment and pipework. However, certain international specifications referred to in this specification (e.g. AWWA specifications) use the term 'coating' to refer also to internal pipe protection and where these specifications are being referred to their terminology is used.
- (e) **Lining:** A system on the inside of plant, equipment and piping.
- (f) **Dis-bonded area:** An area of coating or lining that initially did adhere to the steel substrate after application, but which subsequently became loose from the substrate as a result of mechanical, chemical or other action.
- (g) **Un-bonded area:** An area of coating or lining which at no stage adhered to the steel substrate.
- (h) **Water path:** The shortest distance along the surface of an object embedded in concrete but exposed to water measured along the concrete interface.
- (i) **Holiday:** A discontinuity in a coating or lining which exhibits electrical conductivity when exposed to a specific voltage.
- (j) **Abrasive blast cleaning:** The process of projecting a stream of abrasive particles at high velocity towards a surface for the purpose of removing contaminants from that surface and to produce a textured surface which will increase the surface area and thus increase adhesion of the coating.
- (k) **Dry film thickness (DFT):** The thickness of a coating or lining after it is hard dry.

- (l) **Electrical insulation defect (EID):** Defects in a coating or lining that impair the protective properties of the coating or lining and that are detected instrumentally by either:
 - (m) a low-voltage, wet-sponge detector, or
 - (n) a high-voltage, sparking detector,operated in each case within the parameters specified.

Note: EID's include such defects as steel projections from the substrate, conductive particles embedded in the coatings or linings, voids and those defects commonly known as pinholes and holidays.
- (o) **Fusion bonded epoxy (FBE):** A thermoset epoxy powder coat. (The powder is normally applied by electrostatic spray to a preheated surface. The powder normally melts, fuses and cures at a temperature of 220°C to 250°C.)
- (p) **Inspector:** A person authorised by the Engineer to act as his representative in examining the work and materials and drawing such samples and carrying out such tests as may be necessary to ensure compliance with the specification.
- (q) **Lot:** A number of similar or related items submitted for inspection at one time by the Contractor and of such size that the inspector can reasonably be expected to examine adequately in not more than one working day.
- (r) **Paint:** A liquid material that, when applied as a thin film to a suitably prepared surface by an appropriate method, undergoes a physical or chemical change (or both) that converts it to a solid coating or lining bonded to the surface to which it is applied.
- (s) **Pinhole:** An electric insulation defect detected by the use of a wet sponge detector (see EID).
- (t) **Pot life:** The period, after the contents of the packs of a two-pack paint have been mixed together, during which the paint remains suitable for use without the addition of further solvent.
- (u) **Powder coat:** A material in the form of a dry, free flowing powder that, when applied to a suitably prepared steel surface by an appropriate method, can be fused by application of heat and subsequent cooling to form a continuous coating or lining that is bonded to the surface. A powder coat is classified as thermoplastic when the applied coat may be re-melted by heating, or as thermoset when it cannot be re-melted by heat. Low or medium density polyethylene powder is thermoplastic whilst FBE is a thermoset material.
- (v) **Significant surface:** The part of the article covered or to be covered by the coating or lining and for which the coating or lining is essential for serviceability and/or appearance.
- (w) **Steel:** This term embraces carbon steels, 3CR12 and all grades of stainless steels.
- (x) **Water break free:** A surface which, when wetted all over with plain potable water, maintains a continuously wet surface and the water does not break up into islands surrounded by unwetted surfaces.
- (y) **Wet film thickness (WFT):** The thickness of a coating or lining immediately after application and before any volatile matter has evaporated.
- (z) **Quality control:** The operational techniques and activities that are employed by the Contractor to sustain the required quality of a product, process or service.
- (aa) **SAHDGA:** South African Hot Dip Galvanisers Association.
- (bb) **Sa:** Followed by a number refers to a photographic illustration of the standard of blast cleaning required, as shown in ISO 8501-1
- (cc) **St:** Followed by a number refers to a photographic illustration of the standard of mechanical cleaning required, as shown in ISO 8501-1.

3.2 Abbreviations

The following abbreviations shall have the meaning assigned to them:

µm : Micrometre

3CR12 : A 12% chromium-containing corrosion resistant steel

3LPE	:	Three layer high density polyethylene
ABS	:	Acrylnitrile-butadiene-styrene
Al	:	Aluminium
CI	:	Cast iron
CS	:	Cast steel
DCA	:	Die cast aluminium
DFT	:	Dry film thickness
EID	:	Electrical insulation defect
FBE	:	Fusion-bonded Epoxy
FBP	:	Fusion-bonded Polyester
FBPE	:	Fusion-bonded Polyethylene
GRP	:	Glass fibre reinforced Polyester
HDG	:	Hot-dip galvanized
HDPE	:	High Density Polyethylene
MIO	:	Micaceous Iron Oxide
MS	:	Mild steel
PC	:	Polycarbonate
PVC	:	Polyvinylchloride
QCP	:	Quality Control Plan
SG	:	Spheroidal graphite cast iron
SS	:	Stainless steel – grades 304, 304L, 316 and 316L
UV	:	Ultra Violet
WFT	:	Wet film thickness

4 Requirements

4.1 Contractor's Obligation

The requirements, material, surface preparation and corrosion protection systems prescribed in this Specification is regarded as a minimum requirement for the specific application. No deviation from this Specification shall be allowed without the written approval of the Engineer.

The Contractor is responsible for the design of the corrosion protection system and shall submit to the 333Engineer details of the material selection, surface preparation method and corrosion protection system he intends using as part of his design, including the Manufacturer's Instructions for each product and shall only proceed with the purchase of the corrosion protection materials/paints upon receipt of conformation from the Engineer.

The Contractor shall obtain written evidence from the chosen material manufacturer/supplier that the proposed materials, surface preparation method and corrosion protection system comply with the specified requirements and are suitable for the intended purposes under the specified Environmental Conditions (refer to Clause 4.3). The Contractor shall also obtain the Manufacturer's Instructions (refer

to Clause 4.2). The written evidence and Manufacturer's Instructions shall be submitted to the Engineer for comment before commencement of the work.

In the event that no corrosion protection is specified for any Plant, equipment or pipes within the Specifications or Drawings, this Specification shall be used as a basis to agree on a corrosion protection system for the specific application.

4.2 Manufacturer's Instructions

The manufacturer's instructions shall be regarded as the recommendations supplied by the manufacturer in the form of the latest edition of printed data sheets, or given in writing on the manufacturer's letterhead.

The following details shall be made available to the Engineer and the applicator:

- ▶ Brand and type of corrosion protection material;
- ▶ Mixing and thinning instructions;
- ▶ Recommended type and quantity of solvent required for thinning during application;
- ▶ Pot life of mixed product;
- ▶ Minimum and maximum recommended dry film thickness per coat;
- ▶ Minimum and maximum recommended dry film thickness per layer;
- ▶ Recommended time intervals between coats;
- ▶ Recommended minimum and maximum steel surface temperatures during application;
- ▶ Time for complete drying and curing on applicable surfaces;
- ▶ Substrate surface preparation requirements;
- ▶ Recommended primers for substrate;
- ▶ Recommended method of coating and lining application;
- ▶ Repair procedures for damaged coatings and/or linings and field joints on pipelines;
- ▶ Toxicity if in contact with water, and
- ▶ All relevant information the Supplier wishes to submit on his product.

Verbal instructions by the manufacturer's representative will not be accepted unless confirmed in writing by the Contractor.

4.3 Environmental Conditions

Environmental conditions shall be classified according to SANS 10120-3 HC. The corrosion protection system design and applied by the Contractor shall be suitable for the Environmental Conditions specified.

Unless otherwise specified in the Amendment of this Specification the Environmental Conditions shall be classified as follows:

- ▶ Mildly-corrosive: Dry, indoor/internal, above ground and ventilated conditions, not within 5km from the coastline or polluted industrial area. Relative humidity below 70%.
- ▶ Severely corrosive: Submerged, splash-zone, underground, very moist conditions, or within 5km from coastline or polluted industrial area, or in waste water works, or close to electrical power lines. Relative humidity above 85%.
- ▶ Medium Corrosive: All other conditions not included in the abovementioned definitions.

Notwithstanding the abovementioned information the Contractor shall satisfy himself of the environmental conditions on Site and design the final corrosion protection systems accordingly.

4.4 Workmanship

A high standard of workmanship is required. Only experienced personnel shall be used to carry out corrosion protection work. All work shall be carried out under the constant supervision of a qualified supervisor.

Similarly all repair work at Site shall be done by competent personnel under the supervision of a qualified supervisor.

4.5 Compatibility of Materials

4.5.1 Design Precautions

All equipment shall be designed to suppress corrosion in an exposed environment with special reference to galvanic corrosion.

The Contractor shall ensure that dissimilar metals or alloys alongside each other are compatible or are adequately protected if, in the galvanic series, there is more than a 0,3 volt difference in the galvanic potential.

4.5.2 Galvanic Corrosion Prevention

The Contractor shall ensure that the following steps are taken to minimise corrosion:

- (a) If dissimilar metals are used: Coat all surfaces of the whole assembly including the more noble member of the galvanic series.
- (b) If the noble member of the assembly cannot be entirely covered:
 - (i) Keep the anode/cathode ratio as large as possible in the particular component.
 - (ii) Use electrical insulators between two metals. Insulation must be complete, a bolt requires a sleeve as well as washers of an insulating material.
- (c) Joints and crevices between metals shall be sealed.
- (d) Where fastening is unavoidable, the fasteners shall be more noble (cathodic) than the base material. Fasteners shall be coated where possible and/or adequately electrically insulated between fasteners and the base material.

4.6 Handling of Clean Items

After cleaning, surface shall not be contaminated in any way. Operators shall wear clean gloves and all surfaces shall be clean and free from oil, grease, grit, dirt and other contamination.

4.7 Machined and Matching Surfaces

Mating surfaces of joints shall be coated with primer (where specified) or first coat only. The coating or lining shall be uniform in thickness and shall not interfere with the mechanical tolerances. After assembly the outside surface of the joints shall be fully coated.

4.8 Special Areas

Areas that are inaccessible after assembly shall be prepared and fully coated with the specified system to the specified requirements before assembly. The coats shall be fully cured before assembly.

Steel edges to be welded after coating shall not be coated for a distance of 50 mm from the welding edge. The unlined strip of grit blasted surface shall be temporarily protected with a coat of (red or a different colour to the lining/coating) weldable primer between coating and/or lining application and installation.

Friction grip areas shall be left un-coated unless otherwise specified.

4.9 Supports

During coating and/or lining application, the items shall be so supported to prevent damage to the wet coatings or linings until the coatings or linings have hardened adequately. Items shall remain supported during curing, storing and handling.

4.10 Water Retention Areas

Pockets, recesses and crevices in which water and dirt may collect shall be avoided. Water retention areas shall be properly drained by holes as large as possible.

Surfaces of corrodible metals, such as the insides of tanks or hollow Specifications that cannot be protected by any method (e.g. painting or dipping), shall be avoided, or where not possible, be fully sealed against ingress of air and moisture.

4.11 Stripe Coats and Crevices

All complex surfaces including metal edges, up stands, welds, bolts and nuts shall be adequately coated to ensure complete corrosion protection. Additional stripe coats shall be applied after initial priming, if required or ordered by the Engineer.

Special attention shall be given to crevices and edges to ensure complete coverage and uniform paint thickness.

4.12 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and repairs will be subject to inspections as set out in Clause 11.2. Where the damage is extensive the particular remedial procedures for each such instance shall be agreed with the Engineer in writing.

All repairs shall comply with the requirements of the repair-product Manufacturer's Instructions. The Engineer may at his discretion request that repaired areas undergo adhesion tests.

Any damage occurring during transit from the Contractor's premises to the Site shall be the responsibility of the Contractor. The Contractor shall repair any damage occurring on Site during handling, assembly, storage, transport and erection.

A repaired area shall be tested in accordance with Sub-Clauses 5.4 and 5.9 of SANS 1217 for compliance with the relevant requirements for thickness and electrical insulation defects respectively.

Any item showing electrical insulation defects exceeding an average of five per square metre (a cluster of pinholes within a radius of 25 mm being regarded as a single defective area), or flaking or

other signs of loss of adhesion, shall not be repaired. The item shall be blast cleaned and re-coated in accordance with the relevant requirements of this Specification.

Paint surfaces which become streaky because paint has run, will be rejected.

Touching up of damage to the final paint coat will NOT be permitted. If final paint coat is damaged the item shall completely repainted with the finishing coat in accordance with the specifications.

4.12.1 Repair Methods for Minor Defects

The repair of areas showing electrical insulation defects or low film thickness shall, if approved by the Engineer, be carried out as follows:

- ▶ Degrease in accordance with Clause 7.4.1.
- ▶ Thoroughly abrade the area, including an adjacent surrounding area of at least 25 mm wide, with a medium grade 220 abrasive paper.
- ▶ Vacuum-clean the surface to remove dust and debris in accordance with Clause 7.2 to achieve a dust quantity rating 1 and a dust size class 0 in terms of ISO 8502-3.
- ▶ Wipe the abraded paint surface with methyl ethyl ketone and allow to dry.
- ▶ Apply as many coats of repair material as necessary to achieve the specified electrical insulation thickness and finish as to conform to the adjoining corrosion protection system's requirements.
- ▶ Apply a final top coat over the repaired area to achieve a pleasing, uniform finish of the item.

4.12.2 Repair Methods for Major Defects

The repair of areas showing damage down to the steel surface shall, if approved by the Engineer, be carried out as follows:

- ▶ Degrease in accordance with Clause 7.4.1.
- ▶ Blast-clean area to Sa 3 (ISO 8501-1).
- ▶ Feather the surrounding paint for a distance of 25 mm beyond the damaged areas with a medium grade 220 abrasive paper.
- ▶ Vacuum-clean the surface to remove dust and debris in accordance with Clause 7.2 to achieve a dust quantity rating 1 and a dust size class 0 in terms of ISO 8502-3.
- ▶ Wipe only the abraded paint surface with methyl ethyl ketone and allow to dry.
- ▶ Apply as many coats of repair material as necessary to conform to the specified adjoining corrosion protection system's requirements.
- ▶ Apply a final top coat over the repaired area to achieve a pleasing, uniform finish of the item.

4.13 Quality Control

This clause and its sub-clauses shall be read in conjunction with the project's quality control plan, if any.

4.13.1 Submission for Approval

The Contractor shall submit the following to the Engineer, including data sheets where applicable, for approval:

4.13.1.1 Corrosion Protection

- ▶ A programme;
- ▶ The Quality Control Plan (QCP) for corrosion protection indicating hold points;

- ▶ Process Method Statement;
- ▶ Blast material;
- ▶ Proposed corrosion protection systems; and
- ▶ Proposed pickling and passivating products.

4.13.1.2 Manufacture and Corrosion Protection Programmes

The manufacture and corrosion protection programmes shall state the time and place when the following will be conducted:

- ▶ Inspection of material;
- ▶ Hydrostatic testing of uncoated castings, pipes and fittings;
- ▶ Manufacture of components;
- ▶ Fettling or dressing;
- ▶ Degreasing;
- ▶ Water soluble salts test;
- ▶ Blast cleaning and application of the first coat;
- ▶ Application of intermediate and final coats; and
- ▶ The commencement of Site repairs.

4.14 Health & Safety Requirements

4.14.1 Control of Major Classes of Risk

- (a) Health risks, these include:
- (i) Gases/vapours;
 - (ii) Volatile liquids in the paint; and
 - (iii) Powders/dust.
- (b) Fire or explosion risks, these include:
- (i) Fire risk during storage/transport; and
 - (ii) Explosion hazard during application.

4.14.2 General Aspects of Explosion Hazards

The essential precaution to be taken is, inter alia that sufficient ventilation air shall be provided to maintain the ratio of vapour/air to no more than 10% of the lower explosive limit.

4.14.3 General Aspects of Toxic Hazard

Measures shall be taken by the Contractor to ensure that the following are prevented:

- ▶ Inhalation of dust/fumes;
- ▶ Skin contact with paint;
- ▶ Ingestion of paint; and
- ▶ Eye contact/penetration of paint.

Operators shall be provided with the necessary Personal Protective Equipment (PPE), such as masks/hoods, barrier creams and protective clothing to minimize the chances of the above occurring.

Emergency procedure shall be in place and First Aid kit provided to deal adequately with any of the above occurrences.

The Contractor shall ensure that in terms of Clause 6(2) of the Construction Regulations of the OH&S Act 85 of 1993, an assistant construction supervisor is specifically appointed for the application or

repairs of linings inside enclosed or semi-enclosed areas e.g. pipe linings, prior to the execution of any such work.

4.15 Specific Requirements for Pipes and Specials

4.15.1 Cut Back of Coated Pipes

The blast cleaned surface shall be stopped off or cut back by suitable masking which shall not contaminate the cleaned surface. Cut-backs shall comply with the requirements as set out in Table 4-1 below:

Table 4-1: Cut-back of Coatings

PIPE END	CUT-BACK (mm)	COMMENT
Pipe ends prepared for field butt welding	100	All coatings to be mitred or feathered to prevent air entrapment in the joint coating system
Pipe ends prepared for flexible joint couplings	Various	The coating shall be cut back a sufficient distance to accommodate a standard coupling for the particular diameter of pipe
“Bell and spigot” pipe ends prepared for first welding	100	The cut back shall be measured from either side of the (field) external fillet weld position when the spigot is fully inserted into the “bell”

4.15.1.1 Protection of Pipe Ends on Pipes with Cut-Back

Before delivery cut backs of each pipe for field welds shall be coated with an approved rust inhibitor. This inhibitor shall provide corrosion protection for up to 6 months and shall enable good cutting and welding properties (Sigmaweld 120, Plascon etching primer or equivalent approved). Plain ended pipes (to be joined by flexible couplings) are to be coated with an approved rust inhibitor for a distance of 100mm from the pipe ends on the inside and the outside of each pipe. Careful attention must be paid to ensuring the pipe ends are also completely covered. The inhibitor used must be compatible with both the lining and the coating.

4.15.2 Pipe Ends

4.15.2.1 Extension of Lining

For flanged pipes or specials and pipes or specials intended for joining with flexible couplings or for Site welding by means of double sleeve weld-on couplings, the lining shall extend to the ends of pipes and specials including edges and shall overlap by at least 300 mm on the outside of the pipe. Coatings shall overlap surfaces on the outside by at least 25 mm.

4.15.2.2 Butt Weld Edges

For pipes and specials intended for Site butt-welding, lining and coating shall extend up to a distance of 50 mm from pipe ends. The unlined circumferential strip of grit blasted surface shall be temporarily protected between the Works and Site with a coat of weldable primer (of a different colour to the lining/coating).

4.15.3 Field Joints

No welding whatsoever shall be performed on any pipe or special on which the lining or coating has been completed, unless otherwise approved by the Engineer in writing.

The materials used for the repairs to field joints, linings and coatings shall be the same as that used for the pipes, unless otherwise approved by the Engineer in writing.

The linings and coatings of butt welded steel pipes or continuously welded steel cylinder type prestressed concrete pipes, shall be made continuous over joints as soon as possible after approval and acceptance by the Engineer of the welded joint. At no time shall field joints, lining and coating repairs/remedial work lag more than 250 metres behind the last pipe laid.

Flexible couplings shall be provided with external protection as soon as the pipeline has been hydrostatically tested and electrically bonded, where applicable.

4.15.4 Supports

When pipes are installed or mounted on concrete supports, rubber insertion shall be used to insulate the pipe from the support. The thickness of the rubber insertion shall not be less than 10 mm and protrude not less than 20 mm all round.

4.15.5 Sealing

Pipes that enter or exit concrete shall be sealed on their circumference with a continuous polyurethane or polysulphide flexible sealer, in a 25 mm square recess.

4.15.6 Spare Pipes

Corrosion protection of spare pipes shall where applicable be supplied with a top coat of Re-coatable Polyurethane to a DFT of 30 – 50 µm, colour white or silver, for storage and above ground installation.

5 Materials

The material requirements for each corrosion protections system is specified in the relevant clauses of Clause 10 and shall be read in conjunction with this clause.

5.1 General

All materials in a corrosion protection system shall be purchased from the same manufacturer unless approved by the Engineer.

Materials offered and subsequently approved shall not be changed without written approval of the Engineer.

All corrosion protection materials shall be delivered in the manufacturer's original containers clearly marked with the following:

- ▶ Manufacturer's name;
- ▶ Product Brand and Reference Number;
- ▶ Batch Number which may incorporate the date of manufacture;
- ▶ Abbreviated instructions for storage and use of material, which shall include mixing ratios of the components of multi-component materials, minimum and maximum temperature of application and the method of application; and
- ▶ The SANS mark where applicable.

Any conflict between the manufacturer's data sheet and the specification shall be referred to the Engineer for adjudication.

5.2 Toxicity of Lining Material

Materials used for the lining of equipment that will be in contact with water shall be non-toxic and shall not impart any odour, taste, or colour to the water.

5.3 Storage

All corrosion protection materials shall be kept in an approved dry and enclosed store. The temperature shall not drop below 0°C nor exceed 40°C.

Usage of materials shall be on a first in, first out basis and no materials shall be used that have exceeded the shelf life recommended by the manufacturer.

6 Contractor's Equipment

6.1 Handling and Transportation

The plant and equipment used by the Contractor for handling of pipes, valves, pumps and other equipment, for the purpose of corrosion protection shall be such that no pipe shell, valve or pump casing or any other piece of equipment is over stressed during any operations covered by this Specification.

6.2 Surface Preparation Equipment

The Contractor shall provide all the equipment required for abrasive blast cleaning, preparation and cleaning of all surfaces to be coated.

6.3 Compressor

Compressors used for abrasive blast cleaning shall be fitted with an after cooler and oil and water traps such that the air delivered at the nozzle is completely free from oil and water. The volume displacement of the compressors shall be adequate for the number and bore of blast nozzles, the spray equipment and flame spray equipment that may be necessary to carry out the specified coating operations.

6.4 Application Equipment

The Contractor shall provide all the equipment required for airless spray painting, two component hot airless spray painting, electrostatic powder coating, fluidised bed powder coating, or any other approved method of applying the corrosion protection system in the shop or required for site application and repairs to coats. All equipment shall be thoroughly cleaned on completion of each day's work and maintained in clean working order.

6.5 Inspection of Equipment

All facilities and equipment shall be subject to inspection by the Engineer or the independent inspectorate and defects in the equipment shall be rectified when so required.

6.6 Inspection Equipment

The Contractor shall supply all facilities and equipment for inspecting and testing the specified preparation and corrosion protection of all items supplied under the Contract. Recent calibration certificates shall be available for all equipment requiring calibration. This equipment shall be made available to the Engineer or his independent inspectorate for the purpose of testing the specified corrosion protection systems and verifying the accuracy of the test equipment.

7 PREPARATION OF SURFACES TO BE COATED

The surfaces of all items to be coated and/or lined, irrespective of the corrosion protection system used, shall be prepared in accordance with the relevant following requirements.

7.1 Standards

Reference is made to the latest issues of the following Standards:

- SANS 1344** Medium duty solvent detergent.
- SANS 10064** The preparation of steel surfaces for coating.
- ISO 8501-1** Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after overall removal of previous coatings.
- ISO 8502-3** Preparation of steel substrates before application of paint and related products - Tests for the assessment of surface cleanliness Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method).
- ISO 8504-2** Preparation of steel substrates before application of paints and related products – Surface preparation methods – Part 2: Abrasive blast cleaning.
- SANS 5770** Cleanliness of blast-cleaned steel surfaces for painting (freedom of soluble salts).
- SANS 5772** Profile of blast-cleaned steel surfaces for painting (profile gauge).
- ISO 11125** Preparation of steel substrates before application of paints – Metallic blast-cleaning abrasives.

ISO 11127 Preparation of steel substrates before application of paints – Non-metallic blast-cleaning abrasives.

7.2 Surface Condition

Before surface preparation all items to receive a coating or lining shall be in rust condition A to C of ISO 8501-1. Items in rust condition D will be rejected.

Prepared surfaces shall conform to Table 7-1 below. If only surface cleanliness to ISO 8501-1 is specified in the Specifications then the corresponding values of Table 7-1 for degreasing, surface profile and soluble salts shall apply.

Table 7-1: Surface Condition

Cleanliness to ISO 8501-1 (min)	Sa 3	Sa 2½	St 2
Residual dust quantity rating and size class (ISO 8502-3)	1 / 0	1 / 1	1 / 1
Oil, grease and perspiration	Nil	Nil	Nil
Surface Profile(min)	30 µm	30 µm	n/a
Layers up to 200 µm (max)	50 µm	50 µm	
Surface Profile (min)	50 µm	50 µm	n/a
Layers > 200 and up to 300 µm (max)	80 µm	80 µm	
Surface Profile (min)	60 µm	60 µm	n/a
Layers > 300 and up to 500 µm (max)	100 µm	100 µm	
Water soluble salts:			
Maximum at any point.	100 mg/m ²	400 mg/m ²	500 mg/m ²
Average of any 250 cm of Pipe length.	100 mg/m ²	100 mg/m ²	100 mg/m ²

Note: The maximum surface profile shall be less than 1/3 of the coat thickness.

Unless otherwise specified in the Amendments to this Specifications the surface condition shall conform to the following requirements:

- ▶ Sa 3 for the environmental condition classified as severely corrosive,
- ▶ St 2 for Tape Wrapping, and
- ▶ for all other environmental conditions the surface condition shall be Sa 2½.

7.3 Preparation of Items

Prior to the application of any coat, each item shall comply with the following:

- ▶ Weld splatter shall have been removed by chipping or grinding to a smooth surface flush with the surrounding steel.
- ▶ Weld seams shall have a smooth contour, free from sharp edges, protrusions and undercuts.
- ▶ Sharp edges and protrusions shall have been removed by grinding to a smooth radius. The radius shall be a minimum of 3 mm for steel of thickness 6 mm or greater, or a minimum of 50% of the steel thickness for steel of thickness less than 6 mm.

- ▶ Laminations, scabs or occluded scale shall be ground out. If such grinding penetrates deeper than 3.5% of the metal thickness, the area shall be repaired by welding or the metal shall be rejected at the discretion of the Engineer.
- ▶ Articles for hot-dip galvanizing shall not have any overlapping joints. Closed sections shall be suitably vented.

7.4 Cleaning of Items

7.4.1 Degreasing

All surfaces to be coated shall be tested for oil and grease contamination by the water break free test.

In the event that degreasing is required, items shall be degreased by the use of a water based solvent degreaser such as that complying with SANS 1344 or, for use in enclosed systems, with SANS 1365.

Items shall be thoroughly washed with clean potable water to remove all residues. The items shall then be allowed to dry. The washed surfaces shall be tested after degreasing to show that no oil, grease and chemical contamination are present.

Care shall be taken to avoid entrapment of cleaning agents in recesses or other retention areas.

7.4.2 Blast Cleaning

Blast-cleaning shall be done in accordance with the code of practice SANS 10064. Any abrasive used for blast cleaning shall be composed of clean, non-recycled, sound hard particles free from foreign substances such as dirt, oil, grease, toxic substances, organic matter, water soluble salts and foreign metals.

The surface of the items to be coated or lined shall be blast cleaned by centrifugal or air blast cleaning methods, then vacuum cleaned or blown off to achieve the following requirements:

- ▶ The surface condition shall be in accordance with ISO 8501-1 as stipulated in Clause 4.2 and specified in the Amendments and Additions of the Specification, when tested in accordance with SANS 5772.
- ▶ Any laminations revealed by blast cleaning shall be ground out and re-blast cleaned to meet the above requirements. If grinding penetrates the steel to a depth greater than 3.5% of the nominal wall thickness, the item will be rejected.
- ▶ The time interval between abrasive blast cleaning and paint application shall not exceed those given in Clause 9.2.6.2.

7.4.3 Mechanical Surface Preparation

Cleaning by hand or by means of power tools (e.g. wire brushing) shall be carried out in accordance with the methods described in SANS 10064 to the standards specified in the Amendments of this Specifications and as shown in ISO 8501-1 and Clause 7.2.

7.5 Pickling and Passivation

Where specified the following areas shall be pickled and passivated:

- ▶ All un-coated areas;
- ▶ Ground and sheared edges; and
- ▶ Heat affected zones caused by welding or cutting.

Where possible, pickling and passivation shall be done by the dipping process.

Proprietary pickling and passivation chemicals (as supplied by approved suppliers) shall only be used in accordance with the manufacturer's recommendations. Pickling formulations made up of 15 to 20% nitric acid (HNO₃) and 1 to 2% hydrofluoric acid (HF) by volume with potable water are considered suitable. Care shall be taken not to exceed the maximum contact time recommended.

After pickling and passivation, surfaces shall be very thoroughly washed with clean potable water to remove all traces of acid. Repeat the process, if necessary to remove all discolouration. Surfaces shall be allowed to dry, then polished where necessary, using polishing compounds recommended by the stainless steel manufacturer.

8 Surface Preparation Methods

The requirements as specified below shall be read in conjunction with the requirements of Clause 7 Preparation of Surfaces to be Coated. Each preparation method specified below shall also conform to the relevant requirements of Clause 7 and its sub-clauses. Where in conflict with Clause 7 and its sub-clauses the requirements hereunder shall take precedence.

Unless otherwise specified in the Amendments of this Specifications and subject to the approval of the Engineer, the surfaces of all items to be coated and/or lined shall be prepared in accordance with one or more of the following methods.

8.1 Mild Steel

Components manufactured from mild steel shall be degreased and blast clean before the corrosion protection system is applied. Oil and grease contamination, when present, shall be removed to a water break free surface by degreasing (Refer to Clause 7.4.1) before blast cleaning (refer to Clause 7.4.2).

Steel items less than 2 mm thick may distort when blast cleaned. Sheet steel items less than 2 mm in thickness shall be degreased, acid pickled and phosphated with an approved proprietary 7 or 9 stage process to produce a fine grain zinc phosphate surface complying with SANS 10064 Table 1 Lightweight or by a proprietary process approved by the Engineer for the standard of cleaning specified.

All surfaces of steel 2 mm or more in thickness shall be abrasive blast cleaned in accordance with SANS 10064 Section 5.3 and cleaned to achieve the requirements given in Table 4-1 for the standard of abrasive blast cleaning specified.

8.2 Cast Iron and Cast Alloys

Cast iron shall be abrasive blast cleaned until all sand particles, residual burnt-on sand and casting skin have been completely removed. Cast iron surfaces shall be abrasive blast cleaned in accordance with SANS 10064 Section 5.3 to achieve the requirements given in Clause 7.2 for the standard of abrasive blast cleaning specified.

Blowholes and omegas in cast surfaces shall be opened up where necessary and filled with a two component solvent free epoxy filler. When the filler has set hard, the surface shall be abraded to be flush with the surrounding metal.

8.3 Stainless and Corrosion-Resistant Steel

Components manufactured from stainless or corrosion-resistant steel shall be supplied in the fully passivated condition. Sheared edges, welds or surfaces subjected to any form of heat treatment or contamination with iron or mild steel, shall be pickled and passivated in terms of Clause 7.5.

Surfaces shall thereafter be thoroughly degreased in terms of Clause 7.4.1, then rinsed with potable water to obtain a water-break-free surface.

When it is required to paint stainless steel exceeding 2 mm thickness, the surface shall be blast cleaned in accordance with the parameters given in Clause 7.2, using non-metallic abrasives such as iron slag, copper slag or platinum slag. The use of steel shot, steel grit or cast-iron grit is strictly prohibited. Any contamination with iron or mild steel is prohibited.

Where blasting is impractical, the surface shall be cleaned with detergent solution and roughened manually by the use of non-metallic abrasive pads, followed by washing with clean potable water to a water-break-free surface. If a water-break-free surface is not obtained, detergent cleaning shall be repeated until the surface is water-break-free. Allow the surface to dry before coating.

8.4 Aluminium

Generally, aluminium surfaces will be anodized or powder coated and will require no further treatment. Where painting is required, the aluminium surface shall be thoroughly degreased then rinsed with clean potable water. If the surface is not water break free, repeat the degreasing process until a water-break-free surface is obtained. Allow to dry completely, then apply a thin coat (8 to 13 micrometres dry film thickness) of wash primer, mixed and applied in accordance with the manufacturer's instructions. Note that the "wash primer" is an adhesion promoter and does not replace the primer specified in the paint system.

8.5 Hot-Dip Galvanized Surfaces

Hot-dip galvanized surfaces shall be thoroughly degreased by scrubbing with water rinsable solvent degreaser, followed by thorough washing with clean, potable water. If the water breaks up into islands of non-wetted surface, the degreasing shall be repeated until a water break free surface is obtained. Small areas may be abraded with a non-metallic abrasive paper prior to painting. Large surfaces may be sweep blast cleaned, using ultra-fine abrasive (particle size 0,2 to 0,8 mm) and a nozzle pressure not exceeding 300 kPa. A uniform matt surface shall be obtained. Loss of zinc thickness shall not exceed 10 µm. Cracking and flaking of the galvanized layer is indicative of excessive blast cleaning by using too coarse abrasive or too high blast pressure. Such surfaces will be rejected. The article shall then be stripped and re-galvanized.

8.6 Painted Surfaces

8.6.1 Primer Only

Where the surface has been contaminated it shall be washed and dried to remove dust and deposits before overcoating.

The succeeding coats shall be compatible with the primer. Where the type of primer is unknown, a test patch shall be applied. There shall be not loss of adhesion or other defects of the primer or between primer and undercoat. If defects or adhesion loss occur, the primer shall be completely removed, feather blasted and replaced by a primer which is compatible with the specified system.

8.6.2 Recoatable Materials

Surfaces painted with recoatable paints shall be abraded with abrasive paper grade 220 to a uniform matt finish, washed and dried to remove dust and deposits before overcoating.

8.6.3 Fully Cured Non-Recoatible Materials

Surfaces painted with fully cured non-recoatible paints that have exceeded their overcoating time shall be thoroughly abraded with abrasive paper grade 220 to a uniform matt finish, washed and dried before overcoating. The edges of any damage shall be smoothly feathered into the sound paint. Repairs to damaged areas shall extend 25 mm beyond the damage.

8.6.4 Two Component Paints within their Overcoating Time

Surfaces painted with two component paints where the paint is still within the overcoating time specified by the manufacturer shall be recoated without special surface preparation. Where the surface has become contaminated, it shall be cleaned.

8.7 Plastic Surfaces Such as PVC and GRP

Where the surface has been contaminated it shall be washed and dried to remove dust and deposits before overcoating.

8.8 Concrete and Plaster Surfaces

Concrete and plaster surfaces to be painted shall be clean, dry and free from laitance, dust or similar friable surface layers and from mould oil or similar contaminants that will interfere with the adhesion of the coating or lining.

Mould oil shall be removed by the use of a water-based detergent followed by high pressure water washing. When all contaminants have been removed, the surface shall be allowed to dry either to a damp condition or to a completely dry condition, depending on the coating or lining to be applied.

For immersion or other heavy duty applications, laitance shall be totally removed by water blast cleaning, with abrasive injection, or by mechanical scabbling of the surface, or by acid pickling, followed by very thorough washing with potable water.

Off shutter concrete usually shows surface blowholes or omegas. Omegas shall be drilled or chipped open to the full hole diameter. Blowholes and opened omegas shall be filled with a suitable filler such as acrylic or solvent-free epoxy. The use of gypsum or cellulose-based fillers is not permitted for underwater or humid conditions. Shutter kicks and similar projections shall be removed by grinding to a smooth surface.

For coatings or linings of low water permeability, such as solvent-borne epoxies, vinyls and chlorinated rubber, the moisture content of the concrete or plaster shall be not more than an indicated 5% when tested with an approved electrical conductivity meter, designed for use on concrete or plaster (such as the Delmhorst meter). The pins of the meter shall penetrate the concrete or plaster to a depth of not less than 5 mm.

The first coat of the coating or lining system may require thinning with the manufacturer's recommended solvent to assist in penetration of the substrate.

9 Application of Corrosion Protection System

All coatings and/or linings, irrespective of the surface preparation method or corrosion protection system used, shall be applied in accordance with the relevant following requirements.

9.1 Conditions During Application

If in the opinion of the Engineer adverse weather conditions are such as to interfere with the successful application of an efficient corrosion protective system, he shall order a stoppage of work. The Contractor will be deemed to have accepted this risk and made provision for it in his rates.

9.1.1 Dusty Conditions

Coats shall not be applied in dusty or contaminated conditions.

9.1.2 Surface Temperature

Coats shall not be applied if the surface temperature of the base metal is less than 3°C above dew point or outside the range 5 - 40°C, unless otherwise recommended in the manufacturer's instructions.

9.1.3 Ambient Temperature

Coats shall not be applied when the ambient temperature is less than the minimum or greater than the maximum recommended by the manufacturer's instructions of the corrosion protection material.

9.1.4 Relative Humidity and Time Interval

The time interval between abrasive blast cleaning and paint application shall not exceed those given in Table 9-1.

Table 9-1: Maximum time interval - Between blast cleaning and coating

Ambient Relative Humidity	Maximum Time (hours)
Below 50%	6
50% - 70%	4
70% - 85%	2
Over 85%	Coating not permitted - Reblast and coat when rel. humidity below 85%

Should immediate lining/coating not be possible, or should any atmospheric oxidation take place between the completion of blast cleaning and commencement of lining/coating, such oxidation shall be removed by flash blasting to restore the specified surface finish.

9.2 Paints

9.2.1 Application Method

The recommendations of the paint manufacturer as per the manufacturer's instruction (refer to Clause 4.2) as shown on his data sheets or given in writing shall be followed.

Apart from touch up, all liquid paints applied in the shop shall be applied by means of airless spray machines. Before use all paints shall be thoroughly stirred so as to be completely homogeneous. Two component paints shall be thoroughly mixed in the correct proportions as specified in the manufacturer's data sheet.

Painting on site shall be carried out to the Engineer's written approval. Significant surfaces to be painted on site shall be those specified in the Specification or shown on the drawings. Site application methods shall comply with the paint manufacturer's recommendations.

9.2.2 Colour

Successive coats shall have distinctively different shades to facilitate coverage of each coat. Unless otherwise specified in the Amendments to this Specification, or directed by the Engineer, the final paint colour shall be that given in Appendix B of this specification and shall be a commercial match to the appropriate colour in SANS 1091 - National Colour Standards for Paint.

9.2.3 Wet Film Thickness

The Contractor shall regularly and frequently monitor wet film thickness and shall calculate the dry film thickness from the volume solids of the paint.

9.2.4 Mixing

All paint components, particularly two- or multi-component materials, shall be thoroughly mixed until a homogeneous mixture is achieved.

9.2.5 Degree of Cure

The degree of cure of paint will vary with time, temperature and ventilation and shall be assessed by solvent wiping in accordance with the method given in SANS 1217 (Methyl Ethyl Ketone Resistance Test).

9.2.6 Overcoating

9.2.6.1 Compatibility of Coats

All primer, intermediate, finishing coats and layers shall be mutually compatible and recoatable paints shall be used where applicable. There shall be no loss of adhesion between the consecutive coats or other defects.

9.2.6.2 Overcoating intervals

The minimum and maximum overcoating intervals provided in the manufacturer's data instructions shall be strictly observed. Times and dates of application shall be recorded for each separate item and coat in the quality control records.

Since overcoating times are frequently quoted at 20 °C or 25 °C, longer overcoating times shall be allowed at lower temperatures. As a rough guide, increase time by 50% for a 5° decrease (or by 100% for a 10° decrease) in the ambient temperature below the temperature quoted in the data sheet.

9.2.6.3 Thickness of Consecutive Coats

Generally a corrosion protection system will be build-up with multiple coats. The thickness of all coats, primer, intermediate or finish coats shall be strictly according to the manufacturer's instructions. For solvent-base paints it is imperative that the applicator does not exceed the maximum film thickness per coat applied in order to prevent entrapment of the solvent and the formation of pinholes.

9.3 Duplex or Multi-Layer Systems

Duplex or Multi-layer systems consist of more than one corrosion protection system applied consecutively e.g. a Hot-Dip Galvanizing and Polyurethane system

The specifications for each of the corrosion protection systems shall be strictly followed. Special attention shall be given to adhesion between the systems.

9.4 Finishing on Site

Repairs, finish painting and cleaning on the site are regarded as inherent parts of the installation. On completion of erection, all pipework, control gear and indicating gear shall be thoroughly cleaned.

After erection, paint work shall be washed down, using nylon brushes and detergent to remove all adhering contamination. It shall then be washed with clean water to remove all traces of detergent and allowed to dry. The finishing coat shall then be applied as specified in the Amendments to this Specification.

All surfaces which cannot be painted after erection shall be painted as specified before erection. The painting system so applied shall be allowed to become fully hard dry (for at least two weeks for epoxy type paints) before erection.

For coatings such as epoxies, having a limited overcoating interval as specified in the manufacturer's data sheets, the surface shall be washed and thoroughly abraded to a matt finish before application of the finishing coats in accordance with the manufacturer's instructions.

9.5 Tolerances

9.5.1 Individual Coats Film Thickness

At least 90% of all thicknesses measured shall comply with the minimum thickness of the system specification. Up to 10% of all readings may be below the specific minimum thickness, but no reading shall be less than 70% of the specified minimum thickness.

9.5.2 Total Dry Film Thickness

Not more than 10% of readings shall be less than the minimum specified and no reading shall be less than 90% of the specified minimum. For severely corrosive conditions no reading shall exceed the specified thickness by greater than 60% of the minimum.

10 Corrosion Protection Systems

The requirements as specified below shall be read in conjunction with the requirements of Clause 9: Application of Corrosion Protection Systems. Each system specified below shall also conform to the relevant requirements of Clause 9 and its sub-clauses. Where the requirements of this clause is in conflict with Clause 9 and its sub-clauses the requirements hereunder shall take precedence.

10.1 Recommended Corrosion Protection System

Unless otherwise specified in the Amendments to this Specification and subject to the approval by the Engineer, Plant, equipment and pipework in pump stations and water and wastewater treatment works

and pipelines shall be corrosion protected with one or more of the corrosion protection systems described in the following paragraphs of this Specification.

10.2 System 1: Alkyd Resin Based

Alkyd systems are intended for use in environments of low corrosivity, where a good decorative finish is required. Materials shall therefore be applied with due cognisance of appearance and protection. Defects such as runs, sags, curtaining, shrivelling or wrinkling will not be permitted.

10.2.1 Standards

Reference is made to the latest issues of the following Standard Specifications:

SANS 630: Decorative high gloss enamel paints.

SANS 681: Undercoats for paints

SANS 1319: Zinc phosphate primer for steel

10.2.2 Material

Alkyd zinc phosphate primer for steel shall comply with the requirements of SANS 1319.

General purpose alkyd undercoat shall comply with the requirements of SANS 681 Type 2.

Alkyd enamel shall comply with the requirements of SANS 630.

10.2.3 Surface Preparation

The substrate surface preparation shall conform to the Manufacturer's Instructions or as specified in the Amendments of this Specification as approved by the Engineer. In the event of it being omitted the surface preparation shall conform to the requirements Sa 2½ (ISO 8501-1) and the corresponding requirements as specified in Table 7-1 and the applicable Method as specified in Clause Surface Preparation Methods8.

10.2.4 Application

Coating thicknesses shall be at least 250 µm unless otherwise specified in the Amendments to this Specification.

10.2.5 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and in Clause 4.12.

10.2.6 Testing

Testing shall conform to the requirements of Clause 11 and SANS 1217.

10.3 System 2: Vinyl Resin Based

Vinyl copolymer (PVC) paints are a single component vinyl resin-based paints have excellent resistance to water, chemicals, dilute acids and hypochlorites. Their resistance to heat is poor and they must never be used on surfaces continually subjected to a temperature of 70 °C or higher. They

are not resistant to solvents and should not be used where there may be contact with oils, grease, kerosene, petrol etc.

The main advantage of vinyls is their easy maintainability. Whereas epoxies are difficult to recoat after about one month's exposure, vinyls may be recoated after any period of time.

Vinyls are recommended for use above water and for interior and exterior use where and could be subject to chemical fumes, as in chlorination rooms.

10.3.1 Material

Vinyl copolymer (PVC) paints shall have a solids content of 50% by mass and 32% by volume with a viscosity of 4,5 poise +_ 0,5 poise. The paint shall be stabilised against UV radiation.

10.3.2 Surface Preparation

The substrate surface preparation shall conform to the Manufacturer's Instructions or as specified in the Amendments of this Specification as approved by the Engineer. In the event of it being omitted the surface preparation shall confirm to the requirements Sa 2½ (ISO 8501-1) and the corresponding requirements as specified in Table 7.1.

10.3.3 Application

Coating thicknesses shall be at least 250 µm unless otherwise specified in the Amendments to this Specification.

10.3.4 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and in Clause 4.5.

10.3.5 Testing

Testing shall conform to the requirements of Clause 11 and SANS 1217.

10.4 System 3: Thermal Spray Metal

Thermally sprayed metal coatings shall consist of the metal spray plus the application of a suitable sealant and a suitable coating.

10.4.1 Standards

Reference is made to the latest issues of the following Standard Specifications:

SANS 2063: Thermal spraying - Metallic and other inorganic coatings - Zinc, aluminium and their alloys

10.4.2 Surface Preparation

The substrate surface preparation shall conform to the Manufacturer's Instructions or as specified in the Amendments of this Specification as approved by the Engineer. In the event of it being omitted the surface preparation shall confirm to the requirements Sa 2½ (ISO 8501-1) and the corresponding requirements as specified in Table Table 7-1.

10.4.3 Application

Thermally sprayed metal coatings shall consist of the metal spray plus the application of a suitable sealant and a suitable coating.

The minimum coating thickness for both aluminium and zinc shall be 150 µm. Greater thicknesses may be specified for particular applications.

Thermal spray metal paints shall be continuously agitated in a pressure pot to ensure dispersion of the zinc particles in the liquid components.

The time between surface preparation and coating shall be shortened from 4 hours to 2 hours at any application area closer than 10 km from the coast.

10.4.4 Repair of Damaged Coats

The requirements of Clause 10 shall apply.

10.4.5 Testing

The thickness shall be checked on every surface plane at points not more than 300 mm apart for small articles and 500 mm for large articles. Angles shall be checked along all 4 surfaces, channels along all 6 surfaces, pipes in 4 planes. The minus tolerance on thickness in isolated areas shall also not exceed –10 % and such low areas shall not be larger than 50 mm in diameter.

10.5 System 4: Powder Coats

10.5.1 Standards

Reference is made to the latest issues of the following Standards:

BS 5493: Protective coating of iron and steel structures against corrosion.

10.5.2 Material

Material used shall conform to SANS 1217, Type 2, powder coating.

10.5.3 Surface Preparation

The substrate surface preparation shall conform to the Manufacturer's Instructions or as specified in the Amendments of this Specification as approved by the Engineer. In the event of it being omitted the surface preparation shall conform to the requirements Sa 2½ (ISO 8501-1) and the corresponding requirements as specified in Clause 7.2 and Table Table 4-1.

10.5.4 Application

10.5.4.1 Coating Thicknesses

Coating thicknesses shall be at least 250 µm unless otherwise specified in the Amendments to this Specification.

10.5.4.2 Coating Application

Powder shall be applied in the shop by electrostatic spray or by fluidised bed as applicable. Items for powder coating shall after surface preparation, be pre heated to the required temperature, usually in the range 200 to 250 °C, coated by electrostatic spray or by fluidised bed, then post cured if necessary to obtain complete fusion and cure. For surfaces to be immersed the applied coating shall be tested for defects by high voltage spark testing. No defects will be permitted. Thermoset materials such as FBE shall be fully cured.

10.5.5 Repair of Damaged Coats

No repairs of damaged coatings will be accepted.

10.5.6 Testing

Testing shall conform to the requirements of Clause 11 and SANS 1217.

10.6 System 5: Two Pack Epoxy

This corrosion protection system is suitable for large steel items subject to medium corrosive and severely corrosive environmental conditions such as valves, pipes, etc.

10.6.1 Standards

Reference is made to the latest issues of the following Standard Specifications:

SANS 1217: Internal and external organic coating protection for buried steel pipelines.

ISO 2808: Paints and varnishes - Determination of film thickness.

BS 5493: Protective coating of iron and steel structures against corrosion.

10.6.2 Material

The material used for two component (two pack) high build polyamide epoxies shall be based on epoxy-polyamide resins and shall comply with the requirements of SABS 1217. Epoxies shall be of the high build, modified aluminium epoxy mastic type, containing at least 90% solids.

Solvent free epoxies in accordance with SANS 1217 Type 1B is preferred. Type 1A (solvent-borne chemically cured paint material) will only be approved by the Engineer for specific application conditions.

The epoxies shall be non toxic and non tainting when it will be in contact with potable water.

10.6.3 Surface Preparation

Unless otherwise specified in the Amendments to this Specification the surface preparation shall confirm to the requirements Clause 7.2.

10.6.4 Application

10.6.4.1 Dry Film Thicknesses

Dry film thicknesses shall be at least 250 µm unless otherwise specified in the Amendments to this Specification.

10.6.4.2 Mixing

In the case of two-pack materials, each component containing pigments shall be thoroughly mixed.

The two components shall then be mixed together in the proportions supplied by the manufacturer until the mixture is completely homogeneous. For two pack materials, the use of part of the contents (split packs) is strictly forbidden.

In the case of solvent based Epoxy materials, it is recommended that the mixed material be allowed to stand for an induction period, as recommended by the manufacturer, before use.

During application, paint materials shall be agitated regularly to keep the solids in suspension.

The preparation time, induction time and pot life of these materials shall be closely adhered to.

10.6.4.3 Curing

Adequate ventilation (and heating if required), shall be provided for the proper curing of the epoxy coating or lining in all circumstances with special reference remedial work, repairs and to field joints of pipelines.

10.6.5 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and in terms of Clause 4.12 **Error! Reference source not found..**

10.6.6 Testing

Testing shall conform to the requirements of Clause 11 and SANS 1217.

10.6.7 Pipe Field Joints for Epoxy Linings

The internal corrosion protection System of welded field joints, for pipes with epoxy linings, shall be the same as that used for the adjacent pipes.

The surface preparation of the field joint area shall be the same as for the repair of major defects as specified in Clause 4.12.

10.7 System 6: Fusion Bonded Epoxy (Heavy Duty)

This corrosion protection system is suitable for large steel items subject to medium corrosive and severely corrosive environmental conditions such as valves, pipes, etc.

10.7.1 Standards

Reference is made to the latest issues of the following Standards:

SANS 1217: Internal and external organic coating protection for buried steel pipelines.

ISO 12944: Paints and varnishes – Corrosion protection of steel structures by protective paint systems.

10.7.2 Material

Material used shall conform to SANS 1217, Type 2, powder coating.

10.7.3 Surface Preparation

Unless otherwise specified in the Amendments of this Specification the surface preparation shall confirm to the requirements Clause 7.2.

10.7.4 Application

10.7.4.1 Dry Film Thicknesses

Dry film thicknesses shall be at least 250 µm unless otherwise specified in the Amendments to this Specification.

10.7.4.2 Coat Application

Items shall be heated to a temperature of 200°C (only applicable to heavy items) and coated with Fusion-bonded Epoxy by means of an electrostatic powder gun.

The normal procedures pertaining to powder application shall apply.

On completion of the coating or lining, items shall be cured for 60 minutes at 200°C (mean temperature).

10.7.5 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and conform to the requirements of Clause 4.12. with an approved repair kit.

10.7.6 Testing

Testing shall conform to the requirements of Clause 11 and SANS 1217.

10.8 System 7: Hot-Dip Galvanizing (Heavy Duty)

This corrosion protection system is suitable for steel items subject to mildly corrosive and medium corrosive environmental conditions such as handrails, covers, small diameter pipework, etc.

10.8.1 Standards

Reference is made to the latest issues of the following Standards:

SANS 32:	See EN 10240.
SANS 121:	Hot-dip galvanized coatings on fabricated iron and steel articles.
SANS 1344:	Medium duty solvent detergent.
SANS 2063:	Thermal spraying - Metallic and other inorganic coatings - Zinc, aluminium and their alloys.
SANS 5772:	Profile of blast-cleaned steel surfaces for painting.
ISO 752:	Zinc ingots.
ISO 2808:	Paints and varnishes - Determination of film thickness.
ISO 14713:	Protection against corrosion of iron and steel in structures - Zinc and aluminium coatings - Guidelines.
EN 1179:	Zinc and zinc alloys – primary zinc.
EN 10240:	Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic Plants

10.8.2 Material

Impurities in the molten zinc, as defined in ISO 752 and EN 1179, shall not exceed a total of 1.5%.

Steel to be hot-dip galvanized shall be as listed below. In both cases material certification shall be supplied:

- ▶ For aesthetic appearance:
 - Aluminium killed steel, or
 - Silicon-killed steel with a Silicon content not exceeding 0.04% and a Phosphorus content not exceeding 0.02%.
- ▶ For general corrosion protection:
 - Aluminium killed steel, or
 - Silicon killed steel with a Silicon content not exceeding 0.25% and a Phosphorus content not exceeding 0.02%.

The condition of articles to be hot-dip galvanized shall comply with Clause 7.3 of SANS 121.

The condition of tubes to be hot-dip galvanized on a continuous line shall comply with “Annexure A” of EN 10240.

10.8.3 Surface Preparation

Unless otherwise specified in the Amendments of this Specification the surface preparation shall confirm to the requirements of Clause 7.2.

10.8.4 Application

Galvanizing shall only be done by members of the Hot Dip Galvanizers Association of Southern Africa (HDGASA) in accordance with SANS 121 and EN 10240.

The coating of lining thickness shall comply with the values specified for General Applications or Heavy Duty Applications as specified in this Specification.

Galvanized surfaces which are to be painted shall NOT be passivated by the galvanizer.

10.8.5 Special Requirements

10.8.5.1 Steel Specials

10.8.5.1.1 Surface

Surfaces shall be free from nodules, blisters, roughness and sharp points. Un-coated areas, flux residues, lumps and zinc ash will not be permitted.

Notwithstanding Clause 6.1 of SANS 121, in the case of handrails etc. a high quality surface finish is required and a bright smooth surface shall be achieved. Double dipping shall not be allowed.

10.8.5.1.2 Thickness

The thickness of hot-dip galvanizing shall comply with the requirements of the Table 10-1 below.

Table 10-1: System 7 - Minimum Coat Thickness on Items that are not Centrifuged

ARTICLES AND ITS THICKNESS	HEAVY DUTY	LIGHT DUTY	
	Thickness μm (min)	Local Thickness μm (min)	Mean Thickness μm (min)
Steel ≥ 6 mm	105	70	85
3.0 mm $\leq$ Steel < 6.0 mm	80	55	70
1.5 mm $\leq$ Steel < 3.0 mm	65	45	55
Steel < 1.5 mm	55	35	45
Castings ≥ 6.0 mm	105	70	80
Castings < 6.0 mm	-	60	70

Heavy duty coats are required except in the following cases:

- ▶ Where a high surface finish is required; and
- ▶ Where otherwise specified in the Amendments to this Specification.

10.8.5.2 Steel Tubes

Steel tubes shall be in accordance with Clause 7 of EN 10240.

10.8.5.2.1 Surface

The surface of the coat shall be continuous, smooth and free from flux residues.

10.8.5.2.2 Thickness

The thickness shall comply with the requirements of the coat quality A1, in accordance with Clause 8, Table 1 of EN 10240, as specified below.

Table 10-2: System 7 - Minimum Local Coat Thickness Requirements for Coat Quality A1

REQUIREMENTS	QUALITY A1
Minimum local coat thickness on the inside surface except at the weld bead	55 µm
Minimum local coat thickness on the inside surface at the weld bead	28 µm
Minimum local coat thickness on the outside surface	55 µm

► Adhesion

The coat shall show no evidence of flaking or cracking when tested in accordance with Clause 11.4 of EN 10240.

► Qualities

Coat qualities shall be A1 for water installations – see Sub-Clause 8.2 of EN 10240. The surface of the coat on the inside shall be as smooth as can be achieved by steam blowing.

10.8.6 Testing

This clause and its sub-clauses shall be read in conjunction with Clause 4.13 and Clause 11.1 of this Specification.

10.8.6.1 Steel Items

10.8.6.1.1 Visual Examination

Where a superior aesthetic appearance of hot-dip galvanizing is requested, a bright mirror surface finish shall be achieved by the galvanizer.

10.8.6.1.2 Thickness

Thicknesses shall be in accordance with Clause 10.8.5 and shall be tested in accordance with Sub-Clause 6.2 of SANS 121.

10.8.6.2 Steel Tubes

10.8.6.2.1 Visual Examination

Where a superior aesthetic appearance of hot-dip galvanizing is requested, a bright mirror surface finish shall be achieved by the galvanizer.

10.8.6.2.2 Thickness

Shall be tested in accordance with Sub-Clause 11.3 of EN 10240 (SANS 32).

10.8.6.2.3 Adhesion

Shall be tested in accordance with Sub-Clause 11.4 of EN 10240 (SANS 32).

10.8.6.3 Chemical Analysis

Items shall be tested in accordance with Sub-Clause 11.5 of EN 10240 (SANS 32).

10.8.7 Repair of Damaged Coats

10.8.7.1 General

Repairs to damaged galvanizing shall be carried out in accordance with the procedures specified in SANS 121 by hot metallic zinc spraying unless the use of an appropriate solder is approved. Conventional solder shall NOT be used. Solder composition shall have been approved in writing by the SANS (Metallurgy Division) or by the SAHDGA.

10.8.7.2 Steel Items

The total un-coated areas for renovation by the galvanizer shall not exceed 0.5% of the total surface area of a component. Each un-coated area for renovation shall not exceed 400 mm². If un-coated areas are larger, the item containing such areas shall be re-galvanized.

The repair method shall be approved by the Engineer before repairs are initiated.

Repairs shall be by zinc thermal spray in accordance with SANS 2063 or three component zinc solvent free Epoxy repair system. The repair shall include removal of any scale, cleaning and any necessary pre-treatment to ensure adhesion – refer to Clause 7.

The coat thickness on the renovated areas shall be a minimum of 30 µm more than the local coat thickness specified in Clause 10.8.5 for the relevant hot-dip galvanized coat unless otherwise specified by the Engineer. The coat on the renovated areas shall be capable of giving sacrificial protection to the steel to which it is applied.

10.8.7.3 Steel Tubes

Repairs shall not be allowed on internal surfaces of tubes. Where repairs are required, tubes shall be re-galvanized. Repairs on external surfaces shall be in accordance with Clause 10.8.7.1.

10.9 System 8: Elastoplastic Polyurethane

This part of the Specification applies to two component solvent free elastoplastic polyurethane. This system shall only be used in limited approved applications.

10.9.1 Standards

Reference is made to the latest issues of the following Standards:

SANS 1217: Internal and external organic coating protection for buried steel pipelines.

10.9.2 Material

The paint material shall be a solvent free two-component polyurethane hybrid based on a polyester type polyol and aromatic isocyanate. The cured paint shall comply with the following requirements:

- ▶ Tensile strength at 3 mm thickness - ASTM D638 - not less than 15 MPa.
- ▶ Adhesion to primed steel - SANS Method 776 - not less than 10 MPa.

- ▶ Impact resistance (direct) - ASTM G14 - not less than 9 Joules.
- ▶ Dielectric Strength - not less than 10 kV/mm.
- ▶ Elongation at break - not less than 25%.
- ▶ Compressibility - not less than 25 MPa.
- ▶ Surface hardness of 5 mm thick sample - not less than 60 nor greater than 80 Shore 'D'.
- ▶ Water Vapour Permeability - not greater than 0.5 g/24 h/m²/mm².
- ▶ Cathodic disbonding - when tested in accordance with ASTM G8 Method A, for 60 days, the disbonded area shall not exceed 500 mm².

10.9.2.1 Adhesive

Adhesive shall be a two component polyurethane adhesive designed to maximise adhesion between used polyurethane and freshly mixed polyurethane.

10.9.3 Application

10.9.3.1 Dry Film Thicknesses

Dry film thicknesses shall be at least as follows unless otherwise specified in the Amendments to this Specification:

- ▶ Overcoating as duplex system:
 - The dry film thickness shall be 40 µm minimum.
- ▶ For corrosive/abrasive environmental conditions:
 - The dry film thickness shall be 1.0 mm minimum.
- ▶ For highly corrosive/abrasive environmental conditions:
 - The dry film thickness shall be 3.0 mm minimum.

10.9.4 Repair of Damaged Coats

Repair procedures shall be approved by the Engineer and conform to the requirements of Clause 4.12

10.9.5 Testing

Testing shall conform to the requirements of Clause 11 and SANS 1217.

10.10 System 9: Tape Wrapping

The tape wrapping system is intended to be used in areas where special protection is required due to handling of items e.g. pipelines at road crossings etc. or where it is highly likely that the paint system can be damaged e.g. at specials and addition precaution is required to protect the pipeline. It is also often used to repair field joints of pipelines. It is suitable for severely corrosive environments.

10.10.1 Standards

Reference is made to the latest issues of the following Standards:

SANS 1117: Plastic wrappings for the protection of steel pipelines.

SANS 10129: Plastics tape wrapping of steel pipelines.

10.10.2 Material

Polyethylene pressure-sensitive tape or polyethylene laminated to an elastomeric layer of butyl rubber tapes shall conform to SANS 1117, types A, B or C.

10.10.3 Application

10.10.3.1 General

Steel pipes, fittings and specials, protected by means of tapes, shall be wrapped in accordance with SANS 10129 as amended and supplemented by this Specification. All pipes shall be wrapped outside the trench in accordance with acceptable factory applications. Tape wrapping may be carried out in an "over the trench" operation for pipe diameters up to 450 mm.

10.10.3.2 Surface Preparation

Steel pipe surface preparation shall conform to Clause 3.2 of SANS 10129.

10.10.3.3 Priming

Immediately after surface preparation but not later than 4 hours after cleaning, provided the pipe surfaces are kept dry and free from dust, a primer shall be applied according to Clause 4.2.1 of SANS 10129.

10.10.3.4 Normal Wrapping

Tape wrapping shall be applied with sufficient pre-tensioning immediately after priming, in accordance with Clause 4.2.2 of SANS 10129, and shall ensure a smooth wrap free from wrinkles, blisters, frayed or torn edges, cracks or other defects at temperatures up to 65°C.

For normal wrapping, tape shall be applied in two layers with a minimum overlap of 50 mm on both the inner and outer wraps.

Tape joints and repairs shall be done in accordance with Clause 4.2.3 of SANS 10129.

Hand wrapping shall only be allowed for short lengths that are inaccessible to a wrapping machine, specials, joints, small diameter pipes and small repairs – refer Clause 10.10.6

10.10.3.5 Armouring

Where armour wrapping is specified, two layers of tape wrapping shall first be applied with sufficient pre-tensioning immediately after priming, in accordance with Clause 4.2.2 of SANS 10129, and shall ensure a smooth wrap free from wrinkles, blisters, frayed or torn edges, cracks or other defects even at temperatures up to 65°C.

The first layer of wrap shall overlap by half the tape width plus 25 mm and the second wrap shall overlap by not less than 50 mm.

The above-mentioned layers of tape shall be armoured by the application of a third layer of pressure-sensitive polyethylene tape with a carrier thickness of 750 micrometres and a minimum overlap of 50%.

Armoured wrappings shall generally be applied at the following positions:

- All road crossings through sleeves and culverts;

- ▶ All railway crossings through sleeves or culverts; and
- ▶ Wherever the Engineer may consider that special conditions warrant such measures.

10.10.3.6 Wrapping of Specials

In the case of specials or pipe lengths where length and/or shape preclude the application of a protective wrapping system by any means, the protection shall be carried out either by bitumen-fibre glass or epoxy corrosion protection system in accordance with the requirements of the applicable corrosion protection system. In the case of access, scour, air valve and farmers off-take tees the special shall be deemed to incorporate at least two (2) diameter lengths either side of the main tee barrel.

10.10.3.7 Armour Wrapping of Coated Pipes

Where armour wrapping of coated pipes is specified, a single layer of pressure-sensitive polyethylene tape with a carrier thickness of 750 micrometres and a minimum overlap of 50% shall be applied.

10.10.4 Tolerances

10.10.4.1 Pressure Sensitive Tape Wrapping

The minimum thickness of the inner low-density polyethylene tape carrier component shall be 300 μm and the maximum thickness of the outer high-density tape carrier shall be 1000 μm . Total minimum polyethylene thickness of 1450 μm .

The adhesive part of the inner layer shall be a minimum thickness of 1.5 times the polyethylene tape carrier thickness. For the outer layer the adhesive layer shall be at least equal to the thickness of the polyethylene tape carrier thickness.

10.10.4.2 Butyl Rubber Laminates

The minimum thickness of the completed wrapping shall be 750 μm . The inner layer shall be a butyl rubber laminate of 450 μm minimum thickness of which the butyl rubber film shall not be less than 200 μm thick and the polyethylene film shall not be less than 200 μm thick.

The outer layer shall be high density pressure tape of 300 μm minimum thickness.

10.10.5 Testing

This clause and its sub-clauses shall be read in conjunction with Clause 4.13 and Clause 11.1 of this Specification.

10.10.5.1 Visual Inspection

The wrapping shall have a smooth appearance, free from wrinkles, blisters, bridging across weld beads, frayed edges, cracks, dis-bonding and any signs of physical damage.

10.10.5.2 Non-Destructive Testing

10.10.5.2.1 Electrical Insulation Defect (Holiday) Testing

The entire wrapping of the pipeline shall be tested to ASTM G62 with an approved Holiday Detector equipped with a rolling ring detector around the pipe by the Contractor to the Engineer's satisfaction. The ring shall be in close contact with the surface of the wrapping along the pipe circumference. The test shall be carried out immediately prior to lowering the pipe into the trench. The wrapping on specials or short pipe lengths shall be tested with an approved Holiday Detector fitted with a copper bristle brush detector of suitable form. The wrapping shall exhibit no Holidays when tested with an effective voltage of 12 kV at a nominal pulse frequency of not less than 30 Hz.

The Engineer may instruct any length of pipe or any number of specials to be re-tested using a Holiday Detector with a copper bristle brush detector.

10.10.5.2.2 Insulation Test

The Engineer shall carry out a conductance test on the wrapping over any section of pipeline between valves when the pipeline has been wrapped and installed in the trench with padding and back filling completed. The test shall be conducted as per NACE TM0102 with the valves temporarily removed from the line, at the Contractor's expense, to ensure complete isolation of the pipeline section under test or between gaps left for tie-ins.

The length of the section of pipeline under test shall be carefully measured and the conductance over the section tested shall not exceed 180 micro-Siemens per square metre of pipe surface under all conditions of test. If the results of the test for the section of pipeline tested are not satisfactory, two sections immediately adjacent to the testing section will be tested. If the results on one or both of these sections tested are not satisfactory, all sections of wrapped pipeline shall be tested.

10.10.5.3 Destructive Testing

The Engineer may from time to time collect samples of 10 m of each type of tape and one litre of primer for testing, for compliance with the Specification, by any independent laboratory appointed by the Engineer. The supply of samples shall be for the Contractor's account. The Engineer reserves the right to reject the whole batch of materials from which unsatisfactory samples were obtained.

10.10.5.4 Repair of Damaged Coats

The Contractor shall be required to locate areas of faulty protection on all sections on which unsatisfactory results are obtained and to affect the necessary repairs. The cost of this work and all additional materials provided or supplied, including the reinstatement of the trench and the retest shall be for the Contractor's account.

10.10.6 Repair Methods

Where damage to the wrapping on a pipeline has occurred and where there are creases, wrinkles and folds in the wrapping, proceed as follows:

10.10.6.1 Small Damaged Areas

If the width of the tape being used exceeds by at least 100 mm the length of the section affected, cut the area of damaged wrapping away to bare metal leaving no raised edges or protrusions.

Clean and prime the exposed area in accordance with Clauses 10.10.3.2 and 10.10.3.3 and apply a patch of tape, ensuring an overlap of not less than 50 mm on all sides onto the surrounding wrap.

Apply by hand-wrapping with a 55% overlap, a further layer of tape commencing two turns before and continuing for two turns beyond the patch.

10.10.6.2 Large Damaged Areas

Where the extent of damaged or faulty wrapping is such that the tape cannot span the affected area and provide a 50 mm overlap on all sides it must be completely removed from the pipe over the affected section. The area shall be cleaned and primed in accordance with Clauses 10.10.3.2 and 10.10.3.3. The pipe must be re-wrapped with a 55% overlap, commencing two turns before and finishing two turns beyond the bared section.

10.10.6.3 Damage on Double Wrap

Where damage or a defect has occurred in a section that has been double wrapped and in the case of small Holidays, the outer wrap shall be removed for a distance equal to three (3) times the width of the inner wrap tape on each side of the damaged area.

The appropriate procedure given in Clauses 10.10.6.10.6 shall be used to affect the repair of the inner wrap.

The outer wrap shall be re-instated in accordance with Clause 10.10.3.5.

10.10.6.4 Outer Wrap Damage

Where damage extends through an outer wrap / rockshield (see Section 6 of SANS 10129), this shall be carefully removed for a distance equal to three (3) times the width of the inner wrap tape on each side of the damaged area without damaging the inner wrapping.

The repair shall be carried out by the appropriate method given in Clauses 10.10.6 and the outer wrap/rockshield re-instated in accordance with Clause 10.10.3.5.

10.11 System 10: Petrolatum Wrapping

Profiling mastic and mastic blankets are used for corrosion protection of couplings and flanges in chambers with high humidity and buried in soil.

Standards

Reference is made to the latest issues of the following Standards:

ISO 8501-1: Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after removal of previous coatings.

SANS 10129: Plastics tape wrapping of steel pipelines.

10.11.1 Surface Preparation

Mechanically clean and wire brush the joint to remove all loose rust, scale, old coating or lining and foreign matter to St 2 (ISO 8501-1).

Areas subjected to chemical attack, salt spray, fungus or bacteria shall be neutralized, rinsed with clean potable water and mechanically cleaned as specified above.

10.11.2 Priming

Brush priming solution well over the entire joint area, leaving a thin film (at a nominal coverage rate of 0.8 m²/litre). Apply a liberal amount around the bolt threads, narrow cavities and crevices.

Paste shall be used where excessive surface corrosion has occurred and under high humidity or submerged conditions.

10.11.3 Application

Use profiling mastic and/or strips to fill all voids, crevices and sharp or irregular contours.

Apply mastic tape circumferentially over the area to be coated with a 25 mm overlap on either side of the mastic with a 75 mm end overlap.

Pre-formed petrolatum mastic blanket system (10 mm thick), supported by a coated tape backing, is available to provide a quick and easy method to apply this system.

Eliminate all air pockets, wrinkles and creases.

10.11.4 Top Coat

10.11.4.1 Buried Conditions

Two complete turns of the polyethylene sheeting shall be applied circumferentially. The ends are secured to the pipe barrels with 48 mm wide bands of PVC adhesive tape, which is also applied to the outside diameter of the bolted joint.

10.11.4.2 High Humidity Conditions

Overcoat with a synthetic coat mixed with a cementitious filler to give a tough, flexible coat. The base coat may be over-coated with water based Acrylics or Epoxies.

NOTE:

- Detail of application shall be in accordance with the manufacturer's data sheets and approved by the Engineer.

10.12 System PC1: Solvent Free Polyurethane Coating

This corrosion protection system covers the application of Solvent Free Polyurethane as a coating to steel pipes. Generally the coating is to be applied in accordance with ANSI/AWWA C222-99 'Polyurethane Coatings for the Interior and Exterior of Steel Water Pipe and Fittings'. Where in conflict with ANSI/AWWA C222-99, the amendments hereunder shall take precedence.

10.12.1 Section Numbers of ANSI/AWWA C222-99

The section (clause) and sub-section numbers in this clause refer to the same numbered sections and subsections in ANSI/AWWA C222-99.

10.12.1.1 ANSI Section 4.2 Test Requirements

Replace 'Table 1 Requirements' with the new Table 1 below.

New Table 1: Physical and Performance Requirements

Property	Polyurethane Coating Material	Test Method Sub-Section
Adhesion , MPa min (laboratory)	15 MPa	ASTM D 4541
Impact resistance Kg m, min	1.6 kg m	ASTM D 2794 Intrusion
Water absorption %, max	max 3%	ASTM D 570 long term
Dielectric strength kV/mm thick min	7.5 kV/mm thick min	SANS 1217 clause 5.9
Resistance to abrasion , mg max	max 100/1000 rev	ASTM D 4090 CS17 1 kg 1000 cycles
Cathodic disbondment	max 12 mm radius	ASTM G 95 at 23 deg C
Durometer Hardness	min 65 Shore D	ASTM D2240
Chemical Resistance 10% sulphuric acid 30% NaCl 30% NaOH Diesel fuel	max 5% in mass, length or width max 5% in mass, length or width max 5% in mass, length or width max 5% in mass, length or width	ASTM D543

10.12.1.2 ANSI Section 4.3 Coating Thickness

ANSI Sub-Section 4.3.1

The minimum dry film thickness of coating is to be 2000 microns within a tolerance of -100 microns and +1000 microns.

10.12.1.3 ANSI Section 4.4 Surface Preparation

The requirements of section 4.4 of ANSI/AWWA C222-99 will apply and will take precedence over Clause 3.2 above.

10.12.1.4 ANSI Section 4.7 Welded Field Joints

ANSI Sub-Section 4.7

The hold backs (cut-backs) are to comply with Clause 4.15.1 of this Specification.

10.12.1.5 ANSI Section 5.3 Coating Tests

ANSI Sub-Section 5.3.1

The basis of acceptance of proposed coating material shall be as per method (1).

10.12.1.6 ANSI Section 5.5 Coated Pipe Inspection

ANSI Sub-Section 5.5.4

Electrical continuity inspection shall be conducted on all pipes as per Clause 5.9 'Dielectric strength' of SABS 1217.

10.12.1.7 ANSI Sub-Section 5.5.3

The adhesion is to be tested in accordance with ANSI/ASTM D4541.

10.12.1.8 ANSI Section 6.5 Affidavit of Compliance

The manufacturer is to submit with his/her first request for payment an affidavit that all material and work has been conducted in accordance with the requirements of this standard.

10.13 System PC2: Fusion-Bonded Medium Density Polyethylene

This coating system shall comply with the Australian Standard Specification AS 4321-1955 entitled "Fusion bonded medium density polyethylene coating and lining for pipes and fittings" except as modified hereunder.

10.13.1 Modifications to Specification AS 4321-1955

10.13.1.1 Preparation of Surface

Delete Clause 5.1 of AS 4321-1955 and replace with Section 3 "SURFACE PREPARATION FOR PIPES TO BE COATED AND LINED" of this specification.

10.13.1.2 Repairs

Delete the last sentence of Clause 8.1 of AS4321-1995 and replace with "Damaged areas that pass the continuity test need not be repaired provided that the coating or lining thickness is equal to or greater than the thickness specified in Table 1 of AS 4321-1995. Generally no more than 3 repairs will be allowed per 9m length of pipe and the area of a single repair is not to exceed 0.01 square m. If the area of a single repair does exceed 0.01 square m the pipe will be rejected. Repairs may be undertaken in accordance with Clause 8 of AS 4321 for the following methods of repair:- Fusion bond; Heat shrink sleeve or Hot gas welding. A wrapping system may also be used if applied as detailed hereunder.

10.13.1.2.1 Repairs with Tape

When repairs are permissible the repairs shall be made using a repair system comprising (1) a polymer bitumen primer (Denso Primer D or equivalent approved), (2) an inner seal of modified rubber bitumen sealing tape (Denso Mastic Sealing Tape or equivalent approved) and (3) an outer protective layer of acrylic coated/modified bitumen adhesive pipeline tape (Denso Acrylic Pipeline Tape or equivalent approved) is to be applied with a 50% overlap, ensuring that it is placed 50mm wider all round than the inner repair tape. The outer protective tape is to be wrapped around the entire pipe.

10.13.1.2.1.1 Pinholes

At each pinhole detected by the electrical test, the surrounding area shall be abraded to at least a minimum area of 175mm by 175mm around the hole. The abrasion shall be carried out (with clean

emery paper of 80 to 100 mesh) around the repair so as to provide a suitable rough surface profile without causing the removal or excessive amounts of coating material. The repair area is to be feathered into the surrounding sound coating. Debris and other deleterious matter are to be removed by means of a clean rag moistened with Cleaning Solvent. The primer is applied and once it has dried the prepared surface is covered with a patch of modified rubber bitumen sealing tape (Denso Mastic Sealing Tape or equivalent approved) of size 150mm by 150mm. The bond is to be free of air bubbles and smoothed out by hand or using an aluminium fluted roller. Finally, acrylic bitumen adhesive pipeline tape (Denso Acrylic Pipeline Tape or equivalent approved) is to be applied with a 50% overlap, ensuring that it is placed 50mm wider all round than the inner repair tape.

10.13.1.2.2 Larger Damaged Areas

The edges of the damaged coating must be chamfered back to remove all potential void areas. The primer and modified bitumen rubber are applied as for pinholes but the modified bitumen rubber tape is pre-cut and applied with 55% overlap. Finally acrylic bitumen adhesive pipeline tape (Denso Acrylic Pipeline Tape or equivalent approved) is to be applied with a 50% overlap, ensuring that it is placed 50mm wider all round than the inner repair tape. Weld beads are repaired with suitable lengths of the above size tapes. When covering weld beads, the centre portion of the square must make contact first. Smooth the tape out with an outward direction to remove all entrapped air.

10.13.1.3 Storage, Handling, Transport and Marking

Add to Clause 11 of AS 4321-1955, Clause 1.5 entitled "Plant and Rigging for the handling and delivery of Pipe and Specials" of this specification.

10.14 System PC3: Three Layer System

The three layer corrosion protection system consists of a powdered epoxy primer, a polymeric adhesive and a polyethylene outer sheath which shall be applied in accordance with Canadian Standards Association Specification (CSA) Z245.20-06 and Z245.21-06.

The application is to be in accordance with, inter alia, the following sections of the Canadian specifications listed below.

10.14.1 Z245.20 External Fusion Bond Epoxy Coating for Steel Pipe

(a) General Requirements

(b) Materials

(i) The following Fusion Bonded Epoxy primers are approved for use.

(a) Akzo Nobel PCL 331

(ii) Jotun CORRO-COAT EP-F 1003HW

Should the Supplier wish to use any other make of primer, samples must be left with the Employer or his/her agent for testing. Delays in approval will not be accepted as a reason for late delivery.

(c) Coating Application

(d) Inspection and Testing

(e) Repair of Coated Pipes

(f) Markings

(g) Handling and Storage

(h) Test Reports and Certificates of Compliance

(i) Test Procedures

10.14.2 Z245.21 External Polyethylene Coating for Pipe

(a) General Requirements

The Polyethylene outer sheath is to comply with System B1

(b) Materials

(i) The following adhesives are approved for use:-

- (a) Borealis Borcoat ME0420
- (b) Industrie Polieco M.P.B. SRL COESIVE L8.92.8

(ii) The following HDPE Outer Sheath materials are approved for use:-

- (a) Borealis Borcoat HE3450
- (b) Industrie Polieco M.P.B. SRL HDPE 2050

Should the Supplier wish to use any other make of adhesive or outer sheath materials, samples must be left with the Employer or his/her agent for testing. Delays in approval will not be accepted as a reason for late delivery.

- (c) Coating Application
- (d) Inspection and Testing
- (e) Repair of Coated Pipes
- (f) Markings
- (g) Handling and Storage
- (h) Test Reports and Certificates of Compliance
- (i) Test Procedure

10.15 System PC4: Bitumen Fibre Coating

10.15.1 General

Where bitumen fibre coating of steel pipes is specified, the method of coating is generally to comply with SABS 1178 'The production of lined and coated steel pipes using bitumen or coal tar enamel'. The lining is to consist of a hot-applied bitumen with a double wrap of glass fibre reinforcing material to a thickness of 5mm. There shall not be less than 1mm of bitumen between the pipe surface and the inner wrapping and also between the inner and outer wrappings. Where in conflict with SABS 1178, the amendments hereunder shall take precedence.

10.15.2 Amendments to SABS 1178

The following details are to be noted. The clause and sub-clause numbers hereunder refer to the same numbered clauses and sub-clauses in SABS 1178.

10.15.2.1 SANS Sub-Clause 3.1.1 Primers

Before the application of external protections, pipes and specials shall be primed with primer type (a) a cold applied bitumen primer complying with SABS 1136 or a synthetic primer for bitumen, complying with SABS 1140.

10.15.2.2 SANS Sub-Clause 3.1.2.1 Bitumen

The bitumen used is to conform to SABS 1137.

10.15.2.3 SANS Sub-Clause 3.1.3 Reinforcement Wrappings

Glass fibre material is to be used as the reinforcement wrapping and is to conform to SANS 1130.

10.15.2.4 SANS Sub-Clause 3.1.4 Reflective Finish

A non-stick, reflective covering shall be applied to the coating. This shall consist of a lime wash based on a dolomitic type lime suitable for non-porous surfaces mixed with water to a slurry and further mixed with boiled linseed oil to improve its water resistance.

10.15.2.5 SANS Sub-Clause 3.2.2 Coating and Table 1

The coating type is to be CB6A as per Table 1. However, the inner wrap may conform to type 1 or type 3 of SABS 1130 and the outer wrap may conform to type 1, type 2 or type 3 glass fibre reinforcing material. The minimum coating thickness excluding the weld seam is to be 5mm. The thickness tolerance shall be +2mm,-0mm.

10.15.2.6 SANS Sub-Clause 3.7.7 Disbonded Areas

Holidays are not to be repaired unless authority to do so is given by Umgeni Water's authorized Quality Inspector.

10.15.2.7 SANS Sub-Clause 3.7.8 Holidays

The coating shall be free from holidays and tested in accordance with Clause 7.2.2 of SABS 1178 at 15 Kv.

10.15.2.8 SANS Clause 6 Markings

Refer to Clause 7 of Sub-Clause 2.2 of this specification.

10.15.2.9 SANS Sub-Clause 7.1 Inspection

Add the following sentence:

Before leaving the shop the coating of every pipe and special shall be inspected visually for all defects including, but not restricted to:- tears, holes, mechanical damage and cracking.

10.15.2.10 SANS Sub-Clause 7.2.2 Holiday Detection

A metallic brush or a jointed spiral ring type of scanning electrode is to be used on the variable voltage detector.

10.15.2.11 SANS Sub-Clause 7.3 Destructive Tests

Sufficient coating material shall be removed from the ends of at least one pipe of each day's production for the purpose of carrying out destructive tests as detailed under Clause 7.3 of SABS 1178.

10.16 System PC5: Polymer Modified Bitumen Coating

This corrosion protection system is suitable for large pipes items subject to medium corrosive and severely corrosive environmental conditions.

This specification relates to factory applied pipe coating operations based on hot applied polymer modified bitumen.

10.16.1 Standards

This standard makes reference to the documents listed below. Unless otherwise specified the latest editions of these documents, including all addenda and revisions, shall apply.

British Standards

BS 410	Specification for test sieves.
BS 1796	Methods using test sieves of woven wire cloth and perforated metal plate.
BS 2000	Methods of test for petroleum and its products.
BS 3900	Methods of test for paints: Part A 6 (replaced by EN 535) – Determination of flow time of paints. Part B 2 (replaced by ISO/DR 1515) – Determination of volatile matter and non-volatile matter.
BS 4147	Bitumen-based hot-applied coating materials for protecting iron and steel, including suitable primers where required.
BS 7079	(Replaced by ISO 8501-8504) – Preparation of steel substrates before application of paints and related products.

Swedish Standard

SIS OS 5900 Pictorial surface preparation standards for painting steel surfaces.

American Standard

ASTM D 113-86 Ductility of bituminous materials.

ANSI AWWA C203-91 Coal-tar Protective Coatings and linings for steel water pipelines – enamel and tape-hot applied.

South African Standard

SANS Method 772 Blast profile.

10.16.2 Materials

10.16.2.1 Primer

The primer shall be of synthetic composition, designed to be used with a specific polymer modified bitumen. The drying rate of the primer shall be suited to the application conditions. The primer shall be supplied in new sealed steel drums.

The primer shall have the characteristics shown in Table 10-3:. In addition, when stored in original sealed containers at ambient temperature, the primer shall retain the properties as set out in Table 3 for not less than 6 months from the date of delivery.

Table 10-3: Characteristics of Primer

CHARACTERISTIC	REQUIREMENTS	METHOD OF TEST
Viscosity at 23°C	35-60 seconds	Flow cup No 4
		BS3900: Part A6 = EN 535
Volatile matter	75	BS3900: Part B2 = ISO/DR
(max. % loss by mass)		1515 (105°C for 3 hours)

10.16.2.2 Polymer Modified Bitumen

10.16.2.2.1 Composition

The polymer modified bitumen shall consist of a uniform mixture of the following:

- ▶ A formulated blend of polymer modified bitumen, as specified in (c) and (d) below.
- ▶ A proportion of approved filler (limestone or asbestos shall not be used).
- ▶ Characteristics of the filler shall be as specified in (b) below.

10.16.2.2.2 Filler Grading

Method of test to BS 1796 modified to use the metric sieves specified in BS 410.

Passing 90 microns – not less than 93%.

Passing 250 microns – not less than 99%.

10.16.2.2.3 Characteristics of the Polymer Modified Bitumen

The material shall conform to the requirements given in Table 4 when tested in accordance with the methods specified.

10.16.2.2.4 Performance Tests of the Polymer Modified Bitumen System

The polymer modified bitumen shall be of thermoplastic rubber/bitumen modification.

The polymer modified bitumen containing mineral filler with the characteristics detailed in 10.16.5.1.2 shall pass the performance test specified in Table 10-4.

Table 10-4: Characteristics and Performance Test for Polymer Modified Bitumen

PROPERTIES	METHOD	UNIT	REQUIREMENTS
Softening Point	ASTM D36	°C	115-130
Penetration @ 25°C	ASTM D5	1/10 mm	15-30
Density @ 25°C	BS 4147	g/cm ³	1.1-1.4
Viscosity @ 170°C	Brookfield	Cp	7000-12000
Viscosity @ 190°C	Brookfield	Cp	3000-6000
Filler Content	BS 4147	%	20-30
Impact @ -10°C	BS 4147	mm ²	Max. 6500
Peel Initial / Delayed	BS 4147	mm	Max:
Sag @ 25°C	BS 4147	mm	3,0/3,0
Sag @ 40°C	BS 4147	mm	3,0/3,0
Sag @ 50°C	BS 4147	mm	3,0/3,0
Sag @ 60°C	BS 4147	mm	3,0/3,0
Sag @ 80°C	BS 4147	mm	Max. 1.5
Aging Test @ 190°C	Phoenix	hours	Min. 72
Bend	BS 4147	mm	Min. 15

NOTES:

- ▶ The test plates shall be cleaned by abrasive blasting to grade Sa 2½ of SIS OS 5900 (BS 7079 and ISO 8501 – 8504) and with a profile of 50 – 75 microns (SANS Method 772). They shall be coated with primer at a rate of 100g per m².
- ▶ For the impact test a plate 12.7 mm thick shall be used and a single impact made in each quarter of the plate. The average of the four areas disbonded shall not exceed the permitted value shown in Table 4.
- ▶ The peel test at 25°C is equivalent to / replaces the preliminary adhesion test in the original Specification.

10.16.2.3 Outerwrap

- (a) The outerwrap consists of a combination of polyester and glass fibres to ensure the required strength and elasticity. This is combined with a glass fabric of uniform quality and amount to control the best application and the required amount of bleed through, in order for the outerwrap to provide maximum protection.
- (b) The outerwrap shall be impregnated with the polymer modified bitumen compatible material to fulfil the characteristics shown in Table 10-5.
- (c) The characteristics of the outerwrap shall comply with the requirements of Table 10-5 and shall be determined in accordance with the test procedure.

Table 10-5: Characteristics of Outerwrap Saturant

CHARACTERISTIC	REQUIREMENT	METHOD OF TEST
Softening Point	Min 100°C	BS 2000
Penetration @ 25°C	60-85 1/10 mm	BS 2000
Saturant	Polymer Modified Bitumen	

Table 10-6: Physical Characteristics of Outerwrap

CHARACTERISTIC	TYPE A	TYPE B	METHOD OF TEST
Minimum Thickness (mm)	0.6	0.6	AWWA C203-91
Weight (g) per m²	500 – 700	500 – 700	AWWA C203-91
Tensile strength (N/50 mm)			
Longitudinal	> 800	> 400	AWWA C203-91
Transverse	> 800	> 200	AWWA C203-91

10.16.3 Application

10.16.3.1 Care of Wrapping Materials

All wrapping materials consigned to the coating yard or factory shall be properly stored to prevent damage or deterioration.

10.16.3.2 Care of Pipe

Throughout the wrapping process pipe and coating materials shall be kept clean and away from all foreign matter.

10.16.3.3 Marking

Any pipe manufacturer's identifying marks shall be removed before the start of the wrapping process and shall be permanently marked on the side of each pipe at both ends with a weatherproof paint. Metallic dye stamping shall only be permitted using approved stamps and only on the pipe bevel.

10.16.3.4 Blast Cleaning

In preparation for the application of primer all grease or heavy soil shall be removed without spreading over the surface with a volatile solvent, e.g. xylene (or approved equivalent) and thereafter the external surface of the pipes shall be cleaned by abrasive blasting to at least Sa 2½ grade SIS O5 009 (BS 7079 and ISO 8501-8504) SANS 772 and surface profile amplitude 75 µm. DWS 9900 C1 for detailed description of surface preparation process.

10.16.3.5 Priming

- (d) Following blast cleaning and within 2 hours, the pipe exterior shall be coated with the primer applied at a controlled rate to the manufacturer's recommendations. Pipes shall be coated within 24 hours of being primed.
- (e) The primer shall be applied to a dry, clean and dust free pipe and thereafter the primed pipe shall be kept free from moisture, dust or any other contaminant. The primed pipe shall be uniform and free from runs, drips, flooded or bare areas. Particular care shall be taken to ensure complete coverage of weld areas.
- (f) The primer should be applied at a pipe temperature of 10°C (or above) or 3°C above the dew point. If the pipe temperature is lower than this level or if moisture is present on the pipe, heating of the pipe may be required.
- (g) Deteriorated or contaminated primer shall not be applied to the pipe. Primer that has deteriorated or become contaminated after its application shall be removed to the satisfaction of the Employer or his representative, at the Contractor's expense. The cleaned area shall then be re-primed.

10.16.3.6 External Coating and Wrapping Application

- (h) The pipe, after priming and when the primer is no longer tacky, shall be passed through coating facilities of a type approved by the Engineer. The machine shall coat the pipe weld (longitudinal or spiral) with a 50 mm wide strip of extruded polymer modified bitumen and thereafter the entire pipe with an extruded coating of polymer modified bitumen and shall simultaneously apply the outerwrap.
- (i) All primed surfaces shall be clean and dust free immediately prior to coating.
- (j) The coating shall have an average thickness of not less than 4 mm, with an absolute minimum thickness of 3 mm. The coating shall be reinforced by a spirally-wound layer of outerwrap pulled into the polymer modified bitumen with an overlap of 20 mm, such that the outerwrap is wetted by the polymer modified bitumen. Particular attention shall be paid to the location of the reinforcement and thickness of the wrapping over the weld. The average thickness shall be determined in the following manner: At least four thickness measurements at approximately the pipe quarter points per lineal metre of pipe length shall be taken. At least 25% of the measurements shall be taken at the weld bead. The average thickness shall be the arithmetic average of all measurements.
- (k) The completed coating shall be well bonded to the pipe metal; uniform, smooth and free from Holidays, laminations, voids or other defects.
- (l) The wrapping shall be carefully trimmed off 100 mm from the ends of each pipe and bevelled throughout its thickness over a minimum length of ± 5 mm, unless otherwise specified by the Employer or his representative.
- (m) Solar protection paint shall be applied to the coated pipe while the coating is still warm. It shall be white in colour, water resistant, continuous and shall cover the wrapping sufficiently to form an effective barrier to solar radiation. The solar protection shall be terminated approximately 100 mm from each end of the wrapping (i.e. 200 mm from each end of the pipe).

10.16.4 Inspection and Testing

The Contractor shall be responsible for, and shall bear the cost of a system of inspection and repair of the wrapped pipe approved by the Engineer. The system shall meet all relevant requirements in this Section and in addition the following requirements:

- (n) Monitoring of grit size and the finish of blast cleaned pipe.
- (o) Viscosity measurement (see Table 3) and control of film thickness of external primer at least once for every batch of primer, in addition to visual checks of the applied prime coating.
- (p) Adequate temperature control the polymer modified bitumen at the application head. In order to ensure that the polymer modified bitumen applied to the pipe has the characteristics specified in Table 4, samples of the polymer modified bitumen shall then be taken from the application head and subjected to the following test and frequency of testing shown in Table 10-7.
- (q) Visual checks on the outer wrap and the appearance of the final wrap.
- (r) Holiday detection of 100% of the surface area of every wrapped pipe with approved equipment operating at a minimum 15 kV, maximum 25 kV with regular calibration of the equipment to the satisfaction of Quality Assurance.
- (s) Test of bond strength and thickness of the wrapping including removal of samples of the wrapping for inspection.
- (t) Adequate and proper repair of any defects to ensure compliance with this Section. A need to repair more than 1 defect per m² of pipe coating shall be sufficient grounds to reject the pipe and cause the Contractor to adjust his process to reduce the number of defects to an acceptable level.

Any necessary repairs of tested pipes shall be carried out by the Contractor at no additional cost to the Employer.

One pipe from every day's production shall be held back for examination on the following day. This examination shall include bond testing, thickness testing and examination for laminations, voids or any other defects.

If, in the opinion of the Engineer, there are a signification number of defects on the test pipe, then a back check procedure will be invoked. This will involve checking the ten pipes immediately preceding and the ten pipes immediately following the faulty test pipe (the pipe numbers shall be available from the final inspection). These twenty pipes shall be subjected to an examination similar to that carried out on the test pipe. Should the number of defects detected be, in the opinion of the Engineer, significant, then the entire production for that week shall be quarantined and jointly investigated by the Contractor and the Engineer.

Should tests in any production batch show a defect rate of more than 10%, the Engineer may reject the whole batch. In such cases the Contractor shall conduct an investigation to establish the cause of the defects.

Table 10-7: 'In Plant Testing'

TEST		FREQUENCY OF TESTING
1.	Softening Point	Twice per working shift
2.	Penetration at 25°C	Twice per working shift
3.	Bond test for coated pipes	One pipe per working shift

These tests should be conducted at the coating Plant by the Contractor and monitored by the Approved Inspection Authority (AIA), who would be trained in the procedures by the coating material supplier.

At least once during the Contract or when the method of surface preparation is changed, a sample wrapped pipe shall be tested for resistance to cathodic disbonding.

When tested, the wrapping shall not be disbanded from the pre-damaged area by more than a 5 mm radius after exposure for 28 days at the specified potential, i.e. -1500 mV (BS 3900:F1 1).

The inspection activities shall be coordinated with the Contractor's operations so as to delay or interfere with the operations as little as possible. The Contractor's methods shall, nevertheless, always permit inspection to be made and allow adequate repair of imperfections.

Prior to dispatch from his Plant, the Contractor shall ensure that the wrapped pipe is correctly marked on the internal painted surface of the pipe at each end with approved paint, with sufficient information to enable subsequent identification of the pipe to be made. Documentation shall be supplied to the Engineer to enable the history of the processing of each pipe to be traced.

10.16.5 Methods of Testing

10.16.5.1 Testing of Wrap Characteristics

10.16.5.1.1 General

The procedures given below are reference methods of test, which shall be used to establish conformity to the Specification in cases of dispute. Other similar methods, however, may be used by manufacturers for routine quality control purposes with the approval of the Engineer.

10.16.5.1.2 Thickness

The thickness shall be determined by means of a suitable instrument fitted with a micrometre dial gauge, a cylindrical brass block 57 mm in diameter and giving a nominal loading of 3.45kN/m² and a surface plate.

The thickness shall be measured by interposing the outer wrap between the cylinder and the surface plate. Measurements shall be made by marking 75 mm square across the effective width of the mat and making a measurement within each square. No single reading across the width of the mat shall be less than the specified minimum thickness.

10.16.5.1.3 Weight per m²

The weight per square metre shall be determined by cutting representative samples from the effective width of the outer wrap. The samples shall be of such a size, that the weight per square metre may be determined to an accuracy of $\pm 2\%$.

10.16.5.1.4 Tensile Strength

The tensile strength shall be measured with approved equipment. The size of the samples cut from the roll shall be 520 mm long and shall have the required width. (See Table 4 for the minimum tensile strength).

When mounted in the equipment, the distance between the jaws shall be 320 mm. The constant rate of separation of the jaws shall be in the range of 100 mm to 610 mm/minute and the tensile strength at breaking point shall be determined. For reference purposes the rate of separation of the jaws shall be 200 mm/minute. At least four samples shall be tested and an average figure obtained. The test may be carried out on narrower samples if required, provided that at least two of the reinforcing strands are included in the specimen. Sealing of the ends is recommended.

The value for tensile strength obtained from a narrower sample shall be extrapolated to 150 mm width.

10.16.5.2 Bond Test for Coated Pipes

- (u) Measure the temperature of the coating with a surface thermometer.
- (v) If the temperature of the coating is not between 10°C and 25°C, cool or warm the pipe in the test area to bring the temperature within this range.
- (w) Using a knife, heated if necessary, make two parallel cuts, through the coating down to the pipe surface. The cuts shall be 100 mm long and 30 mm apart.
- (x) With a stiff flat blade, loosen the coating the full width between the two cuts and lift the wrap upward in a direction at right angles to the pipe surface.
- (y) The bond shall be considered satisfactory if the coating does not peel cleanly from the primer or the pipe surface but is removed with difficulty.
- (z) This bond test should be carried out at the start of each shift or change in production and thereafter at a frequency approved by the Engineer.

10.16.6 Handling

At all times the pipe, unwrapped as well as wrapped, shall be handled with the aid of slings, lifting yokes and protected hooks to the approval of the Engineer.

At all times the coated pipe shall be handled and stacked in such a manner as to prevent damage to the coating. Particular care shall be taken immediately after coating to avoid damage while the enamel is above ambient temperature. No stacking or loading shall be undertaken until the coating has cooled sufficiently to avoid marking.

The coated pipe shall be stored at all times clear of the ground and in such a way that either water or mud cannot accumulate on the inside or outside of the pipe. Storage shall be effected by the use of wooden bearers, suitably covered, or mounds of gravel-free sand, covered with polyethylene sheets.

The pipe shall only be stacked to a height such that no flattening of the wrapping occurs.

The pipes shall be separated from each other with approved polyethylene covered pads.

10.16.7 Repairs

Although the polymer modified bitumen has excellent self-healing properties, damage caused by transportation or laying of the coated pipe may occur. This shall be quickly repaired using torch-on membrane.

Damage shall be repaired by removing the existing coating to at least 10 mm beyond the area of damage. The repair area shall then be cleaned of all deleterious matter to 100 mm beyond the proposed repair area. Exposed metal shall be re-primed in accordance with this Section. The repair patch, which shall lap at least 50 mm onto sound coating, shall be applied by gently heating with a gas torch and applying it to the pipe in a manner, which prevents the entrapment of air bubbles. All air bubbles shall be removed using a wooden roller or by other means and the perimeter of the repair patch shall be neatly finished off. The patched area shall then be Holiday tested in accordance with the Specification.

10.17 System PL1: Cement Mortar Lining

This corrosion protection system covers the application of Cement Mortar as a steel pipe lining. The pipes will be used to convey potable water.

10.17.1 Standards

Reference is made to the latest issues of the following Standards:

AS 1281-2001: Cement mortar lining of steel pipes and fittings

10.17.2 Material

All materials for the cement mortar lining of pipes shall be in accordance with AS 1281-2001.

10.17.3 Application

10.17.3.1 Mixing of Mortar

Components of the mix shall be accurately weighed. Each batch shall be identical. Mixing shall be carried out in a suitable mechanical mixer. Aggregate and cement shall be measured in correct proportions, then dry mixed in the mixer. When homogeneous, water shall be added from a measuring vessel to achieve the correct consistency but shall not exceed the amount stated previously. When correctly mixed, the material shall be used as soon as possible and not later than 1 hour after the first addition of water. Re tempering of the mix by further addition of water or other material shall not be permitted.

From a random batch of each days production prepare three 150 mm test cubes, in accordance with SANS 5863. After 28 days curing, the compressive strength shall not be less than 30 MPa.

10.17.3.2 Placing of Cement Mortar

Cement mortar shall be placed to the specified thickness by spin casting (preferred method) or by mechanical drag trowel. In either case, sufficient centrifugal force shall be used to ensure optimum bonding to the pipe wall and optimum compaction of the cement mortar, with minimum segregation of different sizes of aggregate. The finished lining shall be smooth and uniform. Hand application is not permitted except on specials or by prior agreement of the Engineer.

10.17.3.3 Curing of Lining

After completion of placing, spinning, trowelling an end finish, the lining shall not be disturbed until set. The pipe ends shall be closed with waterproof end covers or caps and the pipe shall be left undisturbed for at least 40 hours. After 48 hours the lining shall be sprayed with a fine mist of water and the covers and caps replaced or shall be steam cured by an approved method. The lining shall be kept wet for not less than 7 days. Pipes shall not be transported within 21 days from the date of applying the lining.

During placing of the cement mortar and the whole of the curing period, the pipes shall be kept constantly in the shade or under cover. Pipes shall not be exposed to direct sunlight.

Some of the pipes are likely to be stored on site for periods in excess of 3 months before being laid.

10.17.4 Testing

The Quality Control Plan and Procedure referred to in Clause 4.13 above will detail the means of demonstrating compliance with AS 1281-2001 and will be based on Appendix B of AS 1281-2001.

10.18 System PL2: Solvent-Free Epoxy Lining

This system is specific design to be used as a lining system for pipelines conveying potable water and raw water.

10.18.1 General

This corrosion protection system covers the application of Solvent Free Liquid-epoxy as a steel pipe lining. Generally the lining is to be applied in accordance with AWWA C210-97 'Liquid-epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines'. Where in conflict with ANSI/AWWA C210-97, the amendments hereunder shall take precedence. The full cost of all the testing is to be included in the rates for coating unless it is itemised separately in the Schedule of Quantities.

10.18.2 Amendments to AWWA C210-97

The section and sub-section numbers in this clause refer to the same section and sub-section numbers in AWWA C210-97.

10.18.2.1 AWWA C210 Section 1.1 Scope

ANSI Sub-Section 1.1.2 Coating and Lining Systems

The lining system is to be type (3), a single coat of a two part, chemically cured epoxy coating. In the event of the thickness being less than the minimum specified the coating shall be removed and the pipe length shall be re-blasted and re-lined to comply with the specification.

10.18.2.2 AWWA C210 Section 4.2 Quality and Safety

Details of all quality related controls and tests are to be included in the QCP&P referred to in Clause 4.13 of the Employer's specification above.

AWWA C210 Sub-Section 4.2.2 Certification

Copies of the certification of the products used, as required by this section, are to be submitted with the tender documents.

10.18.2.3 AWWA C210 Section 4.3 Coating Systems

AWWA C210 Sub-Section 4.3.1 Liquid-Epoxy Coatings.

Add the following:-

The following products have been approved by Umgeni Water: - Sigma Line 523, Carboline 891 and Denso ST100. Should the Manufacturer/ Supplier wish to offer an alternative product it will be necessary to get the approval of the client. Only solvent free epoxies which have been certified non-toxic and non-tainting and suitable for use with potable water will be permitted. Any delays in approval will not be accepted as a reason for late delivery.

AWWA C210 Sub-Section 4.3.2 Coating Thickness

The pipes shall be lined to a dry film thickness of a minimum of 406 and a maximum of 1000 microns, and shall be free from sags and runs.

AWWA C210 Sub-Section 4.3.4 Physical Requirements

Replace Table 1 with the following new Table 1

Tests 1 through 3 in the new TABLE 1 new shall be conducted on every pipe.

Tests 4 and 5(a) and 5(b) in the new TABLE 1 below shall be applied to at least one pipe selected at random from the first day's production or from each new batch of liquid epoxy, whichever is more frequent.

Tests 6, 7 and 8 in the new TABLE 1 below shall be applied to at least one pipe selected at random from the first day's production of each item.

Should the Manufacturer experience difficulties in achieving this specification, additional tests may be required by the Purchaser until the problem(s) has been identified and rectified. Such additional tests shall be to the Purchaser's account.

NEW TABLE 1

No	PROPERTY	REQUIREMENT	TEST METHOD
1	Visual	Smooth glossy or semi-glossy finish, free from excessive runs, sags, orange peel, occlusions or other visible defects	Use an experienced observer
2	Coating Thickness	Min 406 microns Max 600 microns	ISO 2808. Take a minimum of 2 readings per m ² of surface up to 300 mm nominal bore, or 12 per m ² over 300 mm
3	Electrical Insulation Defects	Nil defects at 90 Volts, 10 Mega-ohm	SABS 1217, Section 5.10
4	Impact Resistance	No defect at 1 Joules	SABS 1217, Section 5.6 but modified as given in Note 1
5a	Degree of cure: • Static Test	No softening or discolouration when fully cured	SABS 1217, Section 5.8. Cure time shall be in accordance with the manufacturer's data
5b	• Dynamic Test	No softening or discolouration when fully cured	50 Double rubs with cotton wool swab soaked in MEK. Cure time shall be in accordance with the manufacturer's data
6	Adhesion (Hot water soak)	Not more than 15 mm disbonding from point of V	Immerse in water at 75°C for 48 hrs. Make V cut at 30° angle. Test adhesion when panel has cooled to 25°C
7	Cathodic Disbonding	Total disbonded area not to exceed 40 mm diameter after 30 days. Current flow not to exceed 5mA	ASTM G8 Method B – Magnesium Anode - 20°C – 7 mm holiday
8	Cathodic Disbonding	Total disbonded area (including holiday) not to exceed 20 mm diameter	Impressed current -3, 5 volts potential at 75°C for 48 hours 3 mm artificial holiday

NOTE: Impact resistance shall be carried out on a sample of production pipe firmly clamped and choked (to be rebound free) to a rigid base. No electrical insulation defects shall be detected at the point of impact when tested at 1 Joule.

10.18.2.4 AWWA C210 Section 4.4 Coating Application

AWWA C210 Sub-Section 4.4.1 General

Application by airless spray is required.

AWWA C210 Sub-Section 4.4.2 Pipe Preparation

The requirements of section 4.4.2 of AWWA C210-97 will apply and will take precedence over the Purchaser's Clause 3.2 above.

AWWA C210 Sub-Section 4.4.3.2 Hold-Back for Field Welds

The hold backs (cut backs) are to comply with the Clause 4.15.1 of this Specification.

AWWA C210 Sub-Section 4.4.3.4 Application Temperature

Add the following:-

The cure rate of liquid epoxy coating is very dependent upon temperature, with the rate of cure being very slow below 10°C and the reaction generally ceasing below 5°C. Manufacturer's tendering for this type of lining are therefore expected to have a heated shop or warm air blowers with suitable heat insulating tunnels to enable the temperature of the coating to be maintained at not less than 15°C from the time of application until full cure has taken place. Adverse weather conditions will not be accepted as a reason for delay in supply.

10.18.2.5 ANSI Section 4.5 Coating Repair

AWWA C210 Sub-Section 4.5.1 Defective Coating

Add the following at the beginning of the Clause:

Repairs of electrical insulation defects may be carried out provided that the number of repairs necessary does not exceed 3 per pipe. A cluster of pinholes within a radius of 25mm shall be regarded as one defect. Any pipe needing repairs in excess of this number or where the lining shows any sign of flaking or loss of adhesion shall not be repaired. The lining shall be removed and the pipe length shall be re-blasted, cleaned and re-coated to comply with the requirements of the specification.

AWWA C210 Sub-Section 4.5.1.1

Delete this sub-section and replace with the following:-

Repairs with Epoxy

When repairs with epoxy are permissible, the following method shall be used :-

- ▶ Abrade an area at least 25mm diameter around and beyond the defective area. The abrasive paper shall not be coarser than 220 mesh and shall be preferably 400 mesh. It shall be used preferably wet to avoid excessive removal of coating.
- ▶ The repair area shall be smoothly feathered into the surrounding sound area. The repair area shall be abraded to a matt finish, free from deep scratches and excessive removal of coating. After abrasion, the area shall be wiped clean with M.E.K. or other suitable approved clean solvent and allowed to dry.
- ▶ All repairs shall be undertaken using a repair product recommended by the material manufacturer.
- ▶ Repair material shall be mixed in the proportions supplied by the manufacturer. No splitting of packs shall be permitted unless the material is supplied in self metering packs.
- ▶ The mixed repair material shall be applied to the clean, dry, abraded repair area so as to cover the defect and extend to within 1 or 2mm of the edge of the abraded area. A "halo" of abraded area shall be visible around the repair material.
- ▶ After curing, the repair and at least 250mm surrounding area shall be tested for electrical insulation defects as specified in the contract. There shall be no electrical insulation defects.

11 Compliance with Requirements

11.1 Testing

Tests, instruments, methods and criteria shall be as specified below or in the Amendments of this Specification.

The requirements of Clauses 4.13 shall apply.

11.1.1 Visual Inspection

All surfaces shall be inspected visually and shall be free from tears, runs, sags, wrinkles, blisters, change in colour or gloss, orange peel, dirt, visible pinholes, dust or fluff occlusions or any other visible defects.

11.1.2 Holiday Inspection

100% of all coated surfaces shall be tested and there shall be no electrical insulation defects on any area inspected.

For films exceeding 500 µm thickness, a high voltage, electrical insulation defects detector shall be used in accordance with SABS 1217.

Except on system containing conductive pigment (Zn, Al), low-voltage wet sponge electrical insulation defects inspection shall be carried out in accordance with SANS 1217 for coatings and linings of thickness not exceeding 500 µm.

For systems exceeding 500 µm thickness, the high voltage, sparking electrical insulation defects detector shall be used in accordance with SANS 1217.

During the inspection procedure the Contractor shall ensure that sufficient moisture is present at all times on the surfaces to be tested.

11.1.3 Dry Film Thickness

The dry film thickness (DFT) shall also conform to the requirements of Clause 9.5

- (a) Measurements shall be taken in accordance with ISO 2808.
- (b) 100% of all system thicknesses measured shall comply with the minimum requirements of this Specification.
- (c) Film thickness in excess of the prescribed maxima shall not necessarily constitute reason for rejection if the system is demonstrated to be sound in all respects.
- (d) The method used to measure film thickness, and the significance of the readings for each particular project, shall be agreed upon by all parties prior to commencement of the work.

11.1.4 Degree of Cure of Fusion-Bonded Materials

The degree of cure of corrosion protection material shall be assessed by solvent wiping in accordance with the method given in SABS 1217 (methyl ethyl ketone resistance test)

11.1.5 Free of Oil and Grease

11.1.5.1 Wetting with Water

All surfaces cleaned of oil and grease shall be tested using the “water-break-free” method. The surface shall be wetted with water and the entire surface shall be covered by an unbroken film.

11.1.5.2 Solvent-Wiping

Where water soluble lubricants may be present the surface shall be further tested by wiping with a clean cotton wool swab soaked in solvent. No stain shall be evident on the swab after solvent-wiping.

11.1.6 Water Soluble Salt Contaminants

Substrate surfaces shall be tested for the presence of water soluble salt contaminants in accordance with SANS 5770 or by means of the Weber Reilly Test.

11.1.7 Standard of Mechanical Surface Preparation

Mechanical surface preparation shall be visually compared to the standard shown in SABS ISO 8501-1.

11.1.8 Blast Profile

The blast profile of the substrate surfaces shall be determined in accordance with SANS 5772.

11.1.9 Residual Dust and Debris

Substrate surfaces shall be tested for the presence of residual dust and debris in accordance with ISO 8502-3.

11.1.10 Blasting Material

All blasting-materials shall be approved by the Engineer.

11.1.10.1 Metallic Abrasive

Abrasive shall be tested in accordance with ISO 11125 for particle size, hardness, density, foreign matter and moisture.

11.1.10.2 Non-Metallic Abrasive

Abrasive shall be tested in accordance with ISO 11127 for particle size, hardness, density, moisture and water soluble contaminants.

11.2 Pipe and Specials Specific Testing

11.2.1 Dry Film Thickness (DFT)

Measurements shall be taken in accordance with ISO 2808.

100% of all system thicknesses measured shall comply with the minimum requirements of this Specification.

In the case of coats applied after the erection of steel work on Site, the frequency at which measurements of the DFT are taken shall be at the discretion of the Engineer, and may be dictated by accessibility.

DFT in excess of the prescribed maxima shall not necessarily constitute reason for rejection if the paint film is demonstrated to be sound in all respects.

DFT shall be tested within 7 days of application.

The method used to measure DFT, and the significance of the readings for each particular item, shall be agreed upon by all parties prior to commencement of the coating work.

11.2.1.1 Automated Shop Applied Lining and Coating

The film thickness on the first pipe of a production run and thereafter on at least one pipe selected at random from every day's production, but not less than one pipe out of every ten pipes, shall be measured non-destructively by an approved eddy current instrument. At least four readings at equally spaced intervals around the circumference, approximately 300 mm from each end of the pipe, shall be taken. The first reading shall be over the weld bead. When practicable an additional four readings at equally spaced intervals around the circumference in the centre of the pipe shall be taken. The thickness shall not be less than the minimum specified over 100% of the area including weld beads. The Engineer may at his discretion supplement the above test by checking wet film thickness on any or all pipes during application of the coats.

11.2.1.2 Hand and In-situ Applied Lining and Coating

All the hand applied lining and coating thicknesses shall be tested by means of an approved eddy current or magnetic instrument. At least four readings shall be taken at equally spaced intervals around the pipe circumference at any test point. The first reading shall be over the weld bead. The thickness shall not be less than the minimum specified over 100% of the area including weld beads.

12 Measurement and Payment

12.1 General

The rates tendered under this Specification shall not include for the general obligations, Contractor's Equipment and work deemed to be covered by the Items provided in Specification.

Payment for the requirements of this Specification will be included in the payment item for the particular item supplied including painting or corrosion protection. No separate payment shall be made for painting and corrosion protection unless specifically allowed for in the Bill of Quantities.

12.2 Scheduled Items

12.2.1 QCP and documentation Unit: lump sum (Sum)

Separate Items are provided in the Bill of Quantities for the submission of the Quality Control Plan (QCP) and all other pre-manufacture documentation.

The rate shall include full compensation for the preparation and submission of the QCP and the submission of all pre-manufacture documentation in compliance with the Specification.

Payment will only be made after the QCP and all documentation has been approved by the Engineer.”

ANNEXURE A: Applicable Standards

The following Standards and Codes of Practice are referred to in this Specification:

Standards Australia

AS 1281-2001	Cement mortar lining of steel pipes and fittings
AS 4321-2001	Fusion-bonded medium-density polyethylene coating and lining for pipes and fittings

American National Standards Institute

ANSI B31.3	Standards of pressure piping
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American Petroleum Institute

API 5L	Specification for line pipe
API 1104	Standard for welding pipelines and related facilities

American Society of Mechanical Engineers

ASME BPVC-IX	Boiler and Pressure Vessel Code – Section IX, Welding and Brazing Qualifications
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American Society for Testing of Materials

ASTM A240	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASTM A312	Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes
ASTM D543	Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D570	Standard Test Method for Water Absorption of Plastics
ASTM D638	Standard Test Method for Tensile Properties of Plastics
ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness
ASTM D2794	Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)

ASTM D4090

ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

ASTM G8 Standard Test Methods for Cathodic Disbonding of Pipeline Coatings

ASTM G14 Standard Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)

ASTM G62 Standard Test Methods for Holiday Detection in Pipeline Coatings

ASTM G95 Standard Test Method for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method)

American Water Works Association

AWWA M11 Steel pipe – A guide for design and installation (3rd edition)

AWWA: C207 - 1994 Steel pipe flanges 4" through 144".

AWWA: C208 - 1996 Dimensions for fabricated steel water pipe fittings.

AWWA C210-97 Liquid epoxy coating systems for the interior and exterior of steel water pipelines

AWWA C222-99 Polyurethane coatings for the interior & exterior of steel water pipe & fittings

British Standards Institution

BS 970 Specification for wrought steels

BS 2494 Materials for elastomeric joint rings for pipe work and pipelines

BS 2633 Class I arc welding of ferritic steel pipe work for carrying fluids

Canadian Standards Association

CSA Z245.20 External Fusion Bond Epoxy Coating for Steel Pipe

CSA Z245.21 External Polyethylene Coating for Pipe

European Standards

EN 1179	Zinc and zinc alloys – Primary zinc
EN 10240	Internal and/or external protective coatings for steel tubes - Specification for hot dip galvanized coatings applied in automatic Plants

International Organization for Standards

ISO 544	Welding consumables - Technical delivery conditions for welding filler materials - Type of product, dimensions, tolerances and markings
ISO 752	Zinc ingots
ISO 2808	Paints and varnishes - Determination of film thickness
ISO 8501-1	Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of un-coated steel substrates and of steel substrates after overall removal of previous coatings.
ISO 8502-3	Preparation of steel substrates before application of paint and related products - Tests for the assessment of surface cleanliness Part 3: Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)
ISO 8504-2	Preparation of steel substrates before application of paints and related products – Surface preparation methods – Part 2: Abrasive blast cleaning.
ISO 11125	Preparation of steel substrates before application of paints – Metallic blast-cleaning abrasives.
ISO 11127	Preparation of steel substrates before application of paints – Non-metallic blast-cleaning abrasives.

NACE International

NACE TM0102	Measurement of Protective Coating Electrical Conductance on Underground Pipelines
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South African Bureau of Standards

SANS 32	See EN 10240
SANS 62-1	Steel pipes Part 1

SANS 121 (ISO 1461)	Hot-dip galvanised coatings on fabricated iron and steel articles
SANS 630	Decorative high gloss enamel paints
SANS 681	Undercoats for paints
SANS 719	Electric welded low carbon steel pipes for aqueous fluids (large bore)
SANS 1091	National colour standard
SANS 1117	Plastics wrappings for the protection of steel pipelines
SANS 1130	Fibre reinforcing material for pipe wrapping
SANS 1178	The production of lined and coated steel pipes using bitumen or coal tar enamel
SANS 1200 L	Standardized specification for civil engineering construction Section L: Medium-pressure pipe lines
SANS 1217	Internal and external organic coating protection for buried steel pipelines
SANS 1274	Coatings applied by the powder-coating process
SANS 1319	Zinc phosphate primer for steel
SANS 1344	Medium duty solvent detergent
SANS 1365	Solvent degreasers that contain chlorinated hydrocarbons
SANS 1700	Fasteners
SANS 2063	Thermal spraying - Metallic and other inorganic coatings - Zinc, aluminium and their alloys
SANS 5770	Preparation of steel substrates before the application of paints and related products - Test for the assessment of cleanliness of blast-cleaned steel surfaces - Freedom from certain soluble salts
SANS 5772	Preparation of steel substrates before the application of paints and related products - Surface roughness characteristics of blast-cleaned steel surfaces - Profile of blast-cleaned surfaces determined by a micrometre profile gauge
SANS 10044	Welding
SANS 10064	The preparation of steel surfaces for coating
SANS 10120-3 HC	Code of practice for use with standardized specifications for civil engineering construction and contract documents Part 3: Guidance for design Section HC: Corrosion protection of structural steelwork

SANS 10129	Plastics tape wrapping of steel pipelines
SANS ISO 14713	Protection against corrosion of iron and steel in structures - Zinc and aluminium coatings - Guidelines

ANNEXURE B: Paint Colour Coding

MECHANICAL AND GENERAL

ITEMS	COLOUR	SANS 1091 CODE
Structural steel, Gates	Light grey	G29
Hydraulic power Pack	Strong blue	F11
Hydraulic oil	Salmon pink	A40
Hazardous objects/areas (restricted headroom, crane hook etc.)	Golden yellow with black chevron	B49*
Handwheels and levers	Golden yellow	B49
Handrails: vertical - horizontal	Black Golden yellow	G49
Handrails on dam walls - Aluminium - Stainless steel - Galvanized	Un-coated Un-coated Light grey	G29
Floors: - safe and walking areas - restricted areas - open flooring (gratings) – MS galvanized 3Cr12 Stainless steel	Emerald green Golden yellow Un-coated Un-coated Un-coated	E14 B49*
Fire protection Plant	Signal red	A11*
Control panels	Eau de nil	H43

PUMP STATION

ITEMS	COLOUR	SANS 1091 CODE
Electric motors	Light beige	C57
Pumps/control valves: for raw water for chem-treated water	Apple green Middle blue	H29 F07
Fan and coupling guards	Signal red	A11*
Base plates	Black	
Overhead traveling cranes	Golden yellow	B49
Isolating valves: for raw water for chem-treated water	Brilliant green Arctic blue	H10 F28

ELECTRICAL

ITEMS	COLOUR	SANS 1091 CODE
Low voltage panels: Indoor Outdoor	Light orange Light orange	B26* B26
Medium voltage panels: Indoor Outdoor	Admiral grey Admiral grey	G12 G12

ITEMS	COLOUR	SANS 1091 CODE
Panel accessories (gland plates, back plates, interior)	White	
UPS Plant items	Light orange	B26
Transformers	Light stone	C37
LV distribution kiosks, mini subs	Light stone	C37
Standby electrical Plant items(Permanently powered)	Signal red	A11*
General outdoor	Light grey green	H40
All Plant– interior	White	

WATER TREATMENT PLANT

ITEMS	COLOUR	SANS 1091 CODE
Plant	Same colour of respective pipe work	
Handwheels (remote valves)	Same colour of respective pipe work	
PIPE WORK		
Raw water	Brilliant green	H10
Chemical treated raw water	Verdigris green	E22
Clarified raw water	Eau de nil	H43
Filtered water	Pale blue	E39
Chlorinated filtered water	Arctic blue	F28
Backwash water	Cornflower blue	F29
Air saturated water	Turquoise blue	E18
Wash water recovery	Middle buff	B33

SEWAGE PIPE WORK

ITEMS	COLOUR	SANS 1091 CODE
Raw sewage	Dark earth	B11
Settled sewage effluent	Brilliant green	H10
Biologically treated sewage effluent	Verdigris green	E22
Final/chlorinated effluent	Eau de nil	H43
Digested sewage sludge	Middle brown	B07
Raw sewage sludge	Dark brown	B03
Humus sludge	Golden brown	B13
Return activated sludge	Golden brown	B13
Waste activated sludge	Middle brown	B15
Supernatants/underflows returning to head of works	Middle buff	B33

DOSING/CONTROL PIPE WORK

ITEMS	COLOUR	SANS 1091 CODE
Poly-electrolyte	Pinotage	A08
Alum/Ferric chloride	Jacaranda	F18
Chlorine solution	Primrose	C67
Chlorine gas	Lemon	C54
Chlorine liquid	Light orange	B26
Lime slurry	Biscuit	B64
Lime hydrated	Biscuit	B64
Lime saturated water	Biscuit	B64
Air/compressed air	White	
Steam	Pastel grey	G54

NOTE: Colours marked thus * are restricted for specified Plant only.

**EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF
AKKERKLOOF DAM PUMPSTATION
TENDER NO: T 29 OF 2025/2026**

C3.4: ANNEXURES

ANNEXURE A: PHOTOS OF PUMPSTATION AND PUMPS

**EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF
AKKERKLOOF DAM PUMPSTATION
TENDER NO: T 29 OF 2025/2026**

The Akkerkloof Dam Pumpstation



**EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF
AKKERKLOOF DAM PUMPSTATION
TENDER NO: T 29 OF 2025/2026**

Pumpsets



**EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF
AKKERKLOOF DAM PUMPSTATION
TENDER NO: T 29 OF 2025/2026**

Single stage centrifugal pumps



**EMERGENCY BULK WATER SUPPLY PROJECT – KNYSNA REFURBISHMENT OF
AKKERKLOOF DAM PUMPSTATION
TENDER NO: T 29 OF 2025/2026**

Electric Motors

