

Annex: Standard Conditions of Tender

(As contained in Annexure F of the CIDB Standard for Uniformity in Construction Procurement)

F.1 General

F.1.1 Actions

The employer and each tenderer submitting a tender offer shall comply with these conditions of tender. In their dealings with each other, they shall discharge their duties and obligations as set out in F.2 and F.3, timeously and with integrity, and behave equitably, honestly and transparently.

F.1.2 Tender Documents

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

F.1.3 Interpretation

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

F.1.3.2 These conditions of tender, the tender data and tender schedules which are only required for tender evaluation purposes, shall not form part of any contract arising from the invitation to tender.

F.1.3.3 For the purposes of these conditions for the calling for expressions of interest, the following definitions apply:

- a) **comparative offer** means the tenderer's financial offer after the factors of non-firm prices, all unconditional discounts and any other tendered parameters that will affect the value of the financial offer have been taken into consideration
- b) **corrupt practice** means the offering, giving, receiving or soliciting of anything of value to influence the action of the employer or his staff or agents in the tender process; and
- c) **fraudulent practice** means the misrepresentation of the facts in order to influence the tender process or the award of a contract arising from a tender offer to the detriment of the employer, including collusive practices intended to establish prices at artificial levels
- d) **quality (functionality)** means the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs

F.1.4 Communication and employer's agent

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

F.1.5 The employer's right to accept or reject any tender offer

F.1.5.1 The employer may accept or reject any variation, deviation, tender offer, or alternative tender offer, and may cancel the tender process and reject all tender offers at any time before the formation of a contract. The employer shall not accept or incur any liability to a tenderer for such cancellation and rejection, but will give written reasons for such action upon written request to do so.

F.1.5.2 The employer may not subsequent to the cancellation or abandonment of a tender process or the rejection of all responsive tender offers re-issue a tender covering substantially the same scope of work within a period of six months unless only one tender was received and such tender was returned unopened to the tenderer.

F.2 Tenderer's obligations

F.2.1 Eligibility

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

F.2.2 Cost of tendering

Accept that the employer will not compensate the tenderer for any costs incurred in the preparation and submission of a tender offer, including the costs of any testing necessary to demonstrate that aspects of the offer satisfy requirements.

F.2.3 Check documents

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

F.2.4 Confidentiality and copyright of documents

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

F.2.5 Reference documents

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

CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY

REFURBISHMENT OF EERSTHOEK SEWER AND WATER BOOSTER PUMPS

C2.1 Pricing Instructions

1. GENERAL

These pricing instructions provide the Tenderer with guidelines and requirements with regard to the completion of the bill of quantities. These pricing instructions also describe the criteria and assumptions which will be assumed in the Contract to have been taken into account by the Tenderer when developing his prices.

The bill of quantities shall be read with all the documents which form part of this Contract.

The following words have the meaning hereby assigned to them:

Unit	: The unit of measurement for each item of work in terms of the Scope of Work.
Quantity	: The number of units for each item.
Rate	: The payment per unit of work at which the tenderer tenders to do the work.
Amount	: The product of the quantity and the rate tendered for an item.
Lump sum (L.Sum)	: An amount tendered for an item, the extend of which is described in the Pricing Instructions, Bill of Quantities or the Scope of Work but the quantity of work of which is not measured in any units.

2. PAY ITEMS

The method of measurement published by the South African Bureau of Standards in Clause 8 of the Standardised Specifications for Civil Engineering Construction (SABS 1200) is applicable, subject to the variations and amendments contained in section C3.4.2.

Descriptions in the Bill of Quantities are abbreviated and comply generally with those in the Standard Specifications. The measurement and payment clause of each Standard Specification, read together with the relevant clauses of the Scope of Work, set out what ancillary or associated activities are included in the rates for the operations specified. Should any requirements of the measurement and payment clause of the applicable Standard Specification, or the Scope of Work, conflict with the terms of the Bill of Quantities, the requirements of the Standard Specification or Scope of Work, as applicable, shall prevail.

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

mm	=	millimetre	h	=	hour
m	=	metre	kg	=	kilogram
km	=	kilometre	t	=	ton (1000kg)
m ²	=	square metre	No.	=	number
m ² .pass=		square metre pass	sum	=	lump sum
ha	=	hectare	MN	=	meganewton
m ³	=	cubic metre	MN.m	=	meganewton- metre
m ³ .km	=	cubic metre-kilometre	PC sum	=	Prime Cost
Sum					
l	=	litre	Prov sum	=	Provisional
sum					
kl	=	kilolitre	%	=	per cent
MPa	=	megapascal	kW	=	kilowatt
kPa	=	kilopascal	wt	=	wall thickness
			dia	=	diameter

3. QUANTITIES

- 3.1 Unless otherwise stated, items are measured net in accordance with the drawings, and no allowance is made for waste.
- 3.2 The quantities set out in the Bill of Quantities are the estimated quantities of the Works, and do not necessarily represent the actual amount of work to be done. The quantities certified for payment, and not the quantities given in the Bill of Quantities, shall be used for determining payments to the Contractor. The Contract Price for the completed contract shall be computed from the actual quantities of work done, valued at the relevant unit rates and prices.

4. RATES

- 4.1 The prices and rates to be inserted in the Bill of Quantities are to be full inclusive prices for the work described under the several items. Such prices and rates shall cover all costs and expenses that may be required in and for the execution of the work described, and shall cover the cost of

all general risks, liabilities, and obligations set forth or implied in the documents on which the tender is based, as well as overhead charges and profit. Reasonable prices shall be inserted as these will be used as a basis for assessment of payment for additional work that may have to be carried out.

- 4.2 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 or where a word or phrase such as “included” or “provided elsewhere” will be accepted as a rate of nil (R0,00) having been entered against such items and covered by the other prices or rates in the schedule.

Any work executed to which such a pay item applies, shall be measured under the appropriate items in the Bill of Quantities and valued at a rate of nil (R0,00). The rate of nil shall be valid irrespective of any change in the quantities during the execution of the Contract.

- 4.3 The Tenderer shall fill in a rate against all items where the words “rate only” appears in the amount column. The intention is that, although no work is foreseen under such item and no quantities are consequently given in the quantity column, the tendered rate shall apply should work under this item be actually required.
- 4.4 Except where rates only are required, the Tenderer shall insert all amounts to be included in his total tendered price in the “Amount” column and show the corresponding total tendered price.
- 4.5 The Tenderer shall not group together a number of items and tender one rate for such group of items.
- 4.6 All rates and sums of money quoted in the Bill of Quantities shall be in rands and whole cents. Fractions of a cent shall be discarded.
- 4.7 All prices and rates entered in the Bill of Quantities must be **excluding Value Added Tax (VAT)**. VAT will be added last on the summary page of the Bill of Quantities.
- 4.8 Should excessively high unit prices be tendered, such prices may be of sufficient importance to warrant rejection of a tender by the Employer.
- 4.9 Where the Contractor is required to furnish detailed drawings and designs or other information in terms of the Contract Documents, all costs thereof shall be deemed to have been provided for and included in the unit rates and sum amounts tendered for the items scheduled in the Bill of Quantities, and separate additional payments will not be made.

END OF SECTION

NOTE: The schedule of quantities shall be completed in **BLACK INK**.

CHIEF ALBERT LUTHULI LOCAL MUNICIPALITY
REFURBISHMENT OF EERSTHOEK SEWER AND WATER BOOSTER PUMPS

C2.2 Bills of Quantities

**REFURBISHMENT OF EERSTHOEK SEWER AND WATER BOOSTER PUMPS
BID NO: ALMT07/2023**

C3: SCOPE OF WORK

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C3.1 DESCRIPTION OF WORKS

C3.1.1 Employer's objectives

It is the objective of the Employer to solicit tenders from suitably qualified and experienced contractors for the construction AND/OR REFURBISHMENT OF THE EESTERHOEK BOOSTER PUMP STATIONS.

The project will provide opportunity for CIDB-registered contractors to participate in a large infrastructure project.

A preliminary project implementation program for planning purposes is included in clause C3.1.4 and the Contractor shall be deemed to have based his tender price on this program and the Time for achieving Practical Completion as specified in the Contract Data. Any material deviations from this program shall be clearly noted in the Contractor's tender submission as an alternative.

It is furthermore the Employer's objective to stimulate local economic development through this Contract and the Contractor will be expected to participate in the process by employing local labour and acquiring plant and materials from local enterprises as far as practically possible. The Contractor's attention is drawn to section T2.2.18 (Form R) – Local Economic Participation (LEP) Claim Form for more details on this important aspect of the Contract.

C3.1.2 Scope of the works

The Project Specifications form an integral part of the contract documentation, and it supplements the Standard Specifications.

The Standard Specifications which form part of this Contract covers work associated with general infrastructure projects and may therefore cover items not specifically applicable to this particular contract.

The description of the work contained in this section is merely an outline of the Scope of Works but does not limit the work to be carried out under this Contract. Approximate quantities for each type of activity to be carried out under the Contract are listed in the Schedule of Quantities bound in this volume.

Chief Albert Luthuli Local Municipality the municipality has encountered numerous challenges due to a general decay of sewer infrastructure due to its age, and this has led to regular sewage spillage due to blockage and pipe breakage.

in view of the deteriorated condition of the existing pump stations, it was decided to refurbish or construct new pump stations in each of the 10 different areas as listed below.

The scope of works includes, but not limited to the following:

- Establishment of the Contractor on Site.
- Clearing of the site.
- Excavation for pipe trenches and structures.
- Construction of concrete wet and dry wells for pump stations
- Supply and install Self priming wastewater Pumps and associated pipelines to connect to existing pipelines.
- Refurbishment of existing pumps where necessary
- Replacement and refurbishment of dysfunctional valves, chambers and control equipment on the pump stations
- Pipe bedding and backfilling.
- Supply and installation of fittings, valves and all other construction material.
- Supply and installation of LV switch gear and associated electrical components to connect to existing infrastructure
- Associated civil and structural work, including storm water management systems (channels, V-shaped drains, stone pitching, gabions, etc.), pipeline structures

- Interconnecting pipework to pump stations.
- Replacement of Pumps, including alterations and modifications to MCC and Electrical Control Equipment.
- Erection of new fencing.
- Commissioning of the pump stations
- Trial Operation and Maintenance of the pumps and pipe for a limited period.

C3.1.3 Location of the Works and description of the Site

The project area is in Chief Albert Luthuli Local Municipality under Gert Sibande District Municipality in Mpumalanga Province. The Eerstehoek is located on the R38 and is approximately 35KM from the town of Carolina with close proximity suburbs being Nhlazatshe and Tjakastad. It is surrounded by forest plantations and much of its economy originated from this industry.

Generally it has access to engineering and social infrastructure. Economically, it depends on

The two Pump stations are located as follows

Mkhwanazi Sewer booster pump:

Latitude	Longitude
30°48'00.54" E	26°02'34.30" E

Julia Mkhonto water booster pump:

Latitude	Longitude
30°46'44.85" E	26°04'28.43" S

The following climatic and general conditions are prevalent on Site and the specified capacities of all equipment provided under this Tender shall be applicable under these conditions.

- Maximum ambient temperature: 40°C
- Minimum ambient temperature: -10°C
- 24-hour maximum temperature: 26°C
- Altitude (meters above mean sea level): ±1 640 m
- Humidity: 58%
- Atmosphere: Dusty
Lengthy periods of sunshine cause high temperatures in indoor enclosures. High breakdown of outdoor synthetic materials due to extended exposure to ultra-violet rays.
- Lightning: Medium to high lightning rate

C3.1.4 Construction Programme & Cash Flow

It is estimated that the total construction period of the infrastructure will be approximately 6 months from the Commencement Date, including the builder's holiday. It is expected that the Contract will be awarded **in October 2023 with final commissioning by March 2024.**

Alternative offers for a shorter construction period may be submitted as an alternative and will be considered during the tender evaluation stage.

The contractor shall complete the whole of the works within the maximum Time for Completion indicated in the Appendix to tender calculated from the Commencement Date. In this regard the contractor shall note that the minimum trial and operation period of 6 weeks will be required after successful commissioning of the works as specified as part of the Tests on Completion.

Each Tenderer shall submit with his Tender a suitable and realistic preliminary construction programme (referred to as the Tender Programme) for consideration by the Engineer. This programme shall commence on the Commencement Date, shall be prepared in accordance with the maximum Time for Completion comprising the Works and shall provide interim completion dates for each milestone or element of the works, including the period for executing the Test for Completion, especially water-tightness testing of water-retaining structures.

The tenderer shall allow in his programme for all connections shown on the drawings between the new and existing works included in the contract and existing water supply infrastructure. In this regard the tenderer shall ensure that tie-ins and connections are programmed to have limited impact in the operation of existing water treatment infrastructure.

After award of a Contract, the Contractor shall submit a detailed construction programme to the Engineer in accordance with the requirements of Clause 5.6[Programme] of the Conditions of Contract 2015. Except as provided above, the approval by the Engineer of the Contractor's construction programme, or of any amendment or adjustment thereto, shall not in any way alter the Contract, act as an estoppel or limit the right of the Employer to demand due performance under the Contract. The approval of a construction programme by the Engineer indicates only that the Engineer will be satisfied if the work is carried out according to such programme and that the Contractor undertakes to carry out the work in accordance with the programme. However, the approval of a construction programme by the Engineer shall not limit his right to give notice to the Contractor to submit a revised programme if the existing programme fails to comply with the Contract. Delay damages for late completion of the Works are indicated in the Appendix to Tender.

C3.1.5 Exceptionally Adverse Climatic

Extension of time resulting from abnormal rainfall or other forms of exceptionally adverse weather conditions in terms of **Clause 5.12 of the General Conditions of Contract 2015** shall be determined in terms of the Critical-path method.

Critical path method – A delay caused by exceptionally adverse climatic conditions will be regarded as a delay only if, in the opinion of the Engineer, all progress on an item or items of work on the critical path of the latest approved working programme of the Contractor has been brought to a halt. Delays on working days only will be taken into account for the extension of time, but the Contractor shall make provision in his programme of work for an expected “n” working days caused by normal rainy weather, for which he will not receive any extension of time. The value of “n” shall be according to Table 1 below.

Table B1215/1: Rainfall records for Eesterhoek

MONTH	AVERAGE RAINFALL (mm)	(n) DELAY DAYS RAIN (per month)	(n) DELAY DAYS OTHER (per month)
JANUARY	130	5	
FEBRUARY	115	4	
MARCH	98	3	
APRIL	48	2	
MAY	17	1	
JUNE	9	0	1
JULY	8	0	1
AUGUST	10	1	2
SEPTEMBER	30	1	1
OCTOBER	95	3	
NOVEMBER	128	4	
DECEMBER	141	6	
TOTAL	828		

The number of rain-related delays are the days on which 10 mm of rain or more is expected to fall. Other inclement weather delays for which the contractor must make allowance in his programme have been derived from previous experience of wind and temperature influence on similar construction in the area of the site. Actual extensions of time due to inclement weather shall be agreed between the Employer's Agent's and contractor's representatives on the site. The agreed whole days or parts thereof shall be recorded at the monthly site meetings

If approved extensions of time extend the completion date beyond the start of the Contractor's holiday in December, the holiday period shall not be considered as working days. Any remaining extension of time at this date shall be calculated from the first statutory working day in January the following year, provided that the Contractor has shown in his programme that he intends to close during the traditional Christmas/New Year break.

END OF SECTION

C3.2 ENGINEERING

C3.2.1 Employer's design

The Engineer has designed the Works on behalf of the Employer for the intended use and has selected materials that he deems are suitable and fit for purpose:

The Contractor shall be expected to construct the Works in terms of the construction drawings compiled and issued by the Engineer or special directives issued by the Engineer in writing.

In cases where there is a discrepancy between the civil drawings and structural (rebar) drawings, the Contractor shall request clarification from the Engineer prior to proceeding with the affected work.

With regards to pipe items cast into concrete structures as well as interconnecting pipework, the Engineer has provided the proposed layout of the pipework on the Drawings for tendering purposes. However, the Contractor shall be responsible for all final measurements on site, final design, correct manufacturing and installation of all pipe items and pipework covered under the scope of works. The Contractor shall also maintain suitable records of all such items in order for the Engineer to complete the as-built drawings at the completion of the works.

C3.2.2 Alternative offers at tender stage

The tenderer shall complete the tender in terms of the Tender Conditions, requirements, Specifications, information provided and requested in the Tender Document. Failure to complete the Tender Document, including all items included in the schedule of quantities, may lead to the rejection of the tender.

In evaluating tenders received, and in accordance with its adopted procurement policy, the Employer is required to satisfy itself as to the competitiveness and cost effectiveness of each tender received. In addition, as a public entity, the Employer is required to ensure that its procurement process is fair, equitable and transparent at all times. Accordingly, except for alternatives requested in the tender documents, any tenderer wishing to submit alternative offer(s) for the consideration of the Employer shall ensure that the competitiveness and cost effectiveness of the alternative can easily be determined by the Employer. Tenders that are difficult to compare to the prescribed conditions of tender and contract and/or to the specified technical requirements are likely to be rejected. Even if comparable, a tender that deviates from the specified tender conditions, requirements and specifications may not be acceptable to the Employer for reasons of risk apportionment or otherwise. Tenderers are therefore instructed to submit tender offers strictly in accordance with the conditions, requirements, specifications and schedule of quantities in the tender document before submitting any alternative offers for the Works.

C3.2.4 Drawings

Refer to Volume 3 for the drawings issued for tender purposes.

END OF SECTION

C3.3 PROCUREMENT

C3.3.1 General Clauses and Requirements

C3.3.1.1 Tenders received shall be evaluated in terms of the tender evaluation criteria described in the Tender Data, taking cognisance of the Employer's preferential procurement requirements as provided.

C3.3.1.2 The works shall be carried out by a suitably qualified, experienced and capable with a CIBD grading corresponding to the value of the civil works, inclusive of VAT. Based on the Engineer's pre-tender estimate, the required tender grade shall be **4ME or 4PE**.

Failure to meet the minimum CIBD requirements for civil contracting entities may result in the tenders being disqualified and tenders shall submit all information necessary in order for the Engineer to assess the proposed (sub) contractors in terms of the capability and experience (refer to functionality criteria).

C3.3.2 Local Economic Participation

The Contractor shall procure local goods, services and labour in order to stimulate local economic development in terms of the requirement of the Local Economic Participation Specifications included under section T2.2.18 (Form R).

C3.3.3 Sub-contractors

The Contractor shall appoint such authorities and/or specialist sub-contractors and suppliers as may be designated or nominated by the Employer or the Engineer for those portions of the Works specified in the Scope of Works.

In accordance with the Preferential Procurement Regulations, 2017, the Contractor shall subcontract 30% of the Contract Sum (excluding Preliminary and General Items) to a local sub-contractor(s).

As required by the Conditions of Contract, the Contractor shall be responsible for all work carried out by sub-contractors (whether nominated by the Employer or selected by the Contractor) on his behalf. The Engineer will not liaise directly with any such sub-contractor, nor will he become involved in any problems and/or disputes related to payments, programming, workmanship, etc., unless provided for in the Conditions of Contract. Such problems and/or disputes shall remain the sole concern of the Contractor and his sub-contractors.

No additional management fee will be payable to the Contractor for works executed by the sub-contractor(s).

Notwithstanding other requirements of the Contract, the Contractor shall not sub-contract any part of the Contract without prior consent of the Engineer, which consent shall not be unreasonable withheld.

Any consent granted by the Engineer for the appointment of any sub-contractor shall not imply a contract between the Employer and the sub-contractor, or a responsibility or liability on the part of the Employer to the sub-contractor and shall not imply a contract between the Engineer and the sub-contractor, or a responsibility or liability on the part of the Engineer to the sub-contractor and shall not relieve the Contractor from any liability under the Contract and the Contractor shall be liable for the acts, defaults and neglects of any sub-contractor, his agents or employees as fully as if they were the acts, defaults or neglects of the Contractor, his agents or employees.

Before the Engineer, in terms of Clause 14.6 [Issue of Interim Payment Certificates] of the FIDIC General Conditions of Contract, issues any certificate that includes any payment in respect of work done or goods supplied by any sub-contractor in terms of Clause 4.4 [Subcontractors] of the General Conditions of Contract, he shall be entitled to call upon the Contractor to furnish reasonable proof that all payments (less retention moneys) included in previous certificates in respect of the work or goods of such sub-contractors have been made or discharged by the Contractor, in default of which, unless the Contractor:-

- Informs the Engineer in writing that he has reasonable cause for withholding or refusing such payment, and

- Submits to the Engineer reasonable proof that he has informed such sub-contractor accordingly in writing.

The Employer shall be entitled to pay directly such sub-contractor on the Engineer's certificate all payments (less retention moneys) the Contractor has failed to make to such subcontractor and to deduct, by way of settlement, the amount so paid by the Employer from any moneys owing to or that may become owing to the Contractor.

Provided always that where the Engineer has certified and the Employer has paid directly as aforesaid, the Engineer shall, in issuing any further certificate in favour of the Contractor, deduct from the amount thereof the amount paid direct as aforesaid, but shall not withhold or delay the issue of the certificate when due to be issued in terms of the Contract.

C3.3.4 Contractor's Personnel

The Contractor shall limit the utilisation of his permanently employed personnel to that of key personnel only on the Works, as defined below, and shall execute and complete the Works utilising a temporary workforce employed directly by the Contractor and/or by his sub-contractors, using the assistance of the Labour Desk(s), from the various communities that are established in proximity to the Works or which will be consumers from the Scheme.

Without derogating from the Contractor's obligations to complete the Works within the specified time for completion in terms of the General Conditions of Contract, the numbers in each category of the Contractor's key personnel, as stated by the Contractor in the Returnable Schedules, will be strictly controlled during the contract period and any increase in numbers will be subject to the prior approval of the Employer.

Key personnel mean all contracts managers, designers, site agents, site clerks, materials and survey technicians, quantity surveyors, trainers, supervisors, foremen, skilled plant operators, brick layers, welders, shutter hands and the like, and all other personnel in the permanent employ of the Contractor or his sub-contractors who possess special skills, and/or who play key roles within the Contractor's or his sub-contractor's operations.

The Engineer may at his discretion, upon receipt of a written and fully motivated application from the Contractor, and where he deems the circumstances so warrant, authorise in writing that the Contractor may utilise in the execution of the Works, workers not being his key personnel but who are in his permanent employment. Without limiting the generality of application of this sub-clause, circumstances which may be considered by the Engineer to warrant authorization of the use of the Contractor's permanent employees other than key personnel, include:

- a) The unavailability from local sources of sufficient numbers of temporary workers and/or sub-contractors to execute the Works, provided always that the Contractor has satisfied the Engineer that he has exercised his best endeavours and taken all reasonable actions to recruit sufficient temporary workers and sub-contractors from local sources.
- b) The unavailability within the temporary worker pool and/or from subcontractor sources available to the Contractor in terms of the Contract, of sufficient skills necessary to execute the Works or specific portions thereof, in situations where the completion period allowed in the Contract is insufficient to facilitate the creation of the necessary skills through the provision of suitable training as contemplated in the Contract
- c) Any other circumstances which the Engineer may deem as constituting a warrant.

C3.3.5 Temporary Workforce

The Contractor shall employ labour from the local communities through the Labour Desk(s). Accordingly, the workforce that is employed on Site shall consist of local residents, except for approved key staff in the permanent employ of the Contractor, to the maximum extent that is compatible with the requirements of Clause C3.3.2.

With the assistance of the Infrastructure Portfolio Committee of the Chief Albert Luthuli Local Municipality and local ward committees, and a Project Steering Committee (PSC) will be established. The PSC will appoint a Community Liaison Officer (CLO) that will be employed by the Contractor for the duration of the Contract.

The CLO will assist the Contractor with local labour issues, including employment conditions, remuneration, performance monitoring, etc.

The PSC shall assist in identifying available local labour and, where available, semi-skilled labour as well as local sub-contractors. The PSC shall also assist and advice regarding conditions of employment, minimum wages, disputes and disciplinary procedures. The function of the PSC shall however in no way diminish the responsibilities of the Contractor in terms of the Conditions of Contract.

Although the Contractor shall adhere to the statutory minimum wage rates, he is however at liberty to negotiate additional incentive payments based on performance.

A contract of employment or subcontract shall be signed between the Contractor and each of his employees and sub-contractors. Likewise, contracts of employment must be entered into between each such sub-contractor and each of the specific sub-contractor's employees. Although the Contractor shall adhere to the minimum wage rates described below, he is at liberty to negotiate additional incentive payments based on performance.

Contracts of employment or sub-contracts should provide for the following basic conditions:

- a) The minimum wage payable will be determined in terms of latest applicable (at the time of tendering) legislation and shall, as a minimum, adhere to section 56(1) of the Basic Conditions of Employment Act (Act 75 of 1997), Sectorial Determination 2: Civil Engineering Sector as published by the Department of Labour.
- b) The Contractor shall adhere to the provisions for payment method and intervals, overtime and pay for work on Sundays and public holidays (if required) in the Basic Conditions of Employment Act (Act 75 of 1997).
- c) The Contractor shall register all labourers employed on the Contract with the Workmen's Compensation Commissioner and the Unemployment Insurance Fund, as applicable. The Contractor shall obtain the Unemployment Insurance Fund and Workmen's Compensation registration cards.
- d) Workers shall be entitled to one (1) day sick leave with full pay per month worked. This will accumulate if the leave is not used.
- e) Annual leave shall be calculated as published in terms of (the latest edition of) section 56(1) of the Basic Conditions of Employment Act (Act 75 of 1997), Sectorial Determination 2: Civil Engineering Sector as published by the Department of Labour.
- f) Upon termination of the Contract, each locally employed labourer shall be entitled to receive his/her Unemployment Insurance Fund and the Workmen's Compensation registration cards as well as a Certificate of Employment from the Contractor clearly stating the following:
 - I. The type of work done.
 - II. The duration of employment.
 - III. The number of days absent from work.
 - IV. The Contractor's general impression of the quality of work done.
- g) The Occupational Health and Safety Act must be adhered to with reference to the safety of all employees employed by the Contractor. Suitable safety equipment and clothing shall be issued and maintain by the Contractor for the duration of construction.
- h) Contractor's company policy regarding:

- I. Inclement weather
- II. Sickness and absence
- III. Disciplinary matters
- IV. Grievances

Should any of the above conditions be less favourable than any bargaining council agreement or Act applicable to the Contractor, the more favourable condition shall apply.

C3.3.6 Labour Intensive Construction

Labour Intensive Construction shall mean the economically efficient employment of as great a portion of labour as is technically feasible to produce a standard of construction as demanded by the Specifications with completion by the Due Completion Date, thus the effective substitution of labour for equipment.

Appropriate portions of the Works included in the Contract shall be executed using labour intensive construction methods. These portions of the Works shall be constructed utilising only locally employed labour and/or the labour of local sub-contractors, supplemented to the extent necessary and unavoidable by the Contractors key personnel as provided for in clause C3.3.2, unless otherwise instructed by the Engineer. The portions of the Works to be executed using labour intensive construction methods are:

bedding, selected fill and compaction of all pipe trenches irrespective of depth, but assisted by mechanical compaction equipment in order to achieve the specified densities;
construction of all manholes, but excluding the mixing of concrete and transporting of same to the point of pouring;
dismantling and re-erection of fences; and
cleaning and tidying of the Site.

In respect of those portions of works which are not listed above, the construction methods adopted and plant utilised shall be at the discretion of the Contractor, provided always that the construction methods adopted and plant utilised by the Contractor are appropriate in respect of the nature of the Works to be executed and the standards to be achieved in terms of the Contract.

END OF SECTION

C3.4 CONSTRUCTION

C3.4.1 General Clauses and Requirements

These general clauses cover the general, administrative, legal and organizational requirements relating to quality of materials, installation, testing, commissioning and maintenance of the installation applicable to this Contract.

These clauses should be read together with all other sections and Standard and Particular Specifications included in the Contract documents or Standard Specifications mentioned in the Contract documents but separately available. The documents should be read and interpreted jointly in order to determine the full requirements of the Contract.

Any/all deviations from these general clauses or technical specifications shall be listed in writing as Deviations at tender stage. Where the Engineer does not approve of these deviations, the Contractor shall be responsible to conform to the requirements of these General Clauses and Technical Specifications.

C3.4.1.1 *Relevant Acts, Regulations and Standards*

The whole of the installation shall comply and the work shall be executed in accordance with the latest edition of the following:

- a) The Occupational Health and Safety Act, 1993 (Act no 85 of 1993) and the latest applicable Regulations promulgated in terms of the Act or the Factories Machinery and Building Works Act of 1941, whichever is applicable and their respective Regulations;
- b) The regulations and by-laws of the local supply authorities;
- c) The applicable regulations of the relevant telecommunications authority;
- d) The local Fire Department Regulations; and
- e) The latest revisions of the relevant supporting specifications referred to in the Particular Specifications.

C3.4.1.2 *Responsible persons and representation*

The Contractor shall, before establishing on site, appoint and submit to the Engineer in writing a project organisational chart, listing the name(s) of the responsible person(s) in terms of the Occupational Health and Safety Act, 1993 (Act no 85 of 1993) and the Regulations promulgated in terms of the Act within 14 days from being appointed.

The Contractor shall submit to the Employer and Engineer within 14 days of the Commencement Date a list of addresses and telephone numbers of his Representative and key personnel who may be contacted both during and outside normal working hours in connection with the Works. The Contractor shall also refer to Sub-Clauses 4.3 and 6.8 of the Conditions of Contract.

The Contractor shall be responsible for supplying and installing the required safety signs as determined by the Occupational Health and Safety Act, 1993 (Act no 85 of 1993) and the regulations promulgated in terms of the Act, both during the construction phase and the completed works. All safety signs shall comply with the requirements of the latest edition of SANS 1186-1 as applicable.

C3.4.1.3 *Health and Safety*

The Contractor shall allow in his Tender for compliance with the requirements of the Occupational Health and Safety Act, 1993 (Act no 85 of 1993) and the latest applicable Regulations promulgated in terms of the Act, especially the latest Construction Regulation promulgated in 2014.

From the date of site handover until the Taking-Over Certificates are issued, the Contractor shall be responsible for maintaining safe working conditions on Site as prescribed by the Occupational Health and Safety Act and the regulations promulgated in terms thereof. In the event that the Site of the Works is managed by another contractor, the Contractor shall be expected to also adhere to the health and safety regulations prescribed by such contractor.

The Contractor shall be responsible for supplying and installing the required safety signs as determined by the Occupational Health and Safety Act, 1993 (Act no 85 of 1993) and the regulations promulgated in terms of the Act, both during the construction phase and the completed works. All safety signs shall comply with the requirements of the latest edition of SANS 1186-1 as applicable.

The Contractor shall comply with the Occupational Health and Safety Specification prepared by the Employer in terms of the Construction Regulations 2014 promulgated in terms of Section 43 of the Occupational Health and Safety Act (Act No. 85 of 1993).

The Contractor shall submit an approved Health and Safety Plan to the Engineer within 14 days from the date that the Agreement made in terms of the Form of Offer and Acceptance comes into effect.

The Contractor shall, before establishing on site, appoint and submit to the Engineer in writing a project organisational chart, listing the name(s) of the responsible person(s) in terms of the Occupational Health and Safety Act, 1993 (Act no 85 of 1993) and the regulations promulgated in terms of the Act within 14 days from being appointed.

Notwithstanding any actions which the Employer may take, the Contractor accepts sole liability for due compliance with the relevant duties, obligations, prohibitions, arrangements and procedures imposed by the Occupational Health and Safety Act, 1993 (Act 85 of 1993), and all its regulations, including the Construction Regulations, 2014, for which he is liable as mandatory. By entering into this Contract it shall be deemed that the parties have agreed in writing to the above provisions in terms of Section 37 (2) of the Act.

The Contractor and his designer shall accept full responsibility and liability to comply with the Occupational Health and Safety Act, 1993 (Act 85 of 1993) and the Construction Regulations, 2014 for the design of the Temporary Works and those part of the Permanent Works which the Contractor is responsible to design in terms of the Contract.

C3.4.1.4 *Quality assurance and control*

All materials and workmanship shall be of a suitable type and quality to ensure that the Works will operate satisfactorily in accordance with the Specifications.

The Contractor shall submit a Quality Assurance Plan outlining quality assurance policies and procedures to be used for the project relating to the areas such as materials, manufacturing, and installation and testing. A documented quality control and quality assurance system shall be maintained, which shall be in accordance with ISO 9000 or equivalent approved by the Engineer. The Contractor shall ensure that the same requirements is applied to products, systems, and services supplied by his sub-contractors and suppliers. The Contractor shall file all quality certification documents relating to the products and systems supplied for the Works. The Engineer shall have full access to such files.

Registration to ISO 9001:2000 is preferable and evidence of current registration to this or another acceptable quality management system shall be provided upon request.

C3.4.1.5 *Drawings and Documentation*

C3.4.1.5.1 *Tender Drawings and Engineer's Drawings*

The Tender Drawings prepared by the Engineer and issued with the tender show the general layout, position and detail of the Works to be constructed under this Contract. These details may in some instances constitute schematic arrangements. These drawings, together with the Specification, are deemed to provide sufficient detail to enable the Contractor to determine the requirements of the Works and to price and schedule the Works to be completed on time.

Only figured dimensions on the Drawings may be used in the interpretation thereof, and the Drawings shall not be scaled unless the Contractor is so instructed by the Engineer in writing. The Engineer will upon written request provide any dimensions that may have been omitted from the Drawings.

C3.4.1.5.2. *Contractor's Drawings and Documentation*

a) General

All drawings and documentation submitted by the Contractor shall be in English and shall comply with the requirements prescribed below.

All the symbols used in the electrical drawings shall be in accordance with IEC Publication 60617 unless otherwise specified in the Project Specifications and the SI system of units shall be used throughout.

All designs shall be complete, accurate and geographically correct. The designs and drawings shall be sufficiently detailed to enable construction and installation to proceed without further need for additional drawings or documentation.

All drawings and documentation submitted shall be suitably identified and labelled by means of title blocks, page numbers and revision status.

All designs and drawings shall be submitted for the Engineer's approval prior to the commencement of plant ordering, manufacturing or construction on site. Approval by the Engineer of any design or drawing does not relieve the Contractor of his responsibility of any part of the works manufactured or constructed in accordance with the design or drawing. Designs approved by the Engineer shall not be altered without his written agreement.

b) Preparation and submission of Drawings

All drawings shall be accurately scaled in terms of generally accepted scaling factors and submitted on A3 size sheets.

Electronic submissions of drawings shall in all instances comprise of *.DXF (Drawing Exchange Format) or *.DWG (AutoCad) formats accompanied by the *.PDF (Adobe Reader) format.

The Contractor may request a set of the Engineer's drawings in digital or paper format for modification and updating if necessary. These drawings shall be re-titled in accordance with the Contractor's system and shall thereafter be submitted as a Contractor's drawing.

The Contractor shall submit all drawings with reasonable promptness and in an orderly sequence as to cause no delay in the execution of any work directly or indirectly linked to the finalisation of the details contained in the drawings. The Engineer shall be given reasonable opportunity of at least 14 days to evaluate, comment on or approve the drawings. In the event that the Engineer does not respond within the said period, the Contractor shall notify the Engineer in writing of his assumption that the drawings have been approved and that manufacturing and/or construction will commence in accordance with the drawings.

The Contractor shall make the corrections or provide additional information if requested by the Engineer and shall re-submit the corrected or updated drawings until approved. When re-submitting drawings, the Contractor shall specifically direct the Engineer's attention (in writing) on revisions other than the corrections required by the Engineer on previous submissions.

c) "As-Built" Drawings

"As-Built" drawings shall be furnished on completion and the relevant completion or taking over certificate shall not be issued until such drawings have been received and approved by the Engineer.

Final and approved as-built drawings shall be submitted to the Engineer in five-fold hard copy in A3 size accurately scaled. In addition, the Contractor shall also prepare one complete set of all drawings in digital format as specified above for submission to the Engineer.

For large plant such as high voltage switchgear, transformers, standby generators, pumps, compressors and lifts, catalogues and brochures shall be submitted for approval.

Plant and material shall only be approved in writing by the Engineer and the Contractor is responsible for obtaining such approval prior to commencing with the installation.

C3.4.1.6 *Care and supply of documents*

In addition to the documents prepared and issued by the Employer and Engineer for purposes of the Contract, the Contractor shall procure and keep on site, at the most suitable location, one or more copies of the applicable legislation, regulations, standard specifications and codes of practice upon which the Contract rely and which are incorporated into the Contract by reference.

C3.4.1.7 *Operation and Maintenance Manuals and As-Built Drawings*

The submission of draft Operation and Maintenance (O&M) manuals is a prerequisite to commencing with the Tests on Completion. Two (2) copies of the draft manuals shall be submitted in terms of the format described below for the Engineer's approval at least two weeks prior to the commencing of the Tests on Completion.

Once the Operating and Maintenance manuals have been approved by the Engineer, four (4) complete sets of the manuals shall be provided by the Contractor to the Engineer. The submission of these final manuals shall not be later than four weeks after the works have been taken over by the Employer.

The manuals shall be printed on durable paper and be neatly and securely bound in A4 size hard-backed plastic/waterproof ring binders with clear pockets on the spine and front cover for insertion of title slips giving the contract number, scheme description and plant supplied.

As-Built drawings in A3 size, index and other title pages shall be contained in separate pockets.

Layout and content

The manual shall contain the following:

- 1** Title page
- 2** Contents list
- 3** List of drawings and appendices
- 4** Maintenance and Lubrication Schedule (summary)

The maintenance schedule shall be in table format and shall include a summary of all the maintenance actions required of all the different systems and functional units covered by the manual to give an overall summary of maintenance actions required for the complete works.

The schedule shall indicate daily, weekly, fortnightly, monthly and annual maintenance actions. A lubrication schedule shall also be included under this section.

A schedule indicating daily, weekly, fortnightly, monthly and yearly maintenance actions shall also be provided.

5 Detailed Plant description

The main body of the manual shall be divided into sensible sections, each covering a system or functional units. Each section shall contain the following sub-sections:

- >> Pump station description (brief but detailed);
- >> Maintenance and Lubrication Schedule (in table format);
- >> Process and Instrumentation Diagrams (P&ID's);
- >> Operating instructions (including start-up and stopping procedures as well as manual and/or automatic operation)
- >> Fault Finding
- >> Pump station Data Sheets containing as a minimum:
 - a) Plant and Equipment Tag Numbers (for asset register purposes) for the provision of an asset list in the format as required by the AG to MLM WSA.

- b) Plant Description
- c) Supplier Details
- d) Model and Make
- e) Cost of supply (at date of tendering)

>> Plant Technical Manuals

For each piece of plant and/or machine supplied, the following shall be provided under this sub-section:

- a) Supplier's Operation and Maintenance instructions
- b) Parts list and data sheets
- c) Calibration charts
- d) Test certificates for hydraulic pressure tests, flame proof grading, materials, non-destructive tests, coating and lining details
- e) Applicable drawings and details

6 As built drawings

Folded A3-size as built drawings correctly scaled.

7 Computer programmes and software

Digital copies of programmes and software as required by computerised systems installed on the project as required for maintaining, updating or altering the system by the Employer or Operator.

8 Wiring diagrams of electrical installations (separate volume).

All information that is required by the Engineer in order to complete the As-Built Drawings and to prepare a completion report for the Employer must be submitted by the Contractor to the Engineer 4 (four) weeks before the draft O&M Manual is due to be submitted by the Contractor.

C3.4.1.9 *Samples*

The Contractor shall, prior to placing orders, and if required by the Engineer, submit samples of all material and plant to the Engineer for approval.

Plant and material shall only be approved in writing by the Engineer and the Contractor is responsible for obtaining such approval prior to commencing with the installation.

C3.4.1.10 *Contractor's Equipment*

The Contractor's Equipment for construction and erection of the Works shall be adequate for the purpose required, of modern design and in good condition to carry out the Works expeditiously. Should the Engineer be of the opinion that the Contractor's Equipment is in anyway unsuitable for carrying out the Works in a manner or at a rate commensurate with the requirements of the Contract, he shall have the right to instruct the Contractor at any time during the Contract to provide additional or improved plant, tools and equipment in order to meet the specified requirements.

C3.4.1.11 *Concurrent Construction Activities*

The construction of the Works will coincide with other construction activities on Site and the Contractor shall co-operate with any/all other contractors on site regarding final designs in order to determine areas of interface. The Contractors shall be required to co-operate with other contractors and shall carry out his work in such a manner to cause minimum interference and delays to other contractors.

The Contractor shall ensure that neither his operations nor those of his Sub-Contractors nor the activities of his employees shall interfere with or hinder the operations of the Employer or of other contractors and he shall indemnify the Employer against all claims arising through default of this requirement.

The Contractor shall hand over portions of the Site of the Works (whether completed or not), or completed portions of the Works, to these contractors when required by the Employer or detailed elsewhere in this document. The Contractor shall cause no interference with or delays in the execution of these other contracts.

Any service rendered or assistance given by the Contractor to these contractors, save as are provided for in the Project Specifications, shall be for their accounts only since the Employer shall in no way be responsible to the Contractor for any payments in this respect.

The Contractor shall protect all known existing services as well as all work being carried out and structures being erected by other contractors. Any damage caused to these services or structures, or any obstructions or hindrance caused to other contractors by the Contractor, and all claims arising there from, will be the sole responsibility of the Contractor.

All repair work shall be carried out at the Contractor's expense to the entire satisfaction of the Engineer.

C3.4.1.12 Training

Training of relevant staffs on maintenance and operations of wastewater pump stations for a period of 12 month

The entire training period of no less than 2 working days per month shall be supervised by a certified representative of the Contractor in full time attendance on Site during the normal 8 hour working day and on a as required basis during the 12-month period upon request by the client. Course content and presentation shall be of professional quality and training shall be provided on site, as well as at facilities made available by the Employer for this purpose. Provision of lecture materials including the diagrams and procedures in a smaller format will be made available by the contractor. The Contractor shall be responsible for the initial training of the pump Operators during the testing and commissioning of the Works, as well as on-going training during the defects notification period.

Training shall focus on the correct operation and maintenance of the Works and shall address the following issues, amongst others:

- Start-up, shut-down and safety procedures;
- Maintenance requirements and relevant intervals;
- Troubleshooting and corrective actions;
- Understanding all processes, pump station and control methodology.
- Execution of tests, relevant calculations and calibration of plant;
- Maintenance and operation of instrumentation;
- Collection, interpretation and reporting of process data.

Once the training has been completed, all operators shall be examined by the Contractor to ensure that the subjects and training material covered has been adequately mastered. The Contractor shall subsequently compile a training report for the Engineer's approval stating the following:

- Training subjects and material covered;
- Name and ID number of all operators trained;
- Outcomes for examination of Operators;
- Final sign-off from Contractor that all training in terms of Specifications has been completed.

The Contractor's training staff shall be conversant in English and shall be knowledgeable and experienced in the manufacture, erection, testing, fault finding and maintenance of the plant installed under the Contract.

C3.4.1.13 Guarantees

All plant and materials supplied under the Contract, shall be fully guaranteed against all defects arising from faults in the design, manufacture and workmanship for a period of at least 10 years from the date of handing over.

All plant shall be guaranteed for a period of 5 years from the date of handing over to cover all defects attributable to inadequate corrosion protection.

All defects recorded within the above periods shall be rectified entirely at the expense of the Contractor. The attendance of the Contractor, specialists appointed by the Contractor or any subcontractor required to resolve the defect shall be required within 10 days of notification of such defect(s).

Should any design fault become apparent to the Engineer or the Employer for a period of 5 years after handing over of the Works, the Contractor shall deliver all components necessary to correct the fault, together with all the specialist assistance, free of charge to the Employer.

Spare parts

The Contractor shall guarantee and maintain the complete items listed under the spare parts for a period of twelve months after first delivery of the plant/equipment. The list of spares required for the pump stations and not limited to these:

The spare parts to be included and priced for in the submission:

Consumables:

- a. Oil filter
- b. Air filter
- c. Reserve oil

Pumps

- a. Starters and rotors
- b. Bearings and seals
- c. Belts
- d. Pulleys
- e. Flywheels
- f. Motors

Electrical:

- a. Fuses
- b. Surge protection
- c. Phase failure relays
- d. Spare lights for main flood lights
- e. MCC components and indicators

Valves

- a. Casing
- b seals
- c. Packing
- d. O rings
- e. Gasket
- f. Glands
- g. Bushings

TECHNICAL DATA SHEET: RECOMMENDED SPARES

Item	Description	Part Number	Number required in Stock	Each Price	Total cost

TOTAL (VAT EXCLUDED)					

C3.4.1.14 Standards

All electrical material, plant and equipment shall be of approved manufacture and its construction, design and testing shall be in accordance with the requirements of the most recent South African National Standards, British Standards or IEC publications including all amendments issued thereto up to the date of tender. The design and installation of the material, plant and equipment shall also comply with the relevant clauses of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) and the regulations promulgated in terms of this Act, as well as the Code of Practice for the Wiring of Premises, SANS 0142.

For all material, plant and equipment that are required to conform to any national or international specification or standard, the Contractor shall submit a certificate to the Engineer, issued by an accredited testing laboratory clearly stating that the material, plant and equipment complies with the specific specification or standard.

Notwithstanding reference in this specification to the South African or British Standards and the IEC or ISO recommendations, the Contractor may submit for approval by the Engineer, material and designs conforming to other technically equivalent national standards and shall submit documentary proof in English of actual compliance therewith.

All material, plant and equipment offered under this Contract shall be selected to be equal to and similar of make as the existing material, plant and equipment installed on site as far as possible and the Contractor shall do a site inspection prior to submission of the tender to ensure that they comply with this requirement (if applicable to existing structure and buildings).

Contractor shall provide electrical plant for all motor starter panels with at least Type 2 coordinated capabilities. If moulded case circuit breakers and miniature circuit breakers are cascaded and / or discrimination all proven documentation must be supplied by the Contractor

C3.4.1.15 Quality of Materials

All material and plant shall be new and suitable for the prevailing conditions at the Site, which shall include climatic conditions as well as the conditions under which materials and plant are installed, stored and operated without distortion, deterioration or inducing undue stresses in any part such as to affect the efficiency and reliability of the plant and also without affecting the strength and suitability of the various parts for the duty which they have to perform.

All material and plant shall conform in respect of quality, manufacture, tests and performance, with the relevant requirements of the SANS or where no such standards exist, with relevant current specification of the British Standards Institution and/or relevant IEC and/or ISO publications. Where applicable, the material shall bear the stamp of the relevant standards body.

Where proprietary materials and plant are specified or required, approval of such materials or plant shall be at the sole discretion of the Engineer once the appropriate samples or technical literature have been submitted.

C3.4.1.16 Electromagnetic Interference

All plant installed under the Contract shall comply with the requirements of IEC 61000 Parts 1 to 6 Electromagnetic Compatibility (EMC).

Any plant found producing electromagnetic interference subsequent to commissioning shall be suppressed or replaced to the satisfaction of the Engineer without any additional costs to the Employer.

C3.4.1.17 Corona, Radio and TV Interference

All plant and plant shall be designed so as to minimize corona or electrical discharge and radio and TV interference, and shall comply with national rules and regulations in respect to radio and TV interference.

Any plant found producing radio or TV interference subsequent to commissioning shall be suppressed or replaced to the satisfaction of the Engineer without any cost to the Employer.

C3.4.1.18 Interchangeability

Corresponding parts throughout the works shall be made to accurate tolerances that similar components or spares shall be fully interchangeable without any further alterations or adjustments being necessary.

C3.4.1.19 Labels and Notices

The following general requirements shall be applicable:

- a) Identification labels shall be attached to all equipment, motors, control gear and all panels and equipment contained therein (if applicable);
- b) All labels and plates shall be of an approved non-corrosive material and shall be fixed with stainless steel or nickel-plated screws of ISO metric thread form (if applicable);
- c) Labels shall have a matt or satin finish to minimise reflection (if applicable);
- d) Labels shall have black lettering on a white background. Danger plates shall have white lettering on a red background (if applicable);
- e) Cables shall be labelled at both ends, at through joints and at regular intervals (if applicable);
- f) Cables shall be labelled on both sides where the cable passes through a permanent obstruction (if applicable);
- g) All lettering shall be in uppercase letters, except where standard abbreviations of units are used such as kVA, kWh or MPa (if applicable).

C3.4.1.20 Materials, Plant and Equipment Recovered

All materials and equipment recovered under this contract remains the property of the Employer and shall, unless explicitly otherwise agreed, be handed to the Employer for storage and safekeeping.

C3.4.1.21 Testing and Commissioning

C3.4.1.20.1 Factory Acceptance Tests

Manufacturer type or factory acceptance tests (FAT's) shall be performed on all plant and material as described in the Project or Particular Specifications.

For plant and material manufactured outside the borders of South Africa, the requirement for witnessing factory acceptance tests by a representative(s) of the Engineer and the Employer shall be clearly specified in the Project Specification and a separate payment item provided in the schedule of quantities for attendance of such tests.

The Engineer or a duly appointed third party inspectorate reserves the right to be present at all/any tests conducted on any plant and material to be supplied under the Contract.

For any factory acceptance test, at least one (calendar) week notice shall be given to the Engineer of such test in writing.

No plant and material shall be dispatched to site prior to approval of the factory test results by the Engineer.

C3.4.1.20.2 Tests on Completion

Notwithstanding any requirements of Sub clause 7.4.3 [Tests on Completion] of the General Conditions of Contract, the following tests on completion shall be executed by the Contractor:

- a) Dry Commissioning and testing as part of construction

Once the construction of the Works or a Sub-section has reached the stage of completion where it can be tested, the Contractor shall give to the Engineer notice of the date at which the Contractor will be ready to carry out the Dry Commissioning of the Works or any Sub-section thereof. Dry Commissioning tests and inspections shall include checking the following general aspects:-

- Components of the Works or Sub-section are complete and comply with the Drawings, Specifications and data as indicated in the manufacturer's documentation;
 - The assembly has been carried out in compliance with the above documents and professional practice;
 - Visual checking of general installation and appearance.
 - Thorough check of all ergonomic (lighting and noise), maintainability and safety related aspects;
 - Thorough check of flow lines of products, materials, fluid, and compressed air;
 - Thorough check of electrical, hydraulic, pneumatic and electromechanical circuits;
 - Thorough check of all functional and control loop tests (equipment level);
 - Dry-run of every machine and checking of its operation and, if necessary, running in;
 - Calibration checks and supporting documentation on all metering and monitoring equipment;
 - Dry-run or no-load run of every section;
 - Fixing of equipment, pipes, brackets, anchors, etc.;
 - Written proof of all direction testing and alignment tests on pumps, motors and rotating equipment;
 - Statutory testing requirements (Lifting, hoisting, pressure vessels etc.);
 - Checking and testing of all actuators, valve and control valve settings;
 - Water testing of equipment, pipes, joints;
 - Water tightness and pressure tests on all water retaining structures, pressure vessels, pipelines and pipe fittings;
 - Visual checking of general appearance and equipment labelling;
 - Checking of all terminations;
 - Verify correctness of field equipment statuses in relation to PLC and SCADA displays (if applicable);
 - Testing of low voltage cables;
 - Testing of high voltage cables;
 - Checking of all safety settings;
 - Directional testing of rotating elements;
 - General safety of installations;
 - Signals and SCADA/MMI configuration;
 - Completion and issuing of all test reports and test certificates;
 - Completion of lightning protection;
 - Completion of cathodic protection and AC mitigation;
 - Compilation of an asset register suitable for integration with the Financial and Computerised Maintenance Management system of the Employer;
 - Completion and issuing of all equipment and O&M manuals including functional specifications and control philosophy;
 - Supply of all critical spares and special tools on site;
- b) Wet Commissioning and testing as part of construction

Once the dry testing of the Works in terms of the above has been completed, each process and system will be wet commissioned, which shall include the same operations as for Dry Commissioning tests but with the

plant loaded. The Employer will provide suitable water and power as set out by the Contract. Wet Commissioning shall entail the following:

- Performance testing of all equipment at specified duties and efficiencies for at least 24 hours continuously.
- Checking of levels, flows, pressures and temperatures at minimum and maximum operating conditions for all operational scenarios;
- Temperatures of all bearings;
- Vibration of rotating elements;
- Functional and control loop testing (process level);
- Site performance tests on individual equipment as per the testing plan;
- Performance and control tests on the entire system.

After successful completion of the Wet Commissioning of all plant and processes and the Works as a whole, the Trial Operation Period as defined below shall commence.

C3.4.1.20.3 Trial Operation Period

After successful completion of the commissioning phase and submission of the draft Operation & Maintenance manuals in the prescribed format, a 4-week Trial Operation Period shall commence during which the new Works shall be operated under the auspices of the Contractor. The Contractor shall provide full-time attendance for the duration of the Trial Operation Period during normal working hours (07h00 to 18h00) and shall have an individual(s) on standby during non-working hours for any/all emergencies.

The purpose of the Trial Operation Period is to prove the functionality of Works constructed under the Contract and to do final adjustment and optimization of relevant operational settings.

The Trial Operation Period shall be declared successful if / when the Works operates as intended without any failure for a continuous period of 2 (two) consecutive weeks, at which time the Taking-Over Certificate shall be issued signifying the start of the 12-month Defects Notification Period.

C3.4.1.20.4 At the end of the Defects Notification Period

Although the Contractor will not be expected to perform routine maintenance during the Defects Notification Period, all flow meters shall be calibrated every 3 months and at the end of the Defects Notification Period.

All plant, materials and other items supplied under this Contract shall be serviced and tested at the end of the Defects Notification Period, to prove that it complies with the Specifications prior to the issuance of the Performance Certificate signifying final completion and acceptance of the Works.

C3.4.1.20.5 Guarantees of Performance

The Contractor shall guarantee the output and efficiency of all plant and machines, which guarantees shall be binding under the Contract.

The fulfillment of these guarantees shall be demonstrated at the Contractor's factory premises or a suitable off-site test facility approved by the Engineer.

All measuring instruments used in the tests shall have previously been certified by an independent testing authority, not more than one month prior to the test and to the Engineer's satisfaction.

Where guaranteed performance is specified, certified test curves shall be drawn from the test data obtained from the purchased plant and shall include for pump (as an example) head (m), quantity pumped (m³/h or l/s), efficiency (%), power consumption (kW), speed in rpm and speed/torque (rpm/kNm). The probable performance with maximum and minimum impellers shall also be indicated, as well as tested NPSH available.

Each mechanical item (eg. pumps) shall be checked for acceptable vibration limits and noise limits during testing. The Contractor shall ensure that the mechanical item deliver the "Required minimum and maximum output", by adjustment of the plant or taking whatever action is necessary should there be any shortfall in the output measured in fulfillment of the Guaranteed Performance criteria.

Discount by the Contractor in lieu of under-performance of the mechanical plant relative to the Guaranteed Performance will not be acceptable.

C3.4.1.20.6 Test Plan and Reports

Method statements and test reports shall be submitted prior to and after the successful completion of each testing phase. The following documents shall be submitted in writing to the Engineer:

- Overall testing plan, including method statements and schedule of testing activities prior to commencing with dry commissioning;
- Progressive testing reports as detailed in the testing plan;
- Tests on completion:
- Dry Commissioning Report;
- Wet Commissioning Report;
- Method statement for the execution of the Trial Operation Period;
- Performance test report at end of Defects Notification Period;
- Failure investigation reports (where necessary) during Defects Notification Period.

C3.4.1.21 Priority of Specifications

The priority of the Specifications shall be as follows:

- a) Scope of Work (Section C3.4): All clauses except C3.4.2 (Standard Specifications and Particular Specifications).
- b) Scope of Work (Section C3.4): Clause C3.4.2.2 (Particular Specifications).
- c) Scope of Work (Section C3.4): Clause C3.4.1 (Standard Specifications).

END OF SECTION

REFURBISHMENT OF EERSTHOEK SEWER AND WATER BOOSTER PUMPS BID NO: TBA

C3.4.2 STANDARD AND PARTICULAR SPECIFICATIONS

C3.4.2.1 Standard Specifications

The Standard Specifications on which this contract is based are the latest revisions of the South African Bureau of Standard's Standardized Specifications for Civil Engineering Construction (SABS 1200). Note: "SABS has been changed to "SANS".

Although not bound in nor issued with this Document, the relevant sections of the standard specifications shall form part of this Contract. These documents are available at the Contractor's expense from the SA Bureau of Standards, Private Bag X191, PRETORIA, 0001.

All relevant SABS 1200 Standardised Specification for this Contract shall be applicable.

C3.4.2.2 Particular Specifications

The following additional specifications for work not covered by the Standardised Specifications are required for the contract and are bound in hereafter.

PLK	:	Manufacture and supply of valves
PLN	:	Manufacture, supply and testing of steel pipes
PLQ	:	Corrosion protection of steel pipes and fittings
PLT	:	Flow meters (general)
PLTP	:	Manufacture, supply and testing of plastic pipes
PSPPM:		Pumps and Motors

C3.4.3 VARIATIONS AND ADDITIONS TO THE STANDARD AND PARTICULAR SPECIFICATIONS

The Clauses under this section are numbered “PS” and refers to the clauses in the Standard or Particular Specifications. New clauses not covered by clauses in the Standard or Particular Specifications, if included here, are also designated “PS” followed by a number.

All material used in the Works shall, where such mark has been awarded for a specific type of material, bear the SABS/SANS mark. Alternatively, the Contractor shall furnish the Engineer with certificates of compliance of materials, which bear the official mark of the appropriate standard.

PSA defined.	GENERAL	Error! Bookmark not
PSAB defined.	ENGINEER'S OFFICE	Error! Bookmark not
PSC defined.	SITE CLEARANCE	Error! Bookmark not
PSD defined.	EARTHWORKS	Error! Bookmark not
PSDB defined.	EARTHWORKS (PIPE TRENCHES)	Error! Bookmark not
PSG defined.	CONCRETE (STRUCTURAL)	Error! Bookmark not
PSL defined.	MEDIUM-PRESSURE PIPELINES	Error! Bookmark not
PSLB defined.	BEDDING (PIPES)	Error! Bookmark not
PSLE defined.	STORMWATER DRAINAGE	Error! Bookmark not
PSPLT defined.	FLOW METERS (Particular Specification PT)	Error! Bookmark not
PSPPM defined.	PUMPS AND MOTORS (Particular Specification PT)	Error! Bookmark not

PSA GENERAL

PSA1 QUALITY (Clause 3.1)

All material used in the Works shall, where such mark has been awarded for a specific type of material, bear the SABS mark. Alternatively, the Contractor shall furnish the Engineer with certificates of compliance of materials, which bear the official mark of the appropriate standard.

Also refer to Section C3.5 for additional requirements regarding quality assurance and control.

PSA2 PLANT (Clause 4.3)

Except where the use of plant is essential in order to meet the specified requirements by the Due Completion Date, the Contractor shall use only hand tools and equipment in the construction of those portion(s) of the Works that are required in terms of the Scope of Works to be constructed using labour intensive construction methods.

PSA3 SETTING OUT OF THE WORKS (Clause 5.1.1)

Add the following:

Benchmarks are available on Site and shall be used for construction purposes. The position of the permanent survey beacons is shown on the Drawings with the relevant position (X/Y coordinates) as well as the elevation (Z coordinate).

The Contractor shall be responsible for the setting out of the works.

If at any time during the progress of the Works, any error shall appear or arise in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required to do so by the Engineer, shall at this own expense rectify such error to the satisfaction of the Engineer.

The Contractor shall take special precautions to protect all survey beacons or pegs such as benchmarks, stand boundary pegs and trigonometrical beacons, regardless whether such beacons or pegs were placed before or during the execution of the Contract. If any such beacons or pegs have been disturbed by the Contractor or his employees, the Contractor shall have them replaced by a registered land surveyor at his own cost.

PSA4 CONSTRUCTION (Clause 5)

Add the following sub-clauses:

PSA4.1 Wayleaves and permits

The Employer has obtained wayleaves and access rights for the construction of the works.

The Contractor shall give notice and obtain all permits, licences and approvals as required by the Laws, and shall keep copies of such applications, permits, licences and approvals on site at all times. The Employer shall have access to such documents for its purpose under the Contract.

PSA4.2 Care of the Site and public

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

The attention of the Contractor is drawn to the fact that parts of the Works will be constructed within or adjacent to built-up areas. Certain work shall be constructed within urban areas and in the presence of passing traffic. The Contractor shall exercise all necessary precautions and take all necessary steps to ensure the safety and convenience of the public, including the prevention of unnecessary noise, dust or other nuisance or environmental impact. Where applicable, the Contractor shall provide access for

traffic over and through the Works, and for residents to their places of abode. Safety measures shall also provide for wildlife and livestock.

Any rock or debris falling from trucks on the roads in use by the public shall be removed immediately. Precautions shall be taken to prevent fouling of public roads and other works by vehicles and the roads shall be kept clean by the Contractor.

Allowance should be made by the Contractor in his construction programme for delays that may result from foreseen and unforeseen actions that are required to ensure the safety and convenience of the public.

The Contractor shall give residents a minimum of 48 hours written notice of his intent to close access to residential stands and shall provide temporary access during the period of close. No permanent access to residential stands shall be closed for longer than 48 hours. The access shall be fenced off to ensure the safety of the public.

PSA4.3 Contractor's Representative and Superintendence

The Contractor shall submit to the Employer and Engineer within 14 days of the Commencement Date a list of addresses and telephone numbers of its Representative and key personnel who may be contacted both during and outside normal working hours in connection with the Works.

PSA4.4 Safety and security

The Contractor shall operate a security system at all the areas of the Site on a 24 hour per day basis to the satisfaction of the Engineer. He shall co-operate with the local Police and comply with the Engineer's requirements on all matters relating to security of the Works and persons entering the site. Such a system shall include full and effective security control of all accesses to each area including appropriate identification procedures for all persons and vehicles entering and leaving.

The Contractor shall also provide Personnel Protective Equipment (PPE) for the staff of the Engineer.

Security of the site shall include all construction camps and depots and the offices of the Engineer. The Contractor shall allow at all times for the necessary security and watching to prevent theft or damage to materials, plant and contractor's equipment, and to ensure the safety of both the Contractor's personnel, Employer's personnel and the Engineer's personnel.

It is in the interest of the Contractor to establish and maintain healthy community liaison and employment structures throughout the duration of the Contract as healthy structures will serve to elicit the support of affected communities in detecting and prosecuting criminal activity.

The Contractor shall take adequate preventative measures to mitigate the effect of the influx of construction personnel into the local community.

Such measurements shall include the implementation of a code of conduct, disciplinary procedure, access control, Contractor identification measures and safety and security forums.

The Contractor shall include within the safety and security forum community leaders, the South African Police Services (SAPS), local emergency services, Councillors and interested and affected parties. The forum shall set about guidelines and mechanisms to deal with and communicate project related issues between the local community and the Contractor.

In addition, the Contractor shall take adequate measures to restrict personnel movement outside the boundaries and shall provide safe transport to and from the workplace.

The Contractor shall strictly adhere to the following requirements in the Employer's security areas:

- Only persons with valid entry-permits will be allowed in the security area;
- Movement of employees will be restricted to particular areas. Trespassers will forthwith be suspended from the premises;

- Employees shall not be allowed on the premises between the hours of 17h00 – 07h00 without previously obtaining permission;
- When the Contractor finds it necessary to exceed this restriction, arrangements must be made at least 12 hours in advance, with the Chief Security Services or his duly authorised representative;
- Should the Contractor wish to leave a night-watchman on the work premises, he must submit a written application to the Chief Security Officer.

PSA4.5 Notices, signs, barricades and advertisements

Notices, signs and barricades as well as advertisements may only be erected where approved by the Engineer. The Contractor shall be responsible for their supply, erection, maintenance and ultimate removal and shall make provision for this in his tendered rates.

The Engineer shall have the right to have any sign, notice or advertisement moved to another location, or to have it removed from the Site of the Works, should it in any way prove to be unsatisfactory, inconvenient or a safety hazard.

PSA4.6 Accommodation of traffic

Accommodation of traffic during construction of the Works forms an integral part of the obligations of the Contractor. The Contractor's plan for the accommodation of traffic and directional signs shall be prepared in terms of the latest version of the South African Road Traffic Signs Manual and CSRA Road Note 13, 3rd Edition 1988 (ECSRA Road Sign Note) and must be submitted to the Engineer together with the approval of the applicable authorities prior to the commencement of construction activities.

The travelling public shall have the right of way on public roads (whether closed to through traffic or not), and the Contractor shall apply suitable approved methods for controlling the movement of the contractor's equipment, materials, plant and Temporary Works in such a way that the latter will not constitute a hazard to residents and the travelling public.

The Contractor shall exercise all necessary precautions and take all necessary steps to ensure the safety and convenience of the public. In addition, the Contractor shall provide access for traffic over and through the Works, and for residents to their places of abode. Allowance must be made by the Contractor in his programming for delays resulting from the aforesaid.

Failure to maintain road signs, warning signs or flicker lights, etc., in a good condition shall be deemed sufficient cause under the applicable clause of the Conditions of Contract for the Engineer to instruct the Contractor to suspend part or all of the Works at the cost of the Contractor until the default has been rectified.

The Contractor's tendered amounts for the work shall include full compensation for all costs and profit which may arise from the accommodation of traffic and no claims for extra payment in this respect shall be considered.

PSA4.7 General environmental requirements

All chemicals, lubricants and fuels shall be stored in secondary containment units that are capable of storing 110% of the contents stored. These secondary containment units must be impermeable, fire proof and constructed to the approval of the Engineer.

Washing of tools and/or equipment shall take place at dedicated washing facilities within the construction camps. Suitable wash facilities must be provided at all construction camps and all wastewater must be treated before discharge into any natural watercourse.

The Contractor shall prevent discharge of any pollutants, such as cement, concrete, lime, chemicals and fuels into any water sources. Runoff from fuel storage areas/ workshops/vehicle washing areas and concrete swills shall be directed via an oil separator into a settlement pond and this will be disposed of

at a site approved by the Engineer. Appropriate measures to prevent water pollution at/from batching plants must be implemented.

The Contractor shall be responsible to safeguard the plant and areas adjacent to the Contractor's camp against fire caused in any way by the construction activities on Site. The Contractor shall be responsible for any damage or loss suffered in this regard.

PSA4.8 Pre-construction survey

Landowners

The pre-construction survey must be conducted per affected property. It must be attended by the Landowner (or designated representative), the Engineer and the Contractor. The following must be established, agreed and recorded.

- communication protocol for future communication between the parties (introduce all parties, roles and functions)
- contact details
- activities usually undertaken in the construction servitude area, particularly in agricultural areas
- impacted services e.g. telephone, electricity, water supply lines and others, and the protection of these services
- fire protection and fighting measures
- fencing and gate requirements (any special requirements for special livestock, type of stock proof fencing, no of wire strands, location of gates, opening and closing of gates etc.)
- interim access requirements to rivers and streams
- security issues

Information and agreements to be captured in a document for each affected land portion (copy of which to be submitted to the Engineer).

Existing services, buildings and structures

Position, type, condition and other details of existing services (fencing, gates, roads, telephone lines, power lines etc), buildings and structures within the construction site including the pipeline servitudes.

This survey must include photographic records, documented per cadastral portion.

PSA4.9 Fencing

The Contractor shall replace all existing fencing that encroaches within the proposed permanent and temporary servitude with new stock proof or game proof (where applicable) fencing.

New gates shall be installed where required for access to properties or servitudes. The Contractor shall liaise with property owners with regard to the position and width of the gate.

The Contractor shall give all land owners and residents a minimum of 48 hours' notice of its intent to dismantle fences to properties. The Contractor shall note and take photos of all aspects relevant to the condition of existing fencing prior to dismantling, and shall acquire the signature of the owner/occupant agreeing to such conditions.

After reinstatement, the Contractor has to acquire the owner / occupant's written confirmation that the condition of the fence is at least equivalent to its condition before dismantling.

PSA5 SITE FACILITIES

PSA5.1 SITE FACILITIES AVAILABLE

PSA5.1.1 Contractor's Camp

The Contractor's camp shall be kept clean at all times during construction and conform to the requirements and regulations of the Employer, authorities and the applicable Environmental Management Plan.

The Contractor must fence off his construction camp area with 1.8m high diamond mesh fence. The inside of the camp area shall be screened off from the public by 1.8m high green shade cloth neatly tied to the inside of the fence. All temporary fencing must be removed on completion of the Contract.

The camp may be used for the working hours activities of the Contractor's and the Employer's personnel and for all related facilities required by the Contractor and the Employer such as workshops, stores, testing laboratories, etc.

The Contractor shall at all times conform to all requirements contained in law or bylaws, as well as any other requirements set by the controlling local authority.

The Contractor shall water all access roads to the construction camp, as well as working areas used by vehicles inside the camps to prevent dust caused up by vehicles or wind.

At the completion of the construction work, the Contractor must break down and remove all concrete slabs, etc. in the construction camps and at the batching plant (if applicable), remove all rubble from the camp site and hand back the sites in a clean and tidy condition.

No Taking-Over Certificate shall be issued for the Works unless the site clearing is done to the satisfaction of the Engineer.

PSA5.1.2 Source of water supply

The Contractor shall be responsible under the Contract for the supply and distribution at his cost of all water that he may require for purposes of constructing the Works. Accordingly, the Contractor shall pay all connection fees and consumption charges, and at his cost provide all connections, consumption meters, pipework, storage tanks, transport and other items associated with the supply of water for the Works.

The Contractor shall, subject to the approval of the Engineer, make any necessary arrangements with the relevant authority for the connection(s), and shall provide in his tender for the payment of all charges and costs that are associated with making water available for purposes of constructing the Works.

Water for filling, testing and disinfecting the pipelines and structures will be made available by the Employer at no cost to the Contractor. However, should the pipelines and/or structures have to be drained and refilled due to defective materials or workmanship by the Contractor or by his sub-contractors, then the water required for refilling shall be made available at the cost of the Contractor.

PSA5.1.3 Source of power supply

The Contractor shall be responsible under the Contract for the supply and distribution at his cost of all electricity that he may require for purposes of constructing the Works. Accordingly, the Contractor shall pay all connection and consumption charges, and at his cost provide all connections, transformers, consumption meters, cables, distribution boards and other items that are associated with the supply of electricity for construction of the Works.

The Contractor shall, subject to the approval of the Engineer, make any necessary arrangements with the relevant authority for the connection(s), and shall provide in his tender for the payment of all charges and costs that are associated with making electricity available for purposes of constructing the Works. The distribution of electricity shall be in accordance with the applicable bylaws and regulations of the supply authority.

PSA5.1.4 Housing

The Contractor shall not be permitted to house personnel within his camp site(s) or on Site for this contract.

For contracts where accommodation in camp site(s) or on Site is permitted, the Contractor shall inform the Engineer at the commencement of the contract of his intentions regarding the housing of Personnel in camp site(s) or on Site, and he shall thereafter ensure that all such accommodation is kept neat and tidy, hygienic and properly controlled at all times. The Contractor's personnel, including bona fide night watchmen, may only sleep within the camp should the Contractor:

- take all the necessary steps required to comply fully with public legislation and regulations and all specifications governing the environment, health, transport, safety and public disturbance impacts of such on-site accommodation;
- acquire the written permission of the Employer and relevant owner and authority and comply with their requirements.

Should at any stage of the Contract the Employer and/or the Engineer be of the opinion that the housing of Personnel within the camp site(s) or on Site is causing disturbance or inconvenience to the landowner or to nearby residents, then the authority granted by this clause for the Contractor to house Personnel within camp site(s) or on Site may be withdrawn, either partially or entirely.

The Contractor shall at all times conform to all requirements contained in law or bylaws, as well any other requirements set by the controlling local authority.

PSA5.1.5 Access to Site

The Contractor may make use of the existing access roads to and within the Site, but shall be responsible to restore these roads to a similar or better condition that prevailed at the Commencement Date and at his expense. If the Contractor requires additional access to and within the Site, these shall be constructed at his own expense. Proper access control shall be instituted by the Contractor to prevent any unauthorised entry

PSA5.2 SITE FACILITIES REQUIRED

PSA5.2.1 For the Contractor

Whatever may be required for the satisfactory execution of the Contract.

PSA5.2.2 For the Engineer

As specified under Section PSAB.

PSA5.2.3 Sanitary facilities

Water borne sewerage is not available at the Engineer's camp site. Flush toilets or chemical toilets shall be provided and maintained for the use of the Contractor's personnel at all camp sites that the Contractor may establish for construction of the Works. In addition, the Contractor shall at all times during construction of the Works provide adequate sanitary facilities on site so that all employees are at all times within easy reach of sanitary facilities.

Washing, whether of the person or of personal effects and acts of excretion and urination, are strictly prohibited other than at the facilities provided.

The Contractor must use chemical toilets where flush toilets are not available. Chemical toilets shall be inspected on a daily basis to ensure these are in a good working condition and are not overflowing. A competent Subcontractor must be appointed to service the toilets on a regular basis. This Sub-Contractor shall ensure that no spillage occurs when the portable toilets are cleaned or emptied and that the contents are removed to a waste treatment facility.

Latrine and ablution facilities shall comply with the regulations of the local authority concerned and shall be maintained in a clean and sanitary condition to the satisfaction of the Engineer. Toilet facilities supplied by the Contractor for the workers shall occur at a maximum ratio of 1 toilet per 15 persons. These will be furnished at all times with toilet paper.

The toilets shall be placed on a stable surface, no further than 50 m from any works area and must be secured to the ground to the satisfaction of the Engineer to prevent them toppling over due to wind or any other cause and the entrances to toilets shall be adequately screened from public view.

PSA6 TESTING (Clause 7)

PSA6.1 All test results obtained by the Contractor in the course of his process control of the Works shall be submitted to the Engineer or his Representative prior to requesting inspection of the relevant portions of the Works. Any request for inspection shall be submitted on the prescribed forms that will be issued once the Contract has been awarded.

PSA6.2 The Contractor shall make suitable arrangements for process control prior to commencement with the Works. Should he intend using site personnel for this purpose he shall ensure that suitably trained and competent personnel take charge of the necessary test work, and that the necessary equipment is at their disposal prior to commencement of the Works. Failure to comply with these requirements shall be just cause for the Engineer to order suspension of the Works without additional remuneration, or for him to recommend termination to the Employer in terms of the Conditions of Contract.

PSA6.3 The Contractor shall deliver to the Engineer, for his consideration, quality assurance programmes (as obtained from all the Contractor's proposed suppliers of pipes, valves and specials) prior to the Contractor's appointment of any suppliers.

PSA7 ADJUSTMENT OF PRELIMINARY AND GENERAL TIME-RELATED ITEMS (Clause 8.2.2)

PSA7.1 Replace the note on the end of the clause with the following:

Note: An approved extension of time will qualify the Contractor to receive additional payment for each relevant time related item at the original tendered unit rate for such item. The additional payment will be calculated pro rata to the extension of time in relation to the time for achieving Practical Completion for the Works at the date when the agreement came into effect.

PSA7.2 Should the Time for Completion be automatically extended due to abnormal weather conditions occurring during execution of the Contract as provided for in the Conditions of Contract, adjustment to the total for time-related preliminary and general items will be applicable as specified in Clause PSA7.1.

PSA7 HEALTH AND SAFETY

The Works to comply with the Occupational Health and Safety Act (Act 85 of 1993), the Construction Regulations GNR.84 of 7 February 2014 and the Employer's Safety Specifications.

The maintenance of safe work practice at all times and in all sections of the execution of the works shall form part in the day to day site activities of all the Contractor's management, staff and workforce on the contract.

The Construction Regulations requires from the Employer to ensure that the Contractor has made adequate provision for the execution of the works within the Act, Regulations and Specifications. The items listed below have been identified as critical towards ensuring the minimum standards of safe work practice. It must however be noted that the list below is not exhaustive and that it is the Contractor's responsibility to allow for all costs involved to comply with the requirements in terms of the Contract.

Also refer to health and safety requirements in Section 3.5.B (Management).

PSA7.1 Fixed-charge items

Add the following new Clause (Clause 8.3.5):

Compliance with the Occupational Health and Safety Act
(Act 85 of 1993) and its Regulations and with the Employer's
Health and Safety Specification Unit: Sum

The fixed charge item shall include but shall not be limited to the following:

- Preparation and implementation of Health and Safety Plan,
- Establishment of Health and Safety File,
- Health and Safety Training
- Personal Protective Clothing and Equipment
- Fences, Signs and Barricades
- Establishment of Safety Administration
- Compliance to all Health and Safety regulations in terms of COVID-19
- Other Health and Safety Fixed-charge Obligations

PSA7.2 Time-related Items

Add the following new Clause (Clause 8.4.6):

Compliance with the Occupational Health and Safety Act
(Act 85 of 1993) and its Regulations and with the Employer's
Health and Safety Specification. Unit: Sum

The time related item shall include but shall not be limited to the following:

The employment cost of all health and safety personnel including consultants, health and safety officers, inspectors, supervisors and issuers required in terms of the Contractor's Health and Safety Plan, Updating the Health and Safety Plan as needed, Carrying out of periodic own audits and follow-up audits, Compiling ongoing risk assessments and risk assessment reports as required by the Works, Convening of regular safety meetings with the Safety Representatives, Accompanying and supporting the Employer or his Safety Agent during ad hoc audits, Compilation of monthly safety reports and statistics for the Employer or his Safety Agent, Implementation and maintenance of Training Maintenance of personal protective clothing and equipment Maintenance of fences, signs and barricades Implementation and maintenance of safety administration Maintain compliance to all Health and Safety regulations in terms of COVID-19 Other Health and Safety Time-related Obligations

PSA8 ENVIRONMENTAL MANAGEMENT PLAN

The Contractor shall comply with all the conditions of the Environmental Authorisation (Record of Decision) and the Environmental Management Plan bound into Section C3.5C.

PSA8.1 Fixed-charge Items

Add the following Clause (Clause 8.3.6):

Compliance with Environmental Management Plan and
Environmental Authorisation (Record of Decision) Unit: Sum

The sum tendered shall cover all costs, overheads, profits and charges incurred in complying with all the conditions of the Environmental Management Plan and Environmental Authorisation bound into Section C3.5C.

PSA8.2 Time-related Items

Add the following Clause (Clause 8.4.7):

Compliance with Environmental Management Plan
and Environmental Authorisation Unit: Sum

The sum tendered shall cover all costs, overheads, profits and charges incurred in complying with all the conditions of the Environmental Management Plan and Environmental Authorisation bound into Section C3.5.C.

PSA9 PROVISION OF LEP PLAN

Add the following Fixed-Charge Item (Clause 8.3.7):

Provision of a suitable Local Economic Participation Plan Unit: Sum

The sum tendered shall include full compensation for the provision of a suitable Local Economic Participation plan as required in terms of section T2.2.18 [Local Economic Participation Specification]. The tendered sum shall also include for the auditing by a recognised external auditing firm of the expenditure on local goods, services and labour as defined in the mentioned specifications. Two audits shall be included – the first interim audit shall be undertaken once 70% of the construction period has lapsed while the second and final audit will be done once the Taking-Over Certificate has been issued. The issue and approval of the final audit results will be a pre-requisite for the issue of the Performance Certificate. The tendered sum shall furthermore include for the submission of monthly progress information related to LEP.

PSA10 SUMS STATED PROVISIONALLY (Clause 8.5)

PSA10.1 Contingencies

If applicable, a Provisional Sum has been included in the Summary of Schedules for contingencies. No percentage mark-up will be applicable to any payments made using contingency money other than the mark-up included in prices for variations determined in terms of the Conditions of Contract.

PSA10.2 Contract Price Adjustment

If applicable, a Provisional Sum has been included for Contract Price Adjustment in the Summary of Schedules to make provision for contract price adjustment in terms of the Conditions of Contract. The value of the Provisional Sum shall be based on the percentage of the subtotal value as specified in the Summary of Schedules. No percentage mark-up will be applicable to any payments made in this regard.

PSA10.3 Salary for Labour Desk Officer and Community Liaison Officer

If applicable, a Provisional Sum has been included in Schedule 2 for a salary to be paid to the Labour Desk Officer and Community Liaison Officer.

In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the amount to be paid. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA10.4 Artisans and skills training

If applicable, a Provisional Sum has been included in Schedule 2 for payments to be made to specialists for the training of unskilled or semi-skilled persons in industry accredited management and generic skills.

Payment to the Contractor will be based on invoices certified by the Engineer and issued by training specialists to the Contractor for work undertaken in terms of this item.

In addition to the above amount, provision is made in Schedule 2 for a mark-up on any payments made by the Contractor in this regard. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA10.5 Telephone calls and rental

If applicable, a Provisional Sum has been included in Schedule 2 for cell phone and telephone calls and facsimile transmissions for the Engineer's Representative. The Engineer's representative will provide his own cellular telephone for the contract. Payment will be based on call and rental costs, but excluding any deposits and installation costs which shall be priced under the preliminary and general items.

In addition to the above amount, provision is made in Schedule 2 for a mark-up on any payments made by the Contractor. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA10.6 Acceptance control testing

If applicable, a Provisional Sum has been included in Schedule 2 for acceptance control testing ordered by the Engineer to be undertaken by other service providers. Payment will be based on the actual invoicing by the service providers to the Contractor.

In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on any payments made by the Contractor in this regard. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA10.7 Office consumables for Engineer's site facility

If applicable, a Provisional Sum has been included in Schedule 2 for the appointment and payment of office consumables for Engineer's site facility.

In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the amount to be paid. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA10.8 Electronic equipment for Engineer's office

If applicable, a Provisional Sum has been included in Schedule 2 for the appointment and payment of a specialist sub-contractor for electronic equipment for Engineer's site office, including computers, printers, cameras etc.

All equipment procured for the Engineer and his representatives shall be new and remain the property of the Contractor i.e. ownership shall revert back to the Contractor upon completion of the Works.

In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the amount to be paid. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA 10.9 Engineer's accommodation

A Provisional Sum has been included in Schedule 2 for Engineers accommodation to be paid.

In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the amount to be paid. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract

PSA10.9 Locating existing services

A Provisional Sum has been included in Schedule 2 for the location/identification of existing services in terms of the Specifications where required and agreed with the Engineer (eg Ground Penetrating Radar (GPR) survey).

In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the amount to be paid. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for the Conditions of Contract.

PSA10.10 Relocation of existing Services

If applicable, a Provisional Sum has been included in Schedule 2 for the relocation of existing services by specialists where required and agreed with the Engineer.

The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA10.10 Specialized services

If applicable, a Provisional Sum has been included in Schedule 2 for the appointment and payment for specialized services if and when required. These may include all work required by the following specialists:

- Landscaping and hydro seeding;
- CCTV;
- Geotechnical surveys and inspections;
- Land Surveyor; and
- Acceptance control testing of pipework, coatings and linings.

In addition to the abovementioned amounts, provision is made in Schedule 2 for a mark-up on the amount to be paid. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA10.11 Targeted Enterprises Sub-Contractors

The Provisional Sum allocated under this item is for the fluctuation of the Targeted Enterprise sub-contractor rates in excess of the contractor's tendered rates. Payment of the provisional sum shall be on a pro-rata basis to provide compensation for the fluctuation between tendered rates of the Main Contractor and that of the Targeted Enterprise sub-contractors until the provisional sum is depleted. Any costs incurred due to fluctuation in tender rates in excess of the Provisional Sum will be for the Contractor's account. This item is applicable where the Target Enterprise sub-contractor's tender amount is higher than the Main Contractor's tender amount. The Provisional Sum will cover the fluctuation for all tendered rates of the sub-contractors.

PSA10.12 Cathodic Protection and AC mitigation

If applicable, a Provisional Sum has been included in Schedule 2 for work to be undertaken by a sub-contractor in protecting the pipeline against cathodic corrosion and providing mitigation measures against AC high voltage currents. The Engineer undertakes to issue details and instructions describing the exact nature of the work that is required, as well as the specialists that should be employed by the Contractor to undertake the work.

In addition to the above amount, provision is made in Schedule 2 for a mark-up on any payments made by the Contractor in this regard. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA11 PRIME COST ITEMS (Clause 8.6)

PSA11.1 Materials for Dayworks

A Provisional Sum has been included in Schedule 2 for materials to be used during the execution of dayworks. In addition to the abovementioned amount, provision is made in Schedule 2 for a mark-up on the materials used during the execution of the dayworks by the Contractor. Payment made shall be regarded as full compensation for overheads, charges and profit on the materials that are used when executing dayworks.

PSAB ENGINEER'S OFFICE

PSAB1 NAME BOARDS (Clause 3.1)

Name board(s) conforming to the standard requirements of the South African Association of Consulting Engineers and as shown on the relevant drawing must be provided and erected at points to be designated by the Engineer.

PSAB2 OFFICE BUILDING (Clause 3.2)

Office facilities shall be provided and furnished for the Engineer's Representative's personnel and maintained for the duration of the contract. The office facility shall be furnished as per Drawing No. 1890.11.00.AAA.01.U004. All finishing shall be in accordance with the above drawing and all furniture shall comply with specifications in Drawing No. 1890.11.00.AAA.01.U002 and U004.

The Contractor shall provide all electrical equipment as required by the office staff as well as all consumables required for facilities and equipment i.e. paper, toner, stationery etc.

The Contractor shall also be responsible to provide and maintain an adequate internet connection for the Engineer's offices.

All offices, facilities and equipment shall be new and be furnished, serviced, cleaned and maintained by the Contractor. The Contractor shall provide a full time assistant for cleaning the offices and car wash. The Contractor shall provide a full time guard service and ablution facilities for the office complex.

The Contractor shall be responsible for all running costs and costs for other services, including telecommunication, electricity, water, etc. to operate and maintain the offices efficiently.

The Contractor will remain the owner (or renter) of the offices, furniture and equipment and shall be responsible for the maintenance and insurance thereof.

Upon completion of the Works the Contractor shall remove the offices, furniture and equipment from Site.

PSAB3 TELEPHONE (Clause 5.4)

A prime cost item has been allowed in Schedule 2 to cover all call and rental costs that are associated with the provision of this facility (telephones and cell phones) for the Engineer's Representative's staff. The Contractor shall include the invoices as provided by the Engineer in the monthly payment claims.

PSAB4 TESTING

PSAB4.1 General

A laboratory is not required by the Engineer on Site. At the request of the Engineer, the Contractor shall arrange separately with an independent commercial laboratory and/or designated specialists to carry out additional acceptance control tests, over and above the normal quality control testing required for the construction of the Works. A provisional sum is included in the contract for the additional control tests ordered by the Engineer.

The Contractor shall remain responsible to carry out the process control testing required by the Standardized, Particular and Project Specifications.

PSAB4.2 Laboratory Equipment

The Contractor shall supply, insure and maintain the following equipment for use by the Engineer's Representative's personnel for the duration of the Contract:

(a) A Troxler nuclear system Model 3440, complete with accessories and stored in a suitable transit case as supplied by the manufacturer. A detailed description of the unit and principals of operation should be given in the manual for the nuclear instrument. Calibration test certificates shall be provided for such instrument.

(b) Six concrete cube moulds, 150mm nominal size, as well as a suitable concrete cube curing basin to keep all concrete cubes submerged in water for at least 28 days.

PSAB5 SURVEY ASSISTANTS (Clause 5.5)

One suitably educated Survey Assistant shall be made available for the sole use of the Engineer's Representative personnel for the duration of the Contract. Transport shall be supplied for the Survey Assistant by the Contractor for the duration of the Contract should he be requested to do so. In such event payment will be made at scheduled daywork rates.

PSAB6 SURVEY EQUIPMENT

The survey equipment listed below shall be made available and be maintained in good condition for the exclusive use of the Engineer or his Representative for the duration of the Contract.

- (a) Automatic surveyor's level complete with tripod and leather carry case such as Zeiss N1-2 or equivalent 1 No
- (b) Nylon-coated steel surveyor's tape 100m long and 10mm wide 1 No.
- (c) 5m long steel tape 1 No.
- (d) 5m long three-piece telescopic survey staves (metric double-face) complete with angle bracket level 2 No
- (e) Survey books: Level 3 No.
- (f) 2kg hammer with rubber handle 1 No.
- (g) Steel pegs, 300mm long and 12mm dia 120 No.
- (h) Aluminium tags, 100mm long, 15mm wide and 2mm thick 120 No.
- (i) Reverse polar notation pocket calculator (Hp32SII or similar) 1 No
- (j) Change point 2 No
- (k) Measuring wheel 1 No
- (l) Tripod holders for ranging rods (heavy duty) 2 No.
- (m) Optical square (Sokkisha or Wild), complete with telescopic aluminium rod and bubble 1 No.
- (n) "Rabone" steel tape 10 meters long and 13mm wide 1 No.
- (o) Triangular change plate with chain 2 No.
- (p) 100m long 50 kg strength fish line 1 No.
- (q) One-metre-long spirit level 1 No.
- (r) Three metre aluminium straight edge 1 No.

PSAB7 CARPORTS

The Contractor shall provide and maintain carports as indicated on the drawing mentioned in PSAB2 for the duration of the Contract. The floor shall consist of crushed aggregate to alleviate dusty and muddy conditions.

PSAB8 INSURANCE, MAINTENANCE ETC.

The Contractor shall be responsible for the insurance of all facilities and equipment, running costs and costs for other services, including telecommunication, electricity, water, sanitation, etc. to operate and maintain the office efficiently.

The Contractor shall provide assistants for cleaning the offices.

The Contractor shall provide all consumables required for the facilities and equipment.

PSC SITE CLEARANCE

PSC1 DISPOSAL OF MATERIAL (Sub-clauses 3.1 and 8.2.1)

Materials arising from clearing and grubbing shall be disposed of at a suitable spoil site. The Contractor shall be responsible to make his own arrangements for a suitable spoil site. Trees and stumps necessarily removed shall not be burnt unless authorized by the Engineer but shall be cut and stacked at areas designated by the Engineer.

PSC2 AREAS TO BE CLEARED AND GRUBBED (Clause 5.1)

The areas to be cleared and grubbed will be indicated by the Engineer. Should a portion or the whole of the site have been cleared and grubbed by others prior to the start of construction then no clearing and grubbing will be ordered, or payment made with respect to the applicable portion of the site.

PSC3 PRESERVATION OF TREES (Sub-clause 5.2.3)

The penalty in respect of every individual tree, designated as a tree to be preserved, that is damaged or removed unnecessarily by the Contractor, shall be up to R10 000.00 (amount to be determined by the Engineer). Trees that fall within areas upon which the Works are to be constructed or within areas that the Contractor must occupy for the proper construction of the Works will not be designated for preservation. The identification of trees to be designated for preservation will be subject to the discretion of the Engineer.

PSC4 FREEHAUL AND OVERHAUL

Refer to clause PSDB6 in this regard.

PSD EARTHWORKS

PSD1 CLASSIFICATION FOR EXCAVATION PURPOSES (Clause 3.1.2)

Delete clause 3.1.2 (a) and clause 3.1.2 (b) and replace with the following:

3.1.2 (a) Soft excavation:

“All material that is not classified as hard rock excavation in terms of clause 3.1.2 (c), boulder excavation class A in terms of clause 3.1.2 (d) or boulder excavation class B in terms of clause 3.1.2 (e) shall be classified as soft excavation”

In clause 3.1.2 (c) (1), replace the words “equivalent to that specified in (b) (1) above” with the words “of mass approximately 35 t, fitted with a single-tine ripper suitable for heavy ripping and of fly wheel power approximately 220 kW.”

In the last sentence of clause 3.1.2 (d), replace the words “intermediate excavation” with the words “soft excavation.”

In the last sentence of clause 3.1.2 (e), replace the words “or intermediate excavation, according to the nature of the material” with the word “excavation.”

PSD2 SAFEGUARDING OF EXCAVATIONS (Sub-Clause 5.1.1.2)

Any cost the Contractor may undergo in ensuring the safety of excavations or any additional excavation and backfilling he may have to undertake due to the unstable sides of excavations and trenches shall be held to his account and the various rates for excavation and trenching included in the Schedule of Quantities shall include full compensation therefore.

PSD3 EXPLOSIVES (Sub-Clause 5.1.1.3)

Add the following to the sub-clauses:

Blasting must adhere to the relevant statutes and regulations that control the use of explosives.

Prior to blasting, the Contractor shall submit a method statement to the Engineer including:

- The date, time, location, type of blast, zone of influence of ground and air shockwaves, procedures to limit fly rock and noise and any other information deemed necessary for the safe execution of the activity.
- Details of the dwellings / structures / services within the zones of influence including existing positions, lengths and widths of cracks, as well as the condition of doors, windows, roofing, wells, boreholes etc.
- Procedures for informing affected owners, communities, authorities, road users, sensitive receptors etc.
- Measures to mitigate the effects of blasting. The Contractor shall take special measures to protect existing services and structures during blasting operations which will include controlled blasting. The Contractor shall be responsible to repair damages to existing services and structures immediately, to the approval of the Engineer.
- Proposed blasting procedures, including the spacing and loading of each blast. The blasting procedures shall be prepared in writing by an explosive expert retained by the Contractor. The expert shall ensure that the approved procedures are met and that vibration readings are taken during blasting. The Contractor is responsible for the appointment and remuneration of its explosives expert and the name of the explosive expert shall be submitted to the Engineer for his prior approval. The Engineer reserves the right to independently review and monitor all blasting plans and procedures.

The Contractor shall give all residents, authorities or other parties owning buildings, structures and services within an appropriate radius (not less than 500 m) from any point of blasting, a minimum of 48 hours written notice of its intent to execute any blasting work and shall erect sign boards with the time and date of the next blast.

The Contractor shall record all aspects relevant to the conditions of the affected buildings, structures and services prior to blasting, and shall acquire the signature of the owners, occupants and authorities agreeing with the recorded conditions.

Within 48 hours after blasting, the Contractor, owners, occupants and authorities shall sign approved forms confirming the condition of the buildings, structures and services. In the event of damage to existing buildings, structures and services as a result of blasting, remedial work shall be done to the satisfaction of the owners, occupants and authorities at the Contractor's expense. Remedial work must be undertaken within 7 days of blasting.

The Contractor alone shall be responsible for all cost resulting from his activities, including the collection of fly-rock from adjacent lands and fields.

The Contractor will generally be permitted to use explosives for breaking up hard material during excavations, for demolishing existing structures, and for other purposes where explosives are normally required, subject to the following conditions:

- (a) The Engineer may prohibit the use of explosives in cases where, in his opinion, the risk of injury to persons or damage to property or to adjoining structures is too high. Such action by the Engineer does not entitle the Contractor to additional payment for having to resort to less economical methods of construction.
- (b) The Engineer's prior written approval shall be obtained for each and every blasting operation. This approval may be withheld if the Contractor does not use explosives responsibly and carefully.
- (c) The Contractor shall comply fully with the applicable legislation and regulations.
- (d) Before blasting is undertaken, the Contractor shall satisfy the Engineer that he has established whether or not the insurers concerned require pre- and post-blasting inspections of buildings and structures within a certain radius of the proposed blasting.

Should such inspections be required, the Contractor shall, together with the Engineer's representative and the insurer, examine and measure the buildings, houses or structures in the vicinity of the proposed blasting site and establish and record, together with the owner, lessee or occupier, the extent of any existing cracking or damage before blasting operations commence.

- (e) When there is a possibility of damage to power and telephone lines or any other services or property, the Contractor shall adapt his method of blasting and the size of the charges and shall use adequate protective measures (e.g. cover-blasting) to reduce the risk of damage.
- (f) All accidents, injury to persons and animals and damage to property shall be reported to the Engineer in detail and in writing as soon as is practicable.
- (g) The Engineer shall be given 24 hours' notice by the Contractor before each blasting operation is carried out.
- (h) When blasting to specified profiles, the Contractor shall so arrange the holes and charges that the resulting exposed surfaces are as sound as the nature of the material permits. The Contractor shall make good, at his own expense, any additional excavation necessitated by the shattering of rock in excess of any over break allowances specified in the Project Specifications or on the Drawings.

Notwithstanding the Contractor's compliance with the above provisions, the Contractor shall remain liable for any injury to persons and animals and loss of or damage to property occurring as a result of blasting operations.

PSD4 EXISTING SERVICES (Sub-Clause 5.1.2)

PSD4.1 Add the following under sub-clause 5.1.2.1:

The Contractor shall make himself acquainted with the position of all existing services before any excavation or other work likely to affect the existing services is commenced.

The Contractor will be held responsible for any damage to known existing services caused by or arising out of his operations and any damage shall immediately be repaired at his own expense. Damage to unknown services shall be repaired as soon as possible and liability shall be determined on site when such damage should occur.

The position and details of existing services and structures known to the Engineer are shown on the drawings as site data. The Employer and Engineer take no responsibility as to the accuracy or completeness of this information and have provided this information merely as an aid to the tenderers in preparing their tenders for construction of the Works.

The Contractor shall protect all known existing services as well as all work being carried out and structures being erected on the Site by other contractors or public authorities. The Contractor must familiarize himself with the various standard regulations of the relevant public authorities and act accordingly. Any damage caused to these services or structures, or any obstructions or hindrance caused to other contractors or public authorities by the Contractor and all claims arising from such damage, obstruction or hindrance shall be the sole responsibility of the Contractor.

All repair work shall be carried out at the Contractor's expense to the entire satisfaction of the Engineer or the owner of the service.

The Contractor shall conduct the necessary search for unknown services as specified in clause PSD4.2. After searching, all services shall be deemed as known. The Contractors' cost of searching for existing services and accommodating all existing services and relocating all services shown on the tender drawings shall be priced into the appropriate work forming part of the Contract.

The Contractor shall record the details of existing services on the as-built drawings.

The Contractor shall maintain and rehabilitate local public roads and private access roads that it uses for construction purposes. Dust suppression, grading, traffic and safety management will be required.

Existing services need to be exposed by the Contractor early during the Contract. The x, y, z coordinates of the exposed services and PI's need to be determined by the Contractor and provided to the Engineer. This information is required to assess the position and longitudinal sections and to make adjustments where necessary. The coordinates need to be provided to the Engineer at least four weeks before excavation along a specific section of pipeline takes place to allow adequate time for potential adjustments to the drawings.

PSD4.2 UNDERGROUND SERVICE DETECTION AND IDENTIFICATION

PSD4.2.1 Scope

The scope of underground service/utility detection and identification by the Contractor shall include determining the:

- Horizontal position and X&Y coordinates of services;
- Depth and level (Z coordinate) of services;
- Type of service;
- Material of service;
- Pipe, ducts or cable diameter;
- Condition of service;
- Chambers, manholes and sumps basic dimensions and invert levels;
- The invert levels of all incoming and outgoing services.

The above work shall be executed without damaging the services.

PSD4.2. Digital mapping of services (CAD requirements)

- a) Drawings to be in DWG format (supplied electronically). All services lines must be in 3D.
- b) All services to be included in text/ascii format in separate files and to include X, Y, Z data with descriptions.
- c) All services to be labelled correctly and with legends.
- d) All services to be on separate layers.
- e) All services to be correctly coordinated.
- f) All available cadastral and grid information to be added to CAD drawings.

PSD4.2.3 Other requirements

- a) The Contractor shall submit the name of the specialist subcontractor proposed for this work for the Engineer's approval 14 days before commencement of the work.
- b) The Z value must be the invert level for all the pipes.
- c) Surveyed locations to be in WG 29.
- d) Heights to be levelled to mean sea level.
- e) Standard survey procedures to be adopted in fixing control points (Class A accuracy) as set by PLATO.
- f) Levels to be obtained from new and existing benchmarks to ensure required accuracy.
- g) Level accuracy of services to within 0.1m.
- h) List of all control points and survey report to be supplied in digital format (ascii/txt) stored on DVD Rom.
- i) The GPR survey shall detect all underground services to a maximum depth of 5m below grade.
- j) The Contractor shall issue certificates to the Engineer confirming the details of the detected underground services within surveyed area.

PSD4.2.4 Methods and Equipment

The following equipment must be utilised, in conjunction with each other:

- Electro Magnetic (EM) detection (both Indirect and Direct modes);
- Sounding of non-pressurized, non-metallic utilities (i.e. sewer, empty sleeves, stormwater);
- Radio and Power modes, detecting all 50Hz and VLF signals;
- Ground Probing Radar (GPR) with a suitable antenna that penetrates all soil types. Ranges of antenna: 270Hz – 600Hz;
- Seismic detection. This method is to be used to locate and detect all non-metallic, pressurized utilities i.e. potable water.

PSD4.2.5 Deliverables

- a) Survey results shall be presented on a drawing in the relevant systems in the surveyed province.
- b) All data shall be submitted on flash drive in Auto Cad format as well as three sets of hard copies.
- c) The Cad drawings shall include the general layout plan, sections and details in appropriate scale.
- d) The existing services to be indicate on the drawing with the following different colours/layers:
 - Sewage **YELLOW**
 - Stormwater **WHITE**
 - Telecommunications **GREEN**
 - Electrical HT & LT **RED**

- Water (POTABLE & FIRE) **BLUE**
- Gas/Diesel **ORANGE**
- Unknown **BLACK**

- a) The vertical and horizontal datum used for survey shall be noted on the drawings.
- b) The drawings and maps shall include a legend that describes symbols, abbreviations, and graphic scale and north arrow.

PSD5 STORM WATER AND GROUND WATER (Sub-Clause 5.1.3)

Add the following clauses:

Adequate drainage lines must be put in place to prevent flooding and potential contamination of storm water through the Contractors activities. Storm water outside the site must be channelled away from the site and not allowed to flow through the camp or construction areas. Storm water originating on the site must be channelled off site without damaging other properties. Storm water berms must be put in place to divert water away from the works where channels are not appropriate.

All storm water must be channelled via storm water channels fitted with storm water arrestors to areas where the erosive forces of the water can be contained. In order to prevent storm water contamination, fuel, hazardous substances and hazardous wastes must be stored in a bunded, covered area and fitted with a sump. Water collected in the sump will need to be treated before re-use or release.

The Contractor shall not alter or damage existing drainage lines, levees or dams or modify the course or channel of water courses without the prior approval of the Engineer. The Contractor must ensure that all storm water lines are reinstalled or rehabilitated on completion of construction activities.

The Contractor shall be responsible for the prevention of erosion in areas impacted upon by the Contractor's activities. All erosion rehabilitation must be implemented at the first signs thereof and no erosion shall be allowed to develop in a large scale. The Contractor must present the site in an erosion free state before the issuing of the Completion and the Performance Certificates.

Steep slopes and other sections subject to severe erosion/ground slippages, shall be made geotechnical stable. Additional measures may involve:

- Geotechnical works such as gabions, Rheno mattresses, drainage lines and diversion berms;
- Installation of trench breakers prior to backfilling;
- Stone pitching, logging, extra-seeding, etc.

PSD6 DISPOSAL OF SURPLUS MATERIAL (Sub-Clause 5.1.4.3 and 5.2.2.3)

All surplus or unsuitable materials arising from the works shall be spoiled at sites approved by the land owner and relevant authorities or at registered landfill sites. Spoiling shall be in accordance with the specifications, environmental management plan, requirements of the owner of the spoil site and applicable acts, legislations and regulations. Spoiling shall not interfere with future works or disrupt natural flow of storm water run-off.

At spoil areas, rock and soil/clay must temporarily be stockpiled separately. Rock must be placed in the final spoiling position first, followed by soil/clay.

At completion, spoil areas shall be levelled and shaped to gradients not exceeding 1:5 and the areas shall be covered with top soil that were removed prior to commencing with activities.

The Contractor shall be responsible for the rehabilitation of access roads to spoil sites. Spoiling shall comply with the applicable statutory and municipal regulations and requirements of the local or rural authorities and land owners.

The Contractor will be responsible for all costs associated with the opening and development of spoil sites.

For the purpose of tendering it can be assumed that a spoil area will be available within a 15km radius from the middle of the pipeline route.

Where the pipeline is laid within a road reserve the route of the pipeline shall be finished neatly to be flush with the natural ground level or finished sidewalk level as may be applicable. Clause 5.6.7 of SANS 1200 DB shall apply to the cleaning of roadways.

PSD7 ACCOMMODATION OF TRAFFIC (Sub-Clause 5.1.6)

Vehicle and pedestrian traffic must be accommodated across the pipeline corridor at all existing public and private roads and pedestrian pathways.

Full closure of existing roads will not be allowed and alternative accesses to properties must be provided where closure of such accesses are required.

Open trenches and associated construction activities/infrastructure must be fenced and sign boarded. Written notice (in terms of SANS 1200 DB) shall be served to landowners to notify them of any disruption in access to their properties. The position and period of disruption must be determined in consultation with the landowner. Where necessary, detours should be provided.

Traffic control shall comply with the latest issue of the Road Signs Note 13 as issued by CSRA and CUTA as a minimum.

The Contractor shall include costs for resources and equipment required for the proper accommodation of vehicle and pedestrian traffic in terms of the specifications in its tender prices, including but not limited to temporary barricades, the erection and re-erection of existing and/or temporary traffic signs, lights and flagmen for the guarding and protection of the Works, and for making all necessary arrangements with the relevant traffic authorities.

No work may proceed in any section where accommodation of traffic is required until such time as the relevant requirements with regard to signposting are met.

Payment shall be made monthly pro-rata to the overall progress of the works.

PSD8 CONSERVATION OF TOPSOIL (Sub-Clause 5.2.1.2)

Remove the last sentence of this sub-clause.

PSD9 BORROW PITS, SPOIL SITES AND HAUL ROADS (Sub-Clauses 5.2.2.2 and 5.2.2.3)

The Contractor shall be responsible for making his own arrangement regarding the provision of imported material, if required, from commercial borrow pits. The Contractor shall provide in his tender prices for all royalties payable and for the transport of the material to site.

Where applicable, the Contractor shall be responsible for the opening and closing of designated borrow pits and spoil sites and for the associated haul roads. The Employer or the Engineer will obtain the necessary permissions and authority to utilise such borrow pits, where applicable. The Contractor in turn shall in all respect comply with the various requirements of SABS 1200D, the Minerals Act (No 50 of 1991) and the environmental requirements in relation to the opening, closing and utilisation of borrow pits and spoil sites. Except for the crushing or screening of materials in accordance with the written instructions of the Engineer, and for royalties should such become payable, no additional payment will be made for excavating or processing material from designated borrow pits, regardless of the hardness or other properties of the material.

PSD10 TOPSOIL (Sub-Clause 5.2.1.2)

Topsoil shall be removed from all areas where pipelines and structures are to be constructed and shall be stockpiled on the construction servitude and in accordance with the environmental requirements for re-use in rehabilitation.

PSD11 SOILCRETE

Soilcrete backfilling shall be a G5 material (maximum size of 10 mm) as specified in SANS 1200M, stabilised with 5% cement and compacted to 93% modified AASHTO maximum dry density.

PSD12 FREEHAUL AND OVERHAUL (Sub-Clause 5.2.5)

Add the following to the sub-clause:

“The freehaul distance shall be 0.5 km”.

PSD13 OVERHAUL (Sub-Clause 5.2.5.2)

Delete the second sentence of the paragraph and replace with the following:

“All overhaul beyond the free haul distance will be measured as long overhaul and no limited overhaul will be measured”

PSD 13 CONSTRUCTION (Clause 5)

Add the following sub-clauses:

PSD 13.1 Water courses and wetlands

The banks and contours of the water course shall be reshaped in accordance with the photographic and topographical survey to tie in with the surrounding landscape. The bed of the watercourse shall be restored to contain the same bedding material as prior to construction activities taking place.

Wetlands must be identified before construction and the Contractor must submit a method statement to manage and rehabilitate the work in accordance with the specification.

The wetlands shall be rehabilitated immediately after the works have been completed as these are sensitive habitats and disturbance must be kept to a minimum. The beds of the wetlands shall be restored to a similar state, in terms of the soil profile, as well as physical and chemical properties as established in a pre-construction survey.

The Contractor must ensure substratum restoration during the rehabilitation phase of the contract. Impermeable clay layers must be recreated / restored to reinstate the sub-surface hydrology and to ensure the perched water tables sustaining wetland habitats are kept intact. Any impermeable layers encountered within the wetland, shall be recorded, and their depths and types noted. These layers will need to be recreated during rehabilitation. The Contractor shall submit to the Engineer for approval, a method statement that deals specifically with the restoration of impermeable substratum layers prior to the commencement of works.

The Contractor shall take all necessary measures when working within rivers/wetlands to ensure that the water quality of these systems is not adversely impacted by the construction activities.

PSD 14 FILL MATERIAL FOR PLATFORM (Sub-Clause 8.3.4)

Add the following to the sub-clause:

Fill material for the platform shall be placed and compacted in 150 mm thick layers to 97% MOD AASHTO density.

The G5 material supplied from commercial sources shall be stabilised with Portland cement to form an equivalent C3 layer with UCS of 1MPa minimum and 2 MPa maximum.

PSD11 SPOILING HARD ROCK BOULDERS

Add the following to the sub-clause:

During past granite mining activity conducted on site, the un-used granite boulders were spoiled on site, within or in close proximity to the proposed work area. Where these granite boulders create a safety risk during construction, the Contractor may, upon written instruction from the Engineer, spoil these boulders at a spoil site designated by the Engineer.

The quantity of hard rock boulders spoiled will be measured per truck load with a haul distance not exceeding one kilometre.

The rate shall include for loading of hard rock boulders (all sizes) onto trucks, transporting to spoil site, off-loading hard rock boulders and spreading. The rate shall also include full compensation for overheads, charges and profits.

PSDB EARTHWORKS (PIPE TRENCHES)

PSDB1 SPECIAL WATER HAZARDS (Sub-Clause 5.1.2.2)

Where ground water is present during construction to such an extent that, in the opinion of the Engineer, it would hamper the placing and consolidation of granular or concrete bedding, or would cause buoyancy of the pipes, the Engineer may order the provision of a drain in the bottom of the trench to assist with dewatering during the construction and until the trench has been backfilled to such an extent that buoyancy of the pipeline will be prevented.

The drain shall be constructed over the full width of the trench as follows:

Method 1:

300 mm thick 19 mm stone enclosed in non-woven, needle punched, continuous filament, polyester geotextile (Bidim A5 or similar product approved by Engineer)

or

Method 2:

500 mm thick well graded dump rock enclosed within high strength composite (woven and non-woven) geotextile with high modulus characteristics for reinforcement and drainage applications (Rockgrip PC 100/100 or similar product approved by the Engineer)

or

a combination of Method 1 and 2 above with method 1 on top of method 2.

The method of stabilization will be based on the geotechnical conditions and will be subject to the approval of the Engineer.

Sumps shall be formed from which ground water can be pumped to maintain the water table below the pipe bedding level. The Contractor shall establish on site, operate and remove on completion dewatering pumps of 10 l/s minimum capacity as per the requirements of Item 8.3.4(b) of 1200DB. Lengths of trench opened at any one stage shall be limited by the dewatering capacity of the pump.

PSDB2 EXISTING SERVICES (Sub-Clauses 5.1.4)

Where any existing service occurs within the specified trench excavation, and the presence of such service is known before being exposed, the protection of the service will be scheduled and measured as provided for in Clause 8.3.5 of 1200DB. Only known services (as defined in Clause 5.4 of 1200A) shall be measured for payment.

Where an unknown existing service is damaged during construction, and the Engineer orders that the Contractor should undertake the repair of such service, then such repair will either be measured and paid as dayworks or alternatively as a contractual variation in terms of the General Conditions of Contract.

No construction activity which may affect the integrity of telephone or electrical poles or stays may be carried out without the prior written approval of the Engineer, which approval shall only be given subject

to the acceptance of a method statement that will ensure the integrity of such services during construction.

PSDB3 TRENCH WIDTHS (Sub-Clauses 4.1 and 5.2)

Trenches in general shall not exceed the widths laid down in Sub-Clause 8.2.3. If trenches exceed the specified width the Contractor shall be liable for the associated additional cost (e.g. stronger pipes, higher quality bedding) which may be required as a result of the additional trench width.

PSDB4 EXCAVATION (Sub-Clause 5.4)

The Contractor will be required to follow a procedure, whereby laying, jointing, testing and backfilling for each section of the pipeline will follow soon after trenching, and he will not be permitted to open up lengths of trench far in advance of pipe laying and backfilling operations. If in the opinion of the Engineer, trenching has proceeded too far ahead of pipe laying and backfilling, the Engineer shall have the right to stop trenching until the pipe laying and backfilling has caught up and the Contractor shall not be entitled to any extra payment due to this instruction.

Refer to the limitation in pipeline construction activities specified in section C3.5.

PSDB5 TRENCH BOTTOMS (Sub-Clause 5.5)

Replace the first paragraph of this sub-clause "Material that compacted as directed" with the following:

"Where a firm foundation cannot be obtained at the grade indicated due to soft or unsuitable material, the Contractor shall remove such unsuitable material and backfill the excess depth with approved selected material or concrete, as directed by the Engineer in each particular case. Backfill other than concrete, shall be placed in layers of 150 mm uncompacted thickness, each layer thoroughly compacted to 90% of modified AASHTO maximum density, to provide adequate support for the pipe bedding to be placed on top of it.

Should the Contractor remove more soil than is required to secure the proper grade of the pipeline, the Contractor shall, at his own cost, backfill the excess excavation with approved selected material or concrete, as directed by the Engineer in each particular case."

PSDB6 FREEHAUL AND OVERHAUL (Sub-Clause 5.6.8)

All haul shall be considered as freehaul and no payment will be made for haul.

PSDB7 AREAS SUBJECTED TO TRAFFIC LOADS (Clause 5.7.2)

The requirements of Clause 5.7.2 shall apply only to pipes and sleeves crossing streets or paved areas and pipes running parallel to the road as described below.

All service trenches running parallel to the road of which the roadside edge of the trench is located less than 1,4m away from the edge of the road, will be subject to the requirements for the above-mentioned clause.

The measurement and payment will apply to the full trench width. Pipes and sleeves crossing streets or paved areas will be measured and paid for to a length equal to the width of road or length of pavement crossed plus 1,4 m either side of the road edges.

Compaction of other pipe trenches running parallel to the roads shall be considered areas subject to traffic loads only where instructed by the Engineer in writing. The volume will be computed from the minimum base width determined in accordance with Sub-Clause 5.2 and the depth from the top of the back fill to the top of the bedding as specified in Sub-Clause 8.3.3.1.

PSDB8 REINSTATEMENT ROADS AND PAVED AREAS (Clause 3.6 and 5.9.4)

Apart from the re-instating of tarred road surfaces, the Contractor shall also be responsible for the re-instatement of any kerbing, channelling, paving and side drains damaged by the Contractor and any subsidence and re-surfacing and re-instatement work required or deemed necessary by the Engineer.

The Contractor shall remove all paving blocks from driveways before excavating across the driveway and store and protect these blocks. After backfilling has been completed the paving shall be reinstated to match the existing paving. The Contractor shall obtain written confirmation from the relevant owner that the driveway has been re-instated satisfactorily.

The Contractor shall remove grassing in sods before excavation takes place, stack, water and protect the sods. After backfilling has been completed the grassed areas shall be reinstated, using the sods, to the satisfaction of the Engineer. These re-instated areas must be watered for a period of 14 days after re-instatement.

Crushed stone sidewalks shall be reinstated to match the surrounding crushed stone areas, all to the satisfaction of the Engineer.

Unless otherwise specified on the drawings, trenches through roads and paved areas shall be reinstated with a 150mm upper selected subgrade layer compacted to 93 % mod AASHTO density, followed by a 150mm subbase layer compacted to 95 % mod AASHTO density and a 150mm graded crushed stone base compacted to 98 % mod AASHTO density. Bitumen surfaced roads shall be provided with a 25mm thick asphalt seal.

The upper selected subgrade layer shall have a CBR of at least 15, a grading modulus of at least 0.75 and a maximum PI of 12. The subbase shall conform to SABS 1200 ME and the base to SABS 1200 MF.

PSDB9 MEASUREMENT AND PAYMENT (Clause 8.3.2)

PSDB9.1 Basic Principles (Clause 8.1)

Add the following to the sub-clause 8.1.2(a):

Payment for the excavation and backfilling of trenches shall be made at the tendered rates and at the following stages of the construction:

- I. upon completion and approval of the trench bottom, prior to bedding: 40 %
- II. upon completion and approval of top of selected backfill: 70% (cumulative)
- III. upon completion and approval of the main fill: remaining 30 %.

PSG CONCRETE (STRUCTURAL)

PSG-2 INTERPRETATIONS

PSG-2.3 DEFINITIONS

(a) General

Add the following definition:

“Water-retaining structures: All structures designed for containment of aqueous liquids (e.g. reservoirs) or retention of aqueous liquids (e.g. valve chambers, manholes, wet and dry wells of underground pump stations, etc.).”

PSG-3 MATERIALS

PSG-3.1 Approval of material and procedures

Change the title of this clause to the above-mentioned, and add the following to this clause:

“The Contractor shall submit a method statement to the Engineer for his approval containing procedures, construction methods and quality assurance procedures for the practical implementation of the project specifications.”

PSG-3.2 CEMENT

PSG-3.2.1 Applicable Specifications

Replace this clause with the following:

“Subject to the provisions of Clause 3.2.2, cement and blends of Portland cement with extenders, shall comply with the following specifications:

SANS 50197-1 :	Cement Part 1: Composition, specifications and conformity criteria for common cements
SANS 50197-2 :	Cement Part 2: Conformity evaluation
SANS 1491-1 :	Portland Cement Extenders Part 1: Ground granulated blast-furnace slag
SANS 1491-2 :	Portland Cement Extenders Part 2: Fly ash
SANS 1491-3 :	Portland Cement Extenders Part 3: Silica fume
SANS 50413 :	Masonry cement”

PSG-3.2.2 Alternative Types of Cement

Add the following sub clauses:

“PSG-3.2.2.1 Cementitious material for water-retaining structures

A blend of 70 % CEM 1 42.5 (Ordinary Portland Cement) and 27-30 % Fly Ash (FA) and 3% Silica Fume (SF) (optional), shall be used for all concrete (structural, benching, etc.) for water-retaining structures (reservoirs, wet and dry wells, chambers, manholes, drop-structures, etc.) on this Contract.

If aggregates to be used in this Contract are alkali-reactive, the cement used on this Contract shall not have an alkali content ($\text{Na}_2\text{O} + 0,658 \text{ K}_2\text{O}$) which exceeds 0,6% by mass of the cement. The total alkali content of the concrete shall not exceed 2,1 kg/m³ for aggregates falling in the rapidly expanding group (e.g. Malmesbury Group Meta sediments) or 2,8 kg/m³ for Cape Granite. The Contractor shall submit the necessary test results to prove the above.

The concrete mix must be determined by means of a proper mix design by an accredited laboratory and must be approved by the Engineer. Over and above the proportions of the mix, the following information shall also be provided in the mix design report:

- the type, description and source of fine aggregate (e.g. washed quartzitic river sand from ABC) and coarse aggregate (e.g. pink quartzite from XYZ crusher);
- grading analysis and grading graphs of fine and coarse aggregates;
- water demand of fine aggregate determined in accordance with Colto Clause 8105 (e);
- water absorption values of fine and coarse aggregates;
- average crushing values and flakiness index of coarse aggregate;
- petrographic analysis of fine aggregate (see PSG-3.4.1);
- exact composition of the cementitious material in case of a pre-blended cement;
- exact brand name, manufacturer and dosage in ml/100kg cementitious material of admixture, accompanied by a data sheet from the manufacturer.
- workability retention tests (see PSG-3.4.1) if applicable;
- at least the 7 day cube test results for all structural concrete mixes.

PSG-3.2.2.2 Pulverised Fly Ash (PFA)

If PFA is blended with OPC on site, the following additional requirements shall apply:

- (a) PFA shall be obtained from only one power station, of which the PFA has to be approved for use in concrete. Should the Contractor wish to change the source of PFA during the Contract, he shall inform the Engineer accordingly in advance, carry out tests on the PFA, produce trial mixes in accordance with the Specifications and obtain the Engineer's approval in writing. After receiving the approval, the Contractor shall inform the Engineer in writing as to the date when the PFA from the new source is to be used.
- (b) All PFA shall comply with the requirements of BS 3892 Part 1 1982.
- (c) The Contractor shall obtain the producer's test certificates for each consignment of PFA, which shall be retained as record documents.
- (d) Each consignment shall be tested for loss of ignition (which shall not exceed 7%), and the percentage mass retained on a 45 micron sieve by wet screening (which shall not exceed 12,5%). Testing shall be carried out in accordance with the procedures specified in BS 3892 Part 1 1982.
- (e) The chloride and sulphate (SO₃) content of the PFA shall be tested every three months for each power station source.

PFA shall be stored separately from cement and shall have separate delivery facilities. It shall be stored in the same manner as specified for cement.

When handled in bulk and stored in silos, PFA will require a greater silo capacity and more efficient filters than Portland cement, and furthermore, provision must be made for aeration in the storage silo.

The percentage of PFA by mass shall be 27% of the total cementitious material in the concrete, defined as the total mass OPC, PFA and silica fume combined."

PSG-3.2.3 Storage of Cement

Add the following after the words "...may promote deterioration." In the second paragraph:

"It is of prime importance that cements to be used in concrete for water-retaining structures shall always be stored in a cool environment, and it is strongly advised that cement silos be painted white to reduce any temperature rise in the stored cement."

PSG-3.3 WATER

Add the following to this clause:

“To limit heat gain in concrete for water-retaining structures, the temperature of mixing water must be below 20°C when added to the concrete mix.

If the concrete temperature remains above the maximum allowable as specified in PSG-5.5.9.2 despite measures pertaining to cement silo's and shading of aggregate as specified, the Contractor shall employ measures to chill mixing water.”

PSG-3.4 AGGREGATES

PSG-3.4.1 Applicable Specification

Add the following:

“The aggregates shall be uncontaminated dolomitic aggregates and free from organic material and hard burnt lime, and comply with the requirements of SANS 1083. The maximum water absorption of the coarse aggregate shall not exceed 1% and the flakiness index shall not exceed 25 %. The maximum water demand of the fine aggregate shall be 190 liter/m³.

In addition to SANS 1083-2006, the grading of fine aggregate shall preferably comply with the requirements in Table 1 below. If the Contractor proposes to use sand which complies with the prescribed grading of Table 1 of SANS 1083, he shall proof to the satisfaction of the Engineer that the concrete produced will comply with the specifications. In addition, workability retention tests on the proposed mix design(s) shall be conducted by an accredited laboratory by measuring the slump of the mix at 15 minute intervals starting immediately after mixing over a period of 1½ h after mixing.

Table 1: Grading requirements for fine aggregate

Sieve size (mm)	Cumulative % passing	
4.75	90 – 100	
2.36	75 – 100	
1.18	60 – 90	
0.60	40 – 60	
0.30	20 – 40	
0.15	10 – 20	
0.075	Natural sand	Crusher sand
	5 – 10	5 – 20

Petrographic analysis shall be conducted on natural sands to determine the presence of minerals (such as smectite) which may have a negative impact on workability of the fresh concrete or may be detrimental to the hardened concrete.

Aggregates to be used in this contract shall be tested in accordance with subsection C-15 of SANS 1083 to determine whether they are potentially alkali-reactive. If they are alkali-reactive they shall either be replaced with aggregates that are non-reactive or the requirements of Clause PSG-3.2.2.1 in respect of alkali-reactiveness shall apply.

The content of chloride ion in the aggregates shall be determined and shall be within the limits specified in SANS 1083. Test results in this regard shall be submitted to the Engineer.

Both course and fine aggregates shall be free from any organic material. Course aggregate shall be 19 mm stone. Fine aggregate may be obtained from local sources subject to testing of its suitability by an approved laboratory and approval by the Engineer. The fineness modulus (FM) of the fine aggregate (sand) as determined with SABS Method 829 shall be between 2.0 and 2.9 and if necessary shall be achieved by the blending of at most two types of sand. The Contractor shall submit for approval the fineness modulus that he proposes to adopt for the sand and after approval the actual value of the fineness modulus shall not differ from the approved value by more than 0.2.

At tender stage the Contractor shall assure himself by means of tests and test mixes by an accredited laboratory that the fine and coarse aggregates that he intends to use comply with the specification. The tendered rates shall therefore be deemed to allow for the importation of aggregates, if necessary, that do comply with the Specification.

The Contractor shall be responsible for locating the sources of all aggregates.”

PSG-3.4.3 Storage of Aggregates

Add the following additional sub clauses:

“c) The aggregate to be used for water-retaining structures shall at all times be stored in a cool environment and, if at time of mixing, the ambient temperature exceeds 30°C, only the coarse aggregate shall be sprayed with water to assist cooling. It is advisable that all aggregate stockpiles be shaded from the sun by means of 80% shade netting.

d) The Contractor shall ensure adequate drainage of the coarse aggregate stockpile.”

PSG-3.5 ADMIXTURES

PSG-3.5.1 Approval of Admixtures Required

Add the following:

The Contractor shall, by way of the information required in sub clause 3.5.1, prove to the satisfaction of the Engineer that proposed admixtures are non-toxic and beneficial and not detrimental to the durability of the concrete. The use of plasticisers with air-entraining properties will not be allowed.”

PSG-3.5.2 Air-Entraining Agents

Replace the contents of the clause with the following:

“Air-entraining agents shall not be used.”

PSG-4 PLANT

PSG-4.2 BATCHING PLANT

Add the following:

“All concrete shall be weigh-batched.”

PSG-4.4 VIBRATORS

Add the following:

“All concrete shall be compacted by vibrators.”

PSG-4.5 FORMWORK

PSG-4.5.1 Design

Add the following:

“Based on the structural reinforcement design for water retaining structures, only steel formwork shall be used for concrete structures. On days that the ambient temperature is above 30 degrees Celsius, the shutters to be cooled down by spraying with cold water.”

PSG-4.5.3 Ties

Add the following:

"No tie system leaving holes passing through the walls will be permitted. Ferrules shall be of the permanently cast in, sacrificial type."

PSG-5 CONSTRUCTION

PSG-5.1 REINFORCEMENT

PSG-5.1.3 Cover

In Sub clause 5.1.3(a) amend the words " ... or stirrup" to read: "bar, secondary reinforcement, tie stirrup, tying-wire knots or wire ends."

Add to Sub clause 5.1.3: "Tying wire shall not encroach on the specified minimum cover by more than a single strand thickness."

Add the following:

"The minimum concrete cover to reinforcement shall be as follows:

all structural members on the inside of structures:	50 mm
all structural members on the outside of structures	
when against a shutter:	50 mm
when against excavated soil:	75 mm

Cover blocks shall be manufactured from concrete of grade, durability, density and permeability at least equal to that specified for the respective elements except that 12 mm stone uncontaminated dolomitic stone free from organic material and hard burnt lime, instead of 19 mm stone shall be used. The size of the cover blocks shall be 50 mm x 50 mm, with a thickness equal to the specified cover.

Wires shall be cast into the blocks to enable them to be fixed to the reinforcement. The wires shall be fully galvanised Class A as per SANS 675. The wires shall be carefully held in position while the concrete is setting to ensure that all the wires are inserted to a uniform and consistent depth of 50% of the thickness of the cover block for all the cover blocks.

The concrete shall be thoroughly compacted by means of a vibrator or vibratory table and the blocks shall be protected against early drying and shrinkage due to sun and wind, by being kept continually wet while still in the mould. After the blocks have been removed from the mould they shall be kept in water continuously until being used, and this period shall not be less than 14 days.

A proper mix design for concrete in cover blocks shall be submitted to the Engineer for approval."

PSG-5.1.4 Splicing

Add the following:

"Splice lengths for reinforcement shall be as detailed on the bending schedules but shall not be less than 50 diameters. Where possible, splices shall be staggered so that they are evenly spread throughout the structure."

PSG-5.2 FORMWORK

PSG-5.2.1 Classification of Finishes

Add the following additional sub clauses to Sub clause c):

"(i) Special off-shutter finish

Special off-shutter formwork shall produce a finish that will comply with the requirements of degree of Accuracy 1 according to SANS 1200 G Clause 6.2. For this contract the special off-shutter finish is applicable to all visible concrete.

Formwork for all classes of finish shall be made of steel panels. Small approved laminated wooden board inserts to steel framed panels may only be used in confined places and the use thereof will be subject to approval by the Engineer. The panels shall be free from rust, ridges, fins, bulges, imperfections, irregularities, chips and holes. The concrete surface shall be smooth and free from irregularities, bulges, ridges, imperfections, air bubbles, honeycombing or surface discolourations. Grout "checks" shall be used at all construction joints and chamfers shall be provided at all corners.

Joints between panels shall be sealed tightly to prevent local honeycombing or leaching of concrete. Joints between panels shall form straight horizontal and vertical lines which shall be spaced evenly on the formed concrete surface, and shall be even and smooth and require minimal or no finishing. The layout of all formwork panels and construction joints shall be discussed with the Engineer before application and shall be approved in writing prior to erection of formwork.

(ii) Top of wall footings and floor slabs

The top of the wall footings and the floor slabs shall have a steel-floated or power-floated finish.

(iii) Top of walkways, roof slabs and upstand beams

The top of walkways, roof slabs and upstand beams shall have a wood-floated finish.

(iv) Top of free-standing walls

The top of free-standing walls shall have a steel-floated finish except where they form part of walkways, in which case they shall have a wood-floated finish.

(v) Visible corners

All visible corners shall have a 20 mm x 20 mm chamfer."

PSG-5.2.5 Removal of Formwork

Add the following to sub clause 5.2.5.2:

"Formwork for PFA-SF concrete shall remain in place after placing of the concrete as indicated in Table 2 for Portland Blast furnace cement."

PSG-5.5 CONCRETE

PSG-5.5.1 Quality

PSG-5.5.1.3 Workability

Add the following:

"The workability range for all normal PFA-SF concrete (slump) shall be less or equal to 90 mm, and for PFA-SF pump mixes between 110 and 150 mm. Increased slump shall be accomplished by the use of plasticizers or super-plasticizers, and not by changing the water-cement ratio nor by adding air-entraining agents."

PSG-5.5.1.5 Durability

Add the following:

"The maximum ratio of water to cementitious material shall be 0,45 for structural concrete and 0,55 for benching and mass concrete."

PSG-5.5.1.7 Strength concrete

Add the following:

a) Due to the design approach and assumptions adopted for this contract, it is of the utmost importance that good strength concrete with consistent quality and composition is used throughout. All possible measures to limit shrinkage shall be applied.

b) In addition to the requirement that the Contractor design the mixes to the specified strengths, the cementitious material content shall be such as not to cause alkali-aggregate reaction and shall not exceed 380 kg/m³ for 35 MPa/19 mm concrete or 420 kg/m³ for 40 MPa/19 mm concrete.

c) All concrete shall be based on designed mixes. Trial mixes shall be made by an approved laboratory with suitable experience in the design of PFA-SF concrete mixes and mix designs and cube results submitted timeously to the Engineer for approval.

d) Unless otherwise stated, the grades of concrete shall be as follows:

i) Structural concrete shall be 40 MPa/19 mm concrete with the minimum combined cement contents including extenders of 380 kg/m³.

ii) Benching shall be 20 MPa/13 mm concrete.

iii) Structural screeds shall be 25 MPa/13 mm concrete.

iv) Mass concrete, concrete encasement of pipes, thrust blocks and blinding layers shall be 15 MPa/19 mm concrete.

v) No fines concrete shall be 25 MPa/19 mm concrete, cement and water only and cast to the profile depth in one pour.

vi) Screeds shall be 50 mm average (min 30 mm) and enhanced with Sikacem 810 admixture (or equivalent to be approved by the Engineer) to supplier's specification."

Add a new clause:

"PSG-5.5.1.8 No-fines concrete

The Contractor shall be responsible for the design of the no-fines concrete mix on the basis and within the limitations and parameters specified hereafter:

a) Classes of no-fines concrete

No-fines concrete shall be classified by the prefix NF and the size of aggregate to be used e.g. class NF-19 means a no-fines concrete with a 19 mm nominal size aggregate. For this contract class NF-19 shall be used.

The volume of aggregate per 50 kg of cement for each class of no-fines concrete shall be as follows:

Class	Aggregate per 50 kg cement
NF-26,5	0,32 m ³
NF-19	0,30 m ³

b) Aggregates

Aggregate shall be a single-graded aggregate in accordance with SANS 1083, provided that the particle size shall be less than 38 mm and greater than 13 mm. Aggregate shall not contain any dust. Aggregate not complying with these requirements will be summarily rejected.

c) Cementitious materials

Ordinary Portland cement as specified in Clause PSG-3.2 shall be used in no-fines concrete. The addition of pozzolans other than PFA and SF, in whatever form, will not be permitted.

d) Cement Paste

The consistency of cement paste shall be such that all aggregate particle surfaces receive a uniform coating. Paste consistency shall be sufficiently viscous as to prevent the flow of paste through the placed concrete.

e) Strength

Concrete cube strengths at 4 and 28 days shall be 3,0 and 4,0 MPa respectively.

f) Permeability

Notwithstanding the preceding specifications, it is the Contractor's responsibility to ensure the permeability of the no-fines concrete. The Contractor shall be required to demonstrate the permeability of cast no-fines concrete on request of the Engineer. Any portion of the said no-fines concrete, deemed by the Engineer to be of insufficient permeability, shall be broken out and replaced at the Contractor's expense.

g) Batching and mixing

Cement shall be measured by mass or full bags of 50 kg each and aggregate shall be measured by volume in approved measuring boxes or barrows.

The quantity of water added shall be just sufficient to form a smooth paste that will adhere to and completely coat each and every particle of aggregate and that is just wet enough to ensure that at points of contact of the aggregate the grout will run together to form a small fillet to bond the aggregate together. The mix shall contain no more than 20 litres of water per 50 kg of cement.

Mixing shall be carried out in an approved batch-type mechanical mixer.

h) Placing

No-fines concrete shall be placed in accordance with the procedure agreed to by the Engineer. It shall be placed in a single operation in its final position within 30 minutes of mixing.

The concrete shall be worked sufficiently to ensure that it completely fills the space to be concreted and that adjacent aggregate particles are in contact with one another. Excessive tamping or ramming must be avoided and under no circumstances shall the concrete be vibrated.

i) Protection

All no-fines concrete shall be protected from the elements and from loss of moisture. Protection against loss of moisture shall be accomplished in one or more of the following ways:

- Retaining formwork in place.
- Covering exposed surfaces with sacking or other approved material kept wet continuously.
- Covering exposed surfaces with plastic sheeting complying with the requirements of

Clause PSG-5.5.8.

No-fines concrete placed during cold weather shall be adequately protected against frost for at least 3 days."

PSG-5.5.3 Mixing

PSG-5.5.3.2 Ready-mixed concrete

Add the following:

"The use of ready-mixed concrete for this contract shall be permitted provided that it complies with the requirements of this specification. Test results obtained by such a production facility shall not be regarded as part of the quality control system, and the Contractor shall take his own samples of concrete on site and have them tested in accordance with Clause 7 of SANS 1200 G and Clause PSG-7.1.2.

Ready-mixed concrete shall only be acceptable for incorporation into the works if supplied from commercial sources complying with the following criteria:

The batching plant supplying the ready-mix concrete for the contract shall be either:

- a) a SARMA member in good standing, which has been evaluated by means of
a SARMA S.H.R.E.Q. Audit and attained a minimum compliance score of 80% or
- b) ISO 9002 – Standardization; ISO 14001 – Environmental; ISO 39001 – Road Transport Safety Management System; OHSAS 18001 – Legal and SANS 878:2004 – Quality compliant.

Where a commercial ready-mix supplier is commissioned to supply concrete, the contractor shall submit documented proof, to the satisfaction of the Engineer, to prove compliance with the above requirements."

PSG-5.5.5 Placing

PSG-5.5.5.1 Add the following to sub clause 5.5.5.1:

"The casting procedure shall be approved by the Engineer prior to casting. The Contractor shall give the Engineer at least 48 hours' notice of his intention to cast concrete."

PSG-5.5.5.5 Add the following to sub clause 5.5.5.5:

"Concrete in water-retaining structures shall not be allowed to fall freely through a height of more than 2,4 m. This implies that walls in these structures may not be cast in heights exceeding 2,4 m in height unless a chute or tremy pipe is used."

PSG-5.5.5.9 Add the following to sub clause 5.5.5.9:

"When concrete is pumped the slush used to prime the pump shall be wasted before commencing placing of the concrete."

Add the following new sub clauses:

"PSG-5.5.5.10 No kickers in walls or columns will be allowed.

PSG-5.5.5.11 During summer months, when maximum ambient temperatures exceed 25 °C, concreting shall start as early as possible in the mornings, but not later than 7:00. During winter months, when minimum ambient temperatures are below 5 °C, concreting shall start towards mid-morning."

PSG-5.5.7 Construction Joints

PSG-5.5.7.1 Add the following to sub clause 5.5.7.1:

"Before construction work commences the Contractor shall indicate on the drawings his proposal for positioning construction joints and submit these to the Engineer for his comment and approval."

PSG-5.5.7.3 The following additional requirements shall be applicable to water retaining structures:

The Engineer may allow the Contractor to cut an additional straight construction joint if it is possible without prejudicing the water tightness of the structure. The additional construction joint shall be sealed with the same seal that is specified for planned construction joints at the expense of the Contractor.

Construction joints in reinforced concrete walls, embankments, etc. shall consist only of horizontal joints unless noted otherwise. If a vertical construction joint is provided it may only be constructed with the approval of the Engineer.

Construction joints shall only be placed at intervals shown on the drawings or as directed by the Engineer. The exact position of construction joints shall be marked on the formwork in order to obtain truly horizontal joints.

Preparation of Surface

Prior to placing any further concrete the joint must be clean, damp and free of laitance. During the period when the concrete is still green, all loose material shall be removed, without disturbing the aggregates, by light brushing. Where this is not possible, or if the concrete has already set, the surface film shall be removed by mechanical means appropriate to the degree of hardness of concrete so as to expose the aggregate over the entire surface and leave a sound, irregular surface.

Before Placing Concrete

Where the concrete of the previous lift is more than three days old, it shall be kept wet to create a concrete surface that is saturated but surface-dry when the slush and fresh concrete is placed.

On all construction joints the following steps shall be taken after the surface has been prepared and at the most, 30 minutes before placing the concrete:

Install the swellable bar (strictly following the manufacture's specification).

Apply a thin layer (maximum 25 mm thick) of mortar concrete consisting of the same grade concrete to be placed but made richer by reducing the coarse aggregate content by 25% and increasing the sand content by the same mass as the 25% aggregate. Alternatively a wet-to-dry epoxy resin (specifically designed for bonding old concrete to new) may be used. Any such proposed products shall be approved by the Engineer in writing.

Place concrete within 30 minutes.

PSG-5.5.8 Curing and Protection

Replace this clause with the following:

“PSG-5.5.8.1 Early age protection

The use of high pressure fog sprayers (such as electric Kärcher fog sprayers or equivalent to be approved by the Engineer) shall be employed to maintain a state of high humidity immediately above the surface of the concrete in horizontal elements such as floor slabs, roof slabs and wall footings without resulting in pools of water, in order to prevent plastic shrinkage cracking. This procedure shall be employed from the time that placing of concrete starts until after initial and final finishing, at which time curing of the concrete as specified below, can start. The sprayers shall be positioned at strategic positions before placement of the concrete starts.

The number of fog sprayers shall be such as to maintain the high humidity over the complete surface of the particular element being cast, but not be less than two shall be used.

Any pooled or standing water on the surface of the concrete shall be removed before any final finishing operations may commence.

PSG-5.5.8.2 Curing

a) Floor and roof slabs and wall footings

Immediately after final finishing (such as power-floating), slabs shall be covered with approved plastic sheets complying with the requirements below.

The first morning following completion of final surface finishing, the plastic sheets shall be removed. Slabs shall then be cured as follows:

- During summer months (generally September to March): The slab shall be flooded with water to a minimum depth of 25 mm for the full prescribed curing period. On suspended slabs, the water depth shall not exceed 75 mm.

- During winter months (generally April to August): The slab shall be covered with geotextile sheets complying with the requirements below, which shall be thoroughly soaked with water. Immediately thereafter, geotextile sheets shall be covered with plastic sheets in compliance with the requirements below. Plastic sheets shall be removed each morning during the prescribed curing period, where after geotextile sheets shall be thoroughly soaked with water, followed by replacement of plastic sheets.

b) Column footings and wall footings

Immediately after final finishing (such as power-floating), footings shall be covered with approved plastic sheets complying with the requirements below.

The first morning following completion of final surface finishing, the plastic sheets shall be removed, and above-mentioned structural elements shall be covered with geotextile sheets complying with the requirements below, which shall be thoroughly soaked with water. Immediately thereafter, geotextile sheets shall be covered with plastic sheets in compliance with the requirements below. Plastic sheets shall be removed each morning during the prescribed curing period, where after geotextile sheets shall be thoroughly soaked with water, followed by replacement of plastic sheets.

c) Columns

Columns shall be thoroughly sprayed with water immediately after the removal of formwork. Thereafter columns shall be wrapped with minimum 15 micron thickness plastic wrapping of approximately 450 mm width (i.e. 17 micron pallet wrapping rolls), which shall overlap by 50 mm, to be approved by the Engineer.

d) Walls

Both sides of walls shall be covered with geotextile sheets as specified below, which shall be kept moist by means of an irrigation type system as specified below. Geotextile sheets shall be covered with suitable plastic sheets as specified below. Curing shall commence the day after concrete has been cast and shall continue for at least 10 days. If formwork is to remain in position (e.g. to support subsequent lifts), it shall be loosened as soon as the concrete has gained sufficient strength (usually within a day) to allow curing water to thoroughly wet the surfaces of the concrete.

During summer months, formwork shall be struck early in the morning to allow curing to start before loss of moisture from the concrete can occur as the ambient temperature rises. During winter months when minimum ambient temperatures (including the wind chill factor) are below 5°C, formwork shall be struck towards midday to prevent freezing of concrete by curing water.

Special care shall be taken to ensure that the top surfaces of walls are kept wet continuously to prevent rapid drying. If the evaporation rate is high, or the concrete is exposed to freezing conditions, the top of the wall shall be covered with a sausage of geotextile, which shall be kept wet continuously.

e) Irrigation type mist spraying system

The irrigation type system shall consist of an irrigation pipe with nozzles or sprayers which will be spaced at close centres to ensure that the geotextile sheet is kept wet. The pipe shall be located at the top of the wall. The system shall be controlled by an automatic timer with the capacity to activate the system for any chosen time period at any chosen time intervals, such that curing will be continuous over week-ends, public holidays and builders' holidays. Sprayers shall be spaced at such intervals as to ensure that the whole area of concrete is wetted. The design of the system shall be submitted to the Engineer for his perusal. Should the existing water pressure on site be insufficient, a pump should be installed to operate the mist spraying system. The Contractor shall allow for this in his tendered rates and prices.

f) Determination of intervals and duration of application of water

The duration of water application and the intervals of application will be determined on site by the Engineer, and shall be such as to prevent the concrete from drying out. The duration and intervals shall be adjusted to allow for adverse conditions such as high temperatures and/or dry, windy conditions.

g) Plastic sheets and tubes

Plastic sheets used for early age protection and curing shall be new, waterproof and may not be torn or be otherwise discontinuous. Plastic sheets shall be white (such as white PVC sheets by Rhino Plastics or equivalent to be approved by the Engineer) during summer months (generally October to March), and black during winter months (generally April to September), and shall be at least 250 micron thick. Geotextile sheets shall be new, of the Kaymat A4 type (or equivalent to be approved by the Engineer) and may not be torn or discontinuous. Sheets may be re-used for curing of further elements, but shall be replaced with new sheets when torn or damaged.

Plastic and geotextile sheets shall be held down or fixed securely to the elements being cured. Joints in plastic sheets shall be taped to prevent loss of moisture from the concrete (overlapping only would not be sufficient). Sheets shall overlap by at least 500 mm, shall extend at least 500 mm past the area to be cured, and shall be draped around the edges and ends of elements to prevent any loss of moisture from the concrete.

h) Duration of curing

The curing period shall be at least 10 days. The Contractor shall ensure that curing will be continuous over weekends, public holidays and builders' holidays, and therefore shall have responsible employees on site on such days to ensure compliance with this requirement.

i) General

The use of curing compounds for curing is prohibited and will not be allowed under any circumstances.

Before casting of concrete may commence, the Contractor shall prove to the satisfaction of the Engineer that all measures to comply with the requirements of curing and protection of concrete, have been put in place.

Notwithstanding the preceding specifications, the Contractor shall also ensure that the concrete shall not be exposed to thermal shocks during the first 28 days after casting and he shall take the necessary, additional precautionary measures to shield the concrete during extreme warm, cold, dry or windy weather conditions. Curing shall be done in such a manner as not to cause staining, contamination or marring of the surface of the concrete. During summer months, concreting shall start as early in the morning as possible, but not later than 07:00, to prevent concrete from being cast during the hottest part of the day. When the maximum ambient temperature exceeds 30°C, concreting shall start at such time to ensure completion by not later than 10:30. If required, steel formwork shall be sprayed with cold water to lower the temperature thereof. During winter months, concreting shall start as soon as the ambient temperature has risen above 7°C.

The Contractor shall take the necessary precautions to prevent water used for curing from penetrating the soil underneath or adjacent to the structures. The water shall be drained away effectively as soon as possible to prevent any ponding.

Non-compliance with the above-mentioned protection and curing requirements shall be considered as sufficient grounds by the Engineer to order demolition and replacement of affected structural elements.”

PSG-5.5.9 Adverse Weather Conditions

PSG-5.5.9.2 Replace the first sentence with the following:

“The temperature of the concrete when cast shall not be allowed to exceed 25°C.”

PSG-5.5.10 Concrete Surfaces

PSG-5.5.10.2 Add the following to sub clause 5.5.10.2:

a) Wood-floated Finish

When a wood-floated finish is specified, the surface shall first be treated as specified in sub clause 5.5.10.1, and after the concrete has hardened sufficiently, it shall be floated to a uniform surface free from trowel marks with a wood float. The levelled surface shall be wood-floated either by hand or by machine only, to remove trowel marks.

b) Steel-floated Finish

When a steel-floated finish is specified, the surface shall be treated as specified for a wood-floated finish above, except that when the bleed water has disappeared and the concrete has hardened sufficiently to prevent the migration of concrete foam to the surface, the levelled surface shall be floated with a steel trowel on which a firm uniform pressure shall be applied to provide a dense, smooth, uniform surface free from trowel marks.

c) Power-floated Finish

When a power-floated finish is specified, the surface shall be treated as specified for a wood-floated finish above, except that the levelled concrete surface shall be power-floated to provide a dense, smooth, uniform surface of high quality free from trowel marks.”

PSG-5.5.11 Watertight Concrete

Add the following to this clause:

“Valve and other chambers, manholes, concrete structures and the pump station's wet and dry wells (where applicable), built under this contract shall be watertight without the addition of supplementary cement plaster, coatings or membranes. Ensuring water tightness is the exclusive responsibility of the Contractor and he shall take all the measures deemed necessary to achieve this. All remedial work that has to be undertaken to ensure water tightness shall be for the Contractor's own account. Refer also to the relevant payment clause in this regard.”

PSG-5.5.14 Defects

PSG-5.5.14.2 Add the following to sub clause 5.5.14.2:

“a) Where repair of surface defects are ordered, the Contractor shall consult specialist suppliers of concrete repair products, obtain from them a proposal(s) for a suitable repair product(s) along with a detailed method statement from such specialists and submit it to the Engineer for approval. All products shall be applied strictly in accordance with the manufacturer's specification.

The repaired area shall match the surrounding concrete as closely as possible in both colour and texture. All repair materials shall be equivalent to concrete in respect of thermal properties and structural elasticity.

b) If the finish of exposed formed surfaces does not comply with the requirements for accuracy, smoothness at shutter joints or uniformity of texture, appearance and colour, the Contractor shall upon instruction by the Engineer, rub down the exposed surfaces of the entire structure or any part of it as specified below:

The surface shall be saturated with water for at least one hour. Initial rubbing shall be done with a medium-coarse carborundum stone, where a small amount of mortar (having a sand : cement ratio equal to that of the concrete being repaired) is used on the surface. Rubbing shall be continued until all form marks, projections and irregularities have been removed and a uniform surface has been obtained. The paste produced by the rubbing shall be left in place. The final rubbing shall be carried out with a fine carborundum stone and water. This rubbing shall be continued until the entire surface is of a smooth, even texture and is uniform in colour. The surface shall then be washed with a brush to remove surplus paste and powder.

Add the following new clause:

“PSG-5.5.15 Replace the first sentence and clause a) with the following:

“The Contractor shall monitor and record the following on a form (to be drafted by the Contractor and approved by the Engineer), to ensure compliance with the specifications:

- a) - date and time of casting and the time taken to place the concrete;
- structural element and description of pour;
- daily maximum and minimum temperatures;
- ambient temperature at time of casting (start and finish);
- temperature of mixing water (to be obtained from supplier in case of the use of readymix);
- temperature of concrete on arrival at the point of casting.

Add at the end:

To this effect, the Contractor shall install a mini weather station (to be approved by the Engineer) to record meteorological data such as humidity, wind speed, precipitation and ambient temperature continuously. A Major Tech MT605 (or equivalent to be approved by the Engineer) digital pen type thermometer shall be used to record mixing water and concrete temperatures.”

Add the following clauses:

“PSG-5.6 Items built into water-retaining structures

The building in of items, such as puddle pipes etc. into water-retaining structures shall be executed as follows:

- a) the items shall be positioned prior to construction of the relevant part of the water-retaining structure and subsequently cast in simultaneously with the concreting of the specific element of the water-retaining structure.

The Contractor's attention is drawn to the following:

- Water-retaining structures shall be fully watertight, especially around cast in items, and no leaks or damp areas will be allowed. Where cast in items don't have puddle flanges, a swellable bar to be provided around the full perimeter of the item and positioned between the reinforcing steel layers.
- The concrete of the water-retaining structure around the built-in item shall be free of any honeycombing, shall have an acceptable smooth finish and the colour of the whole relevant part shall be uniform.

- Pipes passing through water-retaining structures shall be properly aligned as specified and as detailed on the drawings, and valve stems intended to be vertical shall, for example, be 100 % vertical in both planes.

Building in of items will not be measured separately as it is included in the supply and installation of the pipes and specials measured in SANS 1200 L.

PSG-5.7 Items built into existing structures

Where pipes or other items have to be built into existing water-retaining structures, the existing concrete shall be cut out carefully to obtain sufficient space to install the items.

The building in of the items shall then be executed as follows:

- Recesses or holes to be subsequently grouted or concreted in: The procedure entails sandblasting and water jetting the recess surfaces followed by installing a swellable bar and the application of an approved acrylic polymer bonding agent. The pocket shall be filled with the same type and strength of concrete as the original and properly cured after removal of the formwork.

Building in of the items will not be measured separately as it is included in the supply and installation of the pipes and pipe specials as measured in SANS 1200 L. The cost of breaking into existing concrete and making good after installation will however be measured separately."

PSG-6 TOLERANCES

PSG-6.2 PERMISSIBLE DEVIATIONS (PDs)

PSG-6.2.1 General

Degree of Accuracy I shall apply.

PSG-6.2.3 Specified PDs

Amend this clause to read as follows:

- "(a)1): Spacing between adjacent bars: -10 +10 mm, irrespective of the Degree of Accuracy (additional bars have to be added at the Contractor's expense if the number of detailed bars are insufficient due to creep in position of bars due to incorrect bar placement by the Contractor);
- (a)2): Cover to reinforcement: -0 +5 mm irrespective of the Degree of Accuracy;
- (d)7)ii): Abrupt changes in a continuous surface: Between different concrete pours at construction joints in floors: $\pm 0,5$ mm irrespective of the Degree of Accuracy."

PSG-7 TESTS

PSG-7.1 FACILITIES AND FREQUENCY OF SAMPLING

PSG-7.1.2 Frequency of Sampling

PSG-7.1.2.1 Replace this clause with the following:

"Subject to the requirements of sub clause 7.1.2.4, while concrete of a particular grade and in sufficient quantity is being placed under the same conditions, sets of samples (each sample, as defined in clause 2.3(b), being sufficient for six cubes) shall be taken until 30 valid test results have been obtained. The sets of samples shall be taken in accordance with SABS Method 861 as close as is practicable to the start of placing and at appropriate intervals after that, or from one particular batch and then from subsequent batches chosen at appropriate intervals."

PSG-7.2 TESTING

PSG-7.2.1 General

Add the following:

“The Contractor shall allow in his tendered rates for all the costs for quality or process control testing.”

PSG-7.2.4 Early-Strength Testing

Add the following to this clause:

“Of each sample of six cubes, three cubes shall be tested at 7 days and the remaining three cubes at 28 days.”

Add new sub clauses:

“PSG-7.2.5 Sterilization of Reservoirs

Before a reservoir is sterilized, the roof shall have been tested for water tightness as set out in Clause 7.2.6 below, and the pipelines serving the reservoir shall have been sterilized. The reservoir shall then be thoroughly cleaned out and washed down with clean water.

The roof, beams, columns and walls shall thereafter be thoroughly sprayed down, using pressurised equipment, and the floors shall be scrubbed with water containing 0,015 g per litre of chloride of lime.

On completion of the sterilisation, the sterilising solution shall be run to waste before the reservoir is filled for testing its water tightness.

Should additional work be required to be done inside the reservoir after the water tightness test has been completed, the reservoir shall be re-sterilised at the Contractor's expense.

PSG-7.2.6 Tests for Water Tightness

Water will be supplied free of charge by the Employer for the initial filling and testing only.

All water levels shall be carefully noted and recorded by the Engineer. The Contractor is free to attend the taking of all measurements by the Engineer.

Water-retaining structures (including reservoirs) shall be subjected to watertight testing. A thorough inspection shall be done to ensure that all joints are properly sealed and that all inlet and outlet pipes are closed. The structure shall be filled with water to its maximum operating level at a rate that shall not exceed a rise in water level of 2,0 m in 24 hours.

In structures where the water surface is exposed to the atmosphere a small cylindrical watertight container (like a 20 litre tin) floating in the water should be filled with water to approximately 80% of its capacity.

If there are no visible leakages, the structure shall be allowed to remain filled for a saturation period of two weeks to permit complete saturation of the concrete.

If any leakages are visible, the water test shall be aborted, depending on the seriousness of the leakages, and the leakages repaired by the Contractor at his own cost, in accordance with an approved method and product(s) before another water test shall be done.

During the saturation period readings of the water levels shall be taken by the Engineer at regular intervals. The water level in the structure (and the container, where applicable) shall be carefully noted and recorded by the Engineer. Where applicable, the change in water level in the container (due to

precipitation or evaporation) shall be used to make corrections/adjustments to the recorded water levels in the structure.

At the end of the saturation period, water shall be added, if necessary, to bring the water level back to the maximum operating level (and the water level in the container to the original level, where applicable).

The water levels in the structure and the underfloor drainage pipes shall then be monitored daily for a period of seven days.

The structure shall be deemed watertight if:

- (a) no visible leakage or obvious damp spots are apparent on the outside of the structure; and
- (b) the drop in water level after being corrected for evaporation and precipitation where applicable during the 7-day test period does not exceed 1/500 of the water height or 10 mm whichever is the smaller.

If the structure fails the water tightness test the Contractor shall determine the cause of the leakage. The Contractor shall repair at his own cost the leakage on the inside of the structure after the water has been drained, in accordance with an approved method and product(s). Thereafter the structure shall again be subjected to a complete water test as described above. Full payment under Item 8.4.3 will only be made once the water tightness test has been passed (refer to Clause PSG-8.1.3 hereafter).

Should the failure of the reservoir to pass the first or any subsequent test for water tightness necessitate the drainage of the structure, the Employer reserves the right to utilise the water discharging it into its water-reticulation network, in which case the Contractor –

- shall not have to pay for the subsequent refilling of the reservoir:
- shall, if applicable, reimburse the Employer for any additional costs incurred to make the water fit for consumption, and
- shall not be entitled for extra time whilst waiting for the water to be discharged into the network.

The costs of re-testing the reservoir for water tightness shall be borne by the Contractor.

The roof slabs that are required to be water-retaining shall be ponded with water to a maximum depth of 80 mm and a minimum depth of 20 mm for a period of at least three days. The ponding shall be carried out in an approved systematic manner over the entire top surface area of the slab. The roof slab shall be deemed watertight if there is no visible leakage or damp spots on the soffit of the slab.”

Domed roofs shall be visually inspected from above. Access for visual inspections of the dome roof soffit shall be arranged while scaffolding that supported dome shutters are still in place. Sufficient and safe access walkways shall be provided to enable the Engineer to complete a full visual survey of the dome roof soffit. Should the Engineer not be afforded an opportunity to access the dome roof soffit up close, whether for the initial inspection or any inspections thereafter that may be required after any repair works have been completed, the Contractor shall arrange for a suitable means of access and/or recording of the entire dome roof soffit surface (technology possibly affords, amongst others, the use of high definition footage from drones and/or ultra-high definition cameras with software to stitch all the images into a single image).

The water tightness of a domed reservoir roof shall be tested before that of the reservoir itself by water being continuously sprayed over the roof in an approved manner so that a film of water is maintained on the dome surface. The roof shall be considered watertight if no damp patches are visible on the dome roof soffit after 48 hours of continuous spraying.

The Contractor shall provide sufficient lighting to the dome soffit to the satisfaction of the Engineer during all inspections that may be required up until final acceptance of the dome roof structure.”

PSG-8 MEASUREMENT AND PAYMENT

PSG-8.1 MEASUREMENT AND RATES

PSG-8.1.2 Reinforcement

PSG- 8.1.2.2 Replace subparagraph (a) with the following:

“The mass of steel bars will be measured as the total mass of the steel, irrespective of diameters.”

PSG-8.1.2.3 Amend the clause as follows:

“Delete the words “nominal size 25 mm” in the first line of subparagraph (a).

Delete subparagraph (b).”

PSG-8.1.3 Concrete

Add the following:

“Payment for concrete in water-retaining structures will be made as follows:

- a) Full payment will be made for concrete when it has been placed and accepted by the Engineer as described in sub clause 8.1.3.3 and other relevant clauses, except that payment for curing and testing for water tightness, including any repair work necessary, will be made separately in the case of water-retaining structures.”

Add the following clause:

“PSG-8.1.4 Casting in of pipes and specials

No separate items will be scheduled for building in items supplied under this Contract except for those specially measured in the Bills of Quantities. The relevant rates for supply and installation shall cover the cost for casting in the items supplied under this Contract whether the items are positioned prior to construction or subsequently placed in blocked-out holes.”

PSG-8.4 SCHEDULED CONCRETE ITEMS

PSG-8.4.3 Strength Concrete, Grade

Add the following to the payment paragraph:

“The tendered rate for concrete to be used in water-retaining structures shall also include all measures necessary to store cement, water and aggregates in a cool environment to ensure that the ingredients of the concrete are cool at the time of mixing.”

Add the following items:

“PSG-8.4.7 No-fines Concrete (describe class and position) Unit: m3

The relevant measurement and payment clauses for strength concrete (clause 8.4.3) shall apply.

PSG-8.4.8 Curing of concrete structures (state each structure)

Curing of different in-situ cast concrete structures shall be measured under the following items:

PSG-8.4.8.1 Fixed costs, once off Sum

The rate tendered for the fixed costs for curing of all in-situ cast concrete structures shall cover 3 no x 2500 litre plastic tanks, sufficient quantity of high pressure fog and water sprayers, adequate length of 20 mm and/or 25 mm HDPE pipeline with associated compressions fittings, and sufficient hessian cloth (minimum 100 m2), including all the Contractor's overhead and mark-up costs.

PSG-8.4.8.2 Setting up and removing costs (time-related) hour

The rate tendered for setting up and removing costs associated with curing of all in-situ cast concrete structures, shall cover all the costs for setting up, operating, maintaining and removing the curing system for the different lifts of the concrete structures, including all the Contractor's overhead and mark-up costs, based on the following sub-items:

- a) Crane truck for moving the 2 500 litre tanks/hour
- b) Unskilled labour for moving the 2 500 litre tanks and sprayers/hour
- c) Skilled labour for setting up the 2 500 litre tanks and sprayers/hour
- d) Unskilled labour for setting up the 2 500 litre tanks and sprayers/hour
- e) Unskilled labour for operating the curing system/hour
- f) Water truck for filling up 2 500 litre tanks/hour
- g) Unskilled labour for filling up the 2 500 litre tanks/hour
- h) Unskilled labour for installing hessian cloth hour
- i) Unskilled labour for removing the 2 500 litre tanks, sprayers and hessian/hour

PSG-8.4.9 Test for water tightness of structures (structure to be stated)

Water tightness testing of different in-situ cast concrete structures shall be measured under the following payment items:

PSG-8.4.9.1 Fixed costs: materials for closing or blanking off and sealing all openings in walls and floor of the structure (structure to be stated) m2

The rate tendered shall cover all costs for the supply of materials (e.g. shutters) to effectively close or blank off and seal all openings using Sikaflex-11FC (or equivalent to be approved by the Engineer) in the walls and floor for the in-situ cast concrete structures subjected to water tightness testing.

PSG-8.4.9.2 Setting up and removing costs (time-related) hour

The rate tendered for setting up and removing costs associated with watertightness testing of all in-situ cast concrete structures, shall cover all the costs for setting up, executing and removing the materials required for the water tightness testing of the concrete structures, including all the Contractor's overhead and mark-up costs, based on the following sub-items:

- a. Skilled labour for setting up the water tightness test by installation of the
- b. Materials required for the water tightness test to close or blank off and
- c. Seal all openings in the walls and floor of the structure/ hour
- d. Unskilled labour for setting up the water tightness test by installation of the
- e. materials required for the water tightness test to close or blank off and
- f. seal all openings in the walls and floor of the structure /hour
- g. Compressor for blowing clean to dry the openings to be blanked off/hour
- h. Water truck for filling up the structure/hour
- i. 100mm water pump to fill up the structure/hour
- j. 100mm water pump to empty the structure/hour
- k. Unskilled labour to operate the water pump/hour
- l. Unskilled labour for removing the materials required for the water tightness test/hour

PSG-8.4.10 Concrete screed Unit: m2

The rate shall include all costs associated with the installation of a screed (thickness 50 mm average, minimum 30 mm) enhanced with Sikacem 810 admixture (or equivalent to be approved by the Engineer) to the manufacturer's specifications."

PSG-8.5 JOINTS Unit: m

Add the following:

- a. "a) Valve chambers, in-situ cast concrete manholes and other structures wall/floor construction joints:

The tendered rate shall cover the cost of all materials and labour for the construction of each wall/floor joint as specified in Clause PSG-5.5.7 and shown on the drawings, including the cost of formwork, testing and making good."

Add the following items:

"PSG-8.9 Installation of pipes and pipe specials in existing concrete structures (describe items and locality) Unit: Sum

The tendered sum for each item shall cover the cost of breaking out existing concrete sufficient to allow the installation of the item in its correct position, additional cost for installation not measured elsewhere, and making good of the concrete after completion of the installation of the item. The sum tendered shall be regarded as an extra over the cost for supply and installation of the item which has been measured elsewhere under SANS 1200 L.

PSG-8.10 Miscellaneous Items

These items will be measured per metre, per square metre, or per number or as a sum as scheduled.

The rate or sum shall cover the cost of the complete supply and installation of the scheduled item in accordance with the specifications and as described in the schedule of quantities and as detailed on the drawings including casting into concrete where applicable."

PSL MEDIUM-PRESSURE PIPELINES

PSL1 MATERIALS (Clause 3)

PSL 1.1 Steel pipes

Steel pipes shall comply with the following Particular Specifications:

- PLN: Manufacture, supply and testing of steel pipes.
- PLQ: Corrosion protection of steel pipes and fittings.
- PLS: Cement mortar lining of steel pipelines
- PSL 1.2 Glass Reinforced Plastic Pipe (GRP)
- GRP pipes shall have a stiffness of at least SN 5000.

Manufacturing of the GRP shall be strictly in accordance with SABS 1748-1.

Quality control by a suitable 3rd party quality inspectorate approved by the Engineer shall be implemented during manufacturing, handling, transport and installation of the GRP pipework and the cost for this external inspectorate shall be included in the rates tendered.

PSL 1.3uPVC pipe and HDPE pipes

uPVC and HDPE pipes shall comply with the following Particular Specification:

PLTP: Manufacture, supply and testing of plastic pipes

PSL2 HANDLING AND RIGGING (Clause 4.1)

Pipes, fittings, specials and valves shall be protected during transportation and handling against damage.

Pipes, fittings, specials and valves shall not be laid or stacked directly onto the ground but shall be supported on suitable padded cradles or other approved material near each end of the pipe, fitting, special or valve. Particular care shall be taken with pipes with fitted couplings to prevent pressure on the couplings. Cradles, spiders, jacks etc. shall be used to maintain the shape of pipes during transport, laying, welding and jointing.

The Contractor shall thoroughly inspect all pipes, fittings, specials and valves delivered to site.

All pipes with MDPE, 3LPE or Bit guard coatings shall be painted with a white PVA overcoat (to be approved by the Engineer) for protection against ultra violet damage. The overcoat to be maintained by applying additional layers until the pipe is backfilled.

All pipes shall be stored (at the factory or on site) on sandbags at third of the pipe length from each pipe end. The width of the sand bags shall be at least 500 mm for pipes with Bit guard coating.

PSL2 WELDING (Clauses 5.2.3 and 7.2)

The welding specifications are applicable to all pipe diameters (not only 600 mm or greater).

100% of all site welds shall be examined radiographically in accordance with API 1104 and the Contractor shall price for it accordingly.

Only under special circumstances where allowed by the Engineer, 100% of the site welds of each welder shall be examined radiographically in accordance with API 1104 initially. When a 100% success rate of at least ten consecutive welds is achieved by a welder, the frequency of testing may be reduced to 50%. When a 100% success rate of at least five consecutive tests is achieved by a welder, the frequency of testing may be reduced to 10%.

When a weld defect occurs again, the previous five welds of the relevant welder must also be radiographically examined and the frequency of further tests shall immediately increase to 100%. Any defect in the previous five welds will activate the testing of five further previous welds until a 100% success rate of the five welds is achieved. The testing rate may always be reduced to 50% and 10% as described above.

The following site welds shall in all cases be 100% radiographically examined:

- All welds not subject to hydraulic testing;
- All welds under road and railway lines, under river/stream crossings, under any structures, in sleeve pipes, in culverts and where the pipe will be encased in concrete;
- All mitres.

PSL3 DISINFECTION OF POTABLE WATER PIPELINES (Clause 5.10)

The disinfection shall be done in accordance with SANS 1200L with the exemption that the concentration of calcium hypochlorite can be reduced to 60 mg/l.

PSL4 CONSTRUCTION (Clause 5)

Add the following clauses:

PSL4.1 Connection to pipelines in operation

The Contractor shall give the Employer 14 days' notice in writing for connections to pipelines in operation. The Contractor shall ensure that all required material is available and all preparation work is completed at least 12 hours before the "shutdown" of existing works for the connections. The Contractor shall complete and commission the connections within 12 hours after commencement of the "shutdown".

The Employer will empty the reservoir and existing pipelines as far as possible through existing scour valves. It is the responsibility of the Contractor to control and pump out water which cannot be drained at existing scour valves or water in the pipe as a result of leaking valves. No claims will be considered for standing time due to the scouring of pipes or any other work which is done by the Employer.

PSL4.2 Additional external protection for pipes cast into chamber walls

After the concrete has cured for 7 days, wire brush or scabble the exterior and interior surfaces of the wall to remove laitance. Dry brush to remove all loose powder.

Mix ABE Super Laykold (or similar material approved by the Engineer) and water (1:1 ratio) and apply as a primer to the concrete and the pipe surfaces. After 1 hour apply a thick coat of ABE Super Laykold to the concrete and the pipe and immediately embed 250 mm wide ABE non-woven polyester membrane "SBP" into the Super Laykold. After 3 hours apply another coat of Super Laykold.

This additional protection is required on the inside and outside of chamber walls.

There must be no contact between the steel pipe and the chamber reinforcement.

PSL4.3 Deflection/ovality of pipes

The Contractor shall ensure that his handling and construction methods do not result in horizontal or vertical pipe deflection more than 2% for steel pipes with cement mortar lining and 3% for steel pipes with epoxy lining and plastic pipes.

The deflection is calculated as follows.

Measure the actual vertical diameter of the pipe [DY]

Calculate the difference [Δd] between DY and the inside diameter of a perfectly round pipe

The deflection $\Delta = \frac{\Delta d}{ND} \times 100 \%$, where ND is the nominal diameter of the pipe

After completion of the main backfilling (including joint / "fox" holes) the Contractor shall determine the internal deflection of the pipe every 20 m for pipes with a nominal diameter of 600 mm and larger. Should these 20 m measurements indicate a position where the allowable deflection is exceeded, additional measurements shall be taken to determine the extent of the problem.

These measurements shall be done within 2 working days of the completion of the main backfill unless otherwise approved by the Engineer in writing.

The Contractor shall submit a method statement for the review of the Engineer to rectify deflection problems.

PSL4.4 Pipe coating performance requirements and integrity surveys

PSL4.4.1 Introduction

This section of the Specification provides the performance requirements for the external coatings after installation and field joint repairs.

Excessive apparent coating conductance may be caused by defective field joint coatings, mechanical damage, or spurious contacts to foreign objects or valve chamber reinforcement.

Location of such defective areas may be assisted by the DCVG surveys during construction.

The overall performance of the coated pipeline is defined in terms of specific coating conductance, in accordance with NACE TM 0102. Values normalized for soil resistivity are not utilized.

It should be noted that the requirements of both the construction DCVG survey and the coating conductance measurement must be fulfilled.

Also surveys shall be done by specialist Subcontractors to be nominated by the Engineer or proposed by the Contractor for the Engineer's approval, as specified in the Bill of Quantities.

PSL4.4.2 Standards

The following normative standards are referenced in this section:

NACE TM 0102 Measurement of Protective Coating Electrical Conductance on Underground Pipelines
NACE TM 0109 Aboveground Survey Techniques for the Evaluation of Underground Pipeline Coating Condition

NACE SP 0207 Performing Close-Interval Potential Surveys and DC Surface Potential Gradient Surveys on Buried or Submerged Metallic Pipelines

NACE SP 0502 – 2002 Pipeline External Corrosion Direct Assessment Methodology

PSL4.4.3 Construction DCVG Survey

The coating system is required to be free of significant (as defined by %IR below) defects at the time of installation. This will be ensured by the use of over-the-ditch holiday detection and a DCVG survey after backfilling and consolidation.

A minimum of three months shall elapse between backfilling and evaluation, unless the backfill is hydraulically compacted or significant rainfall has occurred which ensures that the pipeline is fully bedded and in intimate contact with the soil. The timing of this inspection will be determined by the Engineer, and is dependent on the backfill becoming conductive. This may take considerably longer than three months, at least until the soil becomes conductive (due to infiltration of groundwater or seasonal rains).

The coating integrity survey shall be undertaken by means of DCVG survey technique in accordance with NACE TM 0109 Section 6. All DCVG indications shall be geo-referenced by means of DGPS

On completion of the survey, sufficient calibration digs shall be conducted to characterise %IR values in the range of 1 – 5% for determination of the repair level required.

Evaluation of the construction DCVG results shall be undertaken in accordance with the following categories for %IR:

<1% IR No repairs required.

1 – 5% IR Repairs may be required based on results of calibration digs.

>5% IR Repairs required

The %IR values quoted above are only applicable to new construction. Pipeline coatings which have been buried for longer than 2 years shall be evaluated in terms of NACE SP0502 – 2002 Appendix A6.4

All excavations and repairs shall be undertaken at the cost of the Contractor.

PSL4.4.4 Coating Performance Requirements

The CP design is based on the use of coated pipe. The coating is required to be resistant to the effects of high voltage transients due to the proximity of high voltage overhead power lines and existing and future AC traction systems (e.g. of the railways). The performance of the coating is evaluated by means of a current drainage test (CDT)

The specific coating electrical characteristics form an integral part of the CP and ACM design in determining, inter alia, spacing between anode installations.

After installation and backfilling of the pipeline, the pipeline coating shall be evaluated in sections not exceeding 5 km in terms of NACE TM 0102.

A minimum of three months shall elapse between backfilling and evaluation, unless the backfill is hydraulically compacted or significant rainfall has occurred which ensures that the pipeline is fully bedded and in intimate contact with the soil.

The specific coating conductance of the 5 km construction sections shall be less than 60 $\mu\text{S}/\text{m}^2$.

In the event that the pipeline does not meet the coating conductance criterion, alternative survey techniques shall be utilized to determine the cause of the non-compliance. These techniques may include any of the surveys described in NACE TM 0109 or SP 0207 as appropriate and subject to the approval of the Engineer.

All surveys shall be conducted by Contractor.

PSL4.4.5 Tests on Completion and end of Defects Notification Period

On completion of construction and prior to the issue of the Taking-Over Certificate (TOC), the pipeline shall be subjected to a CDT and a coating integrity survey.

The coating conductance shall be calculated on the current requirement for the completed pipeline.

The specific coating conductance for the completed pipeline shall be < 60 $\mu\text{S}/\text{m}^2$.

The pipeline coating integrity shall be evaluated over the entire pipeline length by means of a hybrid CIPS/DCVG survey, which shall be completed in accordance with NACE SP 0207 utilizing a 10 m longitudinal DCVG component. The results of the survey shall be correlated with those of the construction DCVG surveys.

The significance of coating defects or other anomalies identified from the DCVG survey results will be evaluated by assessing the relative loss of polarization at the coating defect utilizing CIPS results. Where DCVG defects result in a local loss in polarization to a level below the relevant cathodic protection criterion, the Contractor will be required to rectify the defect.

The hybrid CIPS/DCVG survey shall be repeated at the end of the Defects Notification Period (DNP) prior to the issue of the Performance Certificate.

The CDT and CIPS/DCVG tests related to TOC and DNP shall be undertaken by a Specialist Service Provider/Sub-Contractor approved by the Engineer.

Any non-compliance with the requirements of the CDT or the hybrid CIPS/DCVG survey shall be investigated and rectified by the Contractor. The Contractor shall prepare method statements for the investigation and rectification and submit it to the Engineer for approval.

PSL4.5 Curing of cement mortar lining of pipes on site

The Contractor responsible for the construction of the pipeline shall be responsible for the following curing process of cement mortar lined pipes for a period of 28 days after it has been off-loaded on site:

The pipes must be stored horizontally
Seal pipe ends with plastic cover
Add 5 litre water per day into each pipe and keep pipe ends closed

PSL4.6 UV protection of joint coating

Joint coatings shall be protected by the Contractor against ultra violet (UV) damage with filter cloth (Kay mat or similar) if exposed for more than 7 days.

PSL4.7 Pipeline markers

Pipeline markers shall be installed exactly above the pipe centre line at the following positions:

Horizontal bends;
Servitude boundaries of provincial roads and railway lines;
Both ends of concrete encased sections;
Property boundaries;
Between horizontal bends and valve chambers where distances in between exceed 300 m.

PSL5 STANDARD HYDRAULIC PIPE TEST (Clause 7.3)

Unless otherwise specified on the Drawings, the test pressure for field testing shall:

Not be less than 1.25 times the maximum operating pressure at design flow or static flow conditions whichever is the highest (excluding transient/surge pressure);
Not be less than 1.1 times the design pressure including transient/surge pressure with surge protection measures as designed operating effectively;
Not exceed 1.5 times the maximum allowable operating pressure of the pipeline;
Not exceed the allowable test pressure for the specific pipe class;
Not exceed 1.5 times the allowable working pressure of the specific valve and fitting class;
Not exceed 800 micro strain (circumferential) for metallic pipes with cement mortar lining.

Immediately after the completion of the hydraulic pipe testing, the valves shall be tested as follows:

Air valves

Isolate the air valve and remove the drain plug on the air valve to check that the float is dropping. Check that the isolating valve is sealing. Put the drain plug back and open the isolating valve to check that the float is closing and the air valve is sealing.

Scour valves

Check the opening, closing and sealing of the scour valves and the functioning of the scour outlet structure and erosion protection measures.

PSL6 REFURBISHMENT OF EXISTING PUMPING LINE

PSL6.1 Corrosion protection

Possible damage to the internal lining to be investigated at the significant dent in the pipeline next to the pump station chamber.

The pipeline to be pressure tested prior to being put into service.

The installation of a cathodic protection system.

An Insulating Flange (IF) kit needs to be installed at the pump station to electrically isolate it from the pipeline.

The electrical continuity of the pipeline over its full length must be ensured.

PSL6.2 Pipework

Pipework inside chambers

- a) Pipe diameter up to 150mm

Pipework shall be hot-dipped galvanized.

The outside end of fittings cast into the walls of the chamber as well as flanges and couplings outside the chamber shall be protected with a Denso Clingwrap protection system.

After installation and where specified the pipe shall be painted with re-coatable polyurethane to the Employer's colour coding specification. All systems to comply with ISO 12944-4 and 12944-5.

- b) Pipe diameter larger than 150mm

Fittings, specials and couplings shall be coated and lined with epoxy paint.

The outside end of the fitting cast into the wall as well as flanges and couplings outside the chamber shall be protected with a Denso Clingwrap protection system.

After installation and where specified the pipe shall be painted with re-coatable polyurethane to the Employer's colour coding specification. All systems to comply with ISO 12944-4 and 12944-5.

Pipework exposed to sunlight

- a) Pipe diameter up to 150mm

Pipework shall be hot-dipped galvanized.

Pipe surface shall be prepared for re-coatable silver polyurethane acrylic site application as per ISO 12944-4.

After installation the pipe shall be painted with re-coatable silver polyurethane acrylic as per ISO 12944-5

- b) Pipe diameter larger than 150mm

Pipework shall be lined with epoxy paint.

Pipes shall be coated in the factory with two component inorganic zinc silicate primer (75 micron) plus one coat of silver polyurethane acrylic (60 micron).

A second coat of polyurethane acrylic (60 micron) must be applied on site. The inorganic zinc silicate must be repaired with "single pack zinc rich epoxy primer".

Exposed pipework inside buildings

- a) Pipe diameter up to 150mm

Pipework shall be hot-dipped galvanized.

Pipe surface shall be prepared for re-coatable polyurethane site application.

After installation the pipe shall be painted with re-coatable polyurethane to the Employers colour coding specification. All systems to comply with ISO 12944-4 and 12944-5.

- b) Pipe with diameter larger than 150mm

Pipes, fittings and couplings shall be lined and coated with epoxy paints.

After installation the pipework shall be painted with re-coatable polyurethane to the Employers colour coding specification. All systems to comply with ISO 12944-4 and 12944-5.

Pipework inside water retaining structures

All pipework (including stainless steel) inside water retaining structures and cast into the walls or floor of water retaining structures shall be lined and coated with epoxy paint.

All stainless steel shall be grade 316L.

PSLB BEDDING (PIPES)

PSLB1 SELECTED GRANULAR MATERIAL (Clause 3.1)

Replace the clause with the following:

Refer to drawing LB-2. For flexible pipes, the bedding cradle shall be from the trench bottom up to 300 mm above the top of the pipe.

Requirements for the bedding cradle (from trench bottom up to 300 mm above the pipe) for flexible pipes are:

- 100% of material shall pass a 9.5 mm sieve opening except for steel pipes, joints, specials and fittings with Polymer Modified Bitumen (Bituguard) or tape wrapping coating where 100% of material shall pass a 3 mm sieve opening;
- Compatibility factor (as determined in test given in section LB of Part 3 of SABS 0120) shall not exceed 0.4;
- To be free from vegetation and other organic material to a standard acceptable to the Engineer;
 - Material types SW, SP, GW and GP under the USC Classification with 12% or less passing the No. 200 sieve (0.075 mm)
- Material types GM, GC, SM and SC under the USC Classification with more than 12% passing the No. 200 sieve (0.075 mm).

The use of A-3 and A-2-4 material (based on AASHTO classification) shall be subject to the Engineer's approval and it shall be compacted at Optimum Moisture Content (OMC) plus 2% or minus 1%. This material shall not be placed and worked in wet conditions nor be allowed to become saturated before it has been placed in position and compacted. If the material has dried out before it is covered, the top surface will break down during activities on the surface and the material shall then be reworked to achieve the specified density.

PSLB2 SELECTED FILL MATERIAL (Clause 3.2)

Replace the clause with the following:

Requirements for the selected fill blanket for flexible pipes (where applicable) are:

Plasticity Index (PI) less than 20;

Material does not contain vegetation or stones exceeding 50 mm in diameter.

In accordance with PSLB1 above, the selected fill blanket forms part of the bedding cradle and is not applicable for flexible pipes on this contract.

PSLB3 MAIN FILL

Main fill shall be well graded material with particles less than 200 mm in diameter with no organic material. All material above the selected fill blanket (drawing SABS LB-2), or bedding cradle where the selected fill blanket is not applicable, will be regarded as main fill and shall be compacted to at least 87% modified AASHTO maximum density.

PSLB4 SELECTION OF SUITABLE MATERIAL

The Contractor shall use the following sources for material for bedding and selected backfilling if it complies with the Specifications:

Separation of excavated material

The Contractor shall separate the suitable material from the unsuitable material during excavation.

Sieving / screening of excavated material.

Where provision is made for this item in the Bill of Quantities, the Contractor shall allow in the rate for sieving/screening of the excavated material for bedding and selected backfilling. The Contractor shall only use source b) if the material from source a) is not sufficient.

Commercial sources

The Contractor shall only use source c) if the material from sources a) and b) is not sufficient.

PSLB5 DETAILS OF BEDDING (Clause 5.1.2)

Rigid Pipes:

All clay and concrete pipes will be regarded as rigid and shall be laid on a class C bedding as shown on Drawing LB-1 of SANS 1200LB.

Flexible Pipes:

Steel, uPVC, mPVC, PVC-O, GRP, Ductile iron and polyethylene pipes (PE) will be regarded as flexible and shall be bedded as per Drawing LB-2 of SANS 1200 LB, as amended in the drawings.

PSLB6 CLASS A BEDDING (Sub-Clause 5.2.1)

Concrete to be used in class A bedding to pipes shall be of class 20/19.

PSLB7 CONCRETE CASING TO PIPES (Sub-Clause 5.4)

Concrete to be used in the casing of pipes shall be of class 20/19.

PSLB8 TOLERANCE ON COMPACTION OF BEDDING MATERIAL (Clause 6.1)

Degree of accuracy II shall prevail.

PSLB9 VOLUME OF BEDDING MATERIAL (Sub-Clause 8.1.3)

The volume computed for bedding material is net, excluding the volume of the pipe and based on trench width specified in SANS 1200 LB.

PSLB10 STONE BEDDING (Sub-Clause 8.2.6)

Add the following new sub-clause:

Stone bedding will be measured per cubic metre under the appropriate item in SABS 1200LB. Type A bedding (crushed stone wrapped in a geotextile blanket) shall be measured per linear metre along the centreline of the trench. The provision, operation and removal of a de-watering pump where authorised by the Engineer will be measured as dayworks under the appropriate item in Schedule 2.

PSLE STORMWATER DRAINAGE

PSLE1 SKEWED ENDS (Sub-Clause 3.1)

Skew ends shall be obtained from the manufacturer.

PSLE2 SOILCRETE LINING AND BACKFILL (New clause)

Soilcrete lining and backfill shall consist of an approved soil or gravel, 9% OPC in channel linings and 5% OPC in culvert backfill, calculated as a percentage of the dry mass of the soil used, a sand filler if required by the Engineer and a suitable volume of water, determined to ensure the correct slump and consistency. The exact mix proportions shall be determined in association with the Engineer after suitable trials. Soilcrete shall be mixed in a mechanical mixer and all constituents properly batched.

Cubes manufactured from the approved mix shall be crushed in an approved laboratory and a proof strength determined. This proof strength and the average deviation obtained on cubes manufactured from batches controlled by the Engineer will be used to establish the strength of soilcrete produced during construction of the Works.

The aggregate used for soilcrete shall be sandy material, but may contain particles of diameter up to 38 mm and shall have a PI of less than 10. Material containing detrimental amounts of silt or clay shall not be used for soilcrete. The aggregate shall be obtained from an approved source.

The soilcrete shall be placed and then thoroughly compacted by means of vibrators so that all voids are filled. Stones or other approved formwork shall be packed at culvert ends to prevent the soilcrete from flowing outside the required limits.

The height to which the backfill in soilcrete is done shall be determined by the Engineer or shown on the Drawings and any remaining backfilling shall be carried out with a granular material as specified.

Payment for soilcrete shall be made per m³. The volume will be calculated from the authorised plan dimensions of the excavations and the height of the backfilling in soilcrete. The volume occupied by the conduits or other structures will not be included in the quantities measured.

The rate shall cover the cost of constructing soilcrete backfilling or channel linings complete, including OPC.

Overhaul will not be paid on any cement, water, or aggregate used for soilcrete.

PSPLT FLOW METERS (Particular Specification PT)

Each flow meter supplied under this contract shall be equipped with separate mountable signal converter unit complete with sufficient length of signal cable. The signal converter shall be locally programmable and shall be supplied complete with programmer unit. The signal converter shall furthermore have an LCD display for instantaneous flow and totalize flow and shall have a 4-20mA and pulsed output for remote indications. The signal converter unit will be mounted in an outdoor type cubicle.

PSPPM PUMPS AND MOTORS (Particular Specification PT)

The tenderer is to supply a standard self-prime pump, powered by electricity, fulfilling the technical specification and complete in all respect with all required standard accessories and attachments. The pump must be of the latest design, adequately robust, with a high strength corrosion resistant material housing with easy access and large fill and drain plugs. The pump must have a good and dependable self-priming capacity. The pump/ engine combination must be matched correctly in terms of delivery pressure, flow, motor power and power required by the pump. The pump shall be powered by a corrosion resistant motor, with a net power output of not less than engineer's specification. The net power output of the motor shall match the required output of the pump. The cable connection shall be waterproof, properly insulated shall be at least 15 m long. The electrical cable connection to the pump shall be rated for continuous operation and have thermal overload protection incorporated in the windings for additional protection.

**REFURBISHMENT OF EERSTHOEK SEWER AND WATER BOOSTER PUMPS
BID NO: TBA**

C3.4: CONSTRUCTION

C3.4.4 Particular Specifications

C3.4.4 PARTICULAR SPECIFICATIONS

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PLK - MANUFACTURE AND SUPPLY OF VALVES

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PLK 1 SCOPE

This section of the Specification includes the manufacture, testing and supply of valves, pumps and motors for the conveyance of raw sewage at ambient temperatures in pipes.

PLK 2 STANDARDS

The most recent issues of the following standard specifications will apply for the purposes of this Specification.

SANS 144	:	Cast-iron single door non-return valves	
SANS 191	:	Cast steel gate valves	
SANS 192	:	Cast steel single door non-return valves	
SANS 664	:	Cast Iron Gate valves for waterworks	
SANS 665	:	Cast iron gate valves for general purposes	
BS 5155	:	Cast iron and carbon steel Butterfly valves	
ISO 2441	:	Pipeline flanges for general use - shapes and dimensions of	pressure
		tight surfaces	
SANS 1123	:	Steel pipe flanges	
SIS 05 5900	:	Pictorial surface preparation standard for painting steel surfaces	

PLK 3 MATERIALS

PLK 3.1 Sluice Valves

PLK 3.1.1 The valve body, bonnet, thrust dome, gate and glands shall be of cast iron or cast steel as specified and depending on the required test pressures.

PLK 3.1.2 The stuffing box shall be of ample depth to afford sufficient space for long period packing and the design shall be such as to allow the gland to be easily and conveniently repacked under pressure.

PLK 3.1.3 Body and gate sealing rings shall be of bronze, gunmetal or stainless steel. RSV gate shall be nitrile rubber covered and fully encapsulated. The rubber shall not be removed from the guides of the gate.

PLK 3.1.3 Spindles shall be of high grade stainless steel.

PLK 3.1.4 An isolating valve must be able to check the specified water pressure from both sides.

PLK 3.2 Butterfly Valves

PLK 3.2.1 Valve bodies and discs shall be of high-grade cast-iron or cast steel as specified and depending on the required test pressures.

PLK 3.2.2 The disc shaft or stub-shafts shall be of stainless steel located in self-lubricating bearings.

PLK 3.2.3 Sealing rings, seal retaining rings, body seat rings and associated screws shall be of stainless steel.

PLK 3.2.4 A butterfly valve must be able to check the specified water pressure from both sides.

PLK 3.3 Reflux Valves

PLK 3.3.1 Valve bodies shall be of cast iron or cast steel depending on the specification or test pressures.

PLK 3.3.2 Valve doors shall be of cast iron or cast steel.

PLK 3.3.3 The valve body and doors or disc shall be fitted with replaceable stainless steel body and door seat rings.

PLK 3.4 Air Valves

PLK 3.4.1 Function

Air valves are required to perform any combination of the following functions:

Uninterrupted high volume air discharge through a large orifice during pipe filling.
Uninterrupted high volume air intake through a large orifice during pipe emptying.
Discharge of pressurised air through a small orifice during normal operation.
Surge alleviation mechanism during rapid air discharge or rejoining of separated water columns.

PLK 3.4.2 Closing mechanism, construction and design

PLK 3.4.2.1 The air release and vacuum break valve shall be of a compact single chamber design with solid cylindrical High Density Polyethylene control floats. Floats of spherical design shall not be accepted. Any hollow float design will not be acceptable due to implosion and distortion making sealing difficult or impossible.

PLK 3.4.2.2 The ends of the cylinder shall be of fusion bonded epoxy powder coated mild steel, secured by means of stainless steel tie rods.

PLK 3.4.2.3 Floats shall be housed in a tubular stainless steel or corrosion protected body, secured by means of stainless steel fasteners.

PLK 3.4.2.4 The seats, spindles, guides, etc shall be of a suitable non-corroding metal with sufficient clearance and shall be designed to prevent abrasion of the ball or float when subjected to frequent operation.

PLK 3.4.2.5 The seats of the orifices shall not have sharp edges and shall be designed so as not to damage the ball or float when subjected to pressure.

PLK 3.4.2.6 The valve shall have an integral surge alleviation mechanism which shall operate automatically to limit transient pressure rise or shock induced by closure due to high velocity air discharge or the subsequent rejoining of separated water columns.

The limitation of pressure rise must be achieved by deceleration of approaching water prior to valve closure.

Relief mechanisms that act subsequent to valve closure cannot react in the low millisecond time span required and are therefore unacceptable.

The performance capability of an integral surge alleviation mechanism shall be substantiated through third party testing, conducted by a recognized authority.

PLK 3.4.2.7 Large orifice sealing shall be effected by the flat force of the control float seating against a nitrile rubber 'O' Ring housed in a dovetail groove circumferentially surrounding the large orifice.

Sealing in any other form shall not be accepted due to the vulcanizing of the float or the wedging of the float in the large orifice.

PLK 3.4.2.8 Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice on a natural rubber seal affixed to the control float.

Valves with slotted air release apertures shall not be considered.

PLK 3.4.2.9 The intake/discharge orifice area shall be equal to the nominal size of the valve i.e. a 200 mm valve shall have a 200 mm intake/discharge orifice.

Valves up to and including 200mm NB shall incorporate an over pressure safety feature that will fail without an explosive effect, such as is normally the case when highly compressed air is released

suddenly. This feature shall consist of easily replaceable components such as gaskets, seals or the like.

PLK 3.4.2.10 The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur by submission to 2 times the designed working pressure.

PLK 3.4.3 Testing

PLK 3.4.3.1 Manufacturers' published performance data must be substantiated by third party testing from a recognized test authority.

PLK 3.4.3.2 A high pressure strength and leak test whereby the valve is filled with water and pressurized to 2 times the rated working pressure which shall be held for a period of 2 minutes. Any leaking, weeping and sweating shall be a reason for rejection. These tests must be on total, completed units including floats.

PLK 3.4.3.3 Any imported valves shall be retested locally in all areas of specification.

PLK 3.4.4 Isolating valves for air valves

PLK 3.4.4.1 Each air valve shall be provided with a suitable double flanged resilient seal gate valve to isolate the air valve from the main.

PLK 3.4.4.2 The isolating valves shall be capable of operating in a horizontal position and shall be provided with a handwheel for operation and gearing is not required.

PLK 3.4.4.3 Each isolating valve shall be provided with a handwheel fitted to the spindle in an approved manner and shall have directional indication so cast into a recess on the upper surface of the rim that the top of the letter, arrows and rim are at the same level.

PLK 3.4.5 Drains

PLK 3.4.5.1 All air valves be provided with drain cocks so that the body of the valve can be drained when isolated from the pipeline. Cast steel gate valves shall be provided for this purpose.

PLK 3.4.6 Pressure gauge fitting

PLK 3.4.6.1 A 12-mm cast steel full bore gate valve shall be fitted to the spool piece between the isolating valve and the air valve flanges for attaching a pressure gauge.

PLK 3.5 Ring needle valves

PLK 3.5.1 The valve body shall be of spheroidal graphite iron or cast-steel with supporting feet. The body seat shall be of stainless steel and shall be replaceable or may be deposit welded on a removable body section.

PLK 3.5.2 For ring needle valves the piston (plunger) shall be of cast stainless steel with replaceable resilient seal to obtain drop tightness, held in place by a retaining ring of stainless steel and corrosion resistant screws.

PLK 3.5.3 For spherical ball valves, the eccentrically supported ball plug shall be of cast stainless steel or spheroidal graphite iron with replaceable resilient seal to obtain drop-tightness, held in place by a retaining ring of stainless steel and corrosion resistant screws. The valve body shall include an access door to permit adjustment or replacement of the valve seal without dismantling the valve.

PLK 3.6 Manufacture

PLK 3.6.1 General

PLK 3.6.1.1 The design pressure of the valves shall not be less than the pressure specified subject to a minimum of 1 000 kPa.

PLK 3.6.1.2 All valves shall be double-flanged with bolt holes drilled off-centre all in accordance with the requirements of SANS 1123 or as otherwise specified.

PLK 3.6.1.3 The Tenderer shall give as a function of the downstream pressure the maximum acceptable discharge of water through the valves without risks of vibration and cavitation. The Tenderer shall also submit the head-loss characteristics of the valves.

PLK 3.6.1.4 The design pressure will be hand stamped on the top edge of the flanges of valves in kPa.

PLK 3.6.1.5 If specified, valves shall be supplied with by-passes to be bolted on to the body of the valve and not to the adjoining pipework.

PLK 3.6.1.6 Valves shall be fitted with position indicators if specified. Fully closed, fully open and intermediate positions shall be indicated in corrosive proof and robust design indicators.

PLK 3.6.1.7 Arrows shall be cast on all handwheels together with the wording "OPEN" or "CLOSE". The closing direction shall be clockwise unless otherwise specified.

In the case of cap top valves, an aluminium disc of at least 100 mm diameter and with the same wording and arrows shall be slipped over the spindle and retained by the cap.

PLK 3.6.1.8 All valves shall be supplied complete including bolts, nuts, washers and gaskets in accordance with the class of valve. Bolts shall be of sufficient length to allow not more than three screw threads to protrude outside units after complete tightening of the assembly. Gaskets for flanged joints shall be of compressed asbestos fibre to BS 2815 Grade A and full faced with a minimum thickness of 3 mm for pressures up to and including 1 600 kPa cloth-inserted rubber may be used.

PLK 3.6.1.9 Where isolating valves are required to be equipped with extended off-set spindles, the spindles shall be equipped with sufficient universal joints to ensure satisfactory valve operation. All spindle extensions shall be secured to permanent structures with galvanised clamps to the Engineer's approval. The rate for such valve items shall include for any required clamps, extensions joint, etc.

Handwheels on such extended spindles shall be mounted on plain-ended spindle or handwheel pedestal as specified or indicated on the construction drawings.

Isolating valve operation:

Cap topCT	
Handwheel	HW
Electric actuator	EA
Pneumatic actuator	PA
Handwheel spindle extension	HSE
Plain ended spindle extension	PESE
Platform-mounted handwheel pedestal	PMP
Handwheel pedestal on wall support bracket	HPWB
Stub handwheel pedestal on wall support bracket	SHWB
Grid-mounted handwheel pedestal	GMP

PLK 3.6.1.10 The following information shall accompany the tender:

- Description
- Flange Drilling
- Maximum working pressure

- Maximum unbalanced pressure
- Test pressure
- Manufacturers number
- Material of components
- Gearing
- Accessories

PLK 3.6.2 Sluice Valves

PLK 3.6.2.1 Double-flanged, wedge-gate, internal (non-rising) spindle sluice valves of the waterworks pattern are required to comply fully with SANS 191 or SANS 664 where applicable.

PLK 3.6.2.2 Only full-way valves will be accepted (i.e. the gate must be clear of the waterway in the fully open position).

PLK 3.6.2.3 The maximum force required to turn the handwheel at the maximum torque shall not be greater than 100 N per hand at the handwheel run (Total effort = 200 N) when operating at an unbalanced pressure equal to the rated working pressure of the valve. This may be achieved with the aid of gearing of a suitable ratio.

Where gears are used replaceable shear pins shall be provided to prevent damage to the valve if excessive pressure is used.

PLK 3.6.3 Butterfly Valves

PLK 3.6.3.1 Horizontal spindle type butterfly valves complete with gearing, handwheels and flanged at both ends with separate bolting for joining to the adjacent pipework is required.

PLK 3.6.3.2 All butterfly valves shall be double eccentric / offset type.

PLK 3.6.3.3 Wafer valves or valves fitted with studs for attachment to the adjacent flanges are not permitted.

PLK 3.6.3.4 Valves shall be drop-tight when closed and metal to metal sealing is not acceptable.

PLK 3.6.3.5 All resilient seals shall be removable and readily replaceable on Site with the valve in position.

PLK 3.6.3.6 Resilient seals shall be retained by corrosion resistant securing elements to prevent corroding in position (e.g. bolts, set screws, etc.)

PLK 3.6.3.7 The valve-water seal shall be of the following types:

- a resilient seal fixed to the edge of the disc by corrosion resistant securing elements sealing on a stainless steel or bronze insert fixed in the body.
- a resilient seal fixed to the body of the valve by corrosion resistant securing elements sealing on a stainless steel or bronze insert fixed in the edge of the discs.

PLK 3.6.4 Reflux Valves

PLK 3.6.4.1 Reflux valves shall be double-flanged, SANS 1551.

PLK 3.6.4.2 Valve bodies and seals shall be free of pockets that will allow dirt accumulation and prevent the doors from closing fully.

PLK 3.6.4.3 Stops or an approved resilient material shall be fitted into the body to prevent the doors from fluttering under full flow conditions.

PLK 3.6.4.4 Valves shall be designed to allow for rapid but non-slamming closing characteristics.

PLK 3.6.5 Air Valves

PLK 3.6.5.1 Air valves shall be supplied with double-flanged, wedgegate internal (non-rising) spindle sluice valves for isolation, which unless otherwise specified shall conform in all respects to this specification.

PLK 3.6.6 Ring needle valves

PLK 3.6.6.1 Ring needle valves used as auto closing valves shall fulfil the following functions:

Electrical operation (isolating and control) suitable for opening and closing against the specified pressure and for continuous operation in any intermediate position.

Automatic as well as manual mode control.

Automatic reflux action for quick closure by means of drop-weight and hydraulic dash pot in case of power failure or motor protective tripping.

Adjustable closing time and adjustable closing characteristic.

PLK 3.6.6.2 The totally enclosed flanged-on gearbox shall include the following:

Either an electro-mechanical unit comprising:

- a totally enclosed brushless electromagnetic gear clutch for quick closing;
- a totally enclosed directly mounted electric valve actuator with integral electric controls and auxiliary handwheel for manual operation;

or an electro-hydraulic unit comprising:

- an oil hydraulic lift cylinder for opening the valve;
- a totally enclosed directly mounted electronic driven oil pump and oil reservoir. The oil pump and reservoir may be individually mounted on each valve or a centralised system may be employed to feed more than one valve and/or pipeline;
- a solenoid operated hydraulic control valve which shall be de-energised to initiate closure of the valve.

PLK 3.6.6.3 Either of the above actuators shall also be provided with:

- o limit switches for signalling the “open”, “closed” and intermediate “10%” positions and further control functions as required;
- o a directly mounted oil hydraulic dashpot with the necessary control valves for adjusting closing time and operating characteristic;
- o means to operate the valve manually;
- o valve shaft (stub shafts) of high tensile stainless steel located in bushes of zinc-free bronze;
- o a drop weight lever arm of steel with adjustable cast iron drop weight. The lever arm shall be keyed or splined to the shaft.

PLK 3.6.6.4 The overhang shaft carrying the drop weight lever arm shall be supported at its bearing housing from the foundation block.

PLK 3.6.6.5 Travel of the drop weight shall be restrained for reasons of safety at either end of the lever arm.

PLK 3.6.6.6 The control valves shall be arranged for selection of either manual-electric or automatic-electric operation controlled from the pump control console. Push buttons “open”, “close” and “stop” for piloting these valves, when throttling is required, shall be incorporated in each pump control console, as well as indicator lamps showing “closed” (green) “intermediate” (amber) “open” (red) positions. In addition, a selector switch “manual/automatic” shall be incorporated, the automatic position being in conjunction with pump starting. A further “test” selector switch shall be mounted inside the panel to permit manual-electric testing of the equipment without running the pumpset.

PLK 3.6.6.7 In the “automatic” mode the valve shall open automatically from the fully closed to fully open position when the pumpset is started, likewise closing automatically, when the pumpset is to be shut

down. In the "manual" mode the valve shall open automatically to at least the "10% open" intermediate position, whereafter manual selection of the valve position shall be enabled.

Each valve shall be interlocked with the pump starter. When the pump is to be stopped, the valve shall close slowly to prevent water hammer either by means of the electric actuator or by releasing hydraulic pressure in the lift cylinder by means of control valves before the pumpset is tripped and stopped by interlocked relays.

Similarly, the valve shall be arranged so that the pump can be started only when the valve is fully closed. The valve shall open only when the starting operation is completed and the motor is up to speed.

PLK 3.6.6.8 The control valves shall have automatic reflux action features to close by drop-weight, controlled by an oil hydraulic dashpot, in the event of power failure or motor protective tripping. The drop-weight shall be released by a solenoid operated clutch or a valve which is constantly energised during pumping operations. Closing time and characteristics shall be adjustable to minimise water hammer.

PLK 3.6.6.9 It shall be possible to energise the "manual" mode only when:

- the associated pump is running.
- the valve is at least 10% open as indicated by the "intermediate" lamp.
- the valve is in the "test" mode

Selection of the "manual" mode shall not affect the automatic reflux action.

When the opening of the valve has been set manually, the valve shall maintain this position in the absence of any further action.

PLK 3.6.6.10 "Test" mode: With both isolating valves closed and electrically interlocked, a test facility shall be provided to enable the maintenance personnel to manually operate the valve without the pumpset running by selection from inside the pump control console.

PLK 3.6.6.11 Valves shall be designed to operate free of cavitation in intermediate positions.

PLK 3.6.7 Electric Actuators

PLK 3.6.7.1 When specified, in the Project Specification the valves shall be fitted with electric, motor-driven flood-proof IP 68 actuators of robust design, capable of closing the valves under all unbalanced pressures.

PLK 3.6.7.2 The Tenderer shall state the maximum torque required to operate the valve in his Tender. In determining this maximum torque an allowance shall be made for any deterioration that could be expected to occur in the bearings during the life of the valve. The actuator shall be capable of transmitting twice this maximum torque without any of its components suffering permanent damage. This shall be proven to the Engineer's satisfaction by workshop tests.

PLK 3.6.7.3 The actuators shall be capable of restraining the valve in any position under all possible conditions of operation, and shall not, in any circumstances, be capable of becoming self-motorised as a result of the dynamic torque loading on the disc or plunger.

PLK 3.6.7.4 All gearing shall be manufactured in accordance with BS 436 Class C and shall be machine cut. All components requiring lubrication shall be adequately lubricated and totally enclosed flood-proof casing fabricated in cast iron and/or die cast aluminium to suit the service weather proof casing whether the valve is to be installed in the open or under cover. Actuators shall also be fitted with mechanical stops to prevent excessive turning and shall be provided with replaceable shear pins.

PLK 3.6.7.5 Handwheels shall be fitted to all actuators. The direction of rotation to close the valve shall be clockwise when viewed from above the end of the input shaft and from the position of operation. In addition, they shall be clearly and indelibly marked with an arrow showing the direction of closing and the words "Close" and "Toe".

PLK 3.6.7.6 Whether the valve is actuator driven or manually operated, the maximum force required to turn the handwheel at the maximum torque defined above shall not be greater than 100 N per hand at the handwheel rim. (Total effort = 200 N.) For large valves the minimum of complete revolutions of the handwheel to move the valve gate from fully open to fully closed shall not be less than 100.

PLK 3.6.7.7 All electric actuators shall be provided with reversing contactors: local and remote control shall be provided; a device making the local control non-operative shall also be provided on the relevant remote control panel.

PLK 3.6.7.8 After factory tests, the actuators shall be removed from the valve and delivered to Site in separate boxes to safeguard against damage.

PLK 3.6.8 Protection

All materials and workmanship to comply with relevant SANS Specifications.

PLK 3.6.8.1 Internal Protection

Internal surfaces of valve bodies and discs shall be grit blasted to a Sa 2½ of SIS 05 50 00 finish. Successive coats of an approved non-toxic epoxy resin paint suitable for spray application (Cupon EP 2300 or similar) shall then be applied to give a final dry film thickness of 250 µm. Drying times between successive layers shall be strictly in accordance with the requirements of the paint manufacturer.

As an alternative to the protection as specified above, the Contractor may be required to use either a solventless epoxy paint system or a fusion bonded epoxy powder coating as specified in the Project Specification.

PLK 3.6.8.2 External Protection

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

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

PLK 3.7 Tolerances

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

PLK 4 TESTING AND INSPECTION

PLK 4.1 Testing by Manufacturer

The Manufacturer shall carry out all tests to ensure that valve materials conform to the requirements of the relevant SABS or BS Specification. These tests will not necessarily be attended by the Engineer but records must be kept and all test results shall be made available to the Engineer.

PLK 4.2 Testing by Independent Body

The Engineer may appoint an independent recognised body to conduct control tests. Samples required for such tests will be provided by the Manufacturer free of charge and sampling will be done by this body in accordance with the relevant SANS or BS Specification.

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

PLK 4.3 Inspection

PLK 4.3.1 Visual, operational and dimensional inspection of valves as well as inspection of protective coatings will be carried out by the Engineer and/or the Manufacturer in the Manufacturers workshops prior to the despatch of valves to site.

PLK 4.3.2 Inspection by the Engineer shall in no way relieve the Manufacturer of any of his obligations to design, manufacture and supply valves strictly in accordance with the Specification.

PLK 4.4 Hydrostatic Testing

PLK 4.4.1 All hydrostatic tests will be witnessed by the Engineer and the Manufacturer will give at least one week prior notification to the Engineer of the proposed dates for such tests.

PLK 4.4.2 Valve bodies will be close end tested to at least 1,5 times the working pressure. Test pressures will be maintained for at least 5 minutes and valve bodies will be water tight in all respects at the test pressure.

PLK 4.4.3 Assembled valves will be open-end tested to 1,5 x working pressure for materials strength and soundness. Valves will be drop tight from both directions over the complete range of pressures from 0 to 1,5 x working pressure.

PLK 4.4.4 Each valve will be supplied with a test certificate certifying that it complies in all respects with the requirements of this Specification.

PLK 5 MEASUREMENT AND PAYMENT

PLK 5.1 General

Tendered prices shall include for the following unless otherwise specified in the Project Specification.

- Protective coatings as specified.
- Couplings and/or jointing material for each type of valve.
- Packing and temporary protection against damage during transport and delivery.
- Temporary storage and maintenance if required.
- Delivery and storage of material on site or in a store as specified.
- Testing and inspections at Manufacturer's works.

PLK 5.2 Valves will be measured per unit of each type

PLN - MANUFACTURE, SUPPLY AND TESTING OF STEEL PIPES

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PLN 1 SCOPE

This specification covers the manufacture and supply of bare, electric welded low carbon steel pipes and steel pipe special items for the conveyance of water at ambient temperatures and at medium pressures.

PLN 2 STANDARDS

Pipes and specials shall be manufactured, tested and inspected in accordance with the latest issues of the following standard specifications unless amended in subsequent clauses in this specification.

Welded pipes larger than 150mm:

- SANS 719: Steel Grades A, B and C
- SABS 1431: Steel Grades 300 WA, 350 WA
- API 5L: Steel Grades, X42, X46, X52, X56 and X60
- EN 10025-2: Steel Grade S355JR + AR (where specified for specials)

Welded specials and fittings smaller than or equal to 150mm:

SANS 62 (Heavy Class) up to 50 bar design pressure

Seamless Pipes:

ASTM A106 – Schedule 40(40 bar) or 80(80 bar) as determined by the design pressure.

Seamless specials and fittings:

ANSI B16.5 & B16.9 – Schedule as determined by the design pressure

Qualifications of Welders

All manual or semi-automatic welds and repair welds shall only be undertaken by welders qualified under the tests laid down in accordance with API 1104.

Non-destructive Tests and Adjudication

Radiographic inspection: API 1104

Ultrasonic inspection: API 5L

In this Specification reference is made to the latest issues of the following specifications:

- SANS 719
- API 5L
- API 1104
- ASME Section V
- BS 2971
- BS 2633

PLN 3 PROCESS OF MANUFACTURE FOR PIPES

PLN 3.1 Welding process

Pipes shall be manufactured by an approved semi-automatic submerged-arc welding process or shall be electric resistance welded. Where semi-automatic submerged-arc welding is employed, at least one pass shall be made on the inside and at least one pass on the outside. The number of longitudinal weld seams shall not exceed:

- one seam for pipes up to 1 000mm nominal diameter
- two seams for pipes larger than 1 000mm and up to 2 000mm nominal diameter

Circumferential welds by semi-automatic submerged-arch welding method for factory double jointed pipes shall have at least one pass on the inside and at least one pass on the outside.

PLN 3.2 Welds

SANS 719, BS 2971 and BS 2633 shall generally apply.

- For fusion welded pipes and specials, the internal weld bead shall not protrude more than 1,0 mm into the bore of the pipe or special.
- For electric resistance welded pipes, the height of upset metal and flash on the inner surface shall not exceed 2,0mm.
- For pipes to be joined by butt welding, the internal weld bead shall be ground flush with the pipe body for a length of 200mm from ends to be jointed.
- For pipes to be coupled by flexible couplings, external weld reinforcement or upset metal and flash shall be ground flush with the pipe body for a length of 200mm from the end to be coupled.

PLN 4 DIMENSIONAL REQUIREMENTS

PLN 4.1 Pipes

All dimensions shall be in accordance with SANS 719 clause 5.1 (or other relevant clause numbers in later versions) except for the following amendment to clause 5.1.3:

The wall thickness of pipe shall, subject to a tolerance of +10% or -0%, be one of the relevant values given in columns 3 to 6 of table 2, unless otherwise specified by the purchaser.

PLN 4.2 Specials

The tolerances on specials will be in accordance with BS 534, Section 4.

Unless shown otherwise, branch and manifold sections of Tees to have a common centre line and of scour tees to have a common invert line.

All dimensions on layout drawings or item details are outer face to outer face, i.e. overall.

Position dimensions for puddle flanges and restraining flange refers to centre of flanges.

PLN 5 TESTING AND INSPECTION AT MANUFACTURER'S WORKS AND AT SITE

PLN 5.1 General

Factory and site testing and inspections (quality assurance), supervision of tests and reviewing of test records shall be carried out by the Contractor.

Unless otherwise specified in the contract documents, the Contractor shall appoint an independent inspectorate ("Inspectorate") and shall be responsible for the Inspectorate's and all associated costs. The name of the Inspectorate to be submitted for the Employer /Engineer's approval. The Inspectorate will be responsible for the monitoring, witnessing and reviewing of the quality assurance plans, testing, inspections and records on behalf of the Employer / Engineer. The service provided by the Inspectorate shall not replace the duties and responsibilities of the Contractor in terms of the Contract.

All tests and inspections at the factory and on site shall be at the expense of the Contractor who shall provide all necessary testing facilities, labour, instruments, equipment and samples that will be required by the Contractor and the Inspectorate, to verify that the material complies with the Specifications. The testing facilities, instruments and equipment shall comply with the requirements of the Inspectorate. The Inspectorate shall be afforded every facility and opportunity during the manufacturing and testing to enable the inspection to be carried out effectively.

All test samples shall be selected by the appointed Inspectorate and all instruments used for testing purposes shall be approved by the Inspectorate and if in the opinion of the Inspectorate any instrument should require calibration, such instruments shall be calibrated at the expense of the Contractor by the SABS or such other body as may be approved by the Inspectorate.

No mechanical working or straining of pipes and specials shall be allowed after testing and inspection.

PLN 5.2 Visual Inspection

All finished pipes and specials shall be visually examined and shall be free of injurious defects as defined in API 5L Section 10.2.7. In addition, welds on specials shall be inspected by the application of a penetrant-dye on the inside of the welds and no trace of the dye should appear on the outside of the pipe after completion of the test.

PLN 5.3 Non-destructive Inspection

PLN 5.3.1 Ultrasonic Inspection

The Engineers approval of a detailed method statement is required for the use of this test method prior to the start of production. When this method is used 100% of all longitudinal or spiral welds on straight pipes shall be checked with an approved ultrasonic method capable of continuous and uninterrupted inspection of the weld seam in accordance with API 5L, Annexure E5. The equipment shall be checked with an applicable reference standard at least twice every production shift.

PLN 5.3.2 Radiographic Inspection to API 1104

Radiographic testing of welds are regarded as industry norm and shall be used unless approved otherwise by the Engineer. Test records are required to be saved in digital format. It is a requirement that 100% of longitudinal, circumferential, spiral welds and scalp welds shall be subject to radiographic inspection in accordance with API 1104, Section 9.3.

Radiographic inspection of pipes shall be as follows:

Longitudinal Welded Pipe

Submerged-arc fusion welded pipe, if inspected full length by ultrasonic methods, shall also be inspected by radiographic methods for a distance of 200 mm from each end of each length of pipe. Electric resistance welded pipes shall, however, only be inspected full length by ultra-sonic methods.

Spiral Welded Pipe

Submerged-arc fusion welded pipe, if also inspected full length by ultrasonic methods, shall also be inspected by radiographic methods for a distance of 100 mm from each end of each length of pipe and of the complete "H" at all skelp end welds including 150 mm of the spiral welds in both directions away from the intersection points with the skelp end welds.

Circumferential Butt Welds

100 percent of the length of circumferential butt welds shall be examined radiographic methods unless consistently acceptable results are obtained. Then the number of welds to be tested may be reduced by the Engineer.

Specials

100 percent of the length of all manual or semi-automatic welds in specials shall be examined radiographically (where possible) and all other welds by liquid penetrant testing unless consistently acceptable results are obtained. Then the number of welds to be tested may be reduced by the Engineer.

Where specials cannot be hydrostatically tested, all welds shall be liquid penetrate tested as per ASME Section V.

Repairs

For straight pipes 100 percent of the total length of all repairs shall be examined radiographically unless repairs are done prior to ultrasonic inspection and such repairs pass ultrasonic inspection. Then no radiographic inspection of same is required.

For pipe specials, 100% of all repairs shall be examined radiographically (where possible) and all other weld by liquid penetrant testing.

Pipes for rail, road and river crossings shall be examined radiographically 100 percent of the total length of all welds.

PLN 5.3.3 Liquid Penetrant Testing

All fillet welds and other welds where requested by the Engineer, shall be liquid penetrant tested in accordance with sub-clause 7.2.1 of SANS 1200 L, clause 9.5 API 1104, ISO 10893-4 and ASTM E165.

PLN 5.3.4 Magnetic Particle Testing

Where requested by the Engineer, magnetic particle testing shall be done in accordance with ASME Boiler and Pressure Vessel Code, Section V, Article 7.

PLN 5.4 Hydrostatic Testing

Each individual straight pipe shall be subjected to a hydrostatic test in accordance with the methods described in API 5L. Test pressures shall be such as to produce tensile fibre stresses in the pipe wall of 90% of the minimum specified yield strength of the steel or shall be 9 MPa whichever is the lesser. Leaks or sweats shall be considered injurious defects.

Should it not be possible to hydrostatically test straight piping and/or specials, the liquid penetrant test as per ASME Section V shall be done on all welds over and above the non-destructive tests specified above. This shall only be applicable with the prior written approval of the Engineer.

PLN 5.5 Repair of Injurious Defects

Injurious defects found by non-destructive testing of welds, visual examination, hydrostatic testing or determined by any other means to exceed the limitations in API 5L Section 10, shall be repaired in accordance with API 5L Annexure D but subject always to the requirements of this specification.

PLN 5.6 Destructive Testing

PLN 5.6.1 Type of tests

The following destructive tests shall be performed in accordance with SANS 719 clause 6.2 on the first pipe and thereafter on one pipe of every 500 subsequent pipes.

- a) Transverse Tensile Test
- b) Root Bent Test (Electric Fusion Welds)
- c) Flattening Test (Electric Resistance Welds)

PLN 5.6.2 Sampling for Destructive Tests

The following samples shall be selected for destructive testing:

First Sample

A section long enough to provide all the test specimens and material shall be cut from the selected pipe.

Second Sample

If the test specimens and material from the first selected pipe fail to pass any of the tests, a section long enough to provide the appropriate specimens for the tests failed by the first sample shall be cut from two further pipes.

Third Sample

If the test specimen from the second sample fails to pass the test(s) a similar section shall be cut from each of a further ten pipes.

Compliance

The piping shall be considered as complying with the specification if after testing of the first or the second or the third sample no defect is found.

PLN 6 FLANGES

Flanges shall be designed and manufactured to BS EN 1092 Part 1 for steel flanges and Part 2 for cast iron flanges, unless otherwise specified on the drawings. Flanges not covered by BS EN 1092 shall be manufactured according to NWS 1676 Revision 0 dated May 1981. Unless otherwise indicated on the drawings or specified in the Bill of Quantities, flanges shall be of forged Grade 300WA steel or ASTM A105.

Sealing faces shall be machined flat to a tool-mark of 0.8 mm to 1.25 mm pitch spiral or concentric serrations and back of flanges to be either machined or spot-faced around holes with sufficient clearance to ensure proper seating of bolt heads and nuts. All bolt holes shall be drilled perpendicular to the flange face. Bolt holes shall be positioned off-centre and symmetrically off-set from the vertical centre lines of the flange and flanges shall be installed truly square to the axis of the pipe. The Contractor shall check the compatibility of drilling of all flanges to be connected together.

Flange thicknesses and bolt sizes shall conform to the appropriate table of BS EN 1092 or NWS 1676 Revision 0 dated May 1981 for flanges not covered by BS EN 1092. The Contractor shall satisfy himself that the flanges in his supply shall match the flanges supplied by others or at interfaces between Subcontractors, if any. The Contractor shall ensure that the drilling patterns of pipe specials to be installed on both sides of valves and flow meters will match that of the appropriate supplied valve and flow meter.

All flanges designed for pressure ratings up to and including 1600 kPa, shall be flat faced with full face gaskets. Flanges designed for pressure rating exceeding 1600 kPa shall be raised face flanges supplied with ring gaskets. Flanges with pressure ratings of 6400 kPa and higher and flange sizes of 2500 mm diameter and larger, irrespective of pressure rating, shall incorporate an "O" ring groove. Details of the "O" ring groove shall be furnished by the Contractor for consideration by the Engineer.

All gaskets supplied under this Contract shall be of tanged graphite full face for flat joint faces and aramid and glass fibre with nitrile rubber binder to BS 7531 ring face for raised faces. Gaskets shall be suitable for the specified pressures with a minimum thickness of 3 mm and purpose made to the dimensions of the matching flanges. Joints in gaskets shall be kept to the minimum. Where not avoidable, joints shall be a tight fitting dovetail design.

Corrosion protection for the area not clamped shall be similar in all respects to that applied externally to the pipework/valve/pump.

All mill scale on flanges shall be removed by abrasive blasting before flanges are fitted and welded to pipes and fittings.

All flanges shall be supplied complete with bolts, nuts, washers and gaskets. Rubber joint rings shall comply with SANS 4633.

Puddle flanges shall not be drilled.

Some flexible couplings to be restrained by means of a restraining flange. Unless specified on the Drawings, the diameter, number and length of the long restraining bolts as well as any possible pipe wall thickening shall be designed by the Contractor with the assistance with the manufacturer. The effect of cyclic loading and fatigue must also be taken into consideration. The seal retaining flange on the flexible coupling may be factory machine scalloped to accommodate the long bolts. All the necessary nuts, washers, etc. for the restraining bolts must be provided by the Contractor.

Restraining flanges need not have all the bolt holes specified in the applicable flange drilling table. Only those required for the long restraining bolts need to be provided. These holes must comply with the applicable flange drilling table and be spaced equally on the flange PCD and symmetrically around the flange centre lines.

Restraining bolts to be positioned so as to not interfere with any stubs specified for an item.

Blank (Blind) flanges for pipes equal to or greater than 400 dia to be provided with two suitable lifting handles with coating similar to the blank flange.

PLN 7 FLEXIBLE COUPLINGS AND FLANGE ADAPTORS

Flexible couplings and flange adaptors shall be the Viking Johnson or Klamflex type or similar approved by the Engineer. Straub, Arpol or similar clamp on couplings are not acceptable.

Manufacturer of straight and stepped couplings (SR-C & ST-C) as well as flange adaptors (FA) to be approved by the Engineer. Couplings must be able to withstand hydrostatic test pressures of 1.5 times the specified design pressures and coupling flanges must be designed to withstand all stresses due to tightening of the bolts.

Rubber rings shall generally comply with SABS 974 Class F.

Flexible couplings shall be supplied complete with all necessary bolts, nuts and rubber jointing rings.

Coupling installation gaps to comply with supplier's specification.

Applicable to all flange adaptors:

- Studs may not be welded onto flange.
- Flange to be drilled and tapped for threaded studs where applicable.
- Drilling to suit connecting flange.

PLN 8 BOLTS, THREADED RODS, STUDS, NUTS AND WASHERS

The following specification is applicable:

- The threads of all bolts, nuts and studs shall be in accordance with SANS 1700-7-3, 1700-7-5, 1700-14-3, 1700-14-4 (in part);
- No brass bolt or stud shall have a diameter of less than 6mm;
- Two washers shall be installed underneath each bolt and nut;
- Each bolt shall protrude by at least three threads but not more than five threads through the nut with all washers in position and all bolts at a flange must be of equal length;
- The Contractor shall supply to the Employer any special tool required for any nut, bolt, screw or other fastener used in a position which is not accessible using conventional tools. This also applies where the size or shape of the fastener is not conventional.

- Bolts, threaded rods, studs, nuts and washers shall be hot dipped galvanised to SANS 763 or ISO 1461 and shall be coated with molybdenum disulphide lubricant after installation.
- Bolts, shall comply with SANS 1700 Grade 8.8.

Stainless steel threads shall be treated with nickel base anti-seize corrosion protection compound.

PLN 9 THERMIT WELDING PADS

Where pipes and specials are to be joined by means of flexible couplings and will be subjected to cathodic protection, the manufacturer shall weld steel plates not less than 50 x 75 x 10 mm thick 250 mm from each end of all pipes during the pipe manufacturing process (i.e. before lining and coating) to provide adequate area for thermit welding pad bonding cables to the piping to make it electrically continuous and enable a cathodic protection system to be applied without damage to the coating.

PLN 10 MARKING OF PIPES

All pipes and specials shall be clearly hand stamped alongside a longitudinal or spiral weld on one end of the pipe with the following.

- a) Grade and thickness of steel
- b) Serial number of the pipe or specials
- c) Outside diameter
- d) Factory hydraulic test pressure in kPa

PLN 11 UV PROTECTION OF COATINGS

All pipes with MDPE, 3LPE or Bituguard coatings shall be painted with a white polypropylene overcoat [to be approved by the Engineer] for protection against UV. The overcoat to be maintained by applying additional layers until the pipe is backfilled.

PLN 12 HANDLING, DELIVERY AND STORING OF PIPES AND SPECIALS

The contractor shall ensure that pipes and specials including coating and lining are not damaged.

Coated pipes and fittings shall be handled with the use of padded slings of width sufficient to prevent damage to the coating. Chain slings, hooks, wire ropes, rope slings without canvas covers, composition belt slings with protruding rivets and any other equipment with a possibility to damage the coating shall not be used. Slings shall be suitably rated for the loads to be handled and in good condition. Deteriorated slings shall not be used.

All pipes are to be handled with the aid of a "spreader" lifting beam. The dragging or skidding of pipes and specials in contact with the ground shall not be permitted.

Pipes shall be stacked with a minimum clearance of 100 mm between adjacent pipe walls and a minimum of 200mm clear of the ground. Pipes shall be stored on sand bags with sufficient supports to prevent permanent longitudinal deflections. Sandbags are required at least at one third of a single pipe length from each pipe end. The sand bags shall be at least 500 mm wide for pipes with Bituguard coating.

Pipes shall also be stacked in a manner that limits loading on lower layers of pipes. Any pipe showing permanent ovality as a result of surcharge loading will be rejected.

All pipe deliveries shall be accompanied by delivery notes which will be checked by the Engineer on-site. The Engineer reserves the right to not accept and reject pipe deliveries where there are discrepancies.

PLQ - CORROSION PROTECTION OF STEEL PIPES AND FITTINGS

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PLQ 15 UV PROTECTION		C3.4.4-
	Error! Bookmark not defined.	
PLQ 16 ADDITIONAL EXTERNAL PROTECTION FOR PIPES CAST INTO CHAMBER WALLS		C3.4.4-
	Error! Bookmark not defined.	
PLQ 17 JOINT BETWEEN EPOXY LINING AND CEMENT MORTAR LINING		C3.4.4-
	Error! Bookmark not defined.	
PLQ 18 MEASUREMENT AND PAYMENT		C3.4.4-
	Error! Bookmark not defined.	

PLQ 1 SCOPE

This specification covers various corrosion protection systems for cast iron, steel and stainless steel pipes and fittings for the conveyance of water at ambient temperatures.

PLQ 2 CORROSION PROTECTION SYSTEMS

PLQ 2.1 Standards and codes

The following standards and codes form part of this specification. Unless otherwise specified herein, the latest edition shall apply.

ASTM–American Society for Testing and Materials

ASTM D2240	Standard test method for rubber property (Durometer Hardness)
ASTM D4541	Standard test method for pull-off strength of coatings using portable adhesion testers
ASTM G14	Standard test method for impact resistance of pipeline coatings (falling weight test)
ASTM D4285	Standard test method for indicating oil or water in compressed air
ASTM G62	Standard test methods for holiday detection in pipeline coatings

BS EN–British Standard European Norm

BS EN 10289	Steel tubes and fittings for onshore and offshore pipelines. External liquid applied epoxy and epoxy-modified coatings
BS EN 10290	Steel tubes and fittings for onshore and offshore pipelines - External liquid applied polyurethane and polyurethane-modified coatings
BS EN 12068	Cathodic protection - External organic coatings for the corrosion protection of buried or immersed steel pipelines used in conjunction with cathodic protection - Tapes and shrinkable materials
BS EN 13000	Steel tubes and fittings for onshore and offshore pipelines. Bitumen hot applied materials for external coating

ISO–International Organization for Standardization

ISO 1514	Paints and varnishes – Standard panels for testing
ISO 2808	Paints and varnishes – Determination of film thickness
ISO 4624	Paints and varnishes – Pull off test for adhesion
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 uncoated steel substrates and of steel substrates after overall removal of previous coatings
ISO 8502	Preparation of steel substrates before application of paints and related products - Tests for the assessment of surface cleanliness
ISO 8503	Preparation of steel substrates before application of paints and related products - Surface roughness characteristics of blast-cleaned steel substrates Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces. Part 2: Method of grading of surface profile of abrasive blast-cleaned steel-comparator procedure. Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile - stylus instrument procedure. Part 5: Replica tape method for the determination of surface profile.
ISO 8504-2	Preparation of steel substrates before application of paints and related products - Surface preparation methods - part 2: Abrasive blast cleaning
ISO 11124-1	Preparation of steel substrates before application of paints and related products - Specifications for metallic blast cleaning abrasives - Part 1: General introduction and classification Part 2: Chilled iron grit

ISO 12944-5	Part 3: High-carbon cast-steel shot and grit Part 4: Low-carbon cast-steel shot Paints and varnishes — Corrosion protection of steel structures by protective paint systems - part 5: Protective paint systems
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NACE - National Association of Corrosion Engineers

NACE RP0274	High-Voltage electrical inspection of pipeline coatings prior to installation
NACE RP0287	Field measurement of surface profile of abrasive blast cleaned steel surfaces using a replica tape
NACE SP0394	Application, performance, and quality control of. plant-applied, fusion-bonded epoxy external pipe

SSPC–Steel Structures Painting Council

SSPC SP11	Power tool cleaning to bare metal
SSPC PA 2	Measurement of dry coating thickness with magnetic gauges (Steel Structures Painting Manual, Ch 5 - Paint Application Specs.)
SSPC SP1	Solvent cleaning

South African Bureau of Standards

SANS 241	Specifications for drinking water
SANS 1160:2011	Drinking water system components - Health effects
SANS 1217	Internal and external organic coating protection for buried steel pipelines

PLQ 2.2 Standard corrosion protection systems

The following corrosion protection systems shall apply unless otherwise specified on the drawings, project specifications and schedule of quantities.

PLQ 2.2.1 Buried steel pipework

Pipe diameter up to 150mm

Pipework shall be hot-dipped galvanized unless otherwise specified.

After installation, the pipework shall be protected with a BS EN 12068 Class A Petrolatum tape system as specified. Denso's Cling wrap, 5mm thick Densotherm HD and similar products approved by the Engineer are also acceptable.

Pipe diameter larger than 150mm

Specials, fittings and couplings shall be lined and coated with epoxy paint unless specified otherwise for a specific project.

After installation the specials and fittings shall be protected with the BS EN 12068 Class C HT50°C tape wrapping system or BS EN 12068 Class B HT50°C (5mm minimum thickness) as specified. Denso's Cling wrap, 5mm thick Densotherm HD and similar products approved by the Engineer are also acceptable.

Standard pipe lengths shall be lined with epoxy paint or cement mortar and coated with fusion bonded medium density polyethylene (MDPE) or Polymer Modified Bitumen or 3LPE or Rigid Polyurethane as specified in this specification, unless otherwise specified in the Project Specifications or the Bill of Quantities or on the Drawings.

PLQ 2.2.2 Pipework inside chambers

Pipe diameter up to 150mm

Pipework shall be hot-dipped galvanized.

The outside end of fittings cast into the walls of the chamber as well as flanges and couplings outside the chamber shall be protected with a Denso Clingwrap protection system.

After installation and where specified the pipe shall be painted with re-coat able polyurethane to the Employer's colour coding specification. All systems to comply with ISO 12944-4 and 12944-5.

Pipe diameter larger than 150mm

Fittings, specials and couplings shall be coated and lined with epoxy paint.

The outside end of the fitting cast into the wall as well as flanges and couplings outside the chamber shall be protected with a Denso Clingwrap protection system.

After installation and where specified the pipe shall be painted with re-coat able polyurethane to the Employer's colour coding specification. All systems to comply with ISO 12944-4 and 12944-5.

PLQ 2.2.3 Pipework exposed to sunlight

Pipe diameter up to 150mm

Pipework shall be hot-dipped galvanized.

Pipe surface shall be prepared for re-coat able silver polyurethane acrylic site application as per ISO 12944-4.

After installation the pipe shall be painted with re-coat able silver polyurethane acrylic as per ISO 12944-5

Pipe diameter larger than 150mm

Pipework shall be lined with epoxy paint.

Pipes shall be coated in the factory with two component inorganic zinc silicate primer (75 micron) plus one coat of silver polyurethane acrylic (60 micron).

A second coat of polyurethane acrylic (60 micron) must be applied on site. The inorganic zinc silicate must be repaired with "single pack zinc rich epoxy primer".

PLQ 2.2.4 Exposed pipework inside buildings

Pipe diameter up to 150mm

Pipework shall be hot-dipped galvanized.

Pipe surface shall be prepared for re-coat able polyurethane site application.

After installation the pipe shall be painted with re-coat able polyurethane to the Employers colour coding specification. All systems to comply with ISO 12944-4 and 12944-5.

Pipe with diameter larger than 150mm

Pipes, fittings and couplings shall be lined and coated with epoxy paints.

After installation the pipework shall be painted with re-coat able polyurethane to the Employers colour coding specification. All systems to comply with ISO 12944-4 and 12944-5.

PLQ 2.2.5 Pipework inside water retaining structures

All pipework (including stainless steel) inside water retaining structures and cast into the walls or floor of water retaining structures shall be lined and coated with epoxy paint.

All stainless steel shall be grade 316L.

PLQ 3 SURFACE PREPARATION

Contractors must submit information on the cleaning methods to be used to comply with the specified requirements.

PLQ 3.1 Surface preparation of steel surfaces

All projections, sharp edges, layers that have formed and tool marks must be removed from the surface so that the surface is smooth, and it must be abrasive blast cleaned in accordance with section 5.3 of SANS 10064:2011 so that it meets the following requirements:

A grade of cleanliness of Sa 3 of ISO 8501-1.

A surface profile between 60 micron and 85 micron when tested in accordance with SANS 5772.

Dust and debris shall not exceed 0,2% when tested in accordance with SANS 8502-3:2008.

The profile produced shall be angular and shall be in accordance with the requirements of the material product data sheet when tested in accordance with SANS 5772 (profile gauge) or SANS 8503-5 (replica tape)

Water soluble salts shall not exceed 100mg/m² when tested in accordance with the Weber Reilly Method. Lower values may be required for certain applications.

Any laminations revealed by blast cleaning shall be ground out and re-blast cleaned to meet the requirements above.

PLQ 3.2 Surface preparation of galvanized surfaces

Surfaces to be coated shall not be passivated.

Galvanized steel surfaces shall be degreased prior to coating, using either a water soluble solvent degreaser in accordance with SANS 1344 and the manufacturer's instructions, or a mild acid-detergent degreasing solution to be approved by the Engineer.

Large areas shall be prepared by sweep-blasting with non-metallic abrasive. Cracking, flaking or any form of de-lamination of the zinc coating due to excessive blast-cleaning shall not be permitted. Removal of zinc by blast-cleaning shall not exceed 10 µm.

Surfaces that cannot be sweep-blasted shall be abraded manually or mechanically with abrasive paper grade 220 or by using non-metallic abrasive pads.

Finally, all dust and debris shall be removed by vacuum-cleaning.

Epoxy primer for galvanised surfaces shall be applied immediately after surface preparation to a minimum dry thickness of 50 µm.

PLQ 3.3 Surface preparation of stainless steel surfaces

Oil and grease contamination shall be removed by:

- Steam-cleaning
- An emulsifiable or aqueous detergent, or
- An alkaline cleaning solution.

Stainless steel surfaces shall be blast-cleaned with stainless steel grit or non-metallic abrasive. The use of steel shot and steel or cast iron grit is strictly prohibited.

The grade of cleanliness shall be at least Sa 2½.

Surface profile shall be in the range of 30 to 50 µm.

Where blasting is impractical, the surface shall be roughened manually with abrasive paper grade 220, disc grinders or flapper wheel abrasive pads. In all instances, clean, uncontaminated equipment must be used.

Dust and debris shall be removed by vacuum-cleaning.

PLQ 4 HOT-DIP GALVANIZING

The following specification is applicable:

- Where galvanising is specified or a requirement of the design, such galvanising shall be performed by the hot-dip process to SANS EN 10240 in part and SANS ISO 1461;
- For all parts, other than wires, the equivalent zinc coating thickness shall not be less than 455 g of zinc per square metre of surface;
- The galvanising must be clean, smooth, of uniform thickness, unblemished and free from defects;
- All drilling, welding, cutting, sawing, punching, filing and bending shall be complete and the metal shall be cleaned of any machining blemishes, millscale, rust and lubricants, before galvanising;
- Galvanised areas must be kept free of lubricants. Surfaces which are in contact with oil shall not be galvanised or cadmium plated;
- Electrolytic deposition of zinc is not acceptable.
- Unless otherwise specified, steel pipes up to 150 mm dia shall be hot-dipped galvanized. Hot-dip galvanizing to be in accordance with SANS 121 ISO 1461 except that minimum thickness shall be 55 micron. Cut ends and small damaged areas shall be repaired by the application of a zinc-rich epoxy (single pack) to SANS 121 ISO 1461 (ZINC GALV 1 – Dulux or POLY GALV – Plascon).
- Only heavy duty galvanising shall be accepted and all items to be provided with a SANS approval certificate.

PLQ 5 EPOXY PAINTS

Epoxy paint shall comply with SANS 1217 or ISO 12944-4 and ISO 12944-5. Surface preparation shall be abrasive blast cleaning to Sa 3 of ISO 8501-1.

The following will be applicable where epoxy paint is specified:

- Lining of pipes with nominal diameter equal or larger than 600 mm and standard pipe lengths of 9,144 m, 12,192 m, 18,3 m and 19.2 m:
- Solvent free epoxy SANS 241 certified (NUI Ultrapox 800/8 or Pipecoat SF or SFX or similar product approved by Engineer), with a minimum dry film thickness of 500 micron and a maximum dry film thickness of 800 micron.
- Lining and coating of all other pipes, specials and fittings, except where multi-purpose epoxy coating is specified:
- Solvent borne epoxy (Carboguard 891 or similar product approved by Engineer) with a minimum dry film thickness of 500 micron and a maximum dry film thickness of 800 micron.
- Epoxy paint and the repair kit for the repair of epoxy shall be from the same manufacturer.
- Edges with epoxy paint shall have a radius of 3 mm or 50 % of the pipe wall thickness (smaller of two).
- Where another type of coating is specified, epoxy paint lining shall continue around pipe edge for each of the following:
- Flanged end

- Onto both flange faces, extending for 50 mm (min) onto pipe outer wall beyond flange.
- Ends suitable for straight or stepped couplings or flange adapters
- Onto pipe outer wall for 250 mm (min) from pipe end.

Ends suitable for flange adapters, incorporating a restraining flange

Onto pipe outer wall from pipe end, up to and including both faces of the restraining flange as well as 50 mm (min) beyond the restraining flange.

The following specification shall be applicable to pipes, specials and fittings to be welded on site:

In the factory:

Abrasive blast cleaning of complete steel surface to Sa 3 of ISO 8501-1. Apply epoxy paint to 100mm from pipe end.

On site:

Abrasive blast cleaning of steel surface to Sa 3 of ISO 8501-1 and 50 mm of painted surface to a surface profile of 60 – 85 microns.

Apply epoxy repair kit from the same manufacturer as the factory applied epoxy to a minimum dry film thickness of 500 micron. The type of epoxy repair kit shall be subject to the approval of the Engineer.

The painted area shall be tested for pinholes and thickness.

At completion of the laying of pipes, after the epoxy lining of welded joints, repair of lining defects and cleaning of pipes and before filling of the pipe with water, the Contractor shall be responsible for the sponge (pinhole) testing of the epoxy lining of the complete pipeline. The Contractor shall implement measures to prevent entrance by persons, animals, water or any other foreign matter into the sections where sponge testing was successfully completed.

The Contractor shall allow for the cost of all testing in the rates in the bill of quantities.

PLQ 6 UV-RESISTANT MULTI-PURPOSE EPOXY PAINT

Multi-purpose Epoxy shall be surface tolerant, self-priming aluminium pigmented epoxy mastic.

PLQ 7 RE-COATABLE POLYURETHANE

The area to be over-coated shall be abraded with abrasive paper grade 220 to a uniform matt finish.

The surface shall be vacuum-cleaned to remove dust and debris.

Over-coat with a 40 µm minimum layer of re-coatable polyurethane in accordance with the Employer's colour code.

PLQ 8 FUSION BONDED, MEDIUM DENSITY, POLYETHYLENE COATINGS (MDPE)

A uniform MDPE coating must be obtained by dipping the already prepared and heated pipe into a fluidified bed of MDPE powder which then fuses directly on to the heated surface.

The pipe coating shall be Sintakote II complying with all aspects of AS 1193, AS 4131 and AS 4321 of the latest revisions.

All coating materials shall be supplied complete with an original ISO 17050-1 Certificates of Conformity (COC) for the materials, clearly indicating compliance with all mechanical, physical and chemical properties of the coating, as defined in AS 4321, AS 1193 and AS 4131.

The supplier shall ensure that testing takes place as per AS 4321 Appendix A, as defined in Table A1 for the pipeline coating at the mill. In addition to this, a detailed third party report indicating compliance as per the 5 Yearly Type Testing and the annual testing as per Table A1 shall be submitted to the Engineer before production commences.

The minimum Dry Film Thickness (DFT) shall be 2.3mm minimum or as per Table 1 of AS 4321 for the different pipeline diameters as agreed by the Engineer.

The pipeline frequency of testing during production shall be as per AS 4321 Table 2.

The surface profile shall be angular and at least 60 μ -75 μ and the dust and debris level shall never exceed Class 2 ISO 8502-3 during production, the latter shall be confirmed during production on every 5th pipe and records shall form part of the hand-over pack issued to the Engineer. The cutback distance of the coating shall be 75mm from the pipe end.

PLQ 9 POLYMER MODIFIED BITUMEN (BITUGUARD)

This specification relates to factory applied pipe coating operations based on hot applied polymer modified bitumen. It is also applicable to modification, refurbishment and repairs on pipes coated with standard (oxidised or blown) bitumen fiberglass coatings.

PLQ 9.1 Applicable Standards

This part of the Specification makes reference to the standards 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.

BS EN 10300 Steel tubes and fittings for onshore and offshore pipelines – Bituminous hot applied materials for external coating.

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.

PLQ 9.2 Materials

PLQ 9.2.1 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 the table below. In addition, when stored in original sealed containers at ambient temperature, the primer shall retain the properties as set out in the table for not less than 6 months from the date of delivery.

CHARACTERISTICS OF PRIMER

CHARACTERISTIC	REQUIREMENTS	METHOD OF TEST
Viscosity at 23oC	35-60 seconds	Flow cup No 4
Volatile matter (max. % loss by mass)	75	BS3900: Part A6 = EN 535 BS3900: Part B2 = ISO/DR 1515 (1050C for 3 hours)

PLQ 9.2.2 Polymer Modified Bitumen

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.
- 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%.
- Characteristics of the Polymer Modified Bitumen
- The material shall conform to the requirements given in the table below when tested in accordance with the methods specified.
- 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 shall pass the performance test specified in the following table:

characteristics AND PERFORMANCE TEST: pMB

PROPERTIES	METHOD	UNIT	REQUIREMENTS
Softening Point	ASTM D36	oC	115-130
Penetration @ 25oC	ASTM D5	1/10 mm	15-30
Density @ 25oC	BS 4147	g/cm3	1.1-1.4
Viscosity @ 170oC	Brookfield	Cp	7000-12000
Viscosity @ 190oC	Brookfield	Cp	3000-6000
Filler Content	BS 4147	%	20-30
Impact @ -10oC	BS 4147	mm2	Max. 6500
Peel Initial / Delayed	BS 4147	mm	Max:
Sag @ 25oC	BS 4147	mm	3,0/3,0
Sag @ 40oC	BS 4147	mm	3,0/3,0
Sag @ 50oC	BS 4147	mm	3,0/3,0
Sag @ 60oC	BS 4147	mm	3,0/3,0

PROPERTIES	METHOD	UNIT	REQUIREMENTS
Sag @ 80oC	BS 4147	mm	Max. 1.5
Aging Test @ 190oC	Phoenix	hours	Min. 72
Bend	BS 4147	mm	Min. 15

Notes:

The test plates shall be cleaned by abrasive blasting to grade Sa 3 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 disbanded shall not exceed the permitted value shown in the table.

The peel test at 25oC is equivalent to / replaces the preliminary adhesion test in the original Specification.

PLQ 9.2.3 Outerwrap

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.

The outerwrap shall be impregnated with the polymer modified bitumen compatible material to fulfil the characteristics shown in the table below.

The characteristics of the outerwrap shall comply with the requirements of the table below and shall be determined in accordance with the test procedure.

characteristics of outerwrap saturant

CHARACTERISTIC	REQUIREMENT	METHOD OF TEST
Softening Point	Min 100oC	BS 2000
Penetration @ 25oC	60-85 1/10 mm	BS 2000
Saturant	Polymer Modified Bitumen	

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

PLQ 9.3 Application

PLQ 9.3.1 Care of Wrapping Materials

All wrapping materials consigned to the coating yard or factory shall be properly stored to prevent damage or deterioration.

PLQ 9.3.2 Care of Pipe

Throughout the wrapping process pipe and coating materials shall be kept clean and away from all foreign matter.

PLQ 9.3.3 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.

PLQ 9.3.4 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 Sa 3 grade SIS O5 009 (BS 7079 and ISO 8501-8504) and surface profile amplitude 75 µm. Refer to 37.15 for detailed description of surface preparation process.

PLQ 9.3.5 Priming

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. 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.

The primer should be applied at a pipe temperature of 10oC (or above) or 3oC 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.

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.

PLQ 9.3.6 External Coating and Wrapping Application

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.

All primed surfaces shall be clean and dust free immediately prior to coating.

The coating (including the outerwrap) shall have a minimum average thickness as specified in SANS ISO 2808 (5.5 mm minimum average and 5 mm minimum at any point) 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.

The completed coating shall be well bonded to the pipe metal; uniform, smooth and free from Holidays, laminations, voids or other defects.

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. 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).

PLQ 9.4 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:

Monitoring of grit size and the finish of blast cleaned pipe.

Viscosity measurement 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.

Adequate temperature control of 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, 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 the table below.

Visual checks on the outer wrap and the appearance of the final wrap.

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.

Test of bond strength and thickness of the wrapping including removal of samples of the wrapping for inspection. 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 significant 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.

'IN PLANT TESTING'

TEST	FREQUENCY OF TESTING
Softening Point	Twice per working shift
Penetration at 25oC	Twice per working shift
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 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 disbonded 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.

PLQ 9.5 Methods of Testing

PLQ 9.5.1 Testing of Wrap Characteristics

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.

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.

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 $\pm 2\%$.

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.

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.

PLQ 9.5.2 Bond Test for Coated Pipes

Measure the temperature of the coating with a surface thermometer.

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.

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.

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.

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.

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.

PLQ 9.6 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.

PLQ 9.7 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.

PLQ 10 THREE LAYER POLYETHYLENE COATING (3LPE)

The 3LPE coating shall comply with ISO 21809-1. The Canadian Specification CSA Z245.20/Z245.21 is not applicable.

The materials supplied as part of the 3LPE coating, including the Fusion Bonded Epoxy (FBE), Copolymer adhesive and Polyethylene (PE) outer coating shall be supplied with ISO 10474 or EN 10204 Inspection Certificates 2.1 and 2.2, giving the results of the testing of coated pipes, as supplied on the contract/purchase order and signed by an authorised representative of the Engineer.

An Inspection and Testing Plan (ITP) providing an overview of the sequence of inspections and tests, including appropriate resources and procedures and a Quality Control Procedure (QCP) shall be submitted for the approval of the Engineer's representative prior to coating production commencing.

Subsequent to the approval of the documentation detailed above, a Procedure Qualification Trial (PQT) shall take place and shall be witnessed by the Engineer's representative as well as subsequent inspection/testing of its properties, to confirm that the Application Procedure Specification (APS) is adequate to produce a coating with the specified properties. All to be carried out prior to the start of production.

The 3LPE shall be Type B coating, as per ISO 21809-1 Table 1.

The minimum thickness of the 3LPE coating shall be as follows:

FBE	0.30 mm
Adhesive	0.20 mm
HDPE	2.00 mm for nominal pipe diameter up to and including 250 mm
	2.50 mm for nominal pipe diameter larger than 250 mm but less than 600 mm
	3.0 mm for nominal pipe diameter 600 mm and larger

The 3LPE shall have minimum total thickness as above, and on heavier wall pipes it shall comply with class B3, as per ISO 21809-1 Table 2.

Polyethylene layer cut back shall be provided at pipe ends as follows:

Pipe ends shall be supplied as bare steel, free of all coating, for a distance of 100 mm (+25mm/-0mm tolerance) from the pipe end. In addition, each pipe end shall be left without polyethylene / adhesive coating so that a 20 mm (+10mm/-0mm tolerance) FBE toe protrudes on the steel beyond the cutback polyethylene coating layer.

The ends of the coating shall be bevelled at 30° to 45°.

The applicator shall use epoxy material that is in accordance with Table 3, Class B, as per ISO 21809-1 and shall test the materials/ensure compliance as detailed above in accordance with ISO 10474 or EN 10204.

The applicator shall use adhesive material that is in accordance with Table 4, Class B, as per ISO 21809-1 and shall test the materials/ensure compliance as detailed above in accordance with ISO 10474 or EN 10204.

The applicator shall use PE/PP material that is in accordance with Table 5, Class B, as per ISO 21809-1 and shall test the materials/ensure compliance as detailed above in accordance with ISO 10474 or EN 10204.

The applicator shall provide batch certificates supplied by the manufacturer of each material and shall contain the information given in Table 6 ISO 21809-1. The batch certificate shall state test methods and acceptance criteria. The applicator shall identify the materials and shall confirm that the certificates comply and relate to the specified materials, as well as the requirements stipulated in Clauses 8.3.2 and 8.3.3 ISO 21809-1.

Prior to the start of coating production and any specified PQT, the applicator shall prepare an APS as per Clause 9.2 ISO 21809-1.

The APS, including any Engineer approved written revisions, shall be approved by the Engineer prior to the start of production and any specified PQT and there shall comply with the requirements of Table 7, Class B coating system.

The APS shall be verified by a PQT in accordance with ISO 21809-1 Annexure L. The applicator shall prepare an ITP and a daily log to record quality control data in accordance with Annexure L of ISO 21809-1.

Prior to the commencement of the surface preparation for the coating operations, a visual inspection shall be performed on the bare steel pipes in order to verify that there are no steel or weld defects (welding slag, spatter or raised/sharp edges) or contamination with oil, grease, soil, dirt and similar contaminants.

In the event that steel defects are detected they shall be rectified using a file, light grinding or any other suitable tool as stipulated in API 1104 Clause 13.10. This intervention shall not reduce the pipe wall thickness below the tolerances specified in the relevant Specifications. In case the steel defect is of the nature that simple correction of this defect cannot be performed, the pipe affected by this defect shall be quarantined until the appropriate measures are taken.

In case oil, grease, or any other residues (e.g. adhesive materials or similar contaminants) are present, then they shall be removed using a high pressure water based detergent cleaner, and/or a suitable "solvent" as per the requirements of SSPC-SP-1 Specification. In the event of other "adherent" contaminant being present, then power tool brushes or any other appropriate method may be utilised in order to remove the contaminant from the pipe surface prior to grit blasting.

The blast cleaning abrasives shall be, at all times, kept dry, clean and free from contamination. The blast cleaning shall be performed when the following conditions are satisfied:

The steel surface temperature is at least 3°C above the ambient dew point, which shall be checked using a calibrated hygrometer or other method approved by the Engineer.

The steel surface shall have no traces of moisture;

The steel surface is protected from bad weather conditions such as rain or strong winds which can bring contaminants such as soil, sand, dirt, salt or any other such similar contaminant.

In the case that the steel surface temperature is less than 3°C above the ambient dew point or traces of moisture are detected on the steel surface, the steel surface shall be heated using induction heating until the steel surface temperature is within the range of 50°C to 60°C. This temperature shall be maintained until all of the moisture has been removed from the steel surface.

Abrasive blast cleaning shall be in strict compliance with ISO 21809-1 Clause 10.1.2 with the exception that the profile shall be measured using ISO 8503-4 (Stylus method), replica tape is not permitted.

As per ISO 8502-3, the cleanliness of the steel surface shall be measured using the ISO Form: "Preparation of Steel Substrates before Application of Paint and Related Products – Test for the Assessment of Surface Cleanliness – Part 3: Pressure Sensitive Tape Method." As prescribed, a strip of clear tension tape shall be placed, tacky side down, onto the blasted steel surface of the pipe after cleaning. The tape shall then be removed from the surface and placed on a piece of white glossy paper where it will be compared to the cleanliness levels provided in the ISO 8502-3 specification procedure. This shall not exceed a "Debris" and

"Dust" level of Class/Level 2 at any given time and shall be recorded during pipe production on at least every 5th pipe to confirm compliance and records shall be kept for the client, which may be inspected at any given time.

The salt level on the bare steel pipe surface shall be measured according to ISO 8502-2 and shall be a maximum of 20 mg NaCl/m². The basic procedure of the test shall be to dampen circular piece of test paper of known area with a specified volume of laboratory water containing less than 0.1µg/cm² of salt. The test paper shall then be applied to the pipe for a period of 2 minutes, after which the test paper will be removed from the pipe and its resistivity measured. The salt content on the pipe will then be determined through the calibrated Salt Contamination Meter which uses the negative correlation between resistivity and salt content, along with empirically measured historical data to provide a reading.

If excessive salt contamination is established (≥ 20 mg NaCl/m²) during production testing, then the applicator shall ensure that a "Pre-Wash" system shall be employed prior to coating in order to remove the salt without causing "flash rusting" or any other "surface contamination". The "pre-wash" shall be performed and shall form an integral part of the production Pre-Qualification Testing (PQT) before acceptance of the "Pre-Wash" procedure.

The maximum time elapsed after completion of the abrasive blasting operation, pre-wash (if applicable) and the application of the P primer shall be 120 minutes if RH < 85% and 60 minutes if RH > 85%. At no time shall the steel surface temperature be allowed to drop below the dew point before application of the P Primer. Should either of these conditions apply, the surface preparation shall be re-inspected and/or the surface preparation repeated as required.

The application of the 3LPE coating shall be in accordance with the approved APS in accordance with Clauses 10.2.2.3 and 4 of ISO 21809-1.

Inspection and testing shall be carried out in accordance with the approved APS and ITP and shall meet the minimum requirements as stipulated in ISO 21809-1 Tables 8 and 9.

Coating repairs shall be addressed in accordance with an Engineer's approved APS and PQT as per Clause 12 ISO 21809-1.

Pipeline marking shall be as per the Employer's requirements, but shall as a minimum include all aspects detailed in Clause 13 of ISO 21809-1.

PLQ 11 RIGID POLYURETHANE COATING (RPU)

PLQ 11.1 Introduction

This part of the Specification defines the minimum technical requirements for liquid applied coating for factory coated pipe and specials. The coating system shall comprise a homogenic layer of 100% solids rigid polyurethane mechanically bonded to the metal substrate.

Where specified it shall be used for the external coating of pipes. The pipeline will be buried and will be protected against external corrosion by the external coating and cathodic protection systems. The external coating (primary corrosion protection system) shall be suitable for the operating conditions applying to the specific pipeline.

PLQ 11.2 Standards

Unless otherwise specified herein, the latest edition of the following Standards should be read in conjunction with this Specification:

American Society for Testing and Materials

- | | |
|------------|--|
| ASTM D16 | Standard Test Method for Paint, related coatings, materials and applications. |
| ASTM D 543 | Standard Test Method for Evaluating the resistance of plastics to chemical reagents. |
| ASTM D 570 | Standard Test Method for Water absorption of plastics. |

ASTM D 2240 Standard Test Method for Rubber Property (Durometer Hardness)
 ASTM D 4060 Standard Test Method for Abrasion resistance of organic coatings by the Taber abraser.
 ASTM D 4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
 ASTM G14 Standard test method for impact resistance of pipeline coatings (Falling Weight Test)
 ASTM D 4285 Method for indicating Oil or Water in Compressed Air

British Standard and European Norm

BS EN 10290 Steel tubes and fittings for onshore and offshore pipelines - External liquid applied polyurethane and polyurethane-modified coatings.

ISO – International Organisation for Standardization

ISO 1514 Paints and varnishes - Standard panels for testing
 ISO 2808 Paints and varnishes - Determination of film thickness
 ISO 4624 Paints and varnishes - Pull off test for adhesion
 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 Uncoated Steel Substrates and of Steel Substrates after Overall Removal of Previous Coatings
 ISO 8502 Preparation of steel substrates before application of paints and related products - Tests for the assessment of surface cleanliness
 ISO 8503 Preparation of Steel Substrates Before Application of Paints and Related Products - Surface Roughness Characteristics of Blast-Cleaned Steel Substrates
 Part 1: Specifications and definitions for ISO surface profile comparators for the assessment of abrasive blast-cleaned surfaces.
 Part 2: Method of grading of surface profile of abrasive blast-cleaned steel comparator procedure.
 Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile - Stylus instrument procedure.
 Part 5: Replica tape method for the determination of surface profile.

ISO 8504-2 Preparation of Steel Substrates Before Application of Paints and Related Products - Surface Preparation Methods - Part 2: Abrasive Blast Cleaning
 ISO 11124-1 Preparation of Steel Substrates Before Application of Paints and Related Products - Specifications for Metallic Blast Cleaning Abrasives -
 Part 1: General introduction and classification
 Part 2: Chilled iron grit
 Part 3: High-carbon cast-steel shot and grit
 Part 4: Low-carbon cast-steel shot

NACE – International

NACE RP0274 High-Voltage Electrical Inspection of Pipeline Coatings Prior to Installation

NACE RP0287 Field Measurement

of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape

NACE RP0394 Application, Performance, and Quality Control of Plant-applied, Fusion-Bonded Epoxy External Pipe Coating

SSPC – Society for Protective Coatings

SSPC SP11 Power Tool Cleaning to Bare Metal

SSPC PA 2 Measurement of Dry Coating Thickness with Magnetic Gauges (Steel Structures Painting Manual, Ch 5 - Paint Application Specs.)

SSPC SP 10 Near-White Metal Blast Cleaning NACE No.2-2000 (Steel Structures Painting Manual, Ch 2 - Surface Preparation Specs.)

PLQ 11.3 Materials

The required coating shall be a two-component liquid applied rigid polyurethane subject to the approval of the Engineer.

The two components shall have different colours allowing the verification of the correct mixing, and checking of the uniformity of the colour of the mixed product.

The coating is considered cured when it has attained the hardness recommended by the product manufacturer.

PLQ 11.3.1 Handling of Materials

Materials shall be handled and stored in accordance with the material manufacturer's recommendations, which shall be available for review by the Engineer at the Contractor's premises. Materials shall be stored in an air-conditioned, temperature controlled environment until required for use.

Coating materials shall be segregated by type and batch during storage and handling. Materials from damaged containers shall be rejected, unless otherwise agreed with the Engineers representative in the factory or on Site.

Materials shall be used in the order in which they are delivered and before their expiry date for use.

PLQ 11.3.2 Documentation from the Materials Manufacturer

The commercial rigid polyurethane coating system offered shall be qualified by the Contractor and will be subject to the Engineer's approval prior to application. Testing should be conducted on each applicable coating and shall meet the acceptance criteria of the table below. The qualification shall be based on tests carried out by an independent recognized certifying body and the relevant documents shall be submitted to the Engineer.

Full traceability of each batch of coating material shall be maintained. As a minimum, the following data shall be compiled and shall be available for immediate review by all parties:

Name of manufacturer;

Complete material identification: Trade name, chemical name and type of product details;

Batch number;

Date of manufacture;

Place of manufacture;

Shelf life / expiry date (if appropriate);

Health and safety, and environmental instructions;

Hazard warnings;

Storage instructions;

Quantity; and

Manufacturing standard.

Any material not labelled with the above information shall not be used.

PLQ 11.3.3 Rigid Polyurethane Properties

The coating material properties and characteristics with respect to the 100% solids rigid polyurethane coating shall comply with the requirements of a Type V coating type in terms of the ASTM D16 Standard. The coating material shall be a homogenic solvent free layer with a chemical three-dimensional covalent cross-linked structure. The layer shall be made up from a liquid two pack coating system with Part A being poly-isocyanate rich and Part B consisting of polyols or amines that ensures relatively short curing times. Aliphatic polyurethanes shall be used above ground and aromatic polyurethanes shall be used below ground.

The performance properties of the coating shall comply with the requirements stated in the following table. The Contractor shall submit a full and comprehensive product datasheet to confirm material compliance with the Specification.

COATING MATERIAL PERFORMANCE PROPERTIES

PROPERTIES	TEST REFERENCE	ACCEPTANCE CRITERIA
Minimum application thickness	BS EN 10290 (Annexure A)	1800 µm (Dry Film Thickness)
Adhesion to steel	ASTM D 4541 Method E	> 15 MPa
Adhesion to factory coating	ASTM D 4541 Method	> 10 MPa
Hardness	ASTM D 2240 (Shore D)	As specified by coating manufacturer
Flexibility	BS EN 10290 (Annexure K)	Pass

PROPERTIES	TEST REFERENCE	ACCEPTANCE CRITERIA
Tensile strength	ASTM D 638	>15 MPa at 3mm thickness
Resistance to cathodic disbondment	BS EN 10290 (Annexure E)	r < 8mm (28 days)
Dielectric strength	ASTM D 149	Minimum 15 V/μm
Specific Electrical Insulation Resistance	BS EN 10290 (Annexure F)	106 ohm.m2
Impact resistance	BS EN 10290	> 5J/mm at 23°C >3J/mm at 5°C
Indentation resistance	BS EN 10290 (Annexure H)	<0.2mm at 23°C

PLQ 11.4 Application

PLQ 11.4.1 Surface Preparation

Refer to Clause PLQ 3 for the general steel surface preparation requirements. The steel surface shall be grit blasted to Sa 3 in accordance with ISO 8504-1 for surface cleanliness with an anchor profile of minimum 75 μm. The hardness of the abrasive material must be Rockwell C 54 or greater. The abrasive material shall be dry, clean, and free from contamination. Salt contamination tests shall be regularly performed on abrasive to verify that total salt level in the soluble contaminants is less than 25ppm. Extensive grinding shall not be performed without Engineer approval. The anchor pattern shall be restored on all ground surfaces.

The quality control plan (QCP) hold point at the completion of the surface preparation shall be subject to the signing off by the Approved Inspection Authority (AIA) prior to the application of the coating material for all pipes, specials and joint repairs.

PLQ 11.4.2 Coating Application

The application of the coating shall only proceed once the cleanliness of the steel substrate has been approved and the substrate temperature is more than 3°C above the dew point temperature. The work area shall be kept dry as the material reacts with humidity and moisture.

When required the surface shall be heated using an induction heating coil, radiant heaters or hot air to a temperature as recommended by the coating material manufacturer and in accordance with this Specification. The temperature shall not exceed 85°C and the use of propane torches or gas burners for pre-heating and post-heating is expressly prohibited. Infrared heaters may be used for post-heating. The temperature of the bare steel shall be monitored using temperature-indicating crayons. The amount of crayon used shall be the minimum amount required for accurate measurement. Crayon markings shall be removed with a wire brush.

The individual liquid components of the rigid polyurethane coating shall be agitated thoroughly before use to disperse pigments and assure homogeneity. No thinning shall be done and the components shall not be mixed together.

The material shall be applied using a plural component, adjusted to the specified mix ratio on a heated airless spray unit with metering pumps. The width of the spray jet, the set up distance from the substrate surface and the overlap, the pipe rotation speed and the rate of application shall be predetermined for the final required dry film thickness applied in the workshop.

The wet film thickness shall be measured in accordance with ISO 2808. Particular attention shall be paid to the recommended dry film thickness which shall be measured in accordance with SSPC PA 2. No spot measurement may be less than 85% of the specified average thickness. Tools and equipment shall be cleaned using only such solvents as are recommended by the product manufacturer. Particular care shall be taken in the handling of the coated items before the coating has reached the minimum value of hardness recommended

by the manufacturer. All pipes and other components shall be high spark holiday tested in accordance with NACE RP0274 at the test voltage recommended by the coating manufacturer.

For factory-coated pipe, bends and specials the cut back shall be 150 ± 20 mm. The edge of the cut-back shall be feathered at $30 - 45^\circ$.

PLQ 11.5 Inspection and Testing

The Contractor shall demonstrate that the proposed coating material and procedures will meet the requirements of this Specification when applied to pipes and pipe specials. The Contractor shall provide the documentation proof that the final selected coating material complies with the requirements listed in Table 37/15.

The Contractor shall test the finished coating during production to demonstrate continued compliance with this Specification. Details of all inspections and testing shall be fully documented in accordance with the approved quality control plan mentioned in Clause 37.4.2.

All stages of the surface preparation, coating and testing shall be subject to 100% inspection by the Contractor. The Engineer shall be informed at least two weeks prior to the start of surface preparation to allow scheduling of inspection personnel in the factory as well as on Site.

PLQ 11.6 Testing of Production Pipes

The Contractor shall execute the following tests and provide written documentation proof of the test results within the agreed time frames:

PLQ 11.6.1 Visual Inspection (every pipe)

The coating shall be smooth, glossy, and free from pin holes, excessive orange peel effect, bubbling or excessive runs or sags.

PLQ 11.6.2 Dry Film Thickness (every pipe)

DFT shall be inspected in accordance with SANS ISO 2808, with a minimum average thickness of 1.8mm and a minimum of 1.6mm at any point.

PLQ 11.6.3 Electrical Insulation Defects (Holiday) Inspection (every pipe)

The coating shall be free from electrical insulation defects when tested with a high voltage holiday detector set at 15 kV.

PLQ 11.6.4 Hardness Shore 'D' (every pipe)

The Shore 'D' hardness shall comply with the minimum set by the manufacturer in pre-qualification.

PLQ 11.6.5 Adhesion (1 test per shift)

The pull-off adhesion at 23°C shall be greater than 15 MPa.

PLQ 11.6.6 Cathodic Disbondment (1 test per 50 pipes and commencement of new batch or new production run))

The disbondment shall be less than 8mm radius. BS EN 10290 Annexure E 48hr.

PLQ 11.6.7 Composition (1 test per 50 pipes or new batch or new production run)

The Thermo Gravimetric Analysis (TGA) scan shall be checked against the manufacturer's qualification scan.

PLQ 11.7 Coating Repairs

Since polyurethane systems are chemically cured, very thorough abrasion of damaged or defective coating is required to ensure an adequate physical bond.

PLQ 11.7.1 Repairs before Full Cure [Within Sixteen (16) Hours at 23°C of Application of Last Coat]

The area to be over-coated shall be abraded with abrasive paper grade 220 to a uniform matt finish.

The abraded surface shall be vacuum-cleaned or be blown clean with uncontaminated dry compressed air to remove dust and debris.

Brush grade polyurethane shall be applied in as many coats as are required to achieve the specified thickness free of electrical insulation defects.

PLQ 11.7.2 Repairs after Full Cure [After Sixteen (16) Hours at 23°C of Application of Last Coat]

The area to be over-coated shall be abraded with abrasive paper grade 220 to a uniform matt finish.

The abraded surface shall be vacuum-cleaned or be blown clean with uncontaminated dry compressed air to remove dust and debris.

The coating manufacturer's adhesive primer or activating solvent shall be applied only to the abraded surface.

After the designated curing time, brush grade polyurethane shall be applied in as many coats as are required to achieve the specified thickness free of electrical insulation defects.

Repairs shall be carried out with repair grade materials of the same grade as the spray-applied coating. The repairs shall be tested in accordance with approved procedures recommended by the material manufacturers. The Contractor shall confirm material compatibility and surface preparation requirements.

Based on the above the Contractor shall prepare a detailed method statement on the repair of the coating for the approval of the Engineer.

PLQ 12 PETROLATUM TAPE WRAPPING SYSTEM

PLQ 12.1 General

An EN 12068 Class A Petrolatum System shall be used for the wrapping of buried flange and flexible joints and where specified in the Specifications, Bill of Quantities or Drawings. The Denso Clingwrap protection system or similar products approved by the Engineer will also be acceptable.

PLQ 12.2 Surface preparation

Bare pipes and fitting to be prepared to a recommended standard of St2 as specified by the Swedish Standard SIS 05590:

St2: Hand Tool Cleaning

Removal of all rust scale, mill scale, loose rust and loose paint to the degree specified by hand wire brushing, hand sanding, hand scraping, hand chipping or other hand impact tools or by a combination of these methods. The substrate should have a faint metallic sheen and also be free of oil, grease, dust, soil, salts and other contaminants.

Chamfer any raised edges or steps in the existing coating.

PLQ 12.3 Primer application

Surface to be primed with Priming Solution (e.g. S105 Paste)

Primer is applied to the steel surface with a brush or paint roller. The primer to be thoroughly mixed prior to application.

The primer to cover the entire steel surface, including the nuts and bolts and overlap onto the mill applied primary coating system by a minimum of 200mm.

The primer must not be diluted. Primer cans should remain covered when not in use to avoid solvent evaporation and contamination.

PLQ 12.4 Profiling mastic application

Apply Profiling Mastic to both sides of the fitting to form a generous fillet from the coupling onto the pipe barrel. The Profiling Mastic is also used to cover the bolt heads and nuts to form a regular profile onto which the Petrolatum Tape can be applied.

PLQ 12.5 Petrolatum tape application

Apply one layer of the Petrolatum Tape to the body of the pipe or fitting, ensuring that there is no air entrapped beneath the tape. The Petrolatum must be applied spirally, with a 55% overlap and at least 100 mm onto the factory coating and the barrel of the pipe.

PLQ 12.6 Cling wrap outerwrap tape application

Spirally apply Clingwrap Outerwrap Tape to cover the entire Petrolatum Tape system. Start at one end, wrapping with a 55% overlap, proceed to the other end and ensure the Clingwrap Outerwrap extends 100mm beyond each end of the repair.

PLQ 13 JOINT COATING SYSTEMS

PLQ 13.1 MDPE, three-layer polyethylene (3LPE) and Rigid Polyurethane coating

The unprotected area at welded joints shall be protected against corrosion as follows:

- The cutback of the coating shall be 100mm from the pipe ends.
- Chamfer any raised edges or steps in the existing coating.
- The factory applied polyethylene pipe surface to which the cold tape wrapping is to be applied shall be abraded with 40 grit abrasive paper or sweep blasted for a minimum of 50 mm onto the mainline coating to obtain a surface profile with an Rz value between 40 and 70 μm
- Abrasive blast clean the steel surface to Sa 3 of ISO 8501-1. The surface profile shall be checked in accordance with ISO 8503-1, ISO 8503-4 and ISO 8503-5 with an average Rz larger than 75 μm . All types of abrasive that are used in the preparation of the field joints and small repairs shall comply with ISO 11124-2 to 4.
- The surface to be coated shall at the time of application be dry and free of dust and any contamination detrimental to the adhesion of the coating to the steel substrate. The Contractor shall prepare a detailed method statement on how the field joint area will be kept dry and clean during the application operation. It shall also include the trench space requirements for the application equipment.
- All dust, detritus and salts shall be removed from the metal substrate. The level of salts shall be measured in accordance with the requirements of ISO 8502-9 and shall be $\leq 30 \text{ mg/m}^2$
- The application of the coating shall only proceed once the cleanliness of the steel substrate has been approved and the substrate temperature is more than 3°C above the dew point temperature.
- The temperature of the substrate shall be within the application temperature range specified by the coating manufacturer. When required the surface shall be heated using an induction heating coil, radiant heaters or hot air to a temperature as recommended by the coating material manufacturer and

in accordance with this Specification. The temperature shall not exceed 85°C and the use of propane torches or gas burners for pre-heating and post-heating is expressly prohibited. Infrared heaters may be used for post-heating. The temperature of the bare steel shall be monitored using temperature-indicating crayons. The amount of crayon used shall be the minimum amount required for accurate measurement. Crayon markings shall be removed with a wire brush.

- Applicable to 3 LPE only: Apply Denso Protal 7200 liquid epoxy to the blast cleaned surface and adjacent prepared factory FBE coating to a minimum dry film thickness of 400 micron.
- The entire joint surface to be wrapped shall be primed with Denso Butyl Primer P16HT.
- Allow approximately 30 minutes drying time or until the primer is tacky to the touch.

Apply 100mm or 150mm wide 3 ply PE/Butyl rubber self-amalgamating inner-wrap compliant with DVGW EN12068 Class C 50°C (DENSO S43HT on similar product approved by the Engineer).

The tape shall be applied to ensure that a minimum 55% overlap.

Apply 100mm or 150mm wide 2 ply PE/Butyl rubber outer-wrap compliant with DVGW EN 12068 Class C 50°C (DENSO R23 on similar product approved by the Engineer).

The tape shall be applied to ensure that a minimum 55% overlap shall be achieved.

The tape shall be applied to a minimum width of 50mm beyond the applied inner tape-wrapped area onto the primed shop applied coating.

Ensure that the tape is in full contact with the underlying surface with no wrinkles, fish-mouths or bubbles.

Holiday detection shall be carried out in accordance with NACE RP0188.

The quality control plan (QCP) hold point at the completion of the surface preparation shall be subject to the signing off by the Approved Inspection Authority (AIA) prior to the application of the coating material for joint repairs

Damaged areas on coatings shall be repaired in accordance with the specifications and guidelines of the coating manufacturer. Hand or power cleaning can be used for small repair areas such as pinholes and areas inaccessible for blast cleaning. 80 Grit or coarser sandpaper can be used to suitably roughen and abrade the area to be prepared. The area shall be sanded to the substrate taking care not to polish the substrate.

Only Engineer approved DVGW Certified and or other Engineer approved certification materials may be used. All materials shall comply with the requirements of EN 12068 Class C HT50°C UV for either tapes and heat shrinkable sleeves (HSS), unless otherwise approved by the Engineer.

An ISO 17050-1 Certificate of Conformity from the supplier (point of origin) stipulating compliance with all chemical, physical and mechanical properties of the applied product, as per ISO 10474 or EN 10204 Inspection Certificates 3.1.B and 3.1 shall be submitted to the Engineer i.e. the DVGW Type Test Report and in-house batch testing for the batch(s) to be supplied.

Pipeline field joint repairs (FJR) may not commence without an Engineer approved Inspection and Testing Plan (ITP) document providing an overview of the sequence of inspections and tests, including appropriate resources and procedures and Quality Control Procedure (QCP).

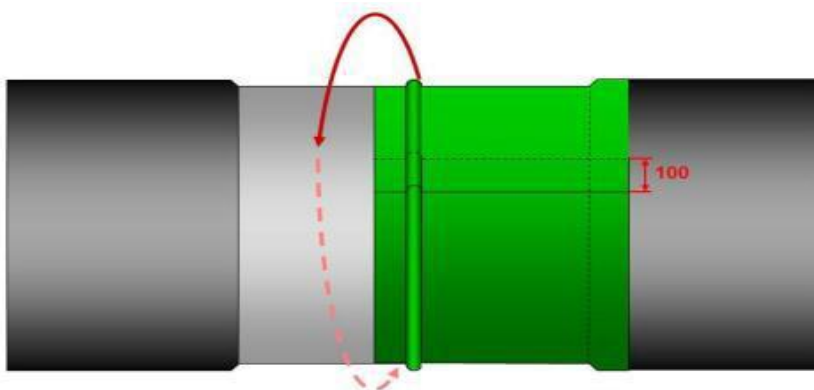
Subsequent to the approval of the documentation detailed above, a Procedure Qualification Trial (PQT) shall be carried out, to be witnessed by the Engineer's representative. The PQT shall include the application of the FJR and subsequent inspection/testing of its properties, to confirm that the Application Procedure Specification (APS) is adequate to produce a FJR system with the specified properties and shall be carried out prior to the start of production.

Alternatively for RPU mainline coatings, the same RPU material can be applied, once the Engineer has approved the APS, QCP and ITP. An ISO 17050-1 Certificate of Conformity from the RPU supplier (point of origin) stipulating compliance with all chemical, physical and mechanical properties of the applied product, as per ISO 10474 or EN 10204 Inspection Certificates 2.1 and 2.2 shall be submitted to the Engineer i.e. the EN 10290 Type Test Report and in-house batch testing for the batch(s) to be supplied as per EN 10290.

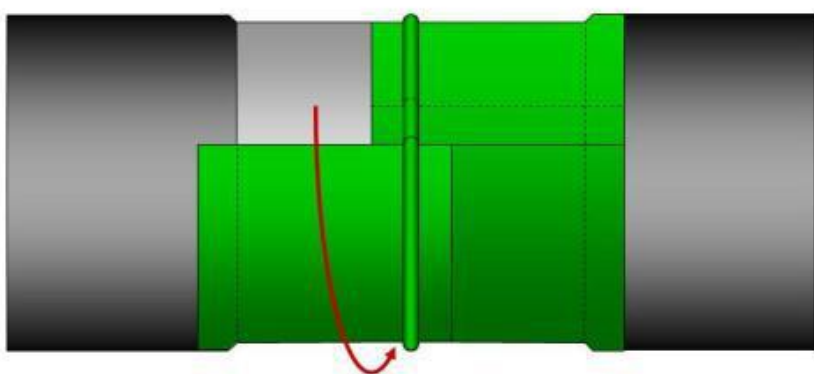
PLQ 13.2 MDPE, 3LPE and RPU coating (Stopaq application)

As an alternative to PLQ 13.1, the unprotected area at welded joints shall be protected against corrosion as follows:

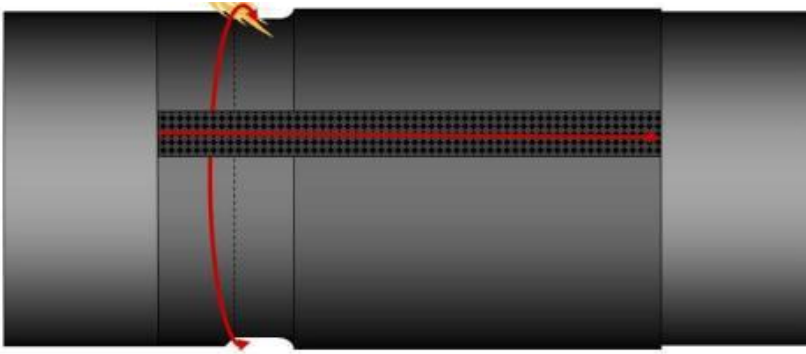
- The cutback of the coating shall be 100 mm from the pipe ends.
- Chamfer any raised edges or steps in the existing coating.
- Abrasive blast clean to Sa 2,5
- Degrease using isopropanol alcohol and a cloth.
- Apply first Stopaq Wrapping band CZH [minimum thickness of 1,5 mm] such that there is a minimum of 50mm overlap over the weld and a minimum of 50mm overlap over the coating.
- Where the end of the Wrapping band meets the beginning, peel back the first 100mm of the release foil such that the end can be applied over the beginning with a 100mm overlap.



Remove the remainder of the release foil and then apply the second Wrapping band in the same manner and remove release foil.



After removing the release foil, rub the Stopaq by hand to release any trapped air and spark test with 15kV. Position the High Impact Shield (HIS) at the 10 o'clock position and wrap around the pipe such that a 100mm overlap results at the joint. The HIS shall extend 50mm either side of the Stopaq coating overlap. Centre and apply the closure strip on the seam of the HIS. Heat the closure strip and tap on it until attachment is complete. Do not use a siliconized roller. Apply heat working from one side to the other against the wind. Apply full heat (100%) to the area there is no Stopaq beneath the HIS. Apply 75% heat to area where Stopaq is present beneath the HIS.



Immediate backfill after application if possible.

Holiday detection shall be carried out in accordance with NACE RP0188.

Damaged areas on coatings shall be repaired in accordance with the specifications and guidelines of the coating manufacturer.

PLQ 13.3 Polymer Modified Bitumen (Bituguard) Coating

The unprotected area at welded joints shall be protected against corrosion as follows:

Where applicable, remove the whitewash for a distance of 150mm from the edge of the factory applied coating. Ensure the end of the factory coating is firmly adhered. Cut back any areas of loose or damaged coating to 10mm beyond the area of damage. Ensure the edge of the factory applied coating is bevelled at 30° or less. Chamfer any raised edges or steps in the factory coating.

Surface preparation shall be abrasive blast cleaning to Sa 2,5 of ISO 8501-1. The white wash on the factory coating to be removed for a distance of 100 mm from the end of the coating.

The steel surface and 100 mm of the factory coating on both sides of the joint to be coated with Bitumen Primer (Denso Primer D or similar product approved by the Engineer).

Using hot air or gas torches, apply custom sized Hot Applied EN 10268 Class B HT50°C Bitumen rolls of membrane to achieve the same minimum thickness as the factory applied coating with a minimum thickness of 5 mm. Densotherm HD heat applied bitumen wrapping is also acceptable. The applied membrane shall overlap onto itself or the factory coating by a minimum of 50 or 100mm respectively.

Ensure a liquid bead of coating is maintained in contact with the steel at all times to prevent air entrapment. The perimeter of the field joint shall be neatly finished off and blended into the factory coating. The finished joint shall be free of air bubbles, and shall exhibit the same bond to steel as the factory coated pipe.

Joint preparation shall be subject to witness and hold inspection by the Engineer prior to application of the primer and coating. The finished joint shall be holiday tested at 15kV and any holidays repaired.

PLQ 14 CUT BACK AT PIPE ENDS

Only if it is expected that the pipes will be exposed to corrosive conditions for long periods before it is installed, the unprotected grit blasted bare steel surface at the ends of pipes, specials and fittings to be welded on site shall be painted with a temporary paint product in the factory, to prevent corrosion of the pipe end before the permanent joint corrosion protection is applied on Site. Alternatively the uncoated steel surface could be temporarily protected by a pressure sensitive tape. The temporary paint and remains of the tape (after being removed by hand) shall be completely removed by abrasive blast cleaning as part of the surface preparation process. For each project the Contractor shall consult with the Engineer whether the temporary paint on the pipe ends is required.

PLQ 15 UV PROTECTION

All pipes with MDPE, 3LPE or Bituguard coatings shall be painted with a white PVA (to be approved by the Engineer) for protection against UV. The overcoat to be maintained by applying additional layers until the pipe is backfilled.

PLQ 16 ADDITIONAL EXTERNAL PROTECTION FOR PIPES CAST INTO CHAMBER WALLS

After the concrete has cured for 7 days, wire brush or scabble the exterior and interior surfaces of the wall to remove laitance. Dry brush to remove all loose powder.

Mix ABE Super Laykold and water (1:1 ratio) and apply as a primer to the concrete and the pipe surfaces. After 1 hour apply a thick coat of ABE Super Laykold to the concrete and the pipe and immediately embed 250mm wide ABE non-woven polyester membrane "SBP" into the Super Laykold. After 3 hours apply another coat of Super Laykold.

Similar products approved by the Engineer can also be used.

This additional protection is required on the inside and outside of chamber walls.

There must be no contact between the steel pipe and the chamber reinforcement.

PLQ 17 JOINT BETWEEN EPOXY LINING AND CEMENT MORTAR LINING

The joint between epoxy lining and cement mortar lining shall be protected as follows:

- Unprotected steel surface to be abrasive blast cleaned to Sa3.
- Epoxy lining to be light abrasive blast cleaned to a surface profile of 60 – 85 micron over a distance of 50 mm minimum.
- Pro-Struct 617NS mortar filler to be applied into the joint between the epoxy and the cement mortar and finished to a smooth surface at a 45 degree angle to the pipe surface.
- Epoxy paint (approved by the Engineer) to be applied on the blast cleaned steel surface, the Pro-Struct 617NS mortar filler and on the cement mortar lining for a minimum distance of 50mm, with a minimum dry film thickness of 500 micron.

PLQ 18 MEASUREMENT AND PAYMENT

Corrosion protection and painting shall not be measured separately. The price for corrosion protection and painting shall be deemed to be included in the price for the pipes, fittings and specials.

PLT - FLOW METERS (GENERAL)

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PLT 1 SCOPE

This section of the Specification deals with the supply, delivery, installation and commissioning of:

- in line ultrasonic flow meters;
- clamp on ultrasonic flow meters
- flanged mechanical turbine meters
- Electromagnetic flow meters.

PLT 2 IN-LINE ULTRASONIC FLOW METERS

PLT 2.1 General Requirements

An in-line ultrasonic flow meter will consist of:

Two machined, stainless steel, weld-on sockets with inserted perspex windows, which are held by two plastic flanges secured with stainless steel bolts and spring washers.

The tenderer shall be responsible for the welding of the sockets on to the pipeline, as well as making good all corrosion protection according to applicable specifications.

Two 1 MHz sensing units, connected via co-axial cables of 50 ohms, with a minimum length of 12 m, to the transmitter.

The sensing units are to be removable under full pressure, while the pipeline is operating.

Both sensing units shall be electrically isolated from the pipeline.

A transmitter that shall have two output circuits:

One circuit for the 4-20 mA output signal to drive an indicator, and if later required a recorder, with maximum load capacity of 1 000 ohm.

The second circuit to drive a 24 V integrator, with a 2% zero flow cut off.

All power requirements other than 230 V will have to be provided for by the successful Tenderer.

The transmitter shall have facilities to adjust for the various pipe diameter and flow rates.

PLT 3 CLAMP-ON ULTRASONIC FLOW METERS

PLT 3.1 General Requirements

Single channel flow meters operated in transit time or time-of-flight mode shall be provided unless otherwise specified. The flow meter provided shall be capable of measuring the instantaneous flow in a pipeline and give the accumulated flow. The installation shall comprise at least two (2) sensing units (transducers) that are connected via co-axial cables and connected to a signal conversion unit. The signal unit shall be locally programmable and shall be supplied complete with programmer unit. The signal converter shall further more have a LCD display for instantaneous flow and totalize flow and shall have a 4-20 mA and pulsed output for remote indications. The signal converter unit will be mounted in an outdoor type cubicle, which will be supplied and installed under the electrical portion of the Contract.

Welding of transducers onto the pipe will not be allowed.

The IP rating for the housing of the transducers shall be submersible.

The mountings on the transducers shall be manufactured by stainless steel.

The location of the flow meter installation shall be indicated on the relevant drawings, together with the following general information:

- Pipe outer diameter
- Pipe material
- Pipe wall thickness
- Internal lining
- Average thickness of internal lining
- Fluid to be measured
- Distance between transducers and signal converter
- The operating temperature for all equipment shall be minimum -10°C and maximum 55°C.

PLT 3.2 Flow Accuracy

The flow accuracy (velocity) shall be $\pm 1\%$ of reading for pipe diameter greater than 150mm and flow velocities greater than 0.3 m/s. For pipe diameters smaller than 150mm, the flow accuracy shall be $\pm 3\%$.

The overall rangeability or turn-down ratio shall be at least 400:1.

The repeatability for clamp-on transducers shall be 0.2 to 0.5% of full scale reading.

PLT 3.3 Calibration

The Contractor shall allow for the calibration of the flow meter one month after installation by Technology Services International of Eskom enterprises. A certificate of calibration shall be submitted to the Engineer, acceptance of which signifies final completion of the installation.

PLT 3.4 Guarantee Period

The ultrasonic flow meter shall be guaranteed for a period of at least 24 Months from date of successful commissioning.

PLT 4 FLANGED MECHANICAL TURBINE METERS

PLT 4.1 Equipment Preferred

All mechanical turbine meters shall be type Sensus or similar and approved.

PLT 4.2 Accuracy

All mechanical meters supplied in terms of this Contract shall perform to an accuracy of better than $\pm 2\%$ error over the meters operating range i.e. between Q_t (transitional flow) and Q_n (continuous flow). The performance characteristics of the meters offered shall be equal to or better than the values tabled below:

Size (DN) (mm)	Q_{min} (m ³ /h)	Q_t (m ³ /h)	Q_n (m ³ /h)	Q_{max} (m ³ /h)
40	0.3	0.8	40	60
50	0.3	0.8	50	90
80	0.5	0.8	120	200
100	0.8	1.8	230	300
150	1.8	4	450	600
200	4	6	800	1200
250	6	11	1250	1600
300	12	15	1400	2000
400	25	50	2000	3000

500	45	60	3000	4500
600	100	180	3300	6500
800	210	320	6000	12000

PLT 4.3 General Requirements

Meters must be fitted with dry dial registers, which comprise 6 digit cyclometer-type totalizers, registering in kilolitres (kl) or m³. These registers must be sealed to prevent ingress of dirt or moisture. The registers, which are to be fitted as standard, must be able to provide one high frequency opto-type pulse output function and two low frequency reed-type pulse output functions. All flow meters shall be provided complete with frequency converter unit and opto coupler. The frequency converter unit will be mounted in an outdoor type cubicle, which will be supplied and installed under the electrical portion of the Contract.

No consideration will be given to meter types, which necessitate the use of special tools or fitment of any form of gland in the process of connecting pulser units, or, meters which require a register-change to switch from one volume unit per pulse to another. Dismantling of registers for this purpose will not be acceptable. Tenderers are to provide full details of these aspects with their tenders.

Cover bolts must be of stainless steel material to facilitate easy removal of mechanisms. Meter bodies must be coated with a high quality sintered epoxy powder coating, both internally and externally, to provide maximum protection against corrosion.

Although most of the meters will be installed horizontally, it must be possible to install the meters vertically (with flow in the upward direction) or in an inclined position (with flow in the upward direction), should site conditions make this necessary.

Tenderers must provide full details of the minimum lengths of straight pipe required upstream and downstream for each size of meter offered, to ensure that the accuracy of the meters remain within the stated limits, under normal operating conditions. Preference will be given to meter types requiring a minimum of straight pipe upstream and downstream, as installation space and lay lengths are at a premium.

The performance of the meters offered shall not be affected by outside magnetic influences.

Details of head loss across the meters offered shall be provided by the Tenderer.

PLT 5 ELECTROMAGNETIC FLOW METERS

PLT 5.1 General Requirements

All electromagnetic flow meters supplied under this contract shall be for high measuring accuracy i.e. $\pm 0.5\%$ of reading plus 0.05% of full scale. The repeatability or reproducibility of measurement shall be $\pm 0.1\%$ of full scale. The meter shall have a long term zero stability of $\pm 0.2\%$ and linear variation shall be less than 0.2%. Electrodes shall be manufactured from a high quality metal and shall be removable for cleaning purposes. Removal of electrodes with the line under pressure is preferred.

The minimum downstream and upstream unrestricted straight pipe run required for the specified measurement accuracy shall be stated by the Tenderer.

Although most of the meters will be installed horizontally, it must be possible to install the meters vertically (with flow in the upward direction) or in an inclined position (with flow in the upward direction), should site conditions make this necessary.

The flow meter shall be equipped with a separate mountable signal converter unit complete with sufficient length of signal cable. The signal converter shall be locally programmable and shall be supplied complete with programmer unit. The signal converter shall further more have a LCD display for instantaneous flow and totalized flow and shall have a 4-20 mA and pulsed output for remote indications. The signal converter unit will be mounted in an outdoor type cubicle supplied under the electrical scope of the Contract.

Electromagnetic meters and converters shall be suitable for outdoor installation and shall be adequately protection against lightning.

PLT 6 DIGITAL INDICATOR/INTEGRATOR

The display shall be a 6-digit, 0.56" (14.2mm) High Red L E D, giving a maximum display of 999999. The decimal point shall be selectable.

A flashing display shall be given during totaliser overflow.

The indicator/integrator shall be powered by 230 V AC at 50 Hz.

The indicator/integrator shall be constructed in such a way that it can be calibrated to the required flow and also by means of a selector button, display the accumulated quantity of water released.

The front bezel shall meet NEMA 4/IP65 requirements

The manufacturer of the indicator/integrator shall comply with ISO 9001 and proof of this to be submitted with the tender documents.

The indicator/integrator shall have a lock-out facility to limit operator entry to the programmable settings and totaliser.

The totaliser shall have a programmable time base with a scale factor of 0.001 to 100.0 and a low-end cut-out. The remote indicator/integrator if required is to be fitted into an IP 66 enclosure in such a way that the flow reading is clearly visible with space available for the labelling and surge protection as specified.

PLT 7 INSTRUMENT PANELS

All panels will comply with the minimum requirements for an IP 65 rating.

All cable entries will be fitted with the appropriate cable gland. All cable glands will comply with IP 68.

Each enclosure is to be fitted with an M10 brass bolt and two nuts that will act as an earth bar. All surge protection in the enclosure to be grounded onto this bolt.

Local indicator/integrator

An instrument panel is required to house the flow meter power supply unit if required, indicator/integrator and surge protection and shall comply with the following:

- At least 500 mm high, 400 mm wide and 200 mm deep.
- Constructed from polycarbonate.
- The door shall be removable and have concealed hinges and captive, stainless steel hinge pins.
- Be fitted with a plain painted metal chassis of at least 2.5 mm thick.
- Be fitted with a polyester internal door for mounting of the totaliser.
- The external door shall be fitted with a window that allows sight of the totaliser.
- The external door shall have an extruded polyurethane seal fitted to a groove.
- Only two closure points that are situated outside the sealed area. At least one of the closure points shall be lockable with a cylindrical barrel type lock and two keys shall be supplied for this lock.
- Shall be wall mountable with 4 stainless steel brackets giving a space of at least 10 mm between the enclosure and the wall.

Remote indicator/integrator (if required)

An instrument panel is required to house the remote indicator/integrator and surge protection and shall comply with the following:

- Constructed from polycarbonate.
- The door shall be removable and have concealed hinges and captive, stainless steel hinge pins.
- Fitted with a polyester internal door or stand-offs for mounting of the totaliser.

- The external door shall be fitted with a window that allows sight of the totaliser.
- The external door shall have an extruded polyurethane seal fitted to a groove.
- Only two closure points which are situated outside the sealed area. At least one of the closure points shall be lockable with a cylindrical barrel type lock and two keys shall be supplied for this lock.
- Shall be wall mountable with 4 stainless steel brackets giving a space of at least 10 mm between the enclosure and the wall.

PLT 8 SURGE PROTECTION

Single phase 230 V AC medium protection units that are certified to withstand surges of up to 75kA.

Two wire, 230 V AC fine protection units that are certified to withstand surges of up to 40kA.

Two wire, 24 V AC fine protection units that are certified to withstand surges of up to 40kA.

Two explosion proof, pipeline spark gaps rated to withstand surges of up to 100kA, complete with pipeline mounting brackets and a fly lead of at least 300mm.

All surge protection units must be grounded to a common earth point in the panel that houses the ultra sonic flow meter. If a nut and bolt arrangement is used it shall be at least an M10 and shall be made of brass. Care has to be taken to ensure that the nut and bolt do not negate the IP 65 rating of the enclosure.

PLT 9 SIGNAL CABLE

All signal cable to be 1,5 mm², 4 core, twisted pair, braided screened cable.

PLT 10 EARTHING

The successful Tenderer is to supply 70 mm², stranded copper cable as well as lugs that will fit the cable and an M10 bolt to connect between the equipotential bar and earth mat.

The successful Tenderer is to supply 16 mm², green PVC insulated, stranded copper cable to connect between the common earth at the instrument panel and the equipotential bar.

PLT 11 EQUIPOTENTIAL BAR

An equipotential bar with cover must be suitably mounted within each flow meter chamber. Modular terminals should be provided to accommodate 3 connections of up to 16 mm², 3 connections of 16 - 95 mm² and 3 for flat connections up to 30 mm wide.

PLT 12 LABELS

Two types of labels are required. One for the site and installation name, the other giving details of the flow meter characteristics.

Labels to be manufactured from plastic engraved stock with white lettering on a black base.

Lettering to be 10 or 6 mm high x 5 and 3 mm wide and labels to be at least 105 mm X 30 mm.

All labels to be fitted with at least two strips of 12 mm wide double sided tape that run for the total length of the label.

PLT 13 GENERAL REQUIREMENTS

All screws, brackets, cable saddles, nuts, bolts, washers etc. used in the installation of the equipment shall be from stainless steel.

Before delivery to site all equipment and all parts supplied under this contract will be checked and certified at the supplier's workshop to ensure that they are in working condition by a delegated representative of the client.

PLT 14 COMMISSIONING

The equipment as supplied under this Contract shall be commissioned after one fault free month of operation.

If during this month the equipment or any part thereof should fail the successful Tenderer shall repair the equipment at his own expense and once again leave the equipment to operate for one fault free month before commissioning. All costs incurred shall be for the successful Tenderer's account. This cycle to continue until one fault free month has been attained.

PLTP - MANUFACTURE, SUPPLY AND TESTING OF THERMOPLASTIC PIPES

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PLTP 1 SCOPE

This Specification covers the manufacturing, supply, installation and testing of thermoplastic pipes and fittings.

PLTP 2 STANDARDS

The latest revisions of the following Standards shall be applicable.

COMMONLY USED STANDARDS FOR PLASTIC PIPING SYSTEMS	
SANS 15874-1	Plastics piping systems for hot and cold water installations - Polypropylene (PP) Part 1: General
SANS 15874-2	Plastics piping systems for hot and cold water installations - Polypropylene (PP) Part 2: Pipes
SANS 15874-3	Plastics piping systems for hot and cold water installations - Polypropylene (PP) Part 3: Fittings
SANS 15874-5	Plastics piping systems for hot and cold water installations - Polypropylene (PP) Part 5: Fitness for purpose of the system
SANS 15875-1	Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X) Part 1: General
SANS 15875-2	Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X) Part 2: Pipes
SANS 15875-3	Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X) Part 3: Fittings
SANS 15875-5	Plastics piping systems for hot and cold water installations - Crosslinked polyethylene (PE-X) Part 5: Fitness for purpose of the system
SANS 1601	Structured wall pipes and fittings of unplasticized poly(vinyl chloride) (PVC-U) for buried drainage and sewerage systems
SANS 16422	Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure - Specifications
SANS 2001-DP1	Construction works Part DP1: Earthworks for buried pipelines and prefabricated culverts
SANS 2001-DP4	Construction works Part DP4: Sewers
SANS 21138-1	Plastics piping systems for non-pressure underground drainage and sewerage - Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene criteria for pipes, fittings and system polyethylene (PE) Part 1: Material specifications and performance(PP)
SANS 21138-2	Plastics piping systems for non-pressure underground drainage and sewerage - Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) Part 2: Pipes and fittings with smooth external surface, Type A
SANS 21138-3	Plastics piping systems for non-pressure underground drainage and sewerage - Structured-wall piping systems of unplasticized poly(vinyl chloride) (PVC-U), polypropylene (PP) and polyethylene (PE) Part 3: Pipes and fittings with non-smooth external surface, Type B
SANS 21307	Plastics pipes and fittings – butt fusion jointing procedures for polyethylene (PE) pipes and fittings
SANS 22391-1	Plastics piping systems for hot and cold water installations - Polyethylene of raised temperature resistance (PE-RT) Part 1: General
SANS 22391-2	Plastics piping systems for hot and cold water installations - Polyethylene of raised temperature resistance (PE-RT) Part 2: Pipes
SANS 22391-3	Plastics piping systems for hot and cold water installations - Polyethylene of raised temperature resistance (PE-RT) Part 3: Fittings
SANS 370	Steel mesh reinforced polyethelene (PE) pipes for water supply
SANS 4427-1	Plastics piping systems - Polyethylene (PE) pipes and fittings for water supply - Part 1: General
SANS 4427-2	Plastics piping systems - Polyethylene (PE) pipes and fittings for water supply - Part 2: Pipes
SANS 4427-3	Plastics piping systems - Polyethylene (PE) pipes and fittings for water supply - Part 3: Fittings

SANS 4427-5	Plastics piping systems - Polyethylene (PE) pipes and fittings for water supply - Part 5: Fitness for purpose of the system
SANS 4437-1	Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) Part 1: General
SANS 4437-2	Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) Part 2: Pipes
SANS 4437-3	Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) Part 3: Fittings
SANS 4437-5	Plastics piping systems for the supply of gaseous fuels - Polyethylene (PE) Part 5: Fitness for purpose of the system
SANS 674	Steel-reinforced spirally wound PE drainage and sewer pipes
SANS 791	Unplasticized poly(vinyl chloride) (PVC-U) sewer and drain pipes and pipe fittings
SANS 8772	Plastics piping systems for non-pressure underground drainage and sewerage - Polyethelene (PE)
SANS 8773	Plastics piping systems for non-pressure underground drainage and sewerage - Polypropylene (PP)
SANS 966-1	Components of pressure pipe systems Part 1: Unplasticized poly(vinyl chloride) (PVC-U) pressure pipe systems
SANS 966-2	Components of pressure pipe systems Part 2: Modified poly(vinyl chloride)(PVC-M) pressure pipe systems
SANS 967	Unplasticized poly(vinyl chloride) (PVC-U) soil, waste and vent pipes and pipe fittings
EN 13476-1 (Parts 1, 2 and 3) and ISO 9969	PE structured wall sewer pipes

STANDARDS RELEVANT TO THE MATERIAL AND RAW MATERIAL QUALITY FOR THERMOPLASTIC PLASTIC PIPING SYSTEMS	
SANS 1133	Plastics - Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics
SANS 2505	Thermoplastics pipes - Longitudinal reversion - Test method and parameters
SANS 2507-1	Thermoplastics pipes and fittings - Vicat softening temperature Part 1: General test method
SANS 3127	Thermoplastics pipes - Determination of resistance to external blows - Round-the-clock method
SANS 9227	Corrosion tests in artificial atmospheres - Salt spray tests
SANS 9852	Unplasticized poly(vinyl chloride) (PVC-U) pipes - Dichloromethane resistance at specified temperature (DCMT) - Test method

STANDARDS FOR THE INSTALLATION PROCEDURES AND WELDING APPLICATIONS OF PLASTIC PIPING SYSTEMS	
SANS 10089-3	The petroleum industry Part 3: The installation, modification, and decommissioning of underground storage tanks, pumps/dispensers and pipework at service stations and consumer installations
SANS 10252-1	Water supply and drainage for buildings Part 1: Water supply installations for buildings
SANS 10252-2	Water supply and drainage for buildings Part 2: Drainage installations for buildings
SANS 10254	The installation, maintenance, replacement and repair of fixed electric storage water heating systems
SANS 10268-1	Welding of thermoplastics - Welding processes Part 1: Heated-tool welding
SANS 10268-2	Welding of thermoplastics - Welding processes Part 2: Electrofusion welding
SANS 10268-3	Welding of thermoplastics - Welding processes Part 3: Hot-gas welding
SANS 10268-4	Welding of thermoplastics - Welding processes Part 4: Hot-gas extrusion welding
SANS 10268-5	Welding of thermoplastics - Welding processes Part 5: Solvent welding

SANS 10268-6	Welding of thermoplastics - Welding processes Part 6: Ultrasonic welding, staking and insertion
SANS 10268-10	Welding of thermoplastics - Welding processes Part 10: Weld defects
SANS 10269	Welding of thermoplastics - Testing and approval of welders
SANS 10270	Welding of thermoplastics - Approval of welding procedures and welds
SANS 1655	Welding of thermoplastics - Welding rods, fillers and solvents
SANS 1671-1	Welding of thermoplastics - Machines and equipment Part 1: Heated-tool welding
SANS 1671-2	Welding of thermoplastics: Machines and equipment Part 2: Electrofusion welding
SANS 1671-3	Welding of thermoplastics - Machines and equipment Part 3: Hot-gas welding
SANS 1671-4	Welding of thermoplastics - Machines and equipment Part 4: Hot-gas extrusion welding
SANS 1671-6	Welding of thermoplastics - Machines and equipment Part 6: Ultrasonic welding, staking and insertion
SANS 6269	Welding of thermoplastics - Test methods for welded joints

STANDARDS USED TO DETERMINE THE STRENGTH AND DIMENSIONAL REQUIREMENTS AND TOLERANCES FOR PLASTIC PIPING SYSTEMS

SANS 130-1	Thermoplastics pipes, fittings and assemblies for the conveyance of fluids - Determination of the resistance to internal pressure Part 1: General method
SANS 9080	Plastics piping and ducting systems - Determination of the longterm hydrostatic strength of thermoplastics materials in pipe form by extrapolation
SANS 11922-1	Thermoplastics pipes for the conveyance of fluids - Dimensions and tolerances Part 1: Metric series

ADDITIONAL INTERNATIONAL STANDARDS FOR TESTING OF PLASTIC PIPING SYSTEMS

ISO 6259-1	Thermoplastics pipes - Determination of tensile properties - Part 1: General test method
ISO 6259-2	Thermoplastics pipes - Determination of tensile properties - Part 2: Pipes made of unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly(vinyl chloride) (PVC-C) and high-impact poly(vinyl chloride) (PVC-HI)
ISO 11357-6	Plastics - Differential scanning calorimetry (DSC) - Part 6: Determination of oxidation induction time (isothermal OIT) and oxidation induction temperature (dynamic OIT)
ISO 13761	Plastics pipes and fittings - Pressure reduction factors for polyethylene pipeline systems for use at temperatures above 20 °C
ISO 18553	Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds
ISO 18553 Amd 1 2007	Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds (AMENDMENT 1)
ISO 21307	Plastics pipes and fittings - Butt fusion jointing procedures for polyethylene (PE) pipes and fittings used in the construction of gas and water distribution systems

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of Centrifugal Pumps:

The Specification shall be read in conjunction with that of the Project Specification.

- SANS 10400: National Building Regulations
- BS 5304: Code of practice for safeguarding of machinery
- SANS 9096-1: 1994: Testing of welders, where applicable to the type of welding required
- BS 292 Part 1: 1987: Dimensions of ball bearings, cylindrical and spherical roller bearings
- SANS 10162-4: Structural use of Steel Part 4: The design of cold-formed stainless steel structural

- SANS 1044-3: Welding Part 3: The fusion of steel (including stainless steel): Tests for the approval of welding procedures
- SANS 10044-4 : Welding Part 4: The fusion welding of steel (including austenitic stainless steel): Tests for the approval of welders working where weld procedure approval is not required.
- SANS 10064 : The preparation of steel surfaces for coating
- SANS 10102-4 : Selection of pipes for buried pipelines Part 1: General Provisions
- SANS 10104 : Hand railing and balustrading (safety aspects)
- SANS 10111-2-1 : Engineering Drawing Part 1: General principles Engineering Drawing Part 2: Geometric Tolerancing Section 1
- SANS 10341 : Installation and maintenance of bearings – General guidelines
- SANS 1700-5-9 : Fasteners Part 5: General requirements & material properties
- Section 8: Corrosion resistant stainless steel fasteners-Bolts, Screws & Studs
- SANS 1700-5-10 : Fasteners Part 5: General requirements & material properties
- Section 8: Corrosion resistant stainless steel fasteners-Nuts
- BS EN ISO 14847:1999: Rotary positive displacement pumps. Technical requirements
- BS EN 734:1995: Pumps and pump units for liquids. Common safety requirements
- BS EN 12162:2001: Liquid pumps. Safety requirements. Procedure for hydrostatic testing
- BS EN 60041:1995: Field acceptance tests to determine the hydraulic performance of hydraulic turbines, storage pumps and pump-turbines.
- BS EN 60994:1993 : Guide for field measurement of vibrations and pulsations in hydraulic machines (turbines, storage pumps and pump-turbines)
- BS EN 22858:1993: End-suction centrifugal pumps (rating 16 bar). Designation, nominal duty point and dimensions
- BS EN 23661:1993: End-suction centrifugal pumps. Baseplate and installation dimensions
- BS EN 733:1995: End-suction centrifugal pumps, rating with 10 bar with bearing bracket. Nominal duty point, main dimensions, designation system
- SANS 1123 : Pipe Flanges
- ISO 281 : Rolling bearings -- Dynamic load ratings and rating life
- BS 4999: General requirements for rotating electrical machines. Specification for standard dimensions
- SIS 05 59 00 : Pictorial Surface Preparation Standards for Painting Steel Surface
- BS 5316 Part 2 : Pump test codes

PLTP 3 CERTIFICATION, DOCUMENTATION AND QUALIFICATIONS

All plastic pipes and fittings have to comply with the relevant SANS Specification and shall be certified accordingly by authorities accredited by SANAS (South African National Accreditation System), for example SABS and SATAS.

Pipe manufacturers have to be members of SAPPMA (South Africa Plastic Pipe Manufacturers Association).

The Contractor shall submit the following documentation of the manufacturers to the Engineer before commencement of the manufacturing of pipes and fittings:

- Proof of current SANS Standard certification for product.
- SANAS accreditation of the certification authority (e.g. SABS or SATAS).
- SAPPMA certificate in order to ensure adherence to the SAPPMA/IFPA code of conduct and quality assurance standards.
- ISO 9001:2015 quality control accreditation.

- All pipes shall be marked with the date and time of production, relevant SANS Standard, mark of certification authority (e.g. SABS or SATAS), SAPPMA mark of quality reassurance, pipe diameter and pressure / strength class.

The following work must be performed by IFPA (Installation Fabrication Plastics Pipe Association) members:

- All fabricated fittings and specials manufactured from HDPE pipe or PVC pipe.
- All on site welding/gluing and fabrication work on Site.

IFPA members are bound by a code of conduct calling for full compliance to policies and local standards. IFPA members are able to prove full traceability to all its employees performing IFPA related tasks.

The Contractor shall provide the necessary training to its employees to ensure IFPA standards are maintained. The Contractor shall submit its IFPA member certificate to the Engineer before commencement of manufacturing and construction.

PLTP 4 MATERIALS

PLTP 4.1 General

The following documentation shall be submitted by the Contractor to the Engineer before manufacturing:

- Certificate of Analysis (raw material)
- Quality Certificates (SABS, SATAS, etc.)
- Quality Control Plan

Inspection Documents shall comply with BS EN 10204 and shall be submitted by the Contractor to the Engineer. Unless otherwise specified in the Specifications or by the Engineer, Inspection Documents Type 3.1 are required.

Delivery of material shall only commence upon completion of the minimum required Batch Released Tests (BRT).

Quality systems shall be in accordance with SANS ISO 9001:2015 including Product Quality Plans for all products.

PLTP 4.2 PVC-O Pipes

PVC-O pipes shall be Class 500 with material properties as specified in paragraphs 4.1 and 4.2 of Technical Specification prCEN/TS 15223:2007(E) published by the European Committee for Standardization (CEN).

PLTP 4.3 High Density Polyethylene (HDPE) Pipes

Only unprocessed PE 100 polymer compliant to SANS ISO 4427-1 shall be used. This requirement shall be validated by the manufacturer.

PLTP 5 WELDING

Refer to PLTP 2 for the relevant welding standards.

The Contractor shall be responsible for the following:

- Compiling of Preliminary Welding Procedure Specification, recording of qualification welds and conducting of 3rd party testing;
- Compiling of Welding Procedure Specification and Qualification Report with required testing;

- Compiling of Final Welding Procedure Specification;
- On-site 3rd party inspections;
- Compiling of Welding Quality Packs with inspection reports, COC's, COA's, Certificates, etc.

Employees responsible for electro-fusion or butt welding of HDPE pipes shall have (as a minimum) a certificate of competence at NQF Level 2 (in accordance to SANS 10268).

Welders shall be trained and qualified for a specific pipe diameter and class and for a specific welding process (e.g. butt, electro-fusion, socket fusion, hot gas extrusion) by Plastics SA. On successful completion of training the welder shall be tested and certified in accordance with SANS / ISO 10269 – Testing and approval of welders.

The IFPA stamp is required at all welds.

Calibration Certificates are required for welding equipment and welding machines shall be able to produce accurate welding reports.

PLTP 6 TESTING

PLTP 6.1 Hydrostatic pressure testing of spigot / socket joints

At least three spigot / socket joints per batch of uPVC pipes shall be subjected to the one hour test as described in Section 5.8 of SANS 966 Part 1 at a laboratory approved by the Engineer. The Engineer shall be provided the opportunity to witness these tests. Should any of the tests fail, the associated uPVC pipe batch will be rejected.

PLTP 6.2 Testing of HDPE butt-weld connections

Quality control testing during butt-welding of HDPE pipes will be required. In addition, the welder shall be separately qualified for all pipe sizes to be welded. The quality control testing for qualifying the welder shall be as follows:

Observe the joining process to confirm that the proper butt-welding procedure is being followed. Visually inspect the joint and compare it to a sample or picture of an acceptable joint.

Allow the joint to cool for at least one hour.

A 300 mm wide ring section of the HDPE pipe shall be cut with the butt-weld joint centered as illustrated in Figure 1. Cut four strips lengthwise through the joint area, 90 degrees apart for visual examination and bend testing. The width of the test bend is proportional to the pipe wall thickness. If the pipe wall thickness is less than 25.4 mm, a 25.4 mm wide strip is recommended. If the pipe wall thickness is greater than 25.4 mm, the width of the test strip shall be equal to the pipe wall thickness.

Visually inspect the strap samples for voids, discontinuities, lack of bonding, misalignment, bead size, etc.

The bend testing consists of the following steps:

- Allow each test strip to cool to a temperature ranging between 18°C and 27°C.
- Each test strip shall then be clamped in a vice 25.4 mm under the weld bead as illustrated in Figure 2.
- A steel extension pipe of appropriate diameter and length shall then be slipped over the free end of the specimen to 25.4 mm above the weld bead.
- The bend test shall be performed by bending the test specimen 180 degrees (minimum 90 degrees) in the direction that places the concave interior surface/root of the pipe wall/weld in tension as illustrated in Figure 2. No failures in the butt-weld area are permitted with all four test strips.

If flaws are observed or develop during bending, try to determine the cause, recheck the procedure, and make another joint.

The welder is disqualified if the second joint is also unacceptable.

Butt-weld of HDPE pipes to be installed shall not commence until a trial fission has passed the bend test.

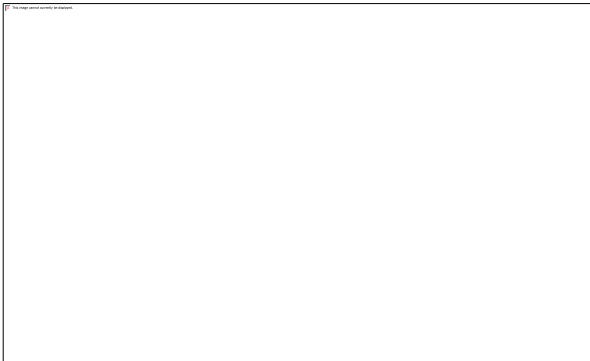


Figure 1: Bend strap test detail

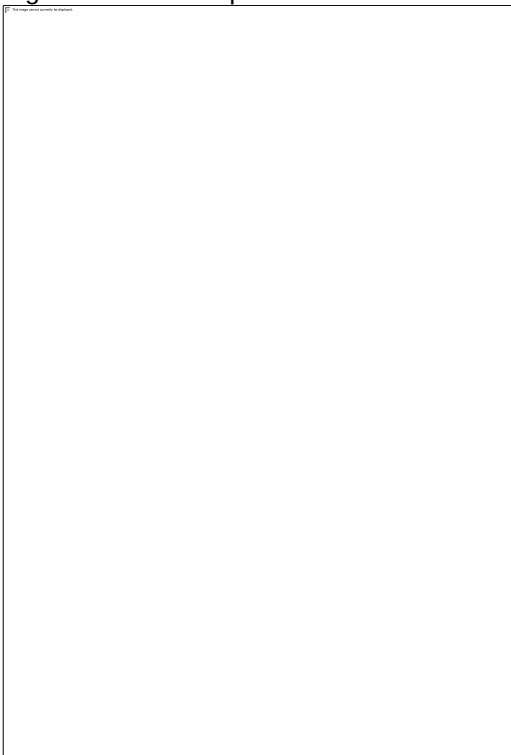


Figure 2: Bend strap test detail (side view)

PLTP 7 HANDLING AND INSTALLATION

PLTP 7.1 General

Handling and installation shall comply with guidelines provided in the Technical Manual of SAPPMA (latest edition).

PLTP 7.2 Ultra Violet (UV) protection

PVC pipes shall be stored under 80% black HDPE UV stabilised shade netting (blocking 80% UV).

PS 1 – SECURITY STANDARD TECHNICAL SPECIFICATION FOR AN OUTER PERIMETER FENCE FOR WASTEWATER PUMP STATION

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SPECIFICATION FOR A SECURITY OUTER PERIMETER FENCE

1.1. SCOPE

1.1.1 The contractor shall furnish labour, equipment, and materials for the following systems in this Section of the specification:

- a) 4.5m Bowed welded mesh security outer fence.
- b) Preparation of strip where fence will be installed
- c) 4.5m bowed fence detection system.
- d) Detection system controller.
- e) Gate detection system.
- f) Surge protection.
- g) Power supplies.
- h) Training.
- i) Spare Parts.

1.2 GENERAL

1.2.1 The Perimeter Security Fence shall be based on the following systems:

- a) 4.5m Bowed outer security fence
- b) Delay fence integrity detection
- c) Gate area detection solution

1.2.2 The Delay fence disturbance detection system shall be based on kinematics principles detecting any cut or removal of components of the delay fence as is detailed hereunder in this specification. This detection system shall be installed on the outer perimeter fence.

1.2.3 The physical perimeter shall consist of an inner fence and an outer fence of 4.5m in height.

1.2.4 Furthermore the outer fence detection system shall be installed on the outer perimeter fence attached to the outer fence structure as per the specifications of the technology manufacturer.

1.2.5 Due to the various gate area designs found on various facilities a gate area security and detection solution has to be designed on an application to application basis and has to be approved by the appointed representative from the head office of the end-user.

The representative shall be identified by the Municipality on a project to project basis.

It is a requirement that all sub-systems must be integrated with the security management system on a site. Contractors shall ensure that the control system offered comply with this requirement.

2. 4.5m PERIMETER SECURITY FENCE

The Perimeter Security Fence must not to be closer than 20m from the buildings except in cases where the site is an existing site and site limitations are experienced. The perimeter fence shall enclose all the buildings and all the support buildings accessible to intruders.

2.1 Standard Fencing Specifications

2.1.1 Posts

Curved 101.6mm x 4.5mm Grade W 300 Hot dipped galvanised tubular posts to radius specified with 3mm capping plate. Posts have predrilled 11mm diameter holes for M8 bolts to fix cover plate to posts. Refer to details for top rail fixing plate. Posts to be positioned in Class 6, 103mm ID P.V.C x 2.58mm wall thickness x 1500mm long sleeves set in 500mm x 500mm x 1500mm 15MPA concrete foundation. Ground conditions may require additional concrete.

2.1.2 Covering plate

Covering plates required on all curved posts from ground to top of post 50mm x 5mm flat steel required, predrilled with 11mm diameter holes for fixing mesh to post.

2.1.3 Fixing Accessories

Cover plates to posts: M8 x 150mm galvanised cup-square bolts with galvanised washers and shear off nuts.
Top rail to post & post at corners: M10 x 40mm galvanised cup square bolts with galvanised washers and shear off nuts.

Corner post bracket: M12 U-bolt galvanised with galvanised washers and shear off nuts.

2.1.4 Welded wire mesh panels

The mesh panels shall be manufactured from high tensile Galfan Class A coated wire in accordance with SANS 10244-2:2003 specification.

Vertical wires shall be welded on either side of the horizontal wires.

The vertical wires on the inside shall be to a height of 3000mm. The vertical wires on the outside shall be for the total length (6000mm) of the welded mesh panel. All vertical wires shall be spaced at 76.2mm and all horizontal wires spaced at 12.7mm centre to centre.

Inside apertures : 72.2mm x 8.7mm

Centre to centre : 76.2mm x 12.7mm

Wire diameter : 4mm

Width of panel : 3050mm

Height of panel : 6000mm

Tensile Strength of wire : 600 – 900 N/mm

Weld strength : 60 – 80%

2.1.5 Top rail

50mm x 50mm x 5mm Angle Iron top rail. Pre-drilled holes.5including 50mm x 5mm covering plate to fix Razor Wire coil to angle iron top rail.

2.1.6 Galvanising

All posts, rails and cover plates to be Hot dipped galvanised in accordance with ISO 1461 (Min.70 microns)

2.2 Additional

- Razor Wire Coil (1)
- Barbed Tape Concertina 730mm dia. Medium barb - Barbed Tape
- Concertina Coil. Galfan Class A coated to SANS 10244-2:2003
- (Maximum stretch – 10000mm)
- Razor Wire Coil (2)
- Barbed Tape Concertina 610mm dia. long barb - Barbed Tape Concertina Coil. Galvanised (Maximum stretch 10000mm)

2.3 Gates

Swing or sliding gates shall be allowed depending on site conditions and management of access control. Ensure that this option is cleared with the client before tenders are invited. Sliding gates shall be controlled manually or by means of an electrically controlled industrial type gate motor. Beams shall be provided to prevent closing of the gate while a vehicle is driving through.

The frame to be constructed of 60 x 40 x 2mm rectangular steel tubing and Hot dipped galvanised to ISO 1461 (Min thickness 45 micron).

Each gate must consist of two leaves of same size.

Locking devices shall be to client's specification and acceptance.

Each section of the gate must be secured to the gate post by means of 3 approved hinges. Proposed hinges shall be submitted for approval before fitting. The gate must be installed in such a way that the leaves can open in both directions. Each gate must be clad with the same mesh as that of the fence using similar cover plate & bolting system. The gap between the bottom of the gate and the road surface shall not exceed 50mm

2.4 Erection of the fencing posts

After excavation of the fencing post holes, 1300mm of the 103mm ID P.V.C sleeve with positioning bolt to be set vertically in concrete foundation. Slide post into sleeve. Minimum 5 days setting time to be allowed before positioning posts. After setting of concrete the top 200mm PVC sleeve to be cut off before erection of posts. The PVC sleeves shall protrude through the 100mm concrete strip. Care must be taken to ensure all posts are aligned (vertically and at tops), plump, perpendicular and in the correct position on the route of the fencing. All sleeves must be encased in a 25/19 concrete footing of adequate size. The contractor shall note that all galvanising shall be done after manufacturing of the posts.

Prior to erection of the fence poles permission shall be obtained from the Civil consultant of the Municipality to ensure that all conditions have been met.

2.5 Concrete slab for outer security fence

A 25/19mm concrete slab must be cast in situ along the inside of the external fence. The dimensions of the slab shall be as follows:

1000 x 100mm or other as specified on top of prepared ground level.

The wire mesh panels of the fence shall be cast into the concrete slab.

An expansion gap of 50mm wide must be provided at 3000mm intervals, to provide drainage and movement.

The wire mesh panels of the fence shall be cast into the concrete slab.

The Section of mesh into concrete beam and in ground shall be bitumen dipped / covered up to 100mm above ground level Civil construction will include route preparations, and casting of the 1000mm wide concrete slab with welded mesh steel reinforcing to a nominal thickness of 100mm and a minimum compressive strength of 20Mpa.

All existing electrical services as well as the cables required for this installation shall be installed in 50mm PVC sleeves in the concrete slab to ensure that these services can be maintained after completion of the contract.

The area underneath the concrete plinth shall be cleared of all vegetation prior to casting and treated with a suitable sterilization herbicide to prevent any vegetation growth.

The contractor shall allow and install a 250 micron PVC sheet underneath the concrete slab, to prevent any vegetation growth.

2.6 Preparation of the fence lines

The fence lines and the eight metre strip between the inner (when required by Municipality, this must be cleared before the contract starts) and the outer fence shall be prepared in such a way that each zone length runs as close as possible to the same gradient.

Marginal gradient changes will only be allowed on zone ends. Approval for gradient changes in soil preparation shall only be done once written approval from the Engineer has been obtained.

2.7 Preparation of the strip between the outer and the inner fences

The eight metre strip between the inner and the outer fence shall be cleared of all vegetation, treated with a suitable sterilization herbicide, preventing any vegetation growth and the area shall be covered by a layer of 19 mm single sized stone on a geo-textile similar to Bidum U34 as part of this contract. The contractor shall include in his offer the cost to maintain this area for the full duration of the contract and shall include as part of his offer a suitable sterilization herbicide treatment once every six months for the full duration of his maintenance contract. The contractor shall note that it shall be the responsibility of the fencing contractor to do all liaisons regarding all civil work with the civil consultant of the Municipality. All information required e.g. soil conditions, back filling etc. shall be taken into consideration during the tender period and no additional costs as a result of poor liaison shall be tolerated.

2.8 SECURITY FENCE PERIMETER LIGHTING*

The tenderer shall design and make allowance for security fence perimeter lighting surrounding the premises. Lamps used in the security fence perimeter lighting system shall be of the compact fluorescent type to ensure instant cold and hot re-strike.

The security fence perimeter fence lighting system shall consist of a streetlight luminaire, equipped with two 26 watt compact fluorescent lamps and mounted at a rake angle of 15 above the horizontal and at 6 metres above ground level on a GRP/galvanised steel pole positioned 1,5m inside the outer fence. The spacing shall be in such a way as to achieve an average initial illumination level of 5 lux and a minimum initial illumination level of 3 lux in the area between the outer and inner fence. In addition, a floodlight luminaire equipped with two 24 watt compact fluorescent lamps and aimed at 60 above the downward vertical, shall be mounted next to the streetlight type luminaire by means of a special spigot arrangement on top of the GRP or galvanised steel pole. Both luminaires are to face towards the inside of the premises. The streetlight type luminaire and floodlight luminaires circuit shall be controlled by a photoelectric cell.

3. OUTER FENCE DETECTION SYSTEM

3.1 POWER AND COMMUNICATIONS CABLE

All cables must comply with the manufacturer recommendations. Exterior wire and cables shall be installed in schedule 40 PVC conduit and rated for direct burial use. The conduit shall be installed in the inner fence concrete strip if an inner fence is simultaneously erected otherwise it shall be installed in the outer fence concrete strip. Power distribution wire from the main equipment room to remote processors, transponders, detection units, or other remote electronics on the site perimeter shall be minimum 2.5 mm² copper and shall be increased in size as necessary to ensure no more than 5% (AC or DC) voltage drop from the main equipment room to the remote equipment. It is required to submit power voltage drop calculations for all field located perimeter equipment.

Provide a two core multimode fiber optic cable, direct bury type cable between all perimeter system enclosures and the head end to create a loop around the perimeter system. Provide 1500mm of spare cable for each cable in each perimeter system enclosure. All cables that will be directly buried shall be rated for direct burial and approved for wet locations.

All conductors shall be rated for direct burial and approved for wet locations in accordance with SABS. Signal and power cables shall be separate cables and not combined as part of the same cabling jacket

3.2 ACCESSORIES

The system shall include all accessories required to perform the functions described in this Section.

3.3 MARKERS AND NAMEPLATES

3.3.1 Cable Tags: Cable tags shall be provided in accordance with SABS.

3.3.2 Nameplates:

- a. Precision engraved letters and numbers with uniform margins.
- b. Character sizes shall be a minimum of 50 mm high.
- c. Indoor : Shall be phonemic, two colour laminated stock, 2 mm thick, machine engraved to expose inn core colour (white).
- d. Outdoor: Shall be Standard aluminium alloy plate stock, minimum 1 mm thick, engraved areas shall be enamel filled or background enamelled with natural aluminium engraved characters.
- e. All nameplates shall be permanently attached.

3.3.3 Zone Identification: a. In order for the perimeter patrol officer to easily identify zone locations, at the end of each zone a 500mm x 250mm sign shall be installed. The sign shall face the perimeter road.

- b. All zones shall be identified by zone number.
- c. Black numbers on a reflective yellow background shall be used.
- d. All signs shall be visible from a distance of 12000mm.

3.4 POWER SUPPLIES

Power supplies shall be furnished with characteristics as required to support the operational performance of the sensor and signal processors.

3.5 ENCLOSURES

All exterior post mounted enclosures must have the following features:

- a. At least 1.6 mm stainless steel plate construction.
- b. Continuously welded seams.
- c. Cabinet lockable with all locks keyed alike.
- d. Equipped with tamper detection device connected to the processor tamper circuit. The tamper switch shall detect any attempt to vandalise the enclosure including the opening of the door and the cutting or breaking of the enclosure.

3.6 EARTHING

3.6.1 A continuous 70mm 2 , bare, stranded, copper earthing conductor shall be buried a minimum of 600 mm under the sidewalk and run the continuous length of the sidewalk.

3.6.2 At each sensor post, via cad-weld connections, the earthing conductor shall attach to the ground bus located inside the enclosure. Also, a 70mm 2 earthing conductor shall bond the processor enclosure, and the nearest outer fence post to the 70mm 2 ground ring.

All doors of field cabinets shall be earthed.

3.6.3 At a point nearest the main electronics equipment room, a 70 mm 2 , bare, stranded, copper conductor shall bond the buildings electrical system ground bus to the 70mm 2 ground ring buried under the sidewalk. All direct buried ground connections shall be cad-weld type connections.

3.6.4 All systems described in this section shall be grounded in accordance with the responsible engineer's recommendations and meet the minimum requirements of the manufacturer.

3.7 SURGE PROTECTION

3.7.1 All metallic data, communications, video, and sensor lines entering or leaving a building shall be protected with surge protection devices.

3.7.2 Earthing of protective devices shall be in accordance with the manufacturer's recommendations and/or as described in these specifications.

3.7.3 All signal line protective devices shall be located at the terminal point nearest the cable interface with the exterior cable plant. Devices shall be mounted to the back panel of the cabinet.

3.7.4 Where equipment is fed from a panel board not protected by a panel board protector, provide a branch circuit protector installed at the panel board.

3.8 DETECTION MEASURES

3.8.1 PURPOSE OF SYSTEM

The outer perimeter fence is a bowed welded mesh fence structure and acts mainly as a delay system. This delay functions of the outer fence need to be protected to ensure that it fulfils its purpose. Detection is required to detect the cutting or removing of the structure and attempts thereof. The required detection is based on direct measurement of the causes of cutting and removing of the structure and not derivatives thereof such as short circuit detection or volumetric detection not measuring fence behaviour. Detection shall be based on the measurement of the kinematical behaviour of the structure during intrusion attempts. The system shall be applied in order to ensure maximum coverage in the detection area.

3.8.2 DESCRIPTION OF SYSTEM

a. Zones The system shall be installed in specific lengths called Zones. Each zone and detection device can provide and report its own intrusion alarms, therefore providing information on the area of any intrusion attempt. Zone lengths should not exceed 20m.

b. Detection units Each zone shall be equipped with detection units, the detection unit shall include the transmitter, receiver, alarm processing unit and the required communication cable. The parameters on the alarm processing unit must be adjustable in both the amplitude and frequency domain.

The system must be commissionable to allow for maximum probability of detection (POD) and minimal nuisance alarms (NAR) and false alarms (FAR).

c. Installation Measuring devices must be directly attached to the fence structure and connected via a field communication network. The network shall be connected to the main detection network via the field nodes and reflect in the main control room. Each device with be represented in the main control user interface allow for parameter setting and diagnostics per device. The operator shall be able to identify the device that caused the alarm within a sector or zone. The detection equipment shall be installed in accordance with the supplier specifications, the installation specifications must be presented before installation commences. The detection units installed shall be sufficient to cover the specified area.

d. Maintenance Sensor maintenance diagnostics shall be available in the control room and replacing a sensor shall be on a "plug and play" principle with no special tools required.

e. Detection

Detection parameters should be adjustable on an individual sensor basis for both the cutting and removing or moving of the fence and detection components. The detection system shall announce at least the following alarm events:

- Fence cut
- Fence components removed
- Detection units moved The contractor shall allow as part of this contract for the necessary tests to be effected as required by the end user.

3.9 FIELD CONTROLLER

3.9.1 Processor Each zone shall be equipped with a field processor unit, performing all the functions associated with a particular zone. A field processor shall provide for / contain the following sub-systems:- - Digital inputs (8x Supervised Loop) - Relay outputs (4 x 24VDC 5Amp) - Processor - Data communication - Reset key switch transmitter type Field processors shall be installed in the middle of each zone. The enclosure shall be manufactured from Stainless steel. Enclosures shall be rated IP 65 and fitted with a door lock and tamper switch as per Par 1.10 d.

A zone reset button (if required) shall be accessible from inside the perimeter fence and shall be of the transmitter type. All cable entries to field units, if exposed shall be protected against vandalism by means of stainless steel covers.

3.9.2 Data Communication Field processors are linked with a fiber optic serial data communication cable, in a closed ring configuration. Communication shall be fully functional with a single cut in communication cable.

Power A single phase power feed shall supply the field processors. (230V should be supplied to each field node.) All equipment shall be protected against lightning surges and transient voltages to all the relevant SABS specifications and regulations

3.9.4 Characteristics The unit shall have features or characteristics as follows:

- a. Accept eight (8) dry contact supervised inputs.
- b. Provide two (4) dry contact outputs.
- c. Input voltage - 230VAC $\pm 5\%$.
- d. Equipped with transient suppression.
- e. Supervised circuits - inputs.
- f. Temperature Operating: -20 deg C to +70 deg C
- g. Humidity - 20% to 95% condensing.
- h. Unit shall be field addressable.
- i. Shall interface with the Perimeter Controller.

3.10 PERIMETER CONTROLLER

3.10.1 System operation

The system shall be installed as a zoned, automatic, supervised alarm detection system.

- a. The alarm condition is transmitted from the post mounted, zone field microprocessor via redundant fiber-optic loop to the perimeter Master Controller.
- b. Each detection zone shall be equipped with fiber-optic communication equipment to eliminate lightning surge problems.
- c. Each independent defined intrusion event shall affect a unique signal on the perimeter controller.
- d. The supervised circuit in the system causes a tamper/status alarm to signal if:
 - i. Sensor circuitry is disturbed (opened or grounded).
 - ii. Tamper switches are activated situated in the control cubicles in the field or control room.
- e. The location at any point at which an attempt is made to tamper with the system shall be identified at the perimeter controller.
- f. Approved detection measures shall be incorporated into the system and used as separate zones protecting the vehicle sally port. (One zone only)
- g. System status and all alarm conditions shall be reported to the central control from the field controllers to a perimeter controller.
- h. From the perimeter controller each zone shall be capable of zone access, alarm acknowledges and alarm reset. The perimeter controller shall have a distinctive audible alarm. Alarm shall annunciate both visually and audibly. The same shall be possible from security management system.
 - i. The perimeter controller shall interface with an event printer located in Central Control. The event printer shall print a date and time stamped message indicating all alarms, alarm resets, and zone accesses.
 - ii. System status and all alarm conditions shall be reported to the system operator from the perimeter controller to a graphics display unit. All fixed components of the perimeter alarm system shall receive power from the UPS provided in central control or a main electronics equipment room.

3.10.2 Hardware

The perimeter controller shall be installed in the Central Control console..

The perimeter controller shall be based on a Linux operating system with the following characteristics:

- a. Industrial grade hardware.
- b. Solid state storage memory.
- c. Complete with power supply.
- d. Standard panel mounting for 19 inch EIA rack.
- e. Serial communication port
- f. Ethernet port
- g. Two USB ports
- h. VGA port
- i. Keyboard and mouse ports

The perimeter controller shall perform the following functions:

3.10.3 Field Communication

Communication with field controllers shall be via a redundant 2 core multimode optical fiber link. Operation of the system shall not be affected in case of a single break in the communication link.

3.10.4 Monitoring and Control

The controller shall contain the status map off all field detection and status devices. These devices shall include the following:

- a. Outer fence detection alarm
- b. Outer fence detection maintenance
- c. Field cabinet tamper 17
- d. Auxiliary inputs including gate area detection devices and gate status contacts at sally port.
- e. Field communication status for each field controller

3.10.5 Alarm and Event

Printing Alarms and selected events shall be printed on a suitable continuous paper printer via a parallel port

3.10.6 Alarm and Event Recording

The following shall be recorded on the alarm or event log: a. All changes in the state of field devices. This includes alarm and maintenance conditions. These events shall be logged per zone and per device.

b. Operator master accept actions.

c. Field reset actions. Log entries shall be date and time stamped to the nearest second.

3.10.7 External Interfaces

The perimeter controller shall provide the following data interfaces: TCP/IP Socket interface All perimeter or system devices shall be included in this interface mechanism. The external system shall initialise on selected devices and events shall be posted when any change occurs in the status of such devices. Events shall also be sent to the perimeter controller. Messages shall be in clear text. Modbus serial and Modbus TCP/IP interface Devices shall be mapped in a set of holding registers for access by an external SCADA system

These external data interfaces shall be used to integrate the perimeter system with a Security Management System or CCTV system.

Where a Security Management System is in operation the Perimeter system shall be fully integrated with the SMS and CCTV systems for annunciation, print recording, and logging of alarms and initiation of CCTV system functions upon an alarm condition. All perimeter alarms shall be logged, annunciate, recorded and managed by the SMS alarm terminal in Central Control. Fence Alarms, trouble and tamper conditions shall be separately annunciate by individual zone designations. The interface definition shall be documented and delivered with the system as part of the deliverable of this project. (Proof of the operability of the interface must be given.)

3.10.8 Wide Area Networking

The Perimeter Controller shall be Internet Protocol (IP) enabled so as to be networked over a Wide Area Network (WAN) for the purposes of remote monitoring, control and viewing of historical information. This shall facilitate the performance assessment of both operator and equipment from anywhere on the client's network.

3.10.9 Diagnostic Tools

A diagnostic screen shall be included at the master indicating the following:- - On/off line status of field processors - The alarm and maintenance status of all individual sensors - The alarm and maintenance status of any other equipment attached to the system as required.

The diagnostic software shall include a data recording facility to record all the digital and analogue signals from any selected field processor unit and any selected detection device.

4. USER INTERFACE – FUNCTIONAL OPERATION

This requirement shall apply to the graphical user interface that may form part of the perimeter controller or implemented on the Security Management System. Site Perimeter Map A graphical presentation of the site perimeter shall include the following:

- a. Position of the perimeter
- b. Detection zones
- c. Gates
- d. Other static information (buildings or roads) that may be required to assist the operator to identify the location of an occurrence.

The following Icons representing the alarm / maintenance status of field detection devices shall be included:

- a. Alarm status of Delay Fence Integrity Detection for each zone.
- b. Tamper status of each field enclosure.
- c. The status of detection devices and status monitoring in the sally port area.
- d. The operational (maintenance) status of field equipment for each field controller.

Abnormal conditions shall be acknowledged by the operator by activating a single icon. This shall also stop the audible sounder. The colour of status icons shall change in the following sequence.

1. Green Normal condition
2. Red - Flashing New alarm condition
3. Red - Solid Condition has been accepted by the operator
4. Yellow Condition has been reset in the field
5. Blue or Green a reset was activated at the central controller

Blue shall indicate a device in a permanent abnormal condition and must be addressed by a maintenance repair procedure.

Step 4 shall be omitted in case of certain maintenance devices or in case of CCTV surveillance where no field reset is required.

The following requirements shall be the minimum requirements for the user interface:

Operational Information

The following are shown on the operator interface:

- Site perimeter Layout Icons representing the alarm status of detection devices Indications of field node status and tamper
- 20 Buttons to accept and reset alarms
- Buttons to issue a reason for alarms
- Management Information Operational Status
- Parameters providing a summary of the operational status of the equipment.

This includes:

- Percentage site online Detection devices in inhibit status
- Status of worst case field node
- Condition of field communication network
- System performance
- Summary of the number alarms during a daily, weekly and monthly period.
- Alarms are categorized as the following types:
 - Valid Alarms
 - Nuisance Alarms
 - Unknown Alarms
- Operator performance
- Values representing the maximum time the current and previous operator took to accept and reset alarms.

- Unattended time shall also be indicated.
- Alarm and Event Reporting
- Open a window to view the log
- Diagnostic Information Real time
- Alarm status of all devices on the selected field node
- Maintenance status of these devices
- Buttons to inhibit any device
- Analogue values of detection devices
- Controls to adjust the operating parameters of field devices Networking Multiple operator interfaces can be linked to the same perimeter controller.
- These user workstations can be local or remote.
- The graphical user interface as proposed must be presented to the end-user's authorised representative for approval before commencement of work.
- All available system information and specified requirements must be accessible through the User Interface.
- The user interface shall always be fully compliant to the above requirements.

1. TESTING:

5.1 The Contractor shall notify the Engineer two (2) weeks prior to the system tests so that arrangements can be made to have The DPW and DCS personnel witness the tests.

5.2 Each penetration of the detection system shall produce an alarm.

5.3 If an alarm is not detected on the first try of any test, the test shall be deemed a failure and all testing shall cease.

5.4 The Contractor shall be allowed time (not to exceed 1 hour) to make the necessary repairs before continuing the test. If additional failures are noted during the test, the test shall cease and be rescheduled for another day.

5.5 If the test is deemed a failure by the Engineer or the Municipality, the Contractor shall be responsible for all cost incurred by the Institution for scheduling a second test.

5.6 The gate area detection system shall be tested based on the requirement that the gate area detection must be of the same standard as the perimeter detection system.

5.7 Delay Fence Integrity Detection System A simulated breaching of the outer perimeter fence shall be performed. The outer fence detection system shall generate an alarm when such an attempt is made.

2. SPARE PARTS

The Contractor shall provide the institution with the following spare parts upon system completion:

6.1. 2 complete field node equipment sets.

6.2. 2 Copies of System Software.

6.3. 10 Delay fence detection units.

6.4. Perimeter controller.

7 COMPLIANCES TO THE SPECIFICATION

The Contractor shall comply with all the requirements as per this specification. Proposed deviations shall only be considered after the award of the contract. Proposed deviations shall only be accepted if it meets with all of the following criteria:

- The proposed deviation offers a substantial improvement to the final product offered.
- The proposed deviation has been proven in other applications. Any deviations from the specification can only be implemented with prior approval from the various representatives from the Municipality.

PROVEN PRODUCT

Due to the security nature of this requirement and the criticality of this application only proven product shall be considered.

Product could be approved only after investigation by all applicable parties. The international guideline for similar applications demands that five installations has to be operational in accordance with the above requirements for a minimum period of no less than two years before it would be considered as a proven product.

END OF SECTION

**REFURBISHMENT OF EERSTHOEK SEWER AND WATER BOOSTER PUMPS
BID NO: TBA**

PORTION 2: CONTRACT

**Section C3.5
Management**

C3.5 General

C3.5.1 Contractor's Project Management Plan

The Contractor is required to prepare and submit a project management plan for the construction. The particular contents that should be included in the Contractor's Project Management Plan are listed below:

Project structures and agreements

The Contractor shall indicate how responsibility for the various work packages will be divided between joint venture partners (where applicable) and sub-contractors. A contract organogram shall be provided showing work apportionment and project management responsibilities. The particular division of work shall match the established capabilities and capacities of each particular partner or subcontractor.

Plant, materials and equipment

The Contractor shall prepare a Plant and Materials procurement plan, indicating the source of key Plant and Materials designated for inclusion in the Works, and demonstrating that such Plant and Materials have a proven track record of successful maintenance support in South Africa.

The Contractor shall also prepare a plan of Contractor's Equipment, indicating the source and details of construction equipment planned for use on the Contract and based on the Contractor's particular approach.

Staffing plan

The Contractor shall prepare a detailed staffing plan showing in an organogram all key members of the Contractor's Personnel, providing a detailed CV for each such key position. The Contractor shall also show the numbers and source of all non-key staff and indicating the particular local content offering of the Contractor.

Method statements

The Contractor shall clearly describe the overall methodology proposed for construction of the Works and include particular method statements for each work discipline included in the Works.

C3.5.2 Construction Programme

C3.5.2.1 General

The Contractor shall submit within the period stated in the Contract Data a suitable and realistic construction programme for the consideration of the Engineer.

The programme shall be of a Gantt chart and shall include the following details:

A work breakdown structure, identifying the major activity groups.

For each activity group further details shall be provided with regard to the scheduled start and end dates of individual activities.

The linkages between activities shall be clearly indicated and the logical network upon which the programme is based, shall be separately submitted to the Engineer if requested. Any constraints shall be classified as being time-related or resource-related.

The critical path(s) shall be clearly indicated and floats on non-critical activities shall be shown (also to be used for the valuation of Contractor's claims)

The Contractor shall indicate the working hours per day, night, week and month allowed for in the programme. Where relevant the Contractor shall state the production rates for key activities, e.g. earthworks, etc.

The Programme shall comply with the Time for achieving Practical Completion as specified in the Contract Data (Section C1.2).

Together with the programme as detailed above the contractor shall submit to the Engineer a cash flow projection, indicating projected monthly invoice amounts. The cash flow projection shall be updated at monthly intervals to reflect actual payments to date and anticipated further payments.

The programme will be reviewed at the monthly site meetings at which the Contractor shall provide sufficient detail that will allow the comparison of completed work per activity that has fallen behind. The updated programme shall be submitted to the Engineer at least two days prior to the monthly meetings.

If the programme has to be revised by reason of the Contractor falling behind his programme, he shall produce a revised programme showing how he intends to regain lost time in order to ensure completion of the Works within the time for completion or any granted extension of time. Any proposal to increase the tempo of work must be accompanied by positive steps to increase production by providing more labour and plant on site, or by using the available labour and plant on site, or by using the available labour and plant in a more efficient manner.

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

The approval by the Engineer of any programme shall have no contractual significance other than that the Engineer will be satisfied that the work is carried out according to such programme and that the Contractor undertakes to carry out the work in accordance with the programme. It shall not limit the right of the Engineer to instruct the Contractor to vary the programme if required by circumstances.

The initial Programme shall be approved by the Engineer in writing and shall constitute the baseline programmes. The critical path shall be clearly indicated on the programmes and shall be used to assess any claims by the Contractor for extension of time due to any reason whatsoever. No extension of time will be granted in the absence of an approved baseline programme, which may be updated from time to time as ordered by the Engineer. Any revisions of the baseline program that influences the critical path shall be brought to the Engineer's attention in writing, also stating the reason for such changes.

C3.5.2.2 Shutdown work

Connections to existing pipework shall be done during planned shut-down periods.

Scheduled shutdowns must be arranged with the Employer and other relevant parties, at least 14 days prior to the specific date. For the purpose of tendering it must be assumed that shutdown time will be from Saturday morning 06:00 hours to Sunday evening 18:00 hours. All fittings should be on site and preparation work must be completed prior to the commencement of the shutdown. It is the Contractor's responsibility to ensure that sufficient resources are available in order to complete all connections and shutdown work within the allocated time. After the allocated time, normal operation of services must continue.

C3.5.3 Quality management

C3.5.3.1 General

The Contractor will be solely responsible for the production of work that complies with the Specifications to the satisfaction of the Engineer. The Contractor will 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 order to comply with the requirements. The Contractor shall deliver to the Engineer, for his consideration, quality assurance programmes prior to the Contractor's appointment of any suppliers or commencement of the Works.

It will be the full responsibility of the Contractor to institute an appropriate Quality Assurance (QA) system on site. The Engineer will audit the Contractor's QA system on a regular basis to verify that adequate independent checks and tests are being carried out and to ensure that the Contractor's own control is sufficient to identify any possible quality problems which could cause a delay or failure.

Where applicable the Employer will appoint an independent inspectorate (Employer's Inspectorate) to assist the Engineer with quality control. This item could also form part of the provisional sums in the Bill of Quantities.

The Quality Plan shall specify quality control hold points (subject to the approval of the Engineer) that will be applicable to specific activities. Work shall not proceed beyond the hold points unless the Engineer or Employer's Inspectorate has signed off the quality control at the specific hold point.

The onus to produce work that conforms in quality and accuracy to the requirements of the specifications and the drawings rests with the Contractor, and the Contractor shall, at its own expense, institute a QA system and provide experienced engineers, foremen, surveyors, materials technicians, other technicians and technical staff, together with all transport, instruments and equipment to ensure adequate supervision and positive control of the quality of the Works at all stages of the Contract. The cost of the Contractor's supervision and process control, including all testing carried out by the Contractor, shall be deemed to be included in the amounts tendered.

Before commencement of manufacturing of plant and materials and construction, the Contractor shall submit a comprehensive proposal for a quality assurance plan to the Engineer for consideration. Only the Engineer may sign off quality assurance plans.

The Contractor shall keep systematic records of the test results and all worksheets relating thereto. All test results obtained by the Contractor in the course of his process control of the Works shall be submitted to the Engineer or his Representative prior to requesting inspection of the relevant portions of the Works. Any request for inspection shall be submitted on the prescribed forms.

The Contractor and all sub-contractors shall work to defined quality assurance programmes compliant with ISO 9001 or similar approved standard. ISO 14001 will be applicable to environmental management.

In respect of sub-contractors, the Contractor shall undertake, where no such acceptable information is available or where the sub-contractor has not been subject to an acceptable external quality audit in accordance with the Contractor's QA procedures, to carry out a quality audit of that sub-contractor to ensure that completion of the work shall be compliant with the Contract requirements.

Nominated sub-contractor(s) shall also be subject to quality audit by the Contractor in which the Engineer may participate.

The Contractor shall establish and maintain a document inspection system capable of producing objective evidence that major components comply with the quality requirements of the Contract.

The Contractor shall include in its orders to sub-contractors a note advising that materials and equipment will be subject to inspection as determined by the Quality Plan.

The Contractor shall advise the Engineer of the readiness for inspection at least ten (10) working days prior to a nominated witness or hold point. Work shall not proceed beyond a hold point without the written agreement of the Engineer or after five working days, if no such agreement or rejection is given.

The Contractor shall keep the Engineer informed in advance of the time of starting and of the progress of the work in its various stages so that arrangements can be made for inspections and tests.

The inspections and tests by the Engineer or Employer's Inspectorate of any components, or lack thereof, do not relieve the Contractor of any responsibility regarding defects or other failures.

The Contractor shall be responsible under the Contract for the quality and testing of materials, workmanship and production processes in fulfilment of the Contract. To this end the Contractor shall institute and operate a quality management system which details the following in order to satisfy the Specifications relevant to each operation pursuant to the Works in accordance with the Contract:

- Quality control procedures;
- Personnel responsibilities;
- Procurement procedures;
- Testing procedures, both on and off-site;
- Equipment and calibration;
- Frequency of testing, calibration, etc.;
- Hold points in production for inspection;
- Rejection and rectification procedures;
- Documentation and communication;
- Drawing issue procedures; and
- Drawing register.

As much of the testing as is practicable shall be carried out on Site, including trial, acceptance and routine testing to be implemented by the Contractor and any other tests as instructed by the Engineer for any complementary investigations required from time to time during the course of the Contract.

The Contractor shall submit a general outline of the above Quality Management system with comprehensive examples of documentation to be used with its tender.

Within 28 days after the Commencement Date and based on the general outline and any amendments thereto requested, the Contractor shall submit comprehensive details of the system as required above, making use wherever possible of diagrams, charts, organograms, etc., in preference to lengthy description, all for the approval of the Engineer. Such details shall be updated from time to time as appropriate or as directed by the Engineer.

The Contractor shall commence the operation of the Quality Management system without delay and in accordance with the Engineer's approval of the general outline and documentation examples as accepted and shall thereafter modify the system from time to time in accordance with further details as approved by the Engineer.

Unless otherwise stated in the Specifications, all testing shall be carried out and interpreted in strict accordance with the methods specified in the relevant South African and British Standards.

Unless otherwise stated in the Specifications, the testing laboratories of the South African Bureau of Standards, the Council of Scientific and Industrial Research (South Africa), and the Portland Cement Institute (South Africa)

will be accepted as approved independent laboratories in which tests or design work required in terms of a Specifications may be carried out. Other testing laboratories may be used by the Contractor subject to the approval of the Engineer.

When required by the Engineer, the Contractor shall furnish all information of the materials to be used in the Works and shall give the Engineer such other particulars as may be required.

When requested, the Contractor shall provide samples, information and manufacturer's test certificates of the materials to be incorporated in the Works.

Unless otherwise specified, all proprietary materials shall be used and placed in strict accordance with the relevant manufacturer's instructions.

The competence of personnel required to undertake operations involving particular skills affecting the quality of the Works shall be demonstrated to the Engineer by means of tests arranged by the Contractor. These could include the following activities: welding, concrete compaction, repairs, grouting, formwork erection, etc. Should the competence of any member of the Contractor's workforce be in doubt, the Engineer may order any re-testing he considers necessary at any stage throughout the Contract.

Workmen shall only receive their practical training on those parts of the Works as agreed by the Engineer.

The Contractor shall carry out sufficient inspection and tests to satisfy himself that all requirements of the Specifications are being met and the results of inspections and tests shall be submitted to the Engineer in accordance with the Contractor's Quality Management System. The Engineer may carry out such inspections and tests as he deems necessary and the results of the Engineer's inspections and tests will be made available to the Contractor if requested. Where the Contractor's or Engineer's inspections and/or tests reveal that the requirements of the Specifications have not been attained, the Contractor shall, at his expense, rectify the work to the extent that it conforms to the Specifications.

Whenever the normal period for carrying out work is to be changed, the Engineer shall be given notice in sufficient time (at least 10 working days) to rearrange staffing for proper inspection. The Engineer shall be given notice of any other proposed changes to normal working times at the weekly progress meetings or as necessary to cope with emergencies.

Reports to the Engineer shall be in a format acceptable to the Engineer.

The Contractor shall submit detailed reports at monthly intervals (at site meetings) of personnel on Site, principal materials ordered, stocks on Site, Contractor's Equipment, Plant and Temporary Works on the Site. The Contractor shall also submit a detailed report at monthly intervals on progress of manufacture of any Plant or Contractor's Equipment ordered.

Records shall be kept daily of labour, materials and equipment where there is an agreement to pay by dayworks. Such records shall be valid only when signed by the Engineer or his Representative. Failure to submit daywork sheets on a daily basis could result in the rejection of the sheets by the Engineer.

In cases where there is any dispute or uncertainty on payment procedure, sheets shall be signed daily by both parties as an agreed record of work done but shall not imply any commitment concerning payment. These sheets shall be annotated "For record purposes only".

The Contractor shall arrange for all tests required for process control to be done by a laboratory acceptable to and approved by the Engineer.

The Contractor may establish his own laboratory on site or he may employ the services of an independent commercial laboratory. Whatever method is used, the Contractor must submit the results of tests carried out on materials and workmanship when submitting work for acceptance by the Engineer. The costs for these tests shall be deemed to be included in the relevant rates and no additional payment will be made for testing as required.

The process control test results submitted by the Contractor for approval of materials and workmanship may be used by the Engineer for acceptance control. However, before accepting any work, the Engineer may have further control tests carried out by a laboratory of his choice. The cost of such additional tests will be covered by a provisional sum provided in the Bill of Quantities, but tests that failed to confirm compliance with the specifications, will be for the account of the Contractor.

Acceptance control, record keeping and payment certificates shall be done in accordance with the Engineer's standard system except if the Engineer approves that the Contractor's standard system may be used.

C3.5.3.2 Method Statements

The Contractor shall prepare method statements and acquire the Engineer's approval before commencing work. A method statement is required for each and every activity, including site establishment. The following minimum information will be required in each method statement:

- Goal of activity
- Dangers identified
- Safety measures
- Security measures
- Measures to accommodate environmental and social requirements
- Work method
- Material to be used
- Quality assurance procedure to ensure compliance to specifications
- Reference to the relevant specifications
- Reference to other relevant method statements

Inspectors and workmen shall be trained to execute the work in accordance with the approved method statements and a copy of the method statement shall be available on site where the work is executed.

The Contractor shall allow for the following time periods for the approval of method statements:

Review by the Engineer and Employer of first submission	2 weeks
Amendments by Contractor (if required)	1 week
Final review and approval by Engineer	2 weeks

Work on an activity shall not commence without a method statement approved by the Engineer. Approval of a method statement by the Engineer will not release the Contractor from his responsibilities and liabilities and it will not mean that the Engineer will be responsible or liable for the construction of the work.

C3.5.4 Occupational health and safety management

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

assume full responsibility to conform to all the provisions of the Occupational Health and Safety Act (OHSA) No 85 and Amendment Act No 181 of 1993, and the OHSA Construction Regulations GNR.84 of 7 February 2014.

The successful Contractor shall, on receipt of notification that he has been awarded the contract, submit without delay his own documented Health and Safety Plan for the execution of the work under the contract in accordance with the OHSA and Construction Regulations to the Engineer. The Health and Safety Plan must at least cover the following:

- a proper risk assessment of the works, risk items, work methods and procedures;
- pro-active identification of potential hazards and unsafe working conditions;
- provision of a safe working environment and equipment;
- statements of methods to ensure the health and safety of subcontractors, employees and visitors to the site, including safety training in hazards and risk areas;
- monitoring health and safety on the site of works on a regular basis, and keeping of records and registers;
- details of the Construction Supervisor, the Construction Safety Officers and other competent persons he intends to appoint for the construction works;
- details of methods to ensure that his Health and Safety Plan is carried out effectively.

The Contractor's Health and Safety Plan will be subject to approval by the Employer or Engineer before commencement of construction work. The Contractor will not be allowed to commence work, or his work will be suspended if he had already commenced work, before he has obtained the Employer's or the Engineer's written approval of his Health and Safety Plan.

Approval of the Contractor's Health and Safety Plan by the Employer or the Engineer will not release the Contractor from his responsibilities and liabilities and the Employer or the Engineer will not be responsible or liable for any activities forming part of the Contractor's responsibilities and liabilities in terms of the Contract.

Time lost due to delayed commencement or suspension of the work as a result of the Contractor's failure to obtain approval for his safety plan, shall not be used as a reason to claim for extension of time or standing time and related costs.

The rates and prices tendered by the Contractor shall be deemed to include all costs for conforming to the requirements of the OHSA, the Construction Regulations and the Employer's Health and Safety Specification as applicable to this contract. Should the Contractor fail to comply with the provisions, he will be liable for penalties as provided in the Construction Regulations and in the Employer's Health and Safety Specification.

The Employer's SHE Management System is included in Section C3.5.B

C.3.5.5 Environmental management

The Works shall comply with the Environmental Authorisation (Record of Decision), the Environmental Management Plan and the Employer's Specifications (if applicable). The applicable documents are included in Section C3.6.

C3.5.6 General Construction and management requirements

C3.5.6.1 General

The Contractor is referred to SANS 1921: 2004: Construction and Management Requirements for Works Contracts, Part 1: General Engineering and Construction Works, and COLTO 1500 - Accommodation of Traffic. These specifications shall be applicable to the contract under consideration and the Contractor shall comply with all requirements relevant to the project.

Certain aspects however require further attention as described hereafter.

C3.5.6.2 Management and disposal of water

The Contractor shall pay special attention to the management and disposal of water and storm water on the site. It is essential that all completed works or parts thereof are kept dry and properly drained. Claims for delay and for repair of damage caused to the works as a result of the Contractor's failure to properly manage rain and surface water, will not be considered.

The Contractor shall implement special measures to keep storm water out of excavations and pipe trenches. These measures shall include for example, cut-off berms, cross-fall of construction road away from trench, coffer dams and drainage pipes across the trench or diversions at water courses, limiting length of open trenches, adequate water pumps.

C3.5.7 Site administration

C3.5.7.1 General

Acceptance control, record keeping and payment certificates shall be done in accordance with a system approved by the Engineer.

C3.5.7.2 Daily site diary

The daily site diary, in accordance with Bigen Africa's pro forma, shall be kept up to date by the Contractor's Representative and will be signed on a daily basis by the Engineer's Representative.

C3.5.7.3 Information in respect of Plant

Information relating to plant on Site shall be recorded in the daily site diary. In addition, the Contractor shall deliver to the Engineer, on a monthly basis, a detailed summary of construction plant kept on the Site, full particulars given for each day of the month. Distinction shall be made between plant in working order and plant out-of-order. Such inventory shall be submitted by the first day of the month following the month to be reported.

C3.5.7.4 Information in respect of Employees

Information relating to labour and management on Site shall be recorded in the daily site diary. In addition, the Contractor shall deliver to the Engineer, on a monthly basis, a detailed summary of supervisory staff, labour employed (own and local labour) by category, and sub-contractors (both local and imported) for each day of the month. Such return shall be submitted by the first day of the month following the month to be reported.

C3.5.7.5 Rainfall records

Rainfall records for the period of construction shall be taken on Site and recorded in the daily site diary. The Contractor shall provide and install all the necessary equipment for accurately measuring the rainfall. The Contractor shall also provide, erect and maintain a security fence plus gate, padlock and keys at each measuring station, all at his own cost. The Contractor shall take and record the daily rainfall readings. The Employer's Agent or his Representative shall be permitted to attend these readings, or take separate readings. Access to the measuring gauge(s) shall at all times be under the Engineer's control.

C3.5.7.6 Site instructions

Site instructions by the Engineer, addressed to the Contractor, will be numbered consecutively and will be deemed to have been received by the Contractor's Representative unless a break in the sequence of numbers is brought to the notice of the Engineer in writing immediately.

C3.5.7.7 Site meetings

The Contractor and his authorised representative shall attend all meetings held on the Site as requested by the Engineer at dates and times to be determined by the Engineer. Such meetings will be held to evaluate the progress of the Contract and to discuss matters pertaining to the Contract. It is not the intention to discuss day-to-day technical matters at such meetings.

Progress meetings shall be held at least once a month on Site from the Commencement Date to the date of Taking-over for coordination purposes and to evaluate the progress of the Contract.

Ad-hoc technical meetings will be arranged at a suitable venue as and when required.

The Contractor shall also allow in his tender for attending at least one HAZOP meeting at the Engineer's offices once the mechanical designs have been completed.

The Contractor or his authorized representative(s) shall attend all steering committee meetings with the appointed Community Liaison Officer.

Weekly commissioning meetings shall be held during the testing and commissioning stages.

The Engineer will chair all progress and technical meetings, prepare and circulate minutes, as determined by him in consultation with the Employer. The Contractor shall chair the commissioning meetings and be responsible for associated administration.

The Contractor shall submit monthly progress reports as required by Sub-Clause 4.21 of the Conditions of Contract in a format to be agreed between the Contractor and Engineer.

C3.5.7.8 Payment certificates

Monthly progress payment certificates shall be submitted by the Contractor to the Engineer not later than the 20th of each month (or on the last working day prior to this date) in order to allow for checking and reconciliation of all quantities, rates, extensions and additions in the certificate. All quantity calculations and certificates submitted by the Contractor for checking shall be in accordance with the Engineer's standard site administration forms and formats.

Where dayworks have been instructed by the Engineer, the Contractor shall submit the returns to the Engineer for signature and approval within twenty-four (24) hours of the end of the working day on which the work was executed. Daywork returns shall be submitted on forms according to the Engineer's standard format. Failure to comply with the terms of this clause could result in non-payment for such dayworks, depending on the Engineer's decision in this regards.

The tax invoice submitted with the certificate shall be dated the date of submission to the Engineer of the payment certificate that was agreed between the Contractor and the Engineer. All costs for the preparation and submission of progress certificates shall be borne by the Contractor.

C3.5.7.9 Photographic records

The Contractor shall keep photographic records of the Works also showing progress, including the following:

- The pipeline routes before commencing work and after clearing;
- State of existing fencing before commencing work and during work and the new fencing at completion;
- Trench excavation and the materials encountered;
- Pipe laying operations, including earthworks;
- Pipe jacking, river and stream crossings, road and railway crossing etc.
- Structures;
- Ancillary structures;
- Landscaping and rehabilitation activities;
- Other specific photographs requested by the Engineer;
- Environmental aspects;
- Health and safety aspects;
- Social aspects; and
- The completed installations.

The photos shall be inscribed with the date taken, location and brief description.

Three prints and an electronic copy on CD shall be delivered to the Engineer each month.

END OF SECTION

REFURBISHMENT OF EERSTHOEK SEWER AND WATER BOOSTER PUMPS

BID NO: TBA

C3.6 Occupational Health and Safety specifications

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PREAMBLE

This “Health and Safety Specifications” document is governed by the Occupational Health and Safety Act, 1993 (Act No 85 of 1993), hereinafter referred to as the Act, with specific reference to Construction Regulation 4(1) (a) Notwithstanding this, cognisance should be taken of the fact that no single ACT or it’s set of Regulations can be read in isolation.

Included in these specifications is set rules to assist the principal contractor, contractors (sub-contractors) and client of the project in controlling and managing health and safety issues on the construction site, as stipulated in the OHSACT.

The specifications and rules do not relief the principal contractor, contractors (sub-contractors) or their employees from any legal obligation under the requirements of the “Basic Conditions of Employment Act” or the “Occupational Health and Safety ACT”.

The specifications and rules will apply for the duration of the project. Should the principal contractor or contractors (sub-contractors) not comply, it will be deemed as a breach of contract.

The principal contractor will carry full responsibility and accountability regarding the adherence to any health and safety issues when contractors (sub-contractors) are used to carry out any construction work on the project. It must be noted that the client may stop any contractor from executing construction work, which is not in accordance with the client’s health and safety specifications or rules for the project or which poses a threat to the health and safety of any person.

SCOPE OF HEALTH AND SAFETY SPECIFICATION DOCUMENT

The health and safety specifications pertaining to this project cover the subjects contained in the index and are intended to outline the normal as well as any special requirements of the Client pertaining to the health and safety matters applicable to the project.

The stipulations in this specification, as well as those contained in all other documentation pertaining to the project, including contract documentation and technical specifications shall not be interpreted in any way whatsoever, to countermand or nullify any stipulation of the ACT, Regulations and Safety Standards which are promulgated under, or incorporated into the Act.

DEFINITIONS

The most important definitions in the Act and Regulations pertaining to this specification document are hereby extracted.

“Purpose of the Act”-

To provide for the health and safety of persons at work and the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work; to establish an advisory council for occupational health and safety; and to provide for matters connected therewith.

“Agent”-

Means any person who acts as a representative for a client;

“Client”-

Means any person for whom construction work is performed;

“Construction Work” is defined as any work in connection with-

- a. the erection, maintenance, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure;
- b. the installation, erection, dismantling or maintenance of a fixed plant where such work includes the risk of a person falling;
- c. the construction, maintenance, demolition or dismantling of any bridge, dam , canal, road, railway, runway, sewer or water reticulation system or any similar civil engineering structure; or
- d. the moving of earth, clearing of land, the making of an excavation, piling, or any similar type of work;

“Contractor”-

Means an employer, as defined in Section 1 of the Act, who performs construction work and includes Principal Contractors;

“Health and Safety File”-

Means a file, or other record in permanent form, containing the information required a contemplated in the regulations;

“Health and Safety Plan”-

Means a documented plan which addresses hazards identified and includes safe work procedures to mitigate, reduce or control the hazards identified;

“Health and Safety Specification”-

Means a documented specification of all health and safety requirements pertaining to the associated works on a construction site, so as to ensure the health and safety of persons;

“Method Statement”-

Means a document detailing the key activities to be performed in order to reduce as reasonably as practicable the hazards identified in any risk assessment;

“Principal Contractor”-

means an employer, as defined in section 1 of the Act who performs construction work and is appointed by the client to be in overall control and management of a part of or the whole of a construction site;

“Risk Assessment”-

Means a program to determine any risk associated with any hazard at a construction site, in order to identify the steps needed to be taken to remove, reduce or control such hazard.

OCCUPATIONAL HEALTH AND SAFETY PLAN

The principal contractor has to demonstrate to the Client that it has developed a suitable and sufficiently documented occupational health and safety plan for the specific project appointed, as well as the necessary competencies, experience and resources to perform the construction work safely.

Contents of the occupational health and safety plan

The health and safety management programme should at least provide a detailed overview of the following matters:

- (a) Structure and organisation of OHSACT responsibilities and appointments
- (b) Management of the project's occupational health and safety hazards and risks.
- (c) Communication of the health and safety management programme.
- (d) Programme for occupational health and safety internal audits and inspections
- (e) Programme for occupational health and safety investigations regarding incidents/accidents.

Structure and organisation of OHSACT responsibilities and appointments

Overall Supervision and Responsibility for Occupational Health and Safety

The Client and/or its Agent on its behalf to ensure that the Principal Contractor, appointed in terms of Construction Regulation 4(1) (c), implements and maintains the agreed and approved H&S Plan. Failure on the part of the Client or Agent to comply with this requirement will not relieve the Principal Contractor from any one or more of his/her duties under the Act and Regulations.

The Chief Executive Officer of the Principal Contractor in terms of Section 16(1) of the Act to ensure that the Employer (as defined in the Act) complies with the Act. The pro forma Legal Compliance Audit may be used for this purpose by the Principal Contractor or his/her appointed contractor.

All OH&S Act (85/1993), Section 16 (2) appointee/s as detailed in his/her/their respective appointment forms to regularly, in writing, report to their principals on matters of health and safety per routine and ad hoc inspections and on any deviations as soon as observed, regardless of whether the observation was made during any routine or ad hoc inspection and to ensure that the reports are made available to the principal Contractor to become part of site records (Health & Safety File).

The Construction Supervisor and Assistant Construction Supervisor/s appointed in terms of Construction Regulation 6 to regularly, in writing, report to their principals on matters of health and safety per routine and ad hoc inspections and on any deviations as soon as observed, regardless of whether the observation was made during any routine or ad hoc inspection and to ensure that the reports are made available to the principal contractor to become part of site records (Health & Safety File).

All Health and Safety Representatives (SHE-Reps) shall be appointed, act and report as per Section 17(1) and 18 of the Act, respectively.

Specific Supervision Responsibilities for Occupational Health and Safety

Several appointments or designations of responsible and/or competent people in specific areas of construction work are required by the Act and Regulations. The following competent appointments, where applicable, in terms of the Construction Regulations, are required to ensure compliance to the Act, Regulations and Safety Standards.

Required appointments as per the Construction Regulations:-

Item	Regulation	Appointment	Action by
1.	4(1) (c)	Principal contractor for each phase or project	Employer
2.	5(3)(b)	Contractor	Principal Contractor
3.	5(11)	Contractor	Principal Contractor / Contractor
4.	6(1)	Construction supervisor	Principal Contractor / Contractor
5.	6(2)	Construction supervisor sub-ordinates	Principal Contractor / Contractor
6.	6(6)	Health and Safety Officer (full-time or part-time)	Principal Contractor / Contractor
7.	7(1)	Risk assessor	Principal Contractor / Contractor
8.	7(4)	Health and Safety trainer/instructor	Principal Contractor / Contractor
9.	8(1)(a)	Fall protection planner	Principal Contractor / Contractor
10.	10(a)	Formwork & support work supervisor	Principal Contractor / Contractor
11.	10(e) + (f)	Formwork & support work inspector	Principal Contractor / Contractor
12.	11(1)	Excavation supervisor	Principal Contractor / Contractor
13.	11(3)(b)(ii) (b)	Professional engineer or technologist	Principal Contractor / Contractor
14.	11(3)(k)	Excavation explosives expert	Principal Contractor / Contractor
15.	12(1)	Demolition work supervisor	Principal Contractor / Contractor
16.	12(2) + (3)	Demolition expert	Principal Contractor / Contractor
17.	12(11)	Demolition explosives expert	Principal Contractor / Contractor
18.	14(2)	Scaffold supervisor	Principal Contractor / Contractor
19.	15(1)	Suspended platform supervisor	Principal Contractor / Contractor
20.	15(2)(c)	Suspended platform compliance plan developer	Principal Contractor / Contractor
21.	15(8)(c)	Erection and maintenance suspended platform expert	Principal Contractor / Contractor
22.	15(13)	Outrigger inspector	Principal Contractor / Contractor
23.	16 (2)	Boatswain's chair inspector	Principal Contractor / Contractor
24.	17(8)(a)	Material hoist inspector	Principal Contractor / Contractor
25.	18(1)	Batch plant supervisor	Principal Contractor / Contractor

Item	Regulation	Appointment	Action by
26.	18(7)	Batch plant operator	Principal Contractor / Contractor
27.	19(2)(b)	Power tool inspector	Principal Contractor / Contractor
28.	19(2)(g)(i)	Power tool controller	Principal Contractor / Contractor
29	20(f)	Tower crane operator	Principal Contractor / Contractor
30.	21(1)(d)(i)	Construction vehicle and mobile plant operator	Principal Contractor / Contractor
31.	21(1)(j)	Construction vehicle and mobile plant inspector	Principal Contractor / Contractor
32.	22(d)	Temporary electrical installations inspector	Principal Contractor / Contractor
33.	22(e)	Temporary electrical installations controller	Principal Contractor / Contractor
34.	26(a)	Stacking and storage supervisor	Principal Contractor / Contractor
35.	27(h)	Fire equipment inspector	Principal Contractor / Contractor

The list may be used as a reference or tool to determine which components of the ACT and Regulations would be applicable to a particular site. This list must not be assumed to be exclusive or comprehensive.

Communication of the health and safety management programme

The communication principles to be applied should cover the following:

(a) Occupational health and safety goals for the project and arrangements for monitoring and reviewing occupational health and safety performance.

Arrangements for:

- regular liaison between stake holders on site
- consultation with the workforce

(c) Selection and control of contractors (sub-contractors)

(d) The exchange of occupational health and safety information between all stake holders (client, contractors (sub-contractors), designers, etc.)

- site security
- site induction, onsite training
- sanitation facilities
- first-aid facilities
- reporting and investigation of accidents and incidents
- the production and approval of risk assessments and method statements
- site rules
- fire and emergency procedures

- (e) Reporting to the client, i.e. results and action of occupational health and safety inspection, incident investigations and minutes of safety committee meetings.
- (f) Reporting of incidents to the Department of Labour and compensation insurer where appropriate.

Health and safety internal audit and inspection

The Client and/or its Agent on the Client's behalf will be conducting periodic audits at times agreed with the principal contractor. This audit will monitor and ensure that the principal contractor has implemented, adhering to and is maintain the agreed and approved health and safety plan. Non – conformances will be highlighted for ratification to endure that the Client is not unduly exposed regarding the requirements as stipulated by the OHSACT.

A representative and/or the relevant health and Safety Representative(s) of the principal contractor must accompany the Client and/or it's Agent on it's behalf on all audits and inspections.

The principal contractor shall conduct his/her own inspections/internal audits at regular intervals. Copies of these inspections/internal audits must be handed to the Client and/or its Agent.

Copies of Health and Safety Committee meeting minutes must be available to the Client and/or its Agent, reflecting recommendations made by the committee to the principal contractor for reference purposes.

Health and safety incident/accident investigations and reporting

The principal contractor shall report all incidents/accidents where an employee is injured on duty to the extent that it is:

- (a) Fatal
- (b) Unconscious
- (c) Loses a limb or part of
- (d) becomes ill
- (e) Permanent physical defect

The principal contractor shall report all investigations regarding incidents, where:

- (a) Major incident (safety, health or environmental) occurred
- (b) Health or safety of any person was endangered.
- (c) Hazardous/danger substance was spilled
- (d) Uncontrolled release of any substance under pressure occurred
- (e) Machinery or any part thereof fractured or failed resulting in flying, falling or uncontrolled moving objects.
- (f) Uncontrolled running of machinery

Health and safety training

The contents and syllabi of all training required by the Act and Regulations including any other related or relevant training as required must be made available to the Client if so required.

Health and Safety Induction Training

All employees of the principal and any other contractor (sub-contractor) must be in possession of proof of health and safety induction training.

This training will include:

- risk identification
- safe work procedures (SWP)
- personal protective equipment (PPE) the use and the necessity thereof
- health and safety outside the workplace
- legal impact of health and safety matters
- introduction to the "Workmen's Compensation Act"
- site security
- sanitation facilities
- first aid facilities
- fire and emergency procedures
- roll of health and safety representatives and the selection of them
- working hours and general working conditions
- incident reporting and procedures
- incident investigation and procedures

Other Training

All employees in jobs requiring competency in terms of the Act and Regulations must be in possession of valid proof of training/experience to be credited for competency.

Specific occupational health and safety training requirements for this project includes:

- occupational health and safety representatives
- first aider – Level 1
- risk assessor

All operators, drivers and users of construction vehicles, mobile plant and other equipment must be in possession of valid proof of training and medical fitness certificates as required by the Act.

Health and Safety Budget

To enable the Client to comply with Construction Regulation 4(1) (h), the principal contractor has to demonstrate to the Client that sufficient provision has been made to implement and managed the health and safety plan of the principle contractor.

A detailed schedule of costs therefore has to be included in the health and safety plan submitted. This includes the following subjects:

Administration

- Compile a health and safety plan
- Notification of construction work
- Proof of good standing with the compensation fund or with a licensed compensation insurer

Health and Safety Management Programme

- Appointment of a Safety Officer(s) (full-time or part-time)
- Appointment of a Health and Safety Consultant if required

Other cost relating to the implementation and managing of the Health and Safety Management Programme

Personal Protective Equipment (PPE)

The Principal contractor is required to identify the hazards in workplace and deal with them on an ongoing basis. He/she must either remove them or, where impracticable take steps to protect workers and make it possible for them to work safely and without risk to health under the hazardous conditions.

Personal protective equipment should, however, be the last resort and there should always first be an attempt to apply engineering and other solutions to mitigating hazardous situations before the issuing of personal protective equipment is considered.

Where it is not possible to create an absolutely safe and healthy workplace the principal contractor is required to inform employees regarding this and issue, free of charge, suitable equipment to protect them from any hazards being present and that allows them to work safely and without risk to health in the hazardous environment.

It is a further requirement that the principal contractor maintains the said equipment, that he/she instructs and trains the employees in the use of the equipment and ensured that the prescribed equipment is used by the employee/s.

Employees do not have the right to refuse to use and/or wear the equipment prescribed by the employer and, if it is impossible for an employee to use or wear prescribed protective equipment through health or any other reason, the employee cannot be allowed to continue working under the hazardous condition(s), for which the equipment was prescribed but an alternative solution has to be found that may include relocating the employee.

The principal contractor may not charge any fee for protective equipment prescribed by him or her but may charge for equipment under the following conditions:

- Where the employee requests additional issue in excess of what is prescribed
- Where the employee has patently abused or neglected the equipment leading to early failure
- Where the employee has lost the equipment

All employees shall, as a minimum, be required to wear the following personal protective equipment on the project:

- Head protection. e.g. hardhats
- Eye protection, e.g. goggles
- Hearing protection, e.g. earplugs
- Footwear, e.g. safety shoes
- Hand protection e.g. gloves
- Clothing, e.g. overalls
- Fall protection, e.g. harnesses (no monkey chain type harness will be allowed on site)
- Inhalation protection, e.g. dust masks

Employee Site Facilities

Adequate facilities shall be provided for employees on site, i.e.

- toilets for each sex
- hand wash facility
- drinking water

Health and Safety Signage

- Access to the construction site must be controlled
- Health and safety signage to inform visiting public, employees, client, etc must be prominently displayed
- The following signage shall be displayed :
- No Unauthorised Entry
- Danger: Construction Work in Progress
- Visitors to Report to Site Office
- Site Office
- Excavation work in progress

This signage must not be assumed to be exclusive or comprehensive

Health and Safety Notice Board

A health and safety notice board (1000mm X 600mm) shall be erected on site with the following information displayed:

- Safety notices
- Safety awareness poster
- Site rules
- Information regarding contact numbers of
- Doctor
- Ambulance
- Hospital
- Fire Brigade
- Safety Officer
- Project Manager
- First aider
- Site evacuation map and zones

Training

Provision to train employees regarding competency as required by the Act and Regulations, this will include the following activities:

Health and Safety Representative(s)

Every contractor on site, with 20 or more employees must have a health and safety representative (Section 17 (1)), and where the total number of all employees on site is less than 20, the principal contractor shall ensure that at least one health and safety representative is available on site.

First Aider

Every contractor with ten or more employees shall have a person with a valid certificate of training in First Aid – Level 1. The first aider shall permanently be available on site

Risk Assessor

Every contractor performing construction work shall before commencement of any construction work and during construction work, cause a risk assessment to be performed by a competent person.

The training provision should be read in conjunction with the ACT, Construction Regulations or any other Regulation and Safety Standards which were or will be promulgated under the Act or incorporated into the Act and be in force or come into force during the effective duration of the project.

First Aid Station

Every contractor with five or more employees shall have a first aid box on site. The first aid box shall contain suitable first aid equipment which includes at least the equipment stipulated in the Annexure of the General Safety Regulations.

A stretcher and cervical collar shall be available at the first aid station.

Logbooks and Registers

The following logbooks and registers shall be implemented and managed in terms of the Act and Regulations:

Health and Safety Appointments

The health and safety appointments and proof of competency shall be as stipulated in the Act and Regulations

Logbooks and Registers

The following logging shall be carried out and recorded for the initial start of the project:

- (a) Fire extinguishing
- (b) First aid
- (c) incident/accident reporting
- (d) incident/accident investigation
- (e) Portable electrical equipment
- (f) Scaffolding
- (g) Ladders
- (h) Gas welding and cutting
- (i) Excavation
- (j) Construction vehicles
- (k) Earth leakage testing
- (l) Information signage
- (m) Health and Safety inspections by Health and Safety Representatives
- (n) Monthly Health and Safety Committee meeting minutes

- (o) Attendance register
- (p) Safety induction training
- (0) toolbox talks

Other logbooks/registers shall be implemented during duration of the project as stipulated by the Act and Regulations.

Record Keeping Responsibilities

The following record keeping responsibilities has been identified for this project:

ITEM	CONSTRUCTION REGULATION No.	RECORD TO BE KEPT	RESPONSIBLE PERSON
1	3(3)	Notification to Provincial Director – Annexure A Available on site	Principal Contractor
2	4(3)	Copy of Principal Contractor's Health & Safety Plan Available on site	Client
3	5(6)	Copy of Principal Contractor's Health & Safety Plan As well as each Contractor's Health & Safety Plan Available on request	Principal Contractor
4	5(7)	Health and Safety File opened and kept on site (including all documentation required i.t.o OHSA & Regulations Available on request	Principal Contractor
5	5(8)	Consolidated Health and Safety File handed to Client on completion of Construction work. To include all documentation required i.t.o. OHSA & Regulations and records of all drawings, designs, materials used and similar information on the structure	Principal Contractor
6	5(9)	Comprehensive and Updated List of all Contractors on site, the agreements between the parties and the work being done Included in Health and Safety file and available on request	Principal Contractor
7	6(7)	Keep record on the Health and Safety File of the Input by Construction Safety Officer [CR 6(7)] at design stage or on the Health and Safety Plan	Contractor
8	7(2)	Risk Assessment – Available on site for inspection	Contractor
9	7(9)	Proof of Health and Safety Induction Training	Every Employee on site
10	8(3)	Construction Supervisor [CR 6(1)] has latest updated version of Fall Protection Plan [CR 8(1)]	Contractor
11	9(2)(b)	Inform contractor in writing of dangers and hazards relating to construction work	Designer of Structure
12	9(3)	All drawings pertaining to the design of structure On site available for inspection	Contractor
13	11(3)(h)	Record of excavation inspection – On site available on request	Contractor
14	21(1)(j)	Findings of daily inspections (prior to use) of Construction Vehicles and Mobile Plant	Contractor
15	22(d)	Record of temporary electrical installation inspections[once a week] and electrical machinery [daily before use] in a register and kept on site	Contractor

OCCUPATIONAL HEALTH AND SAFETY FILE

Contents of the Occupational health and Safety file

The minimum contents of the health and safety file shall include:

- (a) Health and safety plan
- (b) Brief description of work
- (c) Health and safety specifications provided by the Client
- (d) Risk assessment
- (e) Safe work procedures
- (f) Notification of construction work
- (g) Letter of good standing with the compensation fund or approved compensation insurer
- (h) Program of construction work
- (i) Minutes/audits of health and safety inspections and meetings
- (j) Documentation supporting the managing of the health and safety programme
- (k) As-built drawings
- (l) Arrangements with contractors (sub-contractors) and/or mandatories.

PROJECT STANDARDS FOR OCCUPATIONAL HEALTH AND SAFETY

Administrative and legal

OHS ACT SECTION/ REGULATION	SUBJECT	STANDARD
Construction. Regulation 3	Notice of carrying out construction work	Department of Labour notified. Copy of notice available on site
General Admin. Regulation 4	*Copy of OH&S Act (Act 85 of 1993)	Updated copy of Act & Regulations on site. Readily available for perusal by employees.
COID Act Section 80	*Registration with compensation insurer	Written proof of registration / letter of good standing available on site
Construction. Regulation 4 & 5(1)	H&S specification and programme	H&S Specifications received from client and / or its agent on its behalf OH&S programme developed & updated regularly.
Section 8(2) (d) Construction. Regulation 7	*Hazard identification and risk assessment	Hazard identification carried out / recorded. Risk Assessment and - plan drawn up / updated. RA plan available on site employees / sub-contractors informed / trained.
Section 16(2)	*Assigned duties (Managers)	Responsibility of complying with the OH&S Act assigned to other person/s by CEO.
Construction. Regulation 6(1)	Designation of person responsible on site	Competent person appointed in writing as construction supervisor with job description.
Construction. Regulation 6(2)	Designation of assistant for above	Competent person appointed in writing as construction supervisor with job description.
Section 17 & 18 General administrative. Regulations 6 & 7	*Designation of Health and Safety representatives	More than 20 employees – one H&S representative, one additional H&S representative for each 50 employees or part thereof. Designation in writing, period and area of responsibility specified in terms of GAR 6 & 7. Meaningful H&S representatives reports. Reports actioned by management
Section 19 & 20 General administrative. Regulations 5	*Health & Safety committee/s	H&S Committee/s established. All H&S representatives shall be members of H&S committees. Additional members are appointed in writing. Meetings held monthly, minutes kept. Actioned by Management.

OHS ACT SECTION/ REGULATION	SUBJECT	STANDARD
Section 37(1) & (2)	*Agreement with mandataries / (sub-) contractors	Written agreement with (sub-) contractors. List of (sub-) contractors displayed. Proof of registration with compensation insurer / letter of good standing. Construction supervisor designated. Written arrangements re. H&S representatives and H&S committee. Written arrangements re. First Aid.
Section 24 & General administrative. Regulation 8 COID Sections 38, 39 & 41	*Reporting of incidents (Department of Labour)	Incident Reporting Procedure displayed. Incident Reporting Procedure displayed. All incidents in terms of Section 24 reported to the Provincial Director, Department of Labour, within 3 days. (Annexure 1)(WCL 1 or 2) and to the client and/or its agent on its behalf. Cases of occupational disease reported. Copies of reports available on site. Records of First Aid injuries to be kept.
General administrative. Regulation 9	*Investigation and recording of incidents	All injuries which resulted in the person receiving medical treatment other than first aid, recorded and investigated by investigator designated in writing. Copies of reports (Annexure 1) available on site and tabled at H&S committee meeting. Action taken by site management
Construction. Regulation 8	Fall prevention and protection	Competent person appointed to draw up and supervise the fall protection plan. Proof of appointees competence available on site. Risk assessment carried out for work at heights fall protection plan drawn up / updated. Available on site.
Construction. Regulation 8(5)	Roof work	Competent person appointed to plan and supervise roof work. Proof of appointees competence available on site. Risk assessment carried out. Roof work plan drawn up / updated. Roof work inspect before each shift. Inspection register kept. Employees medically examined for physical and psychological fitness. Written proof on site.
Construction. Regulation 9	Structures	Information re. the structure being erected received from the designer including: geo-science technical report where relevant the design loading of the structure the methods and sequence of construction anticipated dangers / hazards / special measures to construct safely Risk assessment carried out. Method statement drawn up. All above available on site. Structures inspected before each shift. Inspections register kept.
Construction. Regulation 10	Formwork and support work	Competent person appointed in writing to supervise erection, maintenance, use and dismantling of support and formwork.

OHS ACT SECTION/ REGULATION	SUBJECT	STANDARD
		Design drawings available on site. Risk Assessment carried out. Support and formwork inspected: before use/inspection before pouring of concrete weekly whilst in place before stripping / dismantling Inspection register kept
Construction Regulation 14	Scaffolding	Competent persons appointed in writing to: * erect scaffolding (Scaffold Erector/s) * act as Scaffold Team Leaders * inspect Scaffolding weekly and after inclement weather (Scaffold Inspector/s) Written Proof of Competence of above appointees available on Site Copy of SABS 085 available on Site Risk Assessment carried out Inspected weekly/after bad weather. Inspection register/s kept
Construction. Regulation 11	Excavations	Competent person/s appointed in writing to supervise and inspect excavation work. Written proof of competence of above appointee/s available on site. Risk Assessment carried out. Inspected: before every shift after any blasting after an unexpected fall of ground after any substantial damage to the shoring after rain. Inspections register kept
Construction. Regulation 12	Demolition work	Competent person/s appointed in writing to supervise and control demolition work. Written proof of competence of above appointees available on site. Risk Assessment carried out. Engineering survey and method statement available on site. Inspections to prevent premature collapse carried out by competent person before each shift. Inspections register kept.
Construction. Regulation 19	Explosive powered tools	Competent person appointed to control the issue of the explosive powered tools & cartridges and the service, maintenance and cleaning. Register kept of above. Empty cartridge cases/nails/fixing bolts returns recorded Cleaned daily after use Work areas are demarcated!
Construction. Regulation 22 / Electrical machinery. Regulation 9 & 10 / Electrical regulations.	*Inspection and maintenance of electrical installation and equipment (including portable electrical tools)	Competent person appointed in writing to inspect / test the installation and equipment. Written Proof of competence of above appointee available on site. Inspections: * Electrical Installation & equipment inspected after installation, after alterations and quarterly. Inspection Registers kept Portable electric tools,

OHS ACT SECTION/ REGULATION	SUBJECT	STANDARD
		electric lights and extension leads must be uniquely identified/numbered. Weekly visual inspection by User/Issuer/Storeman. Registers kept
Construction. Regulation 26 / General Safety Reg. 8(1)(a)	*Designation of stacking and storage supervisor	Competent person/s with specific knowledge and experience designated to supervise all stacking and storage. Written proof of competence of above appointee available on site.
Construction. Regulation 27 Environmental. Regulation 9	*Designation of a person to co- ordinate emergency planning and fire protection	Person/s with specific knowledge and experience designated to co-ordinate emergency contingency planning and execution and fire prevention measures Emergency evacuation plan developed: Drilled / practiced Plan and records of drills / practices available on site All Fire extinguishing equipment identified and on registered on a register. Inspected weekly. Inspection Register kept. Serviced annually.
General Safety. Regulation 2	Personal safety equipment (PSE)	PSE Risk Assessment carried out. Items of PSE prescribed/use enforced. Records of issue kept. Undertaking by employee to use/wear PSE. PSE remain property of employer, not to be removed from premises GSR 2(4)
General Safety. Regulation 3	*First aid	Every workplace provided with sufficient number of first aid boxes. (Required where 5 persons or more are employed). First Aid freely available. Equipment as per the list in the OH&S Act. One qualified first aider appointed for every 50 employees. (Required where more than 10 persons are employed). List of first aid officials, certificates, name of person/s in charge of first aid box/es displayed. Location of first aid box/es clearly indicated. Signs instructing employees to report all injuries/illness including first aid injuries
General Safety. Regulation 9	*Inspection and use of welding / flame cutting equipment	Competent person/s with specific knowledge and experience designated to inspect electric arc, gas welding and flame cutting equipment. Written proof of competence of above appointee available on site. All new vessels checked for leaks, leaking vessels NOT taken into stock but returned to supplier immediately. Purpose made storage available for full and empty vessels. Equipment identified / numbered and entered into a register. Equipment inspected weekly. Inspection register kept separate.
Hazardous chemical substances.	* Control of storage and usage of HCS and flammables	Competent person/s with specific knowledge and experience designated to control the storage and usage of HCS (including flammables).

OHS ACT SECTION/ REGULATION	SUBJECT	STANDARD
Construction. Regulation 23		Written proof of competence of above appointee available on site. Risk assessment carried out. Register of HCS kept/used on site. Separate/purpose made storage available for full and empty containers.
Vessels under pressure. Regulation, 1996	Vessels under pressure (VUP)	Competent Person/s with specific knowledge and experience designated to supervise the use, storage, maintenance, statutory inspections & testing of VUP's Written Proof of Competence of above appointee available on Site Risk Assessment carried out Certificates of Manufacture available on Site Register of VUP's on Site Inspections & Testing by Approved Inspection Authority (AIA): After installation/re-erection or repairs. Every 36 months. Register / log kept of inspections, tests. Modifications and repair.
Construction. Regulation 21	Construction. Vehicles and earth moving equipment	Operators/Drivers appointed to: Carry out a daily inspection prior to use. Drive the vehicle / plant that he/she is competent to operate / drive. Written proof of competence of above appointee available on site. Record of daily inspections kept.
General Safety. Regulation 13A	*Inspection of ladders	Competent person appointed in writing to inspect ladders. Ladders inspected at arrival on site and weekly there after. Inspections register kept. Application of the types of ladders (wooden, aluminium etc.) regulated by training and inspections and noted in register.

Training

SUBJECT	STANDARD
Company OH&S Policy Section 7(1)	Policy signed by CEO and published / circulated to employees. Policy displayed on employee notice boards. Management and employees committed. Rules published.
Company/site OH&S Rules Section 13(a)	Rules displayed on employee notice boards. Rules issued and employees effectively informed or trained: written proof.
Induction and task safety training Section 13(a)	Follow-up to ensure employees understand/adhere to the policy and rules. All new employees receive OH&S induction training. Training includes Task Safety Instructions.
General OH&S training Section 13(a)	Employees acknowledge receipt of training. Follow-up to ensure employees understand/adhere to instructions. All current employees receive specified OH&S training: written proof. Operators of plant & equipment receive specified training.
Occupational Health and Safety Promotion	Follow-up to ensure employees understand/adhere to instructions. Incident experience board indicating e.g.

SUBJECT	STANDARD
	No of hours worked without an injury. No of days worked without an injury. Mission, vision and goal. Star grading- board kept up to date. Safety Posters displayed & changed regularly. Employee notice board for OH&S notices. Site OH&S competition. Participation in regional OH&S competition Suggestion scheme

Public safety, security and emergency

SUBJECT	STANDARD
*Notices and signs	Notices and signs at entrances / along perimeters indicating "No Unauthorized Entry". Notices and signs at entrance instructing visitors and non - employees what to do, where to go and where to report on entering the site/yard with directional signs. e.g. "Visitors to report to Office". Notices and signs posted to warn of overhead work and other hazardous activities e.g. General warning signs.
Site safeguarding	Nets, canopies, platforms, fans etc. to protect members of the public passing / entering the site.
*Security measures	Access control measures/register in operation. Security patrols after hours during weekends and holidays. Sufficient lighting after dark. Guard has access to telephone/ mobile/other means of emergency communication.

Personal Protective Equipment

SUBJECT	STANDARD
*Emergency drill and evacuation	Adequate No. of employees trained to use fire fighting Equipment. Emergency evacuation plan available, displayed and practiced.
* PPE needs analysis	Need for PPE identified and prescribed in writing. PPE remain property of Employer, not to be removed from premises GSR. 2(4)
* Head Protection	All persons on site wearing Safety Helmets including Sub-contractors and Visitors (where prescribed)
* Foot Protection	All employees on site wearing Safety Footwear including Gumboots for concrete / wet work and non-slip shoes for roof work. Visitors to wear same upon request or where prescribed
* Eye and Face Protection	Eye and Face (also Hand and Body) Protection (Goggles, Face Shields, Welding Helmets etc.) used when operating the following: Jack/ Kango Hammers * Angle/ Bench Grinders * Electric Drills (Overhead work into concrete / cement / bricks * Explosive Powered tools * Concrete Vibrators / Pokers * Hammers & Chisels * Cutting / Welding Torches * Cutting Tools and Equipment * Guillotines and Benders
* Eye and Face Protection	* Shears * Sanders and Sanding Machines * CO2 and Arc Welding Equipment * Skill/Bench Saws * Spray Painting Equipment etc
* Hearing Protection	Hearing Protectors (Muffs, Plugs etc.) used when operating the following: * Jack / Kango Hammers * Explosive Powered Tools * Wood/Aluminium Working Machines e.g. saws, planers, routers
* Hand Protection	Protective Gloves worn by employees handling / using: * Cement / Bricks / Steel / Chemicals * Welding Equipment * Hammers & Chisels * Jack / Kango Hammers etc.

Personal Protective Equipment (Continued).

SUBJECT	STANDARD
* Respiratory Protection	Suitable/efficient prescribed Respirators worn correctly by employees handling / using: * Dry cement * Dusty areas * Hazardous chemicals

	* Angle Grinders * Spray Painting etc.
* Fall Protection	Suitable Safety Belts / Fall Arrest Equipment correctly used by persons working on / in unguarded, elevated positions e.g.: * Scaffolding * Riggers * Lift shafts * Edge work * Ring beam edges etc. Other methods of fall prevention applied e.g. catch nets
* Protective Clothing	All jobs requiring protective clothing (Overalls, Rain Wear, Welding Aprons etc.) Identified and clothing worn.
* PPE Issue & Control	Identified Equipment issued free of charge. All PPE maintained in good condition. (Regular checks). Workers instructed in the proper use & maintenance of PPE. Commitment obtained from wearer accepting conditions and to wear the PPE. Record of PPE issued kept on H&S File. PPE remain property of Employer, not to be removed from premises GSR 2(4)
* Scrap Removal System	All items of Scrap/Unusable Off-cuts/Rubble and redundant material removed from working areas on a regular basis. (Daily) Scrap/Waste removal from heights by chute/hoist/crane.
Scrap Removal System	Nothing thrown/swept over sides. Scrap disposed of in designated containers/areas Removal from site/yard on a regular basis.
Stacking	Stacking: * Stable, on firm level surface/base. * Prevent leaning/collapsing * Irregular shapes bonded * Not exceeding 3x the base * Stacks accessible * Removal from top only.

Personal Protective Equipment (Continued).

Storage	Storage: * Adequate storage areas provided. * Functional — e.g. demarcated storage areas/racks/bins etc. * Special areas identified and demarcated e.g. flammable gas, cement etc. * Neat, safe, stable and square. * Store/storage areas clear of superfluous material. * Storage behind sheds etc. neat/under control. * Storage areas free from weeds, litter etc. and kept to a minimum in the work areas.
*Waste Control / Reclamation	(Nails removed/bent over in re-usable timber). Issue of hardware/nails/screws/cartridges etc. Controlled and return of unused items monitored.

	Controlled and return of unused items monitored.
Sub-contractors (Housekeeping)	Sub-contractors required to comply with Housekeeping requirements

Working at Heights (including roof work)

SUBJECT	STANDARD
Openings	Unprotected openings adequately guarded/fenced/barricaded/catch nets installed Roof work discontinued when bad/hazardous weather Fall protection measures (including warning notices) when working close to edges or on fragile roofing material Covers over openings in roof of robust construction/secured against displacement

Scaffolding/Formwork/Support Work

SUBJECT	STANDARD
Access/System Scaffolding	Foundation firm / stable Sufficient bracing. Tied to Structure/prevented from side or cross movement Platform boards in good condition/sufficient/secured. Handrails and toe boards provided. Access ladders / stairs provided. Area/s under scaffolding tidy. Safe/unsafe for use signs Complying with OH&S Act/SABS 085

Scaffolding/Formwork/Support Work (Continued)

SUBJECT	STANDARD
Free Standing Scaffolding	Foundation firm / stable. Sufficient bracing. Platform boards in good condition/sufficient/secured. Handrails and toe boards provided. Access ladders / stairs provided. Area/s under scaffolding tidy. Safe/unsafe for use signs. Height to base ratio correct. Outriggers used /tied to structure where necessary. Complying with OH&S Act/SABS 085.
*Mobile Scaffolding	Foundation firm / stable. Sufficient bracing. Platform boards in good condition/sufficient/secured. Handrails and toe boards provided. Access ladders / stairs provided. Area/s under scaffolding tidy. Safe/unsafe for use signs Wheels / swivels in good condition Brakes working and applied. Height to base ratio correct. Outriggers used where necessary

	Complying with OH&S Act/SABS 085
Formwork/ Support Work	All components in good condition. Foundation firm / stable. Adequate bracing/stability ensured. Good workmanship / uprights straight and plumb. Good cantilever construction. Safe access provided. Areas under support work tidy.
Special Scaffolding	Same standards as for system scaffolding. Special Scaffolding e.g. Cantilever, Jib and Truss scaffolds erected to an acceptable standard and inspected by specialists.
Edges & Openings	Edges barricaded to acceptable standards. Manhole openings covered / barricaded. Stairs provided with handrails. Lift shafts barricaded / fenced off.

Ladders

SUBJECT	STANDARD
*Physical Condition/Use & Storage	Stepladders - hinges/stays/braces/stiles in order. Extension ladders - ropes/rungs/stiles/safety latch/hook in order. Extension/ Straight ladders secured or tied at the bottom / top. No joined ladders used Wooden ladders are never painted except with varnish Aluminium ladders NOT to be used with electrical work All ladders stored on hooks / racks and not on ground. Ladders protrude 900 mm above landings / platforms / roof. Fixed ladders higher than 5 m have cages/Fall arrest system

Electricity

SUBJECT	STANDARD
*Electrical Distribution	Colour coded / numbered / symbolic sign displayed. Area in front kept clear and unobstructed,
Boards & Earth Leakage	Fitted with inside cover plate / openings blanked off/no exposed "live" conductors / terminals/Door kept close Switches / circuit breakers identified. Earth leakage protection unit fitted and operating. Tested with instrument: Test results within 15 —30 milliamps Aperture/Opening/s provided for the plugging in and removal of extension leads without the need to open the door Apertures and openings used for extension leads to be protected against the elements and especially rain
*Electrical Installations & Wiring	Temporary wiring / extension leads in good condition / no bare or exposed wires.
*Electrical Installations & Wiring	Earthing continuity / polarity correct: Looking at the open connectors to connect the wiring, the word "Brown" has the letter 'R' in it, so the b'R'own wire connects to the "R'ight hand connector. "Blue" has the letter 'L' in it, so the b'L'ue wire connects to the L'eft' hand connector. Cables protected from mechanical damage and moisture. Correct loading observed e.g. no beating appliance used from lighting circuit etc. Light fittings/lamps protected from mechanical damage/moisture. Cable arrestors in place and used inside plugs

Electricity (Continued)

SUBJECT	STANDARD
*Physical condition of Electrical Appliances & Tools	Electrical Equipment and Tools: (includes all items plugging in to a 16 Amp supply socket) Insulation / casing in good condition. Earth wire connected/intact where not of double insulated design Double insulation mark indicates that no earth wire is to be connected. Cord in good condition/no bare wires/secured to machine & plug.

	Plug in good condition, connected correctly and correct polarity.
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Excavations

SUBJECT	STANDARD
Excavations deeper than 1.5m	Shored / Braced to prevent caving / falling in. Provided with an access ladder. Excavations guarded/barricaded/lighted after dark in public areas Soil dumped at least 1 m away from edge of excavation On sloping ground soil dumped on lower side of excavation All excavations are subject to daily inspections

Tools

SUBJECT	STANDARD
*Hand Tools	Shovels / Spades / Picks: * Handles free from cracks and splinters * Handles fit securely * Working end sharp and true Hammers: * Good quality handles, no pipe or reinforcing steel handles. * Handles free from cracks and splinters Handles fit securely Chisels: * No mushroomed heads / heads chamfered * Not hardened * Cutting edge sharp and square Saws: * Teeth sharp and set correctly * Correct saw used for the job

Tools (Continued)

SUBJECT	STANDARD
*Explosive Powered Tools.	Only used by trained / authorised personnel. Prescribed warning signs placed / displayed where tool is in use. Work area must be properly isolated/demarcated during use of tool. Inspected at least monthly by competent person and results recorded. Issue and return recorded including cartridges / nails and unused cartridges / nails / empty shells recorded. Cleaned daily after use.

Transport & Materials Handling Equipment

SUBJECT	STANDARD
*Site Vehicles	All Site Vehicles, Dumpers, Bobcats, and Loaders etc: checked daily before use by driver / operator. Inventory of vehicles used/operated on site Inspection by means of a checklist / results recorded.

	No persons riding on equipment not designed or designated for passengers. Site speed limit posted, enforced and not exceeded. Drivers / Operators trained / licensed and carrying proof No unauthorised persons allowed to drive / operate equipment.
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Site Plant and Machinery

SUBJECT	STANDARD
Brick Cutting Machine	Operator Trained. Only authorised persons use the machine. Emergency stop switch clearly marked and accessible. Area around the machine dry and slip/trip free/clear of off-cuts All moving drive parts guarded/electrical supply cable protected Operator using correct PPE - eye/face/hearing/foot/hands/body.
*Electric Arc Welder	Welder Trained. Only authorised / trained persons use welder. Earth cable adequately earthed to work. Electrode holder in good condition/safe Cables, clamps & lugs/connectors in good condition. Area in which welding machine is used is dry/protected from wet. Welder using correct PPE - eye/face/foot/body/respirator. Correct transparent screens & warning signs placed

Site Plant and Machinery (Continued)

SUBJECT	STANDARD
*Woodworking Machines	Operators Trained. Only authorised persons use machines, Provided with guards. Guards used. Operators using correct PPE - eye/face/feet/hearing Circular saws strictly operated according to prescribed methods and settings Only prescribed saw blades (cross-cut, ripping blade, smooth cut, aluminium) shall be used for various applications
*Compressors	Relief valves correctly set and locked / sealed. Maximum Safe Working Pressure (MSWP) indicated on face of pressure gauge, not on glass cover. All drives adequately guarded. Receiver/lines drained daily Hoses good condition/clamped, not wired Compressed air NEITHER used to dust off clothing/ PPE/ and work areas NOR on bare skin
Concrete Mixer / Batch Plant	Top platform provided with guardrails. Dust abatement methods in use. Operators using correct PPE – eye / hands / respirators.
Concrete Mixer / Batch Plant	All moving drive parts guarded. Emergency stops identified / indicated and accessible. Area kept clean/dry/and free from tripping and slipping hazards. Operators overseer identified and crane signals displayed and used.

*Gas Welding Flame & Cutting Equipment -	Only authorized/trained persons use the equipment. Torches and gauges in good condition. Flashback arrestors fitted at cylinders and gauges. Hoses in good condition/correct type/all connections with clamps Cylinders stored, used and transported in upright position, secured in trolley/ cradle/to structure. All cylinders regularly checked for leaks, leaking cylinders returned immediately. Fire prevention/control methods applied/hot work permits
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Plant & Storage Yards/Site Workshops Specifics

SUBJECT	STANDARD
Section 8(2) (1) General Machinery Regulation 2(1): Supervision of the Use & Maintenance of Machinery	Person/s with specific knowledge and experience designated in writing to Supervise the Use & Maintenance of Machinery Critical items of Machinery identified/numbered/placed on register/inventory C4-28 Inspection/maintenance schedules for abovementioned Inspections/maintenance carried out to above schedules Results recorded

Plant & Storage Yards/Site Workshops Specifics (Continued)

SUBJECT	STANDARD
General Machinery Regulation 9(2): Notices re. Operation of Machinery	Schedule D Notice posted in Work areas
Vessels under Pressure	Person/s with specific knowledge and experience designated in writing to Supervise the Use & Maintenance of VuP's
Regulation 13(1)(b): Supervision of the Use & Maintenance of Vessels under Pressure	VuP's identified/numbered/placed on register/Manufacturers plate intact Inspection/maintenance schedules for abovementioned Inspections/maintenance carried out to above schedules Results recorded/Test certificates available
Lock-out Procedure Ergonomics	Lock-out procedure in operation Ergonomics survey conducted — results on record Survey results applied
Demarcation & Colour Coding	Demarcation principles applied All services, pipes, electrical installation, stop-start controls, emergency controls etc. colour coded to own published or SABS standard Employees trained to identify colour coding
Portable & Bench Grinders	Area around grinder clear/trip/slip free. Bench grinders mounted securely/grinder generally in good condition/No excessive vibration. On/Off switch/button clearly demarcated/accessible. Adequate guards in place. Tool rest— secure/square/max. 2 mm gap, perpendicular to drive shaft. Stone/disk - correct type and size/mounted correctly/dressed. Use of Eye protection enforced.
Battery Storage & Charging	Adequately ventilated, ignition free room/area/no smoking sign/s. Batteries placed on rubber/wooden surface. Emergency shower/eye wash provided. No acid storage in area. Prescribed methods in place and adhered to when charging batteries.
Ancillary Lifting Equipment	Chain Blocks/Tirfors/jacks/mobile gantries etc.identified/Numbered on register. Chains in good condition/links no excessive wear/checked daily. Lifting hooks — throat pop marked/safety latch fitted. SWL/MML marked/displayed.

SUBJECT	STANDARD
Presses / Guillotines / Shears	Only operated by trained/200authorized persons. Interlocks/lock-outs fitted/PPE worn or used at all times

Workplace Environment, Health and Hygiene

SUBJECT	STANDARD
*Lighting	Adequate lighting in places where work is being executed e.g. stairwells and basements. Light fittings placed / installed causing no irritating/blinding glare. Stroboscopic effect eliminated (not only reduced) where moving objects or machinery is used.
*Ventilation	Adequate ventilation / extraction / exhausting in hazardous areas e.g. chemicals / adhesives / welding / petrol or diesel/ motors running and in confined spaces / basements.
*Noise	Tasks identified where noise levels exceeds 85 dB at any one time. All reasonable steps taken to reduce noise levels at the source. Hearing protection used where noise levels could not be reduced to below 85 dB.
*Heat Stress	Measures in place to prevent heat exhaustion in heat stress problem areas e.g. steel decks, when the WBGT index reaches 30. (See Environmental Regulation 4). Cold drinking water readily available at all times.
*Ablutions	Sufficient hygiene facilities provided - 1 toilet per 30 employees (National Building Regulations prescribe chemical toilets for Construction sites) Toilet paper available. Sufficient showers provided. Facilities for washing hands provided Soap/cleaning agent available for washing hands Means of drying hands available Lock-up changing facilities/area provided. Ablution facilities kept hygienic and clean.
*Eating/Cooking Facilities	Adequate storage facilities provided. Weather protected eating area provided, separate from changing area Refuse bins with lids provided. Facilities kept clean and hygienic.
*Pollution Environment of	Measures in place to minimize dust generation. Accumulation or littering of empty cement pockets, plastic wrapping / bags, packing materials etc prevented.
*Pollution Environment of	'Spillage / discarding of oil, chemicals and dieseline into storm water and other Drains or into existing or newly dug holes/cavities on site expressly prohibited.
*Hazardous Chemical Substances	All substances identified and list available e.g. acids, flammables, poisons etc. Material Safety Data Sheets (MSDS) indicating hazardous properties and Emergency procedures in case of incident on file and readily available. Substances stored safely.

RISK ASSESSMENT PROGRAMME

Methodology

Prior to drafting the Health and Safety Plan, and in consideration of the information contained here-in, the contractor shall set up a Risk Assessment Programme to identify and determine the scope and details of any risk associated with any hazard at the construction site, in order to identify the steps needed to be taken to remove, reduce or control such hazard. This Risk Assessment and the steps identified will be the basis or point of departure for the Health and Safety Plan.

Due to the wide scope and definition of construction work, every construction activity and site will be different, and circumstances and conditions may change even on a daily/hourly basis. Therefore, due caution is to be taken by the principal contractor when dealing with the identification of hazards and risks.

The risk assessment to be conducted for this project shall be defined as workplace risk assessment. Workplace risk assessment is a set of ongoing management and engineering activities of the project, aimed at ensuring that the health, safety and environmental hazards/risks of the project are identified, understood and minimised to a reasonable, achievable and tolerable level.

The following guide can be helpful to conduct and manage risk assessments:

Step 1: Identifying the current as well as emerging hazard, risks or exposures.

Step 2: Aim to identify major hazards, don't waste time on the minor and detail except if such hazard has the potential to repeat itself on a frequent basis.

Step 3: Involve as many people as possible in the ongoing risk assessment process especially those at risk.

Step 4: Gather all the information and analyse it.

Step 5: Look at what actually could or has occurred including non-routine operations.

Step 6: Use a systematic approach to ensure all hazards are adequately addressed.

Step 7: Assess the risks identified or the risk that occurred by taking into account the effectiveness of current as well as controls under consideration.

Step 8: Ensure the process is practical, realistic, cost and business effective.

Step 9: Always record the assessment in writing including i.e. assumptions, date and why a particular decision has been made.

Contents of the risk assessment programme

All risk assessments shall be conducted in terms of an acceptable methodology, prior to commencement of work, according to the provisions of CR7 and should cover at least the following where applicable

- Movement of construction vehicles
- Bulk earth works
- All work near overhead power lines and underground cables
- Locating underground cables/existing services
- Hand excavation of trenches
- Mechanical excavation of trenches
- All work carried out inside trenches, including compacting, pipe laying, backfilling etc.
- Temporary stockpiling and removal of excavated material
- Transporting material
- Cutting into existing sewage line
- All work carried out from scaffolding
- Exposure to raw sewerage
- All work carried out on live electrical installations
- Welding in confined spaces
- Working at heights
- Tower crane operation
- Piling
- Formwork/Support work

- Demolition work
- Working with hand tools
- Working with portable electrical tools
- Traffic accommodation

All health hazards that can be present during any of the above activities and should include individual dusts, gases, fumes, vapours, noise, extreme temperatures, illumination, vibration and ergonomic hazards due to any of the above activities

The above list is by no means exhaustive and should not be limited to these activities but must cover all activities that forms part of the said construction work. Each activity must be split down to individual tasks and all associated hazards identified and listed in the risk assessment. This ensures that critical tasks and subsequent critical hazards are not missed.

The risk assessment to be included in the Health and Safety Plan must clearly indicate:

The methodology used to dot the risk assessments
Breakdown of processes and activities covered
High risks anticipated

All risk assessments are to be conducted by a competent person as appointed. The plan must include a declaration in this regard or the risk assessment must contain the signature(s) of this appointed persons.

Risk assessments are to be handed to the agent prior to commencement of work.

The agent reserves the right to stop any work if such work is not conducted in terms of the recommendations of risk assessment.

Risk assessments are to cover safety as well as health hazards.

Base-line risk assessment

The following risks were anticipated for this project, and shall form part of the principal contractor's base-line risk assessment.

ITEM	SIGNIFICANT HAZARDS	REFERENCE CONSTRUCTION REG.NO
1.	SAFETY	
1.1	Site security	Sect 9 OHS ACT
1.2	Sub-contractors	5(3), 5(5), 5(9), 5(10), 5(12)
1.3	Fall protection $\pm$ 4m	8
1.4	Construction vehicles and mobile plant	21
1.5	Site housekeeping	25
1.6	Traffic to and from the site	21
1.7	Personal protective equipment (PPE)	8, 15, 23
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Issue-based risk assessment

The purpose of an issue-based risk assessment is to conduct a detailed assessment study of the activities, occupations and tasks identified during the baseline risk assessment as posing a significant risk.

The aim output of the issue-based risk assessment is:

- input into continuous risk assessment
- action plans for the treatment of significant risk
- input to training program, standards, procedures, codes of practice and management systems

The following risks were anticipated as issue-base risks for this project.

Task orientated risks:

Activity/ Task	Hazard/Risk to Safety	Risk to Health	Risk to Environment
Stripping topsoil	Vehicles reversing over equipment and employees. Dirt in eyes and face	Noise induced hearing loss from heavy machinery. Multiple injuries.	Uncontrolled dust. Diesel and oil spillage from heavy machinery. Stripping of protected fauna and flora
Tipping	Trucks reversing over equipment and employees. Trucks toppling over while tipping	Multiple injuries and fatalities.	Diesel and oil spillage
Excavate and load	Tip trucks reversing over personnel. Truck colliding with excavator. Overloading of trucks. Collision with other vehicles. Unguarded trenches, slipping and falling down	Multiple injuries and fatalities.	Uncontrolled dust. Diesel and oil spillage from heavy machinery
Processing and compacting	Machine reversing. Congestion of machines and Noise	Noise induced hearing loss. Multiple injuries	Diesel and oil spillage.
Excavation Mechanical	No non workers allowed in excavation area, Excavated material away from edge of excavation,	Multiple Injuries and fatalities. Electrical shock.	Cutting down of protected trees, etc. Check with Dept. Of Environment Affairs.

Activity/ Task	Hazard/Risk to Safety	Risk to Health	Risk to Environment
	Mechanical malfunction. Machine topples over. Machine collision. Underground services. Unguarded trenches, slipping and falling down.	Gases from burst pipes, etc.	Diesel and oil Spillage

Task orientated risks: (Continued)

Activity/ Task	Hazard/Risk to Safety	Risk to Health	Risk to Environment
Excavation by hand	Caving in of un shored sides, collapse of excavation, personnel and equipment falling in. Unguarded trenches, slipping and falling down. Heat related illness, unsafe picks or shovels, Cuts and lacerations.	Complications Resulting from repetitive work. Multiple injuries, fatalities,	
Backfilling	Sides of excavation collapse, live burials of personnel	Multiple injuries and fatalities	
Formwork	Shuttering lying around, exposed nails, poorly erected scaffolding falls, injuries, fractures, death	Dermatitis from coming into contact with degreasers	Spillage of oils, degreasers onto ground, etc C4-34
Stripping of formwork	Falling shutter boards, timber on ground nails in timber, falls from scaffold while stripping	Dermatitis form coming into contact with degreasers	Spillage of oils, degreasers, onto ground, etc.
Cement mortar and concrete mixing	Inhaling cement dust,	Ingestion, inhaling of cement, contact with skin may cause Dermatitis	Pollution, spillage of cement
Brickwork	Slipping/ tripping, falling of bricks from heights, unsafe stacking of bricks, cutting of bricks, twisting and straining of back muscles, unsafe scaffolding,	Straining of back, falls, fractures, struck by, finger cuts, eyes	Pollution, spillage of cement
Plastering	Slipping/ Tripping, poorly erected scaffolding.	Chemical reaction in wet cement causes Dermatitis	Pollution, spillage of cement
Carpentry and joinery	Unnecessary material, shuttering laying around, injuries falls, struck by, unsafe scaffolding	Multiple injuries, fractures, bruises	
Structural steelwork	Falling objects, sharp/cutting edges, struck by e.g. lifting material with cranes, unsafe scaffolding, hand, foot injuries,	Multiple injuries, bruises, cuts, fractures, fatalities	
Metal works	Falling objects, sharp/cutting edges, strike by, unsafe	Multiple injuries, bruises, cuts, fractures, fatalities	

Activity/ Task	Hazard/Risk to Safety	Risk to Health	Risk to Environment
	scaffold, hand foot injuries		

Task orientated risks (Continued).

Activity/Task	Hazard/Risk to Safety	Risk to Health	Risk to Environment
Scaffolding erection and dismantling	Falls, fractures, fatalities, falling objects, collapsing of scaffold, no toe boards, no handrails, overloading of scaffold	Multiple injuries, fractures, fatalities,	
Ladders	Falling from, damaged steps/legs, no cross bracing, homemade ladders	Multiple injuries, fractures, fatalities,	
Hazardous chemical substances	Diesel	Absorption by the skin	Hazardous chemical Pollution
Fuel supplies	Sparks can cause fire or explosion hazard, eyes, skin ingestion	Burns, inhaling fumes, skin ingestion, eye,	Spillage pollution,
Public and Site visitors	Uncontrolled access	Multiple injuries, fatalities	Uncontrolled access
Fire extinguishers	Uncontrolled used can cause multiple injuries	Inhaling of CO	
Wheel barrows	Back injuries, thorn mussels,	Back injuries, thorn mussels	

Plant and machinery risks:

Activity/Task	Hazard/Risk to Safety	Risk to Health	Risk to Environment
Grader	Fall under wheels, or blade	Multiple injuries, fatalities	Diesel and oil pollution
TLB and Tractor	Fall under, struck by boom or bucket, falling material,	Multiple injuries, fatalities	Diesel and oil pollution
Front end loader	Fall under, stuck by, falling material,	Multiple injuries, fatalities	Diesel and oil pollution, dust
Excavator	Fall under, struck by, run over,	Multiple injuries, fatalities	Diesel and oil pollution, dust
Dumpers	Fall under, struck by, run over,	Multiple injuries, fatalities	Diesel and oil pollution, dust
Water tanker	Fall under wheels,	Multiple injuries, fatalities	Diesel and oil pollution, dust
Water pumps	Open axle	Multiple injuries, fatalities	Polluted water
Concrete mixer	Loose clothing caught in machine, limbs trapped or severed, inhaling cement dust, eye injuries	Eye injuries, Multiple injuries, fatalities	Cement dust, diesel and oil pollution
Plate compactor	Bruises, back injuries, hands and fingers caught in v-belts	Fingers and hands caught in v-belts back injuries,	
Driving vehicles	Accidents, passengers, un road worthy vehicles, driver, roads and weather, alcohol, ignore	Multiple injuries, fatalities	Oil and diesel/ petrol

Activity/Task	Hazard/Risk to Safety	Risk to Health	Risk to Environment
	speed limit, be aware of other vehicles		

Equipment risks:

Activity/Task	Hazard/Risk to Safety	Risk to Health	Risk to Environment
Portable electrical tools	Electric shock, damaged cords, Unsafe plugs, cords run throw water, dust, flying sparks/ chips, burns, noise, fire, jamming of drill bits/of cutting blades, wood splints,	Electric shock cuts and bruises, eye and hand injuries	
Hand tools	Damage handles, mushroom heads chisels, pipe handles,	Cuts and bruises, eye and hand injuries, fractures,	
Flame cutting acetylene and oxygen set and LP gas	Damage gauges, cracked hoses, fall over, explosive gasses, burns, damage torches, fire hazard	Multiple injuries, burns,	Air pollution
Welding	Arc eyes, burns, fumes, fire hazard,	Arc eyes, burns	Fire hazard damage to property
Battery charger	Electric shock, explosive – fumes, fire risk, battery acid	Electric shock Inhaling fumes,	

Physical risks

Activity/Task	Hazard/Risk to Safety	Risk to Health	Risk to Environment
Noise	Ear damage – hearing lost	Noise induced hearing lost	Noise pollution
Vibration	Kidney problems	May result in kidney complications,	Noise pollution
Hot and humid work areas	Exhaustion	Heat exhaustion and heat stroke	
Fire prevention	Combustible refuse: paper, plastics, flammable liquids: petrol, diesel, thinners, turpentine, incorrect fire extinguishers, obstructions in front of fire equipment,	Inhaling smoke and fumes, burns, fatalities	Smoke and fumes pollution

Ergonomically risks

Activity/Task	Hazard/Risk to Safety	Risk to Health	Risk to Environment
Visual work place	Falls from heights, material falling from heights, tripping over material,	Multiple injuries	
Awkward Postures	Back injuries, etc.	Health complications from unnatural postures	
Heavy manual lifting	Back injuries, etc.,	Back injuries, strains	

Behavioural risks

Activity/Task	Hazard/Risk to Safety	Risk to Health	Risk to Environment
Working in the direct path of energy release	Multiple injuries,	Multiple health complications,	
Man/machine interaction	Loose clothing caught in machines, limbs trapped or severed	Multiple injuries, fatalities	
Focusing on activity	Trips, falls, fractures, etc	Multiple injuries, fractures,	
Using right tool for the job	Injuries, cuts bruises, fractures, etc	Injuries, cuts, bruises, fractures	

Occupational Health risks

Activity/Task	Hazard/Risk to Safety	Risk to Health	Risk to Environment
Hygiene	Health risk	Risk for health	C4-38
Alcohol and other drugs	Health risk	Health risk self and for others	

Continuous risk assessment

The purpose of a continuous risk assessment is to operationally identify occupational SHE hazards for the purpose of treating significant risks.

The output of continuous risk assessment is :

- Immediate treatment of risks, in order of significance and in a manner determined during the issue-based risk assessment.
- Information that feeds back into issue-based risk assessment.

The following activities will form part of the basis of continuous risk assessment, which was identified and developed from the issue-based risk assessments:

- Safe work procedures (SWP)
- Planned inspections
- Method statements
- Internal SHE audits

Safe work procedures

Safe Work Procedures are to form part of the Risk Assessment and must be compiled for all the above-identified activities.

The safe work procedures must address the following elements:

- The work method to be followed to conduct work safely
- Mitigation/reducing and controlling of identified risks and hazards
- Responsibilities of competent persons
- Required personal protective equipment
- Correct equipment/tools/machinery to be used
- Reference to relevant registers to be completed

- Reference to applicable risk assessment

The following two tables provide information on all factors to be taken into account when the Risk Assessments and Safe Work Procedures are compiled:

Physical	Chemical	Biological	Mechanical	Psycho-social
Noise	Liquids	Insects	Guards	Stress
Vibration	Dusts	Fungi	Hand tools	Work pressure
Ionising radiation	Fumes	Bacteria	Machinery	Monotony
Non-ionising radiation	Fibres	Viruses		Unsociable hours
Health and cold	Mists			Ergonomically:
Electricity	Gases			* Posture
Pressure	Vapours			* Movement
				* Repetitive tasks

System	Stress/Agency	Illness/Disease
Musculoskeletal	Lifting/loads	Muscular pain syndromes
	Repetitive strain	Tenosynovitis
	Abnormal postures	Bursitis
	Whole body vibration	Osteoarthritis
Sensory	Noise	Hearing loss
Skin	Cement (chromates), RUBBER	Allergic contact dermatitis
	Thinners, epoxies	Irritant contact dermatitis
	Tar, pitch	Acne, Skin cancer
	Solar radiation	Keratosis, Cancer
Respiratory	Silica	Silicosis, TB
	Asbestosis	Asbestosis, Cancer
	Spray paints, wood, epoxies	Asthma
	Irritant dusts, welding fumes	Bronchitis
	Organic Solvents	Headaches, Dizziness, Cancer
Psychosomatic	Physical stress	Head aches
	Psychosocial stress	Depression
		Fatigue
		Substance abuse
Nervous System	Lead	Peripheral and central neuropathy
	Organic solvents	Headaches, Dizziness, Mood disorder, Dementia, Cancer

The following example illustrates a typical SWP for the use of an Angle Grinder under general operational conditions:

Activity: General use of an Angle grinder

Task steps: General operations to cut a steel pipe (150mmØ)

- Risk identified (Ref: HIRA No: (X):
- Cuts
- Lacerations
- Eye injuries
- Sprains/strains
- Electric shock

Equipment Required:

- Angle grinder
- Electrical extension
- Power source

Registers: Portable electrical equipment register

Responsible person:

Portable electrical equipment inspection:

- Construction Regulation 22(d)

Duties:

- Inspect the tool daily before use
- Record finding of the inspections, take corrective action, and report deviations.

Grinder operator:

Duties:

- Inspect tool daily according to Safe working procedure (before starting checks)
- Report deviation to supervisor immediately.

Supervisor:

Duties:

- Conduct regular planed job observation inspections.
- Take on the spot corrective action and note all in SWP Register

PPE:

- Goggles
- Face Shield
- Hard hats
- Hearing protection
- Safety boots
- Overall
- Gloves

Safe Work Procedure:

- Operator checks before starting work:
- No exposed wired
- Flexible cord is serviceable
- Plugs and extension socket free from damage
- Safety switch is serviceable
- No breaks or damage to Machines outer body
- Correct flange and bolting nut are in place for the type of disc being used.
- Guard and handles are secure
- No defect or damage to the disc
- No flammable materials close by

- Other employees are a safe distance away.

Safe operating procedure

- Use two hands when operating the grinder
- Always allow the grinder to “run up” to operating speed before applying it to the job.
- Hold grinder against the work piece with minimum pressure (to ensure it doesn’t dig in and kick back)
- Keep the grinding disc at a 15-to-30-degree angle to the work
- Adopt a comfortable distance (feet apart, well balanced, clear view of the job).
- Never use grinder between legs while sitting on the floor
- Stop the grinder at regular intervals for a short break to rest your arms and hands.
- Disconnect the power and place the grinder on bench with the disc facing upwards when not in use.
- Never put a grinder down until the disc stop running.
- Remove the plug from the power point before changing discs

END OF SECTION

**REFURBISHMENT OF EERSTHOEK SEWER AND WATER BOOSTER PUMPS
BID NO: TBA**

C3.7 HIV/AIDS Requirements

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C3.7 HIV/AIDS requirements

C3.7.1 Scope

This specification contains all requirements applicable to the Contractor for creating HIV/AIDS awareness amongst all of the Workers involved in this project for the duration of the construction period, through the following strategies:

Raising awareness about HIV/AIDS through education and information on the nature of the disease, how it is transmitted, safe sexual behavior, attitudes towards people affected and people living with HIV/AIDS, how to live a healthy lifestyle with HIV/AIDS, the importance of voluntary testing and counselling, the diagnosis and treatment of Sexually Transmitted Infections and the closest health Service Providers.

Informing Workers of their rights with regard to HIV/AIDS in the workplace.

Providing Workers with access to condoms and other awareness material that will enable them to make informed decisions about sexual practices

C3.7.2 Definitions and Abbreviations

Definitions

Service Provider The natural or juristic person recognised and approved by the Department of Public Works as a specialist in conducting HIV/AIDS awareness programmes.

Service Provider Workshop Plan A plan outlining the content, process and schedule of the training and education workshops, presented by a Service Provider which has been approved by the Representative/Agent

Worker Person in the employ of the Contractor or under the direction or supervision of the Contractor or any of his Sub-contractors, who is on site for a minimum period of 30 days in total.

Abbreviations

HIV	:	Human Immunodeficiency Virus
AIDS	:	Acquired Immune Deficiency Syndrome
STI	:	Sexually Transmitted Infection

C3.7.3 Basic method requirement

The Contractor shall, through a Service Provider, conduct onsite workshops with the Workers.

The Service Provider shall develop and compile a Service Provider Workshop Plan to be presented at the workshops and which will be best suited for this project to achieve the specified objectives with regard to HIV/AIDS awareness.

The Service Provider Workshop Plan shall be based on the following information provided by the Contractor:

- Number of Workers and Sub-contractors on site
- When new Workers or Sub-contractors will join the construction project
- Duration of Workers and Sub-contractors on site
- How the maximum number of Workers can be targeted with workshops
- How the Contractor prefers workshops to be scheduled, e.g. three hourly sessions per Worker, or one 2.5 hour workshop per Worker
- Profile of Workers, including educational level, age and gender (if available)
- Preferred time of day or month to conduct workshops
- A Gantt chart reflecting the construction programme, for scheduling of workshops

- Suitable venues for workshops

The Contractor shall submit the Service Provider Workshop Plan for approval within 21 days after the tender acceptance date. After approval by the Representative/Agent, the Contractor shall make available a suitable venue that will be conducive to education and training

The Service Provider Workshop Plan shall address, but will not be limited to the following:

- The nature of the disease;
- How it is transmitted;
- Safe sexual behaviour;
- Post exposure services such as voluntary counselling and testing (VCT) and nutritional plans for people living with HIV/AIDS;
- Attitudes towards other people with HIV/AIDS;
- Rights of the Worker in the workplace;
- How the Awareness Champion will be equipped prior to commencement of the HIV/AIDS awareness programme with basic HIV/AIDS information and the necessary skills to handle questions regarding the HIV/AIDS awareness programme on site sensitively and confidentially;
- How the Service Provider will support the Awareness Champion;
- Location and contact numbers of the closest clinics, VCT facilities, counselling services and referral systems;
- How the workshops will be presented, including frequency and duration;
- How the workshops will fit in with the construction programme;
- How the Service Provider will assess the knowledge and attitude levels of attendees to structure workshops accordingly;
- How the video will be used;
- How the Service Provider will elicit maximum participation from the Workers;
- A questions and answers slot (interactive session)

The Service Provider Workshop Plan shall encompass the Specific Learning Outcomes (SLO) as stipulated

C3.7.4 HIV/AIDS awareness education and training

Workshops

The Contractor shall ensure that all Workers attend the workshops. The workshops shall adequately deal with all the aspects contained in the Service Provider Workshop Plan. A video of HIV/AIDS in the construction industry, which can be obtained from all Regional Offices of the Department of Public Works, is to be screened to Workers at workshops. In order to enhance the learning experience, groups of not exceeding 25 people shall attend the interactive sessions of the workshops

Recommended practice

b.1) Workshop Schedule

Presenting information contained in the Service Provider Workshop Plan can be divided in as many workshop sessions as deemed practicable by the Contractor, provided that all Workers are exposed to all aspects of the workshops as outlined in the Service Provider Workshop Plan

Breaking down the content of information to be presented to Workers into more than one workshop session however, has the added advantage that messages are reinforced over time while providing opportunity between workshop sessions for Workers to reflect and test information. Workers will also have an opportunity to ask questions at a following session

b.2) Service Providers

A database of recommended Service Providers is available from all Regional Offices of the Department of Public Works

HIV/AIDS specific learning outcomes and assessment criteria

Workers shall be exposed to workshops for a minimum duration of two-and-a-half hours. In order to set a minimum standard requirement, the following specific learning outcomes and assessment criteria shall be met:

c.1) Unit 1: The nature of HIV/AIDS

After studying and understanding this unit, the Worker will be able to differentiate between HIV and AIDS and comprehend whether or not it is curable. The Worker will also be able to explain how the HI virus operates once a person is infected and identify the symptoms associated with the progression of HIV/AIDS

Assessment Criteria:

1. Define and describe HIV and AIDS
2. List and describe the progression of HIV/AIDS

c.2) Unit 2: Transmission of the HI virus

After studying and understanding this unit, the Worker will be able to identify bodily fluids that carry the HI virus. The Worker will be able to recognize how HIV/AIDS is transmitted and how it is not transmitted

Assessment Criteria:

1. Record in what bodily fluids the HI virus can be found
2. Describe how HIV/AIDS can be transmitted
3. Demonstrate the ability to distinguish between how HIV/AIDS is transmitted and misconceptions around transmittance of HIV/AIDS.

c.3) Unit 3: HIV/AIDS preventative measures

After studying and understanding this unit, the Worker will comprehend how to act in a way that would minimise the risk of HIV/AIDS infection and to use measures to prevent the HI virus from entering the bloodstream:

Assessment Criteria:

1. Report on how to minimise the risk of HIV/AIDS infection
2. Report on precautions that can be taken to prevent HIV/AIDS infection
3. Explain or demonstrate how to use a male and female condom
4. List the factors that could jeopardize the safety of condoms provided against HIV/AIDS transmission

c.4) Unit 4: Voluntary HIV/AIDS counselling and testing

After studying and understanding this unit, the Worker will be able to recognise methods of testing for HIV/AIDS infection. The Worker will be able to understand the purpose of voluntary HIV/AIDS testing and pre- and post-test counselling

Assessment Criteria:

1. Describe methods of testing for HIV/AIDS infection
2. Report on why voluntary testing is important
3. Report on why pre- and post-test counselling is important

c.5) Unit 5: Living with HIV/AIDS

After studying and understanding this unit, the Worker will be able to recognize the importance of caring for people living with HIV/AIDS and be able to manage HIV/AIDS

Assessment Criteria:

1. List and describe ways to manage HIV/AIDS
2. Describe nutritional needs of people living with HIV/AIDS
3. Describe ways to embrace a healthy lifestyle as a person living with HIV/AIDS
4. Explain the need for counselling and support to people living with HIV/AIDS

c.6) Unit 6: Treatment options for people with HIV/AIDS

After studying and understanding this unit, the Worker will be familiar with the various treatments available to HIV/AIDS infected or potentially HIV/AIDS infected people

Assessment Criteria:

1. Discuss anti-retroviral therapy
2. List methods of treatment to prevent HIV/AIDS transmission from mother-to-child transfer
3. Describe the need for treatment of opportunistic diseases for people living with HIV/AIDS
4. Describe post exposure prophylactics

c.7) Unit 7: The rights and responsibilities of Workers in the workplace with regard to HIV/AIDS

After studying and understanding this unit, the Worker will be able to identify the rights and responsibilities of the Worker living with HIV/AIDS in the workplace. The Worker will recognise the importance of accepting colleagues living with HIV/AIDS and treating them in a non-discriminative way.

Assessment Criteria:

1. Discuss the rights of a person living with HIV/AIDS in the workplace
2. Discuss the responsibilities of a person living with HIV/AIDS in the workplace
3. Report on why acceptance and non-discrimination of colleagues living with HIV/AIDS is important

Displaying of plastic laminated posters and distribution of information booklets

The Contractor shall obtain a set of four laminated posters conveying different key messages and information booklets, which are available from all Regional Offices of the Department of Public Works

The above-mentioned posters and information booklets have been prepared to raise awareness and to share information about HIV/AIDS and STI's

Posters or display stands shall be displayed on site as soon as possible, but not later than 14 days after the date of site handover

Posters shall be displayed in areas highly trafficked by Workers, including toilets, rest areas, the site office and compounds

The posters on display must always be intact, clear, and readable

Information booklets must be distributed to all Workers as soon as possible, but not later than 14 days after site handover, or as soon as the Worker joins the site.

C3.7.5 Providing workers with access to condoms

The Contractor shall provide and maintain condom dispensers and make both male and female condoms, complying with the requirements of SABS ISO 4074, available at all times to all workers at readily accessible points on site, for the duration of the contract. The Contractor may obtain condom dispensers from the Department of Health and condoms may be obtained from the Local Clinic or the Department of Health

At least one male and one female condom dispenser and a sufficient supply of condoms, all to the approval of the Representative/Agent, shall be made available on site within 14 days of site hand over. Contractors should note that arrangements to obtain condoms from the Department of Health Clinics prior to site hand over may be necessary, to ensure that condoms are available within 14 days of site handover

Condoms shall be made available in areas highly trafficked by Workers, including toilets, the site office and compounds

C3.7.6 Ensuring access to HIV/AIDS testing and counselling facilities and treatment of Sexually Transmitted Infections (STI)

The Contractor shall provide Workers with the names of the closest Service Providers that provide HIV/AIDS testing and counselling and Clinics providing Sexually Transmitted Infection (STI) diagnosis and treatment. Information on these Service Providers and Clinics must be displayed on a poster of a size not smaller than A1 in an area highly trafficked by Workers.

C3.7.7 Appointment of an HIV/AIDS awareness champion

Within 14 days of site handover the Contractor shall appoint an Awareness Champion from amongst the Workers, who speaks, reads, and writes English, who speaks and understands all the local languages spoken by the Workers and who shall be on site during all stages of the construction period. The Contractor shall ensure that the Awareness Champion has been trained by the Service Provider on basic HIV/AIDS information, the support services available, and the necessary skills to handle questions regarding the HIV/AIDS programme in a sensitive and confidential manner.

The Awareness Champion shall be responsible for:

- Liaising with the Service Provider on organising awareness workshops;
- Filling condom dispensers and monitoring condom distribution;
- Handing out information booklets;
- Placing and maintaining posters

C3.7.8 Monitoring

The Contractor shall grant to the Representative/Agent reasonable access to the construction site, in order to establish that the Contractor complies with his obligations regarding HIV/AIDS awareness under this contract

The Contractor must report problems experienced in implementing the HIV/AIDS requirements to the Representative/Agent. The attached SITE CHECKLIST (SCHEDULE A) shall be completed and submitted at every construction progress inspection to the Representative/Agent

The attached SERVICE PROVIDER REPORT (SCHEDULE B) shall be completed and submitted on a monthly basis to the Department's Project Manager, through the Representative/Agent

The attached CONTRACTOR HIV/AIDS PROGRAMME REPORT (SCHEDULE C), a close out programme report, shall be completed by the Contractor at the end of the contract

SCHEDULE A: HIV/AIDS PROGRAMME: SITE CHECKLIST

When did construction commence

Name of Departmental Project Manager

Please refer to HIV/AIDS Programme activities during the reporting period

DATE	PI	PI	PI	PI	PI	PI
Programme implemented within 14 days of site handover						
Awareness champion on site						
HIV/AIDS awareness service provider report						
Male condom dispenser						
Sufficient male condoms available						
Male condom dispenser in a highly trafficked area						
Female condom dispenser						
Sufficient female condoms available						
Female condom dispenser in a highly trafficked area						
All four types of posters displayed						
Posters in a good condition						
Posters in a highly trafficked area						
Posters displayed on local support services: clinic & VCT centre						
Support service poster/s in highly trafficked area						
Support service poster/s in a good condition						
Workers on payroll (at PI)						
Sub-Contractors who will be on site for longer than 30 days (at PI)						
Workshop attendees						
Number of workshops held						
Scheduled workshops according to approved workshop plan						
Booklets distributed						
Male condoms distributed						
Female condoms distributed						
..... Representative/Agent						
..... Contractor						

Date of progress inspection (dd/mm/yy)

Reporting period: (dd/mm/yy)to (dd/mm/yy) deviations from HIV/AIDS awareness programme plan:

Corrective actions

--

Corrective actions

--

.....
Representative/Agent

.....
Departmental Project Manager

.....
Date

.....
Date

SCHEDULE B: HIV/AIDS AWARENESS PROGRAMME: SERVICE PROVIDER REPORT

Reporting period: (dd/mm/yy) to (dd/mm/yy)

Number of workshops conducted in reporting period

Number of scheduled workshops according to approved workshop plan

Deviations from workshop plan:

--

State reasons for deviating from workshop plan:

--

Corrective actions:

--

.....
Representative/Agent

.....
Departmental Project Manager

.....
Date

.....
Date

HIV/AIDS AWARENESS PROGRAMME: WORKSHOP CONTENT ADDRESSED

Fill in the applicable information with regard to each workshop conducted																								
DATE	W/S				W/S				W/S				W/S				W/S				W/S			
	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M	D	D	M	M
Content of work shop: (Mark the content included)																								
SLO1																								
SLO2																								
SLO3																								
SLO4																								
SLO5																								
SLO6																								
SLO7																								
HIV/AIDS in construction video																								
Indicate the duration of the workshop in hours																								
Total number of Workers																								
Indicate workshop venue																								

HIV/AIDS AWARENESS PROGRAMME: ATTENDANCE REGISTER

[illegible]

SCHEDULE C: CONTRACTOR HIV/AIDS PROGRAMME REPORT

Project name

Project Location

Contract value of project (R)

Department of Public Works Project Manager

HIV/AIDS Programme duration: (dd/mm/yy)to (dd/mm/yy)

AWARENESS MATERIAL

Describe location of posters displayed during the programme

.....

.....

.....

Comments on posters

.....

.....

.....

Indicate total number of booklets distributed

Comments on booklets

CONDOMS

Indicate total number of male condoms distributed

Indicate total number of female condoms distributed

Describe where male condom dispenser was placed

Describe where female condom dispenser was placed

HIV/AIDS WORKSHOPS

Indicate the total number of HIV/AIDS workshops conducted

Indicate the duration of workshops

Indicate the total number of Workers that participated in the HIV/AIDS workshops

Indicate the total number of Workers that were exposed to the video on HIV/AIDS in the Construction Industry

Comments on HIV/AIDS workshops on site

.....

.....

.....

GENERAL

Briefly describe programme activities and satisfaction with outcome

.....

.....

.....

Additional comments, suggestions, or needs with regard to the HIV/AIDS awareness programmes on site.....

.....

Please indicate if your company has a formal HIV/AIDS policy focussing on HIV/AIDS awareness raising and care and support of HIV/AIDS Workers

Yes	No	Currently developing one
-----	----	--------------------------

Please indicate if, to your knowledge, you have lost any workers during the duration of the project to HIV/AIDS related sicknesses. One or more of the following might indicate an HIV/AIDS related death:

Excessive weight loss
Reactive TB
Hair loss
Severe tiredness

Coughing or chest pain
Pain when swallowing
Persistent fever
Diarrhoea

Vomiting
Meningitis
Memory loss
Pneumonia

Number of HIV/AIDS-related deaths

.....

Contractor

.....

Date

.....

Departmental Project Manager

.....

Date

C4: SITE INFORMATION

C4.1 LOCALITY PLAN

C4.2 TENDER DRAWINGS

C4.1 LOCALITY PLAN

The project area is in Chief Albert Luthuli Local Municipality under Gert Sibande District Municipality in Mpumalanga Province. The Eerstehoek is located on the R38 and is approximately 35KM from the town of Carolina with close proximity suburbs being Nhlanzatshe and Tjakastad. It is surrounded by forest plantations and much of its economy originated from this industry.

Generally it has access to engineering and social infrastructure. Economically, it depends on

The two Pump stations are located as follows

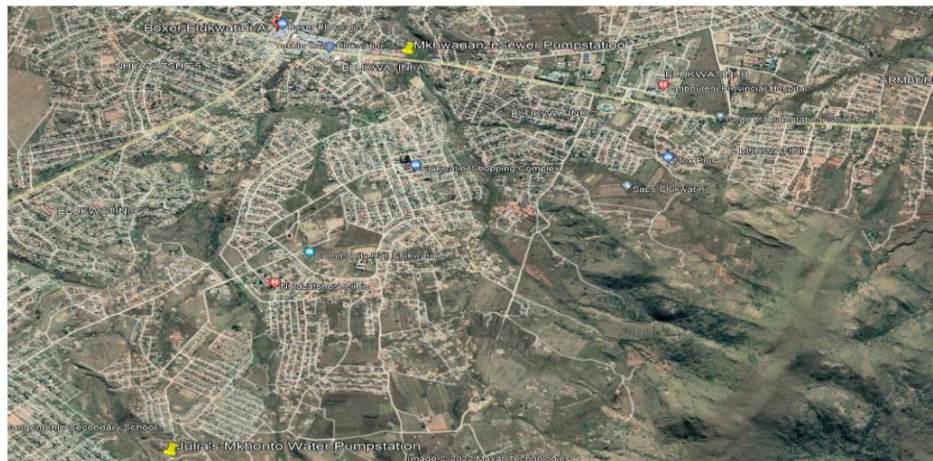
Mkhwanazi Sewer booster pump:

Latitude	Longitude
30°48'00.54" E	26°02'34.30" E

Julia Mkhonto water booster pump:

Latitude	Longitude
30°46'44.85" E	26°04'28.43" S

Figure 1: Project Locality



C4.2 TENDER DRAWINGS

A separate booklet containing the reduced size tender drawings have been issued under Volume 2 (BOOK OF DRAWINGS) of the tender documentation.