

## Section B Additions and Variations to SANS 1200

### Contents

PSA	GENERAL (SANS 1200 A)	B2
PSAB	ENGINEER'S OFFICE (SANS 1200 AB)	B17
PSC	SITE CLEARANCE (SANS 1200 C)	B21
PSD	EARTHWORKS (SANS 1200 D)	B23
PSDB	EARTHWORKS (PIPE TRENCHES) (SANS 1200 DB)	B35
PSDM	EARTHWORKS (ROADS, SUBGRADE) (SANS 1200 DM)	B40
PSG	CONCRETE (STRUCTURAL) (SANS 1200 G)	B43
PSH	STRUCTURAL STEELWORK (SANS 1200 H)	B77
PSHA	STRUCTURAL STEELWORK (SUNDRY ITEMS) (SANS 1200 HA)	B79
PSHC	CORROSION PROTECTION OF STRUCTURAL STEELWORK (SANS 1200 HC)	B85
PSL	MEDIUM-PRESSURE PIPELINES (SANS 1200 L)	B86
PSLB	BEDDING (PIPES) (SANS 1200 LB)	B126
PSLD	SEWERS (SANS 1200 LD)	B130
PSLC	CABLE DUCTS (SANS 1200 LC)	B145
PSLD	SEWERS (SANS 1200 LD)	B149
PSLE	STORMWATER DRAINAGE (SANS 1200 LE)	B166
PSLG	PIPE JACKING (SANS 1200 LG)	B169
PSM	ROADS (GENERAL) (SANS 1200 M)	B172
PSMJ	SEGMENTED PAVING (SANS 1200 MJ)	B175
PSMK	KERBING AND CHANNELLING (SANS 1200 MK)	B176
PSPG	HIGH SECURITY FENCES AND GATES	B179
PSER	REVEGETATION	B184

NOTE : Numbering in the Project Specifications correspond with the numbering of clauses in the Standard Specifications (SANS 1200). Additional clauses are preceded by an asterisk “\*”.

Tenderers must make provision for all the relevant Specifications to be included when calculating the prices of the various items in the Bill of Quantities. In addition, the sum tendered shall cover all initial costs incurred in complying with the requirements of Contract Specific Data.

**PSA GENERAL (SANS 1200 A)**

**PSA 2 INTERPRETATIONS**

**PSA 2.2 Applicable edition of standards**

**Add at the beginning of SANS 1200 A, sub-clause 2.2:**

"Unless a specific edition is specified (see the List of Applicable Specifications)"

**PSA 2.3 Definitions**

**Add at the beginning of SANS 1200 A, sub-clause 2.3:**

"The terms "ESCOM", "ESC" and "Electricity Supply Commission" shall mean "Eskom"."

**PSA 2.4 (b) Abbreviations**

**Add the following to SANS 1200 A, sub-clause 2.4(b):**

"MAMDD: Modified AASHTO maximum dry density."

**PSA 2.8.1 Principle**

**In the fourth line of SANS 1200 A, sub-clause 2.8.1, after the word "specification", add:** "or in the measurement and payment clause of the standard specification, particular specification or project specification".

**Add the following to SANS 1200 A, sub-clause 2.8.1:**

"Items which are designated as provisional quantities or provisional in the Bill of Quantities are intended to provide for works, the need or extent of which cannot be forecast. Work scheduled as such shall only be undertaken on the written instruction of the Engineer and, where applicable, shall be paid for at the tendered rate or in the absence of rates shall be valued in accordance with the Contract.

The Bill of Quantities shall not be used for ordering purposes and no liability or responsibility shall be admitted by the Engineer in respect of materials ordered or procured by the Contractor on the basis of the Bill of Quantities."

**PSA 2.8.2 Preliminary and general section**

**Add the following to SANS 1200 A, sub-clause 2.8.2:**

"In addition, the sum tendered shall cover all initial costs incurred in complying with the requirements of Section B (Contract), which includes, but is not limited to:

- Part C1: Agreement and Contract Data
- Part C2: Pricing Data

- Part C3: Scope of Work
- Part C4: Site Information

Facilities for the Contractor shall include all the costs of providing water for construction other than the water required for watertightness testing of water retaining structures. Water for such tests will be measured according to PSG 7.2.5 Watertightness test.

The Contractor is to make his own arrangements with the Employer (and/or in consultation with the Emfuleni Local Municipality) for water and sanitation connections.

No separate payment will be made for the cost of constructing and maintaining the temporary access roads, the removal of the roads and the reinstatement of the areas, on completion. The sums tendered for in the Bill of Quantities shall include all such costs."

**Add the following new sub-clause to SANS 1200 A, sub-clause 2.8:**

**\*PSA 2.8.3 Time-related items**

"The Contractor shall tender a lump sum in the Bill of Quantities to cover his time-related establishment costs. The amount tendered and paid shall be full compensation to the Contractor for:

- The establishment and maintenance of his whole organization as established for this Contract.
- The establishment and maintenance of all insurances, indemnities and guarantees required in terms of the Conditions of Contract or Tender, where applicable.
- Compliance with all general conditions and requirements which are not specifically measured elsewhere for payment in these Contract Documents.

The Contractor shall tender a lump sum for the above mentioned items.

Payment of the lump sum shall be made monthly in compliance with the method laid down in Sub-clause 8.2.2 of SANS 1200:A. Provided that the total of the monthly amounts, so paid for the item, is not out of proportion to the value of the progress of the works as a whole.

The Contractor will not be paid Time-Related Preliminary and General Charges for any Special Non-Working Days, which shall be deemed to have been allowed for in his rates.

The payment to the Contractor for Time-Related Items shall be adjusted in accordance with the following formula in the event of the Contract being extended by means of a variation order:

$$\begin{array}{ccccc}
 \text{A} & & \text{x} & & \text{B} & & = & & \text{C} \\
 \text{(A) Sum of Tendered} & & & & \text{(B) Extension of Time} & & & & \text{(C) Tender Contract} \\
 \text{amounts for Time} & & & & \text{authorised by the} & & & & \text{Period} \\
 \text{Related Items} & & & & \text{Contract} & & & & 
 \end{array}$$

\*For the purposes of applying this formula "Extension of Time" will exclude the Contractor's December/January close-down period, if applicable.

The abovementioned adjustment of the payment for Time-Related Items shall be made in accordance with the Determination made by the Engineer.

Where extension of time is approved, payment for time-related items shall only be applicable to working days as defined in the Contract."

## **PSA 3 MATERIALS**

### **PSA 3.1 Quality**

**Add the following to SANS 1200 A, sub-clause 3.1:**

“Where material to be used in this Contract is specified to comply with the requirements of an SABS Standard Specification, and such material is available with the official SABS mark, the material used must bear the official mark as proof of quality.

The Contractor shall submit in good time, before any construction commences, to the Engineer on site samples of all materials intended to be incorporated into the Works. The samples shall be accompanied by results of tests undertaken by an approved independent laboratory on the samples in question on behalf of the Contractor and at his cost, before consideration by the Engineer.

The Engineer, during construction, will take independent samples from stockpiles of proposed construction materials on site and from the completed works. Approval will not be granted for samples delivered by the Contractor directly to the Engineer’s office. The Contractor shall be responsible for the cost of all failures on test samples and control testing.

All pipes, fittings and materials used in the Works, must bear the official standardisation mark of The South African Bureau of Standards, where applicable. The mark and the class of a pipe shall be visible from above after the pipe is laid.

Rubber articles, including pipe insertion or joint rings shall be stored in a suitable shed and kept away from sunlight, oil or grease.

Large items not normally stored in a building (or storage shed) shall be neatly stacked or laid out above ground on suitable cleared areas on the Site. Grass or vegetation shall be kept short (or completely removed) in the storage areas and the material shall be kept free of dust, mud and be protected from stormwater and ponding water. Pipes shall be handled and stacked in accordance with the manufacturer’s recommendations. Special care must be taken to avoid placing pipes over hard objects and stacking pipes to heights above those recommended by the manufacturer. uPVC pipes shall be protected from direct sunlight with suitable covers. Reinforcing will also be staked above ground with no grass cover beneath it. All reinforcing must be cleaned with steel brush before utilised in any structures construction.

Every precaution shall be taken to keep cement dry and prevent access of moisture to it from the time it leaves the place of manufacture until it is required for use on the Site. Cement is to be used on a first in/first out basis. Bags of cement which show any degree of hydration and setting shall be removed from the site of the Works and replaced at the Contractor’s own expense. Any cement older than six weeks is to be removed from site at the Contractor’s own expense.

Materials shall be handled with proper care at all times. Under no circumstances may materials be dropped from vehicles. Large pipes or large plant shall be lifted or lowered only by means of suitable hoisting equipment.

Proprietary materials are specified to indicate the quality, or type of materials, or specific articles, required for the specific installation or construction purpose. The terms “or other approved” or “or approved equivalent” are used in connection with proprietary materials or articles. The Contractor is to supply with their tender the name of the manufacturer and supporting documentation which shows that the materials or articles comply with the relevant specifications. It is understood that the approval shall be at the sole discretion of the Employer and the Engineer.”

## **PSA 4 PLANT**

### **PSA 4.2 Contractor’s offices, stores and services**

**Add the following to SANS 1200 A, sub-clause 4.2:**

“The suitable first aid services required in terms of sub-clause 4.2 of SANS 1200 A shall include, inter alia, a First Aid cabinet fully equipped and maintained with at least the minimum contents as listed in Regulation 3 of the General Safety Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993), to deal with accidents and ailments which are likely to occur during the construction period.”

## **PSA 5 CONSTRUCTION**

### **PSA 5.1.1 Setting out of the works**

**Add the following to SANS 1200 A, sub-clause 5.1.1:**

“The Contractor shall be fully responsible for the setting out of the Works, and where labour intensive work is specified, for the setting out of the daily tasks.

The Contractor must, within two (2) weeks after the site has been handed over, ascertain the correctness of all the setting out pegs and bench marks. Any discrepancy shall immediately be reported in writing to the Engineer. Any costs or subsequent costs arising from discrepancies which had not been reported to the Engineer, within the aforementioned period, shall be the sole responsibility of the Contractor.

Before commencement of work, the Contractor is to liaise with the Engineer to establish exactly the status of all boundary pegs adjacent to the Works. The position of all erf pegs found must be recorded on a layout print. If any pegs are missing, he shall immediately inform the Engineer in writing.

On Completion of the Contract the pegs that have been unavoidably disturbed will be replaced by the Employer. Pegs which have, in the opinion of the Engineer, been disturbed due to the negligence of the Contractor will be replaced by a registered Land Surveyor at the Contractor’s cost.”

### **PSA 5.2 Watching, barricading, lighting**

**Add the following to SANS 1200 A, sub-clause 5.2:**

“The Contractor shall employ competent watchmen to guard the Works both by day and night.

From the time any portion of the Works commences, until the Completion of the Works and the issue of the Taking-Over Certificate, the Contractor shall be responsible for protecting the property of the Employer. The Contractor shall also be responsible for all persons having business on the Site from anything dangerous, or likely to cause damage or injury. The Contractor shall take all practical precautions to avoid nuisance or inconvenience to the owners/occupiers of properties near to the Site, as well as the public generally, whilst carrying out the Works. The Contractor shall at all times keep the Site clean and in a safe and satisfactory condition.

Temporary traffic signs shall be erected when work is being done within and adjacent to roadways. The number and layout of the traffic signs shall comply with the Site Manual entitled “Safety at Roadworks in Urban Areas”, as published by the Department of Transport. Traffic signs shall have a yellow background with either a red or black border.”

#### **PSA 5.4            Protection of overhead and underground services**

**Add the following to SANS 1200 A, sub-clause 5.4:**

“Temporary and permanent alterations made to existing services by the Contractor will be measured and paid under the relevant scheduled items. The length of a service that is re-laid will be measured in its final position.

The sums or rates (as indicated in the Bill of Quantities) shall cover the cost of excavation and backfilling, lifting, recovery of the existing service, laying of the service in the new position, any other related work and materials such as new rubber ring seals, packing, etc., required to complete the alteration.

New material can be used to make up shortfalls resulting from a longer route, existing material damaged during recovery (beyond the control of the Contractor), and other additional work carried out by the Contractor in making permanent alterations. These new materials, for which no scheduled items apply for, will be measured and paid under "**Error! Reference source not found.**".

All additional work to locate and expose the existing service if the existing service is situated further than 2,0 m from the position indicated, (i.e., excluding the initial work within 2,0 m from the indicated position) will be measured and paid under “SCHEDULE OF DAYWORK”.

The tendered rates shall further cover the cost of backfilling the excavation with selected material compacted to 90% AASHTO density, keeping the excavation safe and taking care that the services are not damaged in any way. No direct payment will be made for the protection of such services.”

#### **PSA 5.5            Dealing with water on works**

**Add the following to SANS 1200 A, sub-clause 5.4:**

“The Contractor shall take all precautions to keep stormwater away from the excavations. He shall deal with all water inclusive of seepage and groundwater, such that construction is not hampered and shall supply and operate all necessary plant.

The cost of supplying and operating the equipment for dewatering of excavations and the controlling of stormwater, shall be covered by the tendered sums in the Bill of Quantities."

**Add the following new sub-clause to SANS 1200 A, sub-clause 5.6:**

**\*PSA 5.6.1 Environment management**

"Compliance with the Environment Management Plan of the approved Environmental Impact Assessment Report in terms of the Department of Environmental Affairs and Tourism regulations, as well as any specific Environmental Management Specification from the Employer/Engineer is a prerequisite for the Contractor.

The Contractor is to price the lump sum provision provided in the Preliminary and General Section of the Bill of Quantities to cover the Contractor's cost for compliance with the requirements of the Environment Management Plan. The cost of producing the Environmental Management Plan as well as training and appointing the necessary personnel to ensure compliance with the required regulations and specifications (such as, but not limited to the Employer/Engineer Environmental Management Specification), shall be included in this lump sum.

A provision for a Time Related Item is made in the Preliminary and General Section of the Bill of Quantities. The amount submitted shall include full compensation for the provision of the training, plans, audits, assessments, administration, etc. and all other costs required for full compliance.

Fines issued for non-compliance will be deducted from these Provisional Sums, but are not limited to the value of the Provisional Sum stated."

**PSA 5.7 Safety**

**Add the following to SANS 1200 A, sub-clause 5.7:**

"Compliance with Occupational Health and Safety Act, 1993, the Construction Regulations, 2014 and the Employer's Health and Safety Specification, is another prerequisite for the Contractor. The Contractor is to price the lump sum provision provided in the Preliminary and General Section of the Bill of Quantities, to cover the Contractor's cost for compliance with the requirements mentioned above. The cost of producing the Contractors Safety Management Plan and Risk Assessment as well as training and appointing the necessary personnel to ensure compliance with the required regulations and specifications, shall be included in this lump sum.

A provision for a Time Related Item is made in the Preliminary and General Section of the Bill of Quantities. The amount submitted shall include full compensation for the provision of the training, PPE's, plans, audits, assessments, administration, etc. and all other costs required for full compliance. Fines issued for non-compliance will be deducted from the above Provisional Sums, but are not limited to the value of the Provisional Sum stated.

No separate item shall be allowed for in the Bill of Quantities for the accommodation of traffic. The Contractor's movement of construction activities is mainly between the site camp and the construction site which does not cross any municipal roads. In the event that the Contractor need to cross any municipal roads, he will ensure that he takes all necessary precautions for safety which will be deemed included in his rates."

**Add the following new sub-clauses to SANS 1200 A, clause 5:**

**\*PSA 5.9          Record drawing information**

“As the Works progress, the Contractor shall mark on a special set of drawings, all as-built details and submit the information to the Engineer for approval on a monthly basis. No extra payment shall be made for preparation of these as-built plans and recording as built information.

The Taking-Over Certificate shall only be issued once all the as-built information has been received and verified by the Engineer.”

**\*PSA 5.10          Clearance of site on completion**

“The Contractor shall obtain a certificate, signed by each property owner listed in the Project Specification as being affected by the Works, which indicates that the property owners are satisfied with the standard of reinstatement of any fences, boundary walls and structures.

The Contractor should also obtain a similar certificate of satisfaction for any compensation paid for loss or damage to stock, crops or property, material spoiled on their properties or any other condition affecting their properties as a result of the operations of the Contractor. All such certificates must be lodged with the Engineer before the Talking-Over Certificate will be issued.”

**\*PSA 5.11          Community Liaison Officer**

“A provisional monthly rate has been included to allow for the salary of a person working full time as the Community Liaison Officer, for the duration of this Contract’s construction period. The Contractor shall ensure that the salary and other expenses such as payment to the PSC (Project Steering Committee), or any other identified entity, are paid on time and recorded.

A separate, percentage based item, for overheads, charges and profit on the above item is applicable.”

**\*PSA 5.12          Connection into existing sewers**

“A provisional sum has been included to cover the cost of connecting into the existing sewer. The sum includes all labour, plant, specials, and materials required to complete the work, and deal with the existing flaws. Payment for all the work will be based on existing rates and/or Daywork rates where applicable.”

**\*PSA 5.13          Relocation of existing services**

“A provisional sum has been included to cover the cost of re-locating existing services. The sum includes all labour, plant, specials, and materials required to complete the work. Payment for all the work will be based on existing rates and/or Daywork rates where applicable.”



**\*PSA 5.14 ESKOM connection fee**

“A provisional sum has been included to cover the cost of connecting to existing ESKOM services. The sum includes all labour, plant, specials, and materials required to complete the work. Payment for all the work will be based on existing rates and/or Daywork rates where applicable.”

**\*PSA 5.15 Geotechnical Engineer**

“A provisional sum has been included to allow for the salary of a qualified and professionally registered person working as the Geotechnical Engineer on site. The Geotechnical Engineer shall be working full time on site until the excavation horizons, especially the vertical faces, have adequately been protected against any form of collapse. Thereafter this person’s working time will be reduced to a monthly site visit to assist with implementation of the Occupational Health and Safety (Act and Specifications) with the periodic excavation safety inspections. The Contractor shall ensure that the salary and other expenses are paid on time and recorded.

The Geotechnical Engineer’s qualification, professional registration, and appointment must be approved by the Engineer. The Geotechnical Engineer will analyse excavation profiles, assist with soil stabilization of excavated horizons, design lateral support systems and conduct periodic excavation safety inspections.

The materials management must be maintained continuously on site, periodic inspections of the site during construction must be conducted to ensure that any variation in the anticipated ground conditions can be assessed and revised recommendations subsequently provided to the Contractor.”

**PSA 6 TOLERANCES**

**PSA 6.2 Degrees of Accuracy**

**Add the following to SANS 1200 A, sub-clause 6.2:**

“The degree of accuracy shall be Degree II except for:

- a) Smooth formwork which shall be Degree I.”

**PSA 7 TESTING**

**PSA 7.1 Testing principles**

**Add the following to SANS 1200 A, sub-clause 7.1:**

“Every completed layer or section of the Works shall be subject to check testing by the Contractor. Whenever possible the check testing should be done in the presence of the Engineer. Once the Contractor is satisfied with the standard of the Works, the Engineer will be requested to perform acceptance testing for the particular section. When giving notice, the Contractor shall provide the

Engineer with the results of the check testing, thus indicating that the Work is to specification. The Engineer shall be given 48 (forty-eight) hours' notice of when testing or inspections are required.

The Engineer may from time to time carry out his own check tests on the work performed by the Contractor. Should these test result differ significantly from the data provided by the Contractor, the quality of the Contractor's control testing can be called into question. Upon such a discovery the Engineer may order further check tests to be carried out on work already completed. All costs associated with such check tests shall be for the Contractor's account, and so shall the costs of any other check tests whose results do not comply with the specification.

Failure by the Contractor to notify the Engineer or to provide the required information or, where specified, to perform the required test, will be grounds to exempt the Employer from payment for the associated work. This exemption is applicable to all subsequent work, which would be affected by the failure of the specific portion not tested.

The Engineer will be under no obligation to the Contractor to perform acceptance tests. If the Engineer elects not to perform a particular test after notification by the Contractor and is satisfied with results of the Contractor's check tests, the Contractor will be issued with a written instruction to proceed with the relevant works without the acceptance test being performed.

Nothing contained in this clause will relieve the Contractor of any responsibilities under the specifications or in any way limit the tests, which the Engineer may call for or perform in terms of the specification.

The Employer reserves the right to recover cost from the Contractor in instances where the Engineer is called to witness certain control tests, such as the pressure testing of a pipeline, and the results of such tests do not comply with the specifications."

## **PSA 7.2            Approved laboratories**

**Replace SANS 1200 A, sub-clause 7.2 with the following:**

"Acceptance testing shall be done by a laboratory selected by the Engineer. The Engineer requires 48 (forty-eight) hours' notice from the Contractor in order to perform the relevant acceptance test.

All acceptance testing by the Engineer shall be paid by the Contractor. The cost of such tests which meet the specification requirements will be reimbursed to the Contractor in the monthly payment certificate. This payment amount shall consist of a billed amount plus the tendered mark-up.

A Provisional Sum for the sole use of the Engineer has been provided in the Bill of Quantities to allow for the cost of such testing.

The Contractor shall make due allowance for testing procedures in the construction programme."

## **PSA 8                MEASUREMENT AND PAYMENT**

### **PSA 8.2.2          Time related items**

**Replace SANS 1200 A, sub-clause 8.2.2 with the following:**

“Payment for time-related items will be effected as follows only after payment for the relevant fixed-charge item has been made: Subject to the provision of SANS 1200 A, sub-clauses 8.2.3 and 8.2.4 payment will be made monthly in equal amounts, calculated by dividing the sum tendered for the item by the tendered contract period in months, multiplied by the months completed, provided always that the total of the monthly amounts so paid for the item is not out of proportion to the value of the progress of the works as a whole.”

**PSA 8.3            Scheduled fixed-charge and value-related items**

**SANS 1200 A, sub-clause 8.3 to include payment for:**

PSA 2.2	Interpretations
PSA 2.8.1	Principle
PSA 2.8.2	Preliminary and general
PSA 3.1	Quality
PSA 5.1.1	Setting out of the works
PSA 5.2	Watching, barricading, lighting
PSA 5.4	Protection of overhead and underground services.
PSA 5.9	Record drawing information
PSA 6.2	Degrees of accuracy

**PSA 8.3.2.2 (a) Offices and storage sheds**

**SANS 1200 A, sub-clause 8.3.2.2 (a) to include payment for:**

PSA 4.2	Contractor’s offices, stores and services
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**PSA 8.3.2.2 (h) Dealing with water**

**SANS 1200 A, sub-clause 8.3.2.2 (h) to include payment for:**

PSA 5.5	Dealing with water on works
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**PSA 8.3.3            Other fixed charge obligations**

**SANS 1200 A, sub-clause 8.3.3 to include payment for:**

*PSA 5.6.1	Environmental Management
PSA 5.7	Safety
*PSA 5.11	Community liaison officer
*PSA 5.12	Connection into existing sewers
*PSA 5.13	Relocation of existing sewers

**PSA 8.3.4            Removal of site establishment**

**SANS 1200 A, sub-clause 8.3.4 to include payment for:**

\*PSA 5.10 Clearance of site on completion

**PSA 8.4 Scheduled time-related items**

**SANS 1200 A, sub-clause 8.4 to include payment for:**

\*PSA 2.8.3 Time related items

**PSA 8.4.2.2 (a) Offices and storage sheds**

**SANS 1200 A, sub-clause 8.4.2.2 (a) to include payment for:**

PSA 4.2 Contractor's offices, stores and services

**PSA 8.4.2.2(h) Dealing with water**

**SANS 1200 A, sub-clause 8.4.2.2 (h) to include payment for:**

PSA 5.5 Dealing with water on works

**PSA 8.4.3 Supervision for duration of construction**

**SANS 1200 A, sub-clause 8.4.3 to include payment for:**

\*PSA 5.9 Record drawing information  
 PSA 6.2 Degrees of accuracy  
 PSA 7.1 Testing principals  
 PSA 3.1 Quality  
 PSA 5.1.1 Setting out of the works  
 PSA 5.2 Watching, barricading, lighting  
 PSA 5.4 Protection of overhead and underground services

**PSA 8.4.5 Other time-rated obligations**

**SANS 1200 A, sub-clause 8.4.5 to include payment for:**

\*PSA 5.6.1 Environmental management  
 PSA 5.7 Safety  
 \*PSA 5.11 Community liaison officer

**PSA 8.5 (b) Sums stated provisionally by Engineer**

**SANS 1200 A, sub-clause 8.5 (b) to include payment for:**

PSA 7.2 Approved laboratories

**Add the following new payment items to SANS 1200 A, clause 8.5:**

**\*PSA 8.5.1 Registered Geotechnical Engineer..... Unit: Prov. Sum**

“The rate shall include for the provision of a professionally registered and qualified Geotechnical Engineer to analyse excavation profiles and assist with soil stabilization of excavated horizons. Appointment to be approved by the Engineer. To include payment for PSA 5.15.”

**\*PSA 8.5.2 Cathodic protection specialist..... Unit: Prov. Sum**

“Appoint a cathodic protection specialist to do a site resistivity survey and formal cathodic protection design including suitable coating specification for steel pipe and cast iron valves. Contractor to obtain three quotations for the service and the appointment is to be approved by the Engineer.”

**Add the following new payment item to SANS 1200 A, sub-clause 8.8:**

**\*PSA 8.8.7 Survey of existing services.....Unit: Sum**

“The tendered Sum shall cover the cost of surveying, by a qualified surveyor, the location, detail (e.g. type, diameter, material, etc.) and invert levels of existing services, including any wastewater treatment works structures specified by the Engineer. The information shall be presented to the Engineer in reproducible format (e.g. AutoCAD) and allowance shall be for all related cost and time implications. The existing services to be surveyed shall be verified with the Engineer before commencement.”

**Add the following new sub-clauses to SANS 1200 A, clause 8.8:**

**\*PSA 8.9 Environmental Control Officer (ECO)**

“A provisional sum of R17 000.00 per month must be provided, to pay the Environmental Control Officer (ECO) for undertaking the environmental audits of the site and work done. The Contractor is required to basically enter into a contract, with the ECO to provide this service. Payment will be made to the Contractor against this item on receipt of the ECO’s monthly report.

The Contractor will be required to pay the ECO the sum in each certificate within 7 days of receipt of payment by the Employer. A penalty, equal to the amount due to the ECO, will be charged to the Contractor for failure to pay the ECO within 7 days of him receiving payment from the Employer. This penalty will be doubled to twice the amount due to the ECO, should the ECO not receive payment within 14 days of the Contractor receiving payment from the Employer. The penalty will not be reversed once payment to the ECO has been made.”

**\*PSA 8.10 Miscellaneous items**

“An item which, in the payment clause column of the Bill of Quantities, refers to this clause will be measured in the unit scheduled.

The sum or rate for such item shall cover the cost of all materials, labour and plant required to execute and complete the work as specified, described in the Bill of Quantities or shown on the drawings.”

**Add the following new payment items to SANS 1200 A, clause 8.8:**

**\*PSA 8.11 Mechanical and Electrical**

**\*PSA 8.11.1 Contractor’s design related documentation and drawings.....Unit: Sum**

“The tendered Sum shall include for all requirements of the Mechanical Specifications and the Electrical Specifications (also refer to Contract Specifications) for the preparation and provision of design related documentation and drawings. Payment shall be made on a pro rata basis in terms of SANS 1200 A, sub-clause 8.2.2. Failure to provide any item or comply with any instruction of the Responsible Person could be cause for non-payment of the whole sum.”

**\*PSA 8.11.2 Provision of operation and maintenance manuals.....Unit: Sum**

“The tendered Sum shall include for all requirements involved in the preparation and submission of Operation and Maintenance Manuals. Payment shall only be made upon handing over of the final manuals to the Employer.

Three (3)-off draft copies of the O&M Manuals shall be submitted for approval (2 weeks prior to commissioning) and five (5)-off final copies of the O&M Manuals, hard copies and electronic copies, shall be provided.

The manuals shall be all inclusive of the requirements of the Mechanical Specifications and Electrical Specifications and the following minimum information shall be provided:

- Contact information for all parties involved
- Description of Works
- Equipment List
- Drawings
- Electrical Cable Schedule
- Electrical Certificates
- Pipe and Valve Test Records
- Process and Control System Description and Operating Manual
- Maintenance Schedule of Mechanical Equipment
- Specification Sheets and Part Lists for all Mechanical Equipment
- Specification Sheets and Part Lists for all Electrical Equipment
- Specification Sheets and Part Lists for all Electronic Equipment

The Contractor’s attention is drawn to the fact that the above list is not exhaustive and serves merely as a guideline to assist the Contractor.”

**\*PSA 8.11.3    Training of the Employer’s operating staff..... Unit: Sum**

“The tendered Sum shall include for all requirements of the Mechanical Specifications and the Electrical Specifications related to the training of the Employer’s operating staff during the commissioning period, or any such period identified for this purpose.

During the operational acceptance period/commissioning and trial operation period the Contractor shall train the Employer’s and/or Emfuleni Local Municipality’s operating staff and instruct them in the proper operating and maintenance procedures for the equipment concerned. This shall include troubleshooting procedures in the case of malfunction of equipment.

Training shall take place for the duration of the commissioning period and the Contractor shall submit a comprehensive training schedule to the Engineer for approval. The schedule shall indicate the time and date of the training, type of training, the target group for the training, the duration of the training, training materials provided, name of person presenting the training etc.

The training schedule shall be submitted to the Engineer not less than four (4) weeks prior to the intended commencement date of the training, to allow comments to be made and incorporated. This period is also required to allow the Employer and/or Emfuleni Local Municipality to make scheduling arrangements in order to ensure the availability of staff members for training.

Where the Employer and/or Emfuleni Local Municipality staff works on a shift basis the Contractor shall allow for the fact that certain training sessions may have to be presented more than once in order to allow all relevant staff members to attend.”

**\*PSA 8.11.4    28 Day trial operation period..... Unit: Sum**

“When the Commissioning tests have been successfully completed to the satisfaction of the Engineer, a Trial Operation Period shall start and shall consist of a continuous period of operation under full load conditions of four weeks (28 days). The tendered Sum shall include for all necessary items during the trial period (e.g. servicing of equipment, adjustments to plant, monitoring and recording of performance, supervision, etc.) for all Mechanical and Electrical Works.”

<b>*PSA 8.11.5    Storage of equipment.....</b>	<b>Fixed portion</b>	<b>Unit: Sum</b>
	<b>Time related portion</b>	<b>Unit: Weeks</b>

“Equipment should, as far as possible be procured in a “just-in-time” manner, but will not delay the Works. Where ordered the equipment is required to be stored for an extended period before commissioning, the Contractor will identify these items in his Tender and will provide information as to why these items will need to be stored for an extended period of time. The schedule is subdivided into a fixed portion and a time related portion. 50% of the fixed portion will be paid for the preparation for storage, packaging, labelling of crates etc. and 40% of the fixed portion will be paid for site storage, the removal from packaging and preparation for installation.

5% will be paid on handover of the commissioned works to the Employer and covers the cost of storage on site while installation and commissioning takes place. The remaining 5% will be paid on completion of the maintenance period.

An optional item to cover the cost of double handling into and again out of storage may be included and payment shall be made on the basis of 95% on loading from store and 5% on completion of the maintenance period.

The time related portion will be paid on a monthly basis and covers the cost of storage, insurance, etc. measured from the time of entry into the store to the date of removal from the store."

**Add the following new payment items to SANS 1200 A, clause 8.8:**

**\*PSA 8.12      Signage..... Unit: Sum**

"The tendered sum(s) shall cover the cost of providing and attaching signs to the new proposed structures, namely: "Pump Station 34", "Pump Station 34 Connection Box" and "Inlet Division Box". Labels to be painted on 0.8mm Steel plate and adequately bolted to the structure. All paints to have gloss finish and comply with SAND 1519-2. Colour of paint to conform to BS 2000 No.0/013. All lettering to be done according to the provision of the latest edition of the South African Development Community Road Traffic Signs Manual. All lettering to be 50mm DIN 1451 Part 2 Style unless otherwise indicated."



## **PSAB ENGINEER'S OFFICE (SANS 1200 AB)**

### **PSAB 3 MATERIALS**

#### **PSAB 3.1 Nameboards**

**Adjust the first sentence of the first paragraph of SANS 1200 AB, sub-clause 3.1 to read as follows:**

**Delete:** "The standard board of the South African Institution of Civil Engineers" **and replace by:** "the standard nameboard of the Employers Engineering Department, all in accordance with standard drawing issued by the Engineer contained in this document under Section B: Additions and Variations to SANS 1200 for Upgrade Works."

**Add the following the following to SANS 1200 AB, sub-clause 3.1:**

"Two Employer's nameboards shall be erected within one month of the commencement of construction and shall be placed where ordered by the Engineer. Any damage to this board shall be repaired within 14 days of a written instruction received from the Engineer. The cost of the repair will be for the Contractors account.

Erection of two Contractor's nameboards of maximum size 2.5 x 3 m will be allowed in the area of the Works, at positions approved by the Engineer, who may at any time order their removal if any objections are received.

Sub-Contractor's boards may be erected if sanctioned by the Engineer. All nameboards shall be removed 14 days prior to the date of the Talking-Over Certificate."

#### **PSAB 3.2 Office building**

**Adjust the first sentence of the first paragraph of SANS 1200 AB, sub-clause 3.2 to read as follows:**

"The Contractor shall supply, erect, maintain and service one office with adequate lighting for the sole use of the Engineer (and his team) and the Employer."

**The furniture stated in SANS 1200 AB, sub-clause 3.2, (a.... j) shall be replaced by the following items to be provided in the site office:**

- a) Two desk(1.5m x 0.9m) with at least one lockable drawer and 3 office chairs
- b) One plans table (2 m long x 1 m wide x 0.9 m high) suitable for working with AO drawings plus one high stool.
- c) One A0 plan rack and hangers to accommodate 30 drawings hanging vertically.
- d) One lockable upright steel cabinet with three shelves or a lockable steel filing cabinet with four drawers
- e) At least four metres of file/book shelving.
- f) One noticeboard/pin-board of 2 m<sup>2</sup> size
- g) One whiteboard of 2 m<sup>2</sup> size with 3 coloured markers and duster
- h) Two independent power points, each supplied with a four plug extension cord
- i) One suitable electrical heater/air conditioner
- j) Adequate equipment and provisions for making tea or coffee.
- k) One small electric refrigerator.
- l) One small microwave oven.
- m) An acceptable blind on each window.

- n) A wash-hand basin inclusive of all necessary plumbing, soap and paper towels.
- o) Acceptable lighting

**Add the following to SANS 1200 AB, sub-clause 3.2:**

“The Contractor shall also supply and maintain two corrugated iron covered carports with closed sides and gravelled floor for the sole use of the Engineer and the Employer.

The Contractor shall also supply, maintain and service a boardroom for 20 m<sup>2</sup> minimum floor area able to seat 10 people for joint use by him, the Engineer and the Employer. This room shall be equipped with adequate lighting, chairs, tables, a 2 m<sup>2</sup> noticeboard, a 2 m<sup>2</sup> whiteboard with stationary and air-conditioning.”

**PSAB 4 PLANT**

**PSAB 4.1 Telephone**

**Replace SANS 1200 AB, sub-clause 4.1 with the following:**

“Mobile phone

The Contractor will be required to supply the Engineer with a new mobile phone inclusive of sim card as soon as the contract has commenced and pay for all calls made from this phone up to a maximum amount of R3000.00 per month

Telephone, Fax and Mobile Network

The Contractor shall supply a site telephone, fax, photocopier and a reliable fibre facility/ADSL only if a fibre facility is not available for use by the Engineer and Employer for the duration of contract. The Contractor shall be responsible for the cost of all calls, installation, rental, supplies, maintenance, etc.

The fibre facility may require a separate installation with modem from a reputable service provider which will be approved by the Engineer. The minimum speed of the connection will be 50 Mbps (download and upload).

**Add the following new sub-clauses to SANS 1200 AB, clause 4:**

**\*PSAB 4.2 Computer**

“An amount is to be allowed for the purchase of a computer, printer, scanner and copier, with required software for full functionality of all hardware, up to a maximum value of R100 000.00 for the exclusive use of the Engineer for the duration of the contract.”

**\*PSAB 4.3 Survey equipment**

“The Contractor shall upon request provide the following survey equipment on the Site from commencement to the completion of the Works.

- (a) 1 Engineers level and levelling staff.
- (b) 1 steel tape of 100 m length and measuring wheel.
- (c) Wooden and steel pegs and hammers as required.

The equipment shall be provided for the exclusive use of the Engineer. The Contractor shall keep the equipment continuously insured against any loss, damage or breakage, and he shall indemnify the

Engineer and the Employer against any claims in this regard. The Contractor shall also maintain the equipment in good working order throughout the Contract period.

The following additional equipment/service may be required from time to time by the Engineer and shall be supplied by the Contractor when required. The equipment/service may be shared with the Engineer.

- (d) Two chainmen to assist with levelling and surveying;
- (e) Theodolite and prism;
- (f) Spray paint (selected colour)

Upon completion of the whole of the Works, ownership of the above equipment shall revert to the Contractor."

**\*PSAB 4.4 Site instruction books and daily site diary**

"The Engineer shall supply a site instruction book for specific use on the Site.

The Contractor shall supply a triplicate book for site correspondence and inspection requests to the Engineer. Reasonable notice time shall be allowed prior to inspections. All inspections requests and approval/disapproval thereof shall be recorded by the Site staff in writing.

The Contractor in conjunction with the Engineer must ensure that a suitable site quality record system is put in place to record that each section complies with the relative works specification.

The Contractor and the Engineer shall keep a daily diary recording all the pertinent information and sign acceptance of each other's record on a daily basis. The daily record is to include weather conditions, any other factor that may affect the progress, labour on site, activity in progress, materials delivered, delays including reasons, site instructions received, plant on site and remarks pertaining to any other event on site."

**PSAB 8 MEASUREMENT AND PAYMENT**

**PSAB 8.2 Payment**

**SANS 1200 AB, sub-clause 8.2 to include payment for:**

PSAB 3.1	Nameboards
PSAB 3.2	Office building
PSAB 4.1	Telephone
PSAB 4.2	Computer
PSAB 4.3	Survey equipment
PSAB 4.4	Site instruction book and daily site diary

**Add the following new sub-clauses to SANS 1200 AB, clause 8:**

**\*PSAB 8.3 Electronic equipment for the Engineer**

"The Contractor will provide various items of electronic equipment for the exclusive use by the Engineer and his site staff, to assist in the administration of the Contract, for the duration of

construction. The equipment may include a digital camera(s), computer(s), software, printer(s), GPS, cell phones and related consumables.

The equipment shall remain the property of the Engineer during the execution of the project, where after ownership will revert to the Employer. The Contractor shall have no obligation other than the payment in terms of PSAB 8.2."

**\*PSAB 8.4 Accommodation for the Engineer's staff**

"The Engineer will locate suitable accommodation for the Engineer's staff which shall be leased in the name of the Contractor. The period of the lease shall extend until the end of the month in which the Taking-Over Certificate is issued."

## **PSC SITE CLEARANCE (SANS 1200 C)**

### **PSC 3 MATERIALS**

#### **PSC 3.1 Disposal of materials**

**Add the following to SANS 1200 C, sub-clause 3.1:**

“Unless otherwise ordered by the Engineer, the Contractor shall dispose of material resulting from clearing and demolition operations at a site to be determined by the Contractor. Such a site shall have the approval of the Engineer, the Local Authority and the Environmental Officer. No additional payment will be made for the transportation of such material.”

### **PSC 5 CONSTRUCTION**

#### **PSC 5.1 Areas to be cleared and grubbed**

**Add the following to SANS 1200 C, sub-clause 5.1:**

“All areas to be constructed on inclusive of a two meter strip round the perimeter of each structure shall be cleared and grubbed. A strip up to 1.5m wide on either side of the centerline of the pipes shall be cleared and grubbed. This work will be paid under the relative item in the Bill of Quantities.

For the access and site roads the width of clearing shall only be sufficient for the construction of the road i.e. for the cut and fill operations and allowing for side slopes. The cost of this work will be for the Contractor’s account.

The platform constructed shall be cleared and grubbed to the toe of the outside slope including the concrete block retaining wall. Clearance for workspace shall be included in the rate.

No trees with a trunk girth of more than 1 m shall be removed without the written permission of the Engineer.”

#### **PSC 5.3 Clearing**

**Add the following to SANS 1200 C, sub-clause 5.3 (e):**

“Where the pipeline route crosses an existing fence or wall, a section of fencing or wall not exceeding 10,0 m in length may be removed temporarily during construction and thereafter reinstated to a condition no worse than the original condition as soon as the pipeline has been installed and backfilled in the immediate vicinity of the crossing. For the period while the existing fence or wall is dismantled, the Contractor shall erect, at the end of each day’s operations, a temporary fence to close the gap in the existing fence or wall and shall maintain security adequate to prevent use of the temporary fence as a point of access by unauthorized persons.”

#### **PSC 5.6 Conservation of topsoil**

**Add the following to SANS 1200 C, sub-clause 5.6:**

“The topsoil up to a depth of 150 mm, if available and approved by the Engineer, shall be removed from the above specified cleared areas and stockpiled not higher than 2m on approved sites for later reuse. Until required for spreading, the stockpiles of topsoil material shall be stabilized by watering or other approved means to limit dust pollution.

When in the opinion of the Engineer, there is an insufficient quantity of topsoil available as a result of the Contractor's failure to comply with the above, the Contractor shall import topsoil at his own cost.”

## **PSC 8 MEASUREMENT AND PAYMENT**

### **PSC 8.2.1 Clear and grub**

**Add the following to SANS 1200 C, sub-clause 8.2.1:**

“The rate tendered for clearing and grubbing shall include loading the clear and grub material onto trucks, hauling to a legal dump site, and offloading the material or by another approved means. Debris should be dealt with as per PSC 3.1, as amended.

The area to be cleared and grubbed will be measured by area and will include trees up to 1.0m girth.

The rate tendered for will include payment for PSC 5.1, as amended.”

### **PSC 8.2.5 Take down existing fencing**

**Add the following to SANS 1200 C, sub-clause 8.2.5:**

“The rate tendered for taking down existing fencing to include payment for PSC 5.3 Clearing.”

### **PSC 8.2.10 Remove topsoil to nominal depth of 150mm and stockpile**

**Add the following to SANS 1200 C, sub-clause 8.2.10:**

“The rate tendered for the removal of in-situ topsoil shall include loading the topsoil onto trucks, hauling for a distance of up to 1km, offloading the material and shaping stabilizing and protecting the stockpiles of topsoil and include payment for PSC 5.6, as amended.”

## **PSD EARTHWORKS (SANS 1200 D)**

### **PSD 2 DEFINITIONS**

#### **PSD 2.3 Restricted excavation**

**Add the following to SANS 1200 D, sub-clause 2.3 under Restricted excavation:**

"Irrespective of the method of excavation, all excavations for platforms, concrete water retaining structures above the level of the underside of the particular floor slab's blinding layer shall be considered to be "bulk excavation". All excavations below this level will be considered as "restricted excavations"."

### **PSD 3 MATERIALS**

#### **PSD 3.1.2 Classes of Excavation**

**Replace SANS 1200 D, sub-clauses 3.1.2 (a), (b) and (c) with the following:**

"All material encountered in any excavations for any purpose including restricted excavations will be classified as follows:

1. Excavation in all materials, excluding hard rock. This category of excavation includes excavation in all sandy and disturbed material; in clay; in undisturbed and weathered Shale (clay); Sandstone; Mudstone and in all rip-able rock.
2. Excavation in hard rock will require blasting or rock splitting. Areas where rock splitting is required will be indicated on site by the Engineer.

Other earthworks

Non-plastic sandy material from excavations shall be used in the following order:

1. As selected granular material for pipe bedding.
2. As blanket and backfill to pipe trenches.
3. As backfill to structures.
4. As spoil stockpiled in selected areas indicated by the Engineer.

The Contractor shall employ selective methods of excavation to obtain topsoil, and material suitable for backfill, embankments, pipe bedding and selected granular material."

### **PSD 4 PLANT**

**Add the following new sub-clauses to SANS 1200 D, clause 4:**

#### **\*PSD 4.5 Restriction on use of Plant**

“Where the Contractor finds it impractical to use mechanical plant for excavation or to complete portions of the work due to restrictions caused by difficult access or the presence of existing structures, pipelines or services shown on tender drawings, the Contractor will be deemed to have satisfied himself as to the alternative requirements when entering rates against the appropriate items in the Bill of Quantities as no claim for extra payment based on the inability to use plant in such circumstances will be considered.

**\*PSD 4.6      Vibration loadings from use of Plant**

“The onus will be on the Contractor, when proposing to use heavy plant or equipment to complete work in close proximity to existing structures, pipelines or services, to determine the effect of the vibration loading from the plant or equipment on the supporting ground or foundation and the structure, pipeline or service and take all necessary steps to ensure that the stability or integrity of the element concerned is not compromised by the particular selection and use of plant or equipment.

Any damages caused to existing elements directly or indirectly arising out of the use of plant and equipment in close proximity shall be made good, to the satisfaction of the Engineer by the Contractor at his own expense.”

**PSD 5            CONSTRUCTION**

**PSD 5.1.1.2      Safeguarding of excavations**

**Replace SANS 1200 D, sub-clause 5.1.1.2 by the following:**

“The Contractor must note that the excavations for some structures are deep and the concrete walls to be constructed are vertical. The deep vertical faces of excavations could collapse during construction causing injury or death. A suitably qualified and professionally registered Geotechnical Engineer must be employed by the Contractor, as described in PSA 5.14.

Excavation rates are to include all the Contractor’s costs required for full compliance of the Occupational, Health and Safety Act. This can include the provision of:

- A shoring system, designed by the Contractor and signed off by a suitably qualified and professionally registered Geotechnical Engineer,

**OR**

- The reduction of the slope of excavations to the safe angle as determined by a suitably qualified and professionally registered Geotechnical Engineer.

Contractor must also take notice of:

- 1) Restricted area for excavation due to existing structures surrounding the site.
- 2) Findings and recommendations detailed in the Geotechnical Investigation Report.
- 3) Anticipate that the groundwater resides at 4.0m to 5.0m below surface and water ingress should be expected during the bulk earthworks.



- 4) The sidewalls are anticipated to not hold up and not remain stable in the absence of the soils natural confining pressures. This is due to the low friction angle and low cohesion measured in the shear box tests.
- 5) These properties would be severely affected by water ingress due to the shallow water table and stormwater ingress, and could destabilize the walls further, and result in failure and collapse, during the construction phase.

The Contractor shall ensure that all excavations which are accessible to the public or which are adjacent to a public road or thoroughfare, or by which the safety of persons may be endangered are protected as set out in Occupational, Health and Safety Act and that watchmen are employed to ensure that barricades, barriers and lights are effective at all times. No danger tape is allowed to be used for excavation demarcation. Excavations shall be protected using rigid fencing. The supports shall consist of poles or iron standards securely planted in solid ground at not more than 10 m centres so as to enclose the spoil and the excavations. No excavation demarcation/protection shall be install on the spoil."

#### **PSD 5.1.1.3 Explosives**

##### **Add the following to SANS 1200 D, sub-clause 5.1.1.3:**

"The Engineer shall be notified at least 48 hours beforehand of the Contractor's intention to use explosives on site.

It shall be the Contractor's responsibility to make himself aware of the restrictions to blasting imposed by electric transmission or telephonic lines and other similar services. Where the presence and location of electric transmission or telephonic lines etc., are known or are shown on the Engineer drawing at tender stage the Contractor shall make allowance in his rates and programmes for restrictions and delays which may result from restrictions imposed by the authorities."

##### **Add the following sub-clauses to SANS 1200 D, sub-clause 5.1.1.3:**

#### **\*PSD 5.1.1.3a) Use of Explosives**

"Generally, the Contractor will be permitted to use explosives for breaking up rock and hard material during excavations, for demolishing existing structures and for such other purposes where it may normally be required, subject to the following conditions:

- a) The Engineer or Inspector of Explosives shall have the power to prohibit the use of explosives in cases where in his opinion, the risk of injury or damage to persons, property or adjoining structures is too high. Such action by the Engineer shall not entitle the Contractor to any additional payment for having to resort to other less economical methods of construction unless otherwise provided in the Contract Data or Bill of Quantities.
- b) Should blasting be necessary, the Contractor shall take every precaution to protect the Works and persons, animals and property in the vicinity of the site. The Contractor will be held responsible for any injury or damage caused by any blasting operations and shall make good

such damage at his own expense.

- c) The requirements of the Explosives Regulations Act (Act 26 of 1956) and the requirements of the Inspector of Explosives shall be complied with. In addition, where applicable, the requirements of Chapter 9 of the Regulations published in terms of the Mines and Works Act (Act 27 of 1956) and the requirements of the Government Mining Engineer shall be complied with.
- d) A copy of each blasting permit issued to workmen, and of each permit issued to the Contractor to cover the purchase, storage and transport of explosives, shall be handed to the Engineer. The Contractor shall grant the Engineer access to all records maintained for the Inspector of Explosives or the Government Mining Engineer, as the case may be.
- e) Before any blasting is undertaken, the Contractor, together with the Engineer shall examine and measure up any buildings, houses or structures in the vicinity of the proposed blasting and establish and record together with the owners thereof the extent of cracking or damage that may exist before commencement of blasting operations. It is advised that a photographic record will be required of neighbouring structures before blasting commences. These structures will be pointed out by the Engineer. It shall be the responsibility of the Contractor to make good at his own expense any further damage to such houses, buildings or structures which is a result of the blasting.
- f) Where there is reasonable danger of damage to power and telephone lines or any other property, the Contractor shall suitably adapt his methods of blasting and the size of the charges and use adequate protective measures such as cover blasting in order to limit the risk of damage as far as possible.
- g) When blasting to specified profiles, the Contractor shall so arrange the holes and charges such 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 allowance specified in the Specification Data or in any other specification or given on a drawing."

**\*PSD 5.1.1.3b) Limitations for Blasting**

**"a) Approval of methods and keeping of records**

No blasting work may be carried out prior to the Engineer approval being given in writing

Prior to starting any drilling for the first section of blasting, the Contractor shall submit for approval to the Engineer, details of the proposed overall methods of blasting that will be used on site, including spacing, depth and pattern of holes, charging levels (kg/m<sup>3</sup>), spacing and positioning of relays, method of blast initiation, precautions to prevent 'fly rock', maximum charge per relay, traffic arrangements during blasting, and any other details he may consider relevant. These details shall

be submitted in writing and supported with sketches at least 7 days before the commencement of drilling and blasting.

The Engineer will evaluate these details in relation to the given limitations and prior to giving his approval, will indicated to the Contractor any changes that may possibly be needed to comply with the limitations.

For all subsequent blasts, the Contractor shall, at least 24 hours beforehand, notify the Engineer of the intention to blast and at the same time shall note if any changes will be made relative to the approved method.

The Engineer reserves the right to order the Contractor to modify his method of drilling and blasting, or to employ reduced blasting, without thereby invalidating the Contract. The Contractor shall have no claim for extra payment, over and above his tendered rates, due to his being ordered to use such a different method of drilling or blasting or reduced charges, regardless of any prior approval by the Engineer of any previous method.

After every blast, the Contractor shall, within 24 hours, submit to the Engineer details of the actual total mass of explosives used, the approximate volume of material loosened and the maximum simultaneous mass of explosives detonated (maximum charge per relay).

Notwithstanding any approval given by the Engineer, the Contractor shall at all times be responsible for the safety of the Works, persons, animals and property in the vicinity of the Site during blasting operations.

## b) Vibrations

Blasting vibrations are caused by the transmission of the shock wave from the explosion charge through the material being blasted. This shock wave could cause damage to structures in the vicinity of the blasting if the vibrations are not limited to acceptable levels. Damage to structures is closely associated with peak particle velocity of the ground vibrations in the vicinity of the structure. Advisable maximum levels for peak particle velocity are given in Table 2.

**Table 2 - Maximum Particle Velocities (Vibration)**

Maximum peak particle velocity (mm/s)	Effect on people and buildings
0,5	Threshold of human perception unlikely to cause damage of any type
5	Limit for blasting adjacent to historical monuments
25	Limit for blasting near private dwellings in order to reduce disturbance to residents to a minimum
50	Limit for blasting adjacent to residential structures on good foundations

84	Limit for property owned by concern doing the blasting (i.e. minor plaster cracks acceptable)
120	Recommended maximum level for blasting adjacent to sturdy reinforced concrete structures

The peak particle velocity V is related to the distance D from the blast and the maximum mass of explosive E instantaneously detonated (maximum charge per relay) by the general equation:

$$V = \left( \frac{k}{D} \right)^m \times E^n$$

where k, m and n are constants for a particular set of circumstances. V is in mm/s, D is in metres and E is in kilograms. Experimentation has shown that n = 0,5 but k and m have to be determined for each site by means of vibration measurements. However blasting can be safely conducted without vibration measurements or expert advice if the following relationship is used:

$$V = \left( \frac{1150}{D} \right) \times E^{0.5}$$

Which gives the maximum charge levels for V = 50 mm/s listed in Table 3.

**Table 3 - Maximum Charge Levels**

Minimum distance from nearest blast hole structure m)	Maximum charge mass per relay (kg)
10	0,19
20	0,76
30	1,7
40	3,0
50	4,7
60	6,8
70	9,3
80	12,1
90	15,3
100	18,9

*Only detonating relays of at least 20 milliseconds delay interval shall be used.*

The above relationship can be used to calculate charge mass for other velocity limits. However, if higher charge levels have to be used for practical reasons, expert advice and possibly vibration measurements will be required.

Notwithstanding the above blasting limits, the Contractor shall at all times be responsible for the safety of the Works, person, animals and property in the vicinity of the Site during blasting operations."

**\*PSD 5.1.1.3c) Negligence**

“The Contractor shall be liable for all damages to services caused as a result of the Contractor’s negligence.”

**PSD 5.1.3 Groundwater**

**Add the following to SANS 1200 D, sub-clause 5.1.3:**

“The Contractor shall provide, operate and maintain sufficient pumping equipment, pipes and other equipment on site as may be necessary for the proper execution of the Works.”

**PSD 5.1.4.1 Dust nuisance**

**Add the following to SANS 1200 D, sub-clause 5.1.4.1:**

“The Contractor is responsible for dust control and is liable for all claims, that may result from the dust nuisance on all parts of the site and at all times, from the date of handing over of the Site, to the Completion date of the Contract.

The Contractor shall plan the Works accordingly and shall use sufficient water or other methods to keep the level of dust to a minimum. This shall be done in consultation with the Engineer and to the Engineer’s approval.

The Contractor must make allowance for the above in the rates tendered for excavation.”

**PSD 5.1.4.3 Disposal of surplus material**

**Add the following to SANS 1200 D, sub-clause 5.1.4.3:**

“All surplus material and unsuitable material not required for backfilling shall be disposed of at disused borrow pits or other suitable sites to be located by the Contractor. All such sites shall require the approval of the Engineer and the local Authority and community. No additional payment will be made for the transportation of such material

Dumping shall proceed in an orderly manner with coarse material placed at the bottom and covered with finer material, where possible. Upon completion of dumping the material shall be shaped to provide free draining surfaces and slopes and finished off to the satisfaction of the Engineer.

All movement of cut to fill material shall be regarded as free-haul. In addition, all movement of topsoil, overburden soil or any other material within the boundary of the site and less than 5 km from the site boundary shall be regarded as free-haul.”

**PSD 5.2.2.1 (c) Excavation for general earthworks and for structures**

**Add the following to SANS 1200 D, sub-clause 5.2.2.1(c):**

“The Contractor shall excavate to the net outlines of the structures plus an allowance for working space. Vertical concrete walls shall not be cast against excavated surfaces, except in the case of bases, concrete encasement to pipes and footings for brick walls.”

**PSD 5.2.2.1 (e) Excavation for general earthworks and for structures**

**Add the following to SANS 1200 D, sub-clause 5.2.2.1(e):**

“The Contractor shall inform the Engineer, in writing, at least 14 days before commencing any work which will result in a change of the topography of the site, whether such work is for the permanent works, or for temporary works which the Contractor intends to execute for his own convenience. After clearing the area to be worked on of all vegetation and before commencing the work, the Contractor shall in presence of the Engineer take cross-sections of the original ground profiles or any other approved method to determine the ground profiles of the entire area to be worked. In addition all rock and/or foundation levels shall be recorded as the work proceeds.

The information so obtained shall be permanently recorded on a drawing or drawings by the Contractor each of which shall be signed off by both the Contractor and the Engineer. The Contractor shall then provide the Engineer with a copy of each drawing to serve as a permanent record. The Contractor is to provide the Engineer with an electronic copy of the relevant information for the purpose of determining the quantities of excavation and earthworks carried out in the construction of the permanent works and the extent to which temporary works shall be removed or temporary excavations shall be filled upon completion of the Works.

Where the Contractor excavates to depths in excess of those shown on the drawings or ordered by the Engineer or if the material in the bottom of an excavation is loosened before concrete has been cast, or if there is any over-excavation, or any loose or disturbed soil it shall be removed and the over-excavation shall be replaced by mass concrete of prescribed mix Grade 15/19 mm. Backfilling over-excavation with concrete will not be measured for payment unless the over-excavation is ordered by the Engineer in order to remove unsuitable material, in which case the additional excavation will be measured and paid as excavation in all materials and the concrete will be measured by volume, all to the additional dimensions ordered by the Engineer.

Where structural concrete is to be cast or where precast elements are to be placed on surfaces established by restricted excavation, the Contractor shall, in the case of rock surfaces, over excavate to 100 mm below the bottom of the structure and use mass concrete Grade 15/19 mm for bringing the level to the bottom of the blinding or mass concrete.

Excavations to final level, ready to receive a blinding layer or concrete footing, shall be completed less than 24 hours before such layer or footing is cast.

The Contractor shall arrange for the inspection by the Engineer of all surfaces to receive concrete immediately before casting concrete.”

**PSD 5.2.3.1 Construction of platform and embankments**

**Add the following to SANS 1200 D Sub-clause 5.2.3.1:**

“The areas over which earth fills are to be constructed shall, after site clearance and removal of 150 mm topsoil, be ripped to a depth of 150 mm and compacted to 90% of Mod AASHTO Density. Should the topsoil layer be in excess of 150 mm the Contractor is to notify the Engineer in writing and request a directive as to how to proceed.

The Contractor shall plan his operations and particularly his cut and fill operations in such a manner that all cut material may be used to the best advantage of the Employer. This would mean that no material shall be unnecessarily spoiled. The Contractor shall therefore not spoil any materials without the Engineer’s approval and without satisfying the Engineer that this is necessary and the most economical method of constructing the works.

Where the earthworks pattern is such that the selected materials cannot be placed directly in their appropriate positions the Engineer may authorise their removal to temporary stockpiles.

Wherever practical, fill shall be placed in successive layers parallel to the final level of the platform.

The material to be used for the platform construction will be G7 minimum quality material.

Fill in other applications shall be compacted to the densities specified in SANS 1200 D, sub-clause 5.2.3.1 and SANS 1200 DM, sub-clause 5.2.4.2 (100% for sand). Material shall be placed in such a way that adjacent layers at any stage of the operation do not differ in height by more than 600 mm.

The construction of benches shall be measured as “cut to fill” or cut to spoil as the case may be.”

**PSD 5.2.3.2 (a) General backfilling**

**Add the following to SANS 1200 D, sub-clause 5.2.3.2 (a):**

“Backfill measured under the various items in the Bill of Quantities shall be compacted to a density as stipulated in the scheduled item.

Material for backfilling around structures must be selected so that no clay, boulders or rock is used for backfilling within 300 mm of the structure.”

**PSD 5.2.4.2 Topsoiling**

**Add the following to SANS 1200 D, sub-clause 5.2.4.2:**

“Topsoil shall not be stockpiled higher than 2 m. Care shall be exercised to prevent the compaction of topsoil in any way especially by vehicles travelling over such material.

Topsoil shall be placed as directed in SANS 1200 D, sub-clause 5.2.4.2 on the faces of cut slopes and embankments and other flatter areas, as shown on the drawings or ordered by the Engineer.”

**Amend the last sentence of SANS 1200 D, sub-clause 5.2.4.2 to read:**

“The final thickness of topsoil after light compaction shall be at least 100mm.”

## **PSD 7 TESTING**

### **PSD 7.2 Taking and testing of samples**

**Add the following to SANS 1200 D, sub-clause 7.2:**

“The Contractor shall carry out sufficient process control checks (one test per 7.5 cubic metres of backfill) on the compaction of all backfill layers before calling the Engineer to inspect the work completed. The frequency of testing shall be such that at least 9 tests shall be carried out for every lift of backfill material across a 225 m<sup>2</sup> grid block. The costs of testing shall be deemed to be included in the rates for backfilling of the platform.”

## **PSD 8 MEASUREMENT AND PAYMENT**

### **PSD 8.3 Scheduled items**

**SANS 1200 D, sub-clause 8.3 to include payment for:**

*PSD 4.5	Restriction on use of Plant
*PSD 4.6	Vibration loadings from use of Plant
PSD 5.1.1.2	Safeguarding of excavations
PSD 5.1.1.3	Explosives
*PSD 5.1.1.3a)	Use of Explosives
*PSD 5.1.1.3b)	Limitations for Blasting
*PSD 5.1.1.3c)	Negligence
PSD 5.1.3	Groundwater
PSD 5.1.4.1	Dust nuisance
PSD 5.1.4.3	Disposal of surplus material
PSD 5.2.2.1(c) PSD 5.2.2.1(e)	Excavation for general earthworks and for structures
PSD 5.2.3.1	Construction of platform and embankments
PSD 5.2.3.2(a)	General backfilling
PSD 7.2	Testing and testing samples.

### **PSD 8.3.2 Bulk excavation**

**Add the following to SANS 1200 D, sub-clause 8.3.2:**

“No extra over payment will be made for excavation in material classified in terms of SANS 1200 D, sub clause 3.1.2 as intermediate excavation and boulder excavation Class A and B. The tendered rate for excavation in all materials shall include for the cost of such excavation. Rock quantities are to be measured and agreed with the Engineer prior to backfilling. In the event that backfilling has taken place before rock quantities have been agreed with the Engineer then no rock payment will be made.”



**PSD 8.3.3      Restricted excavation**

**SANS 1200 D, sub-clause 8.3.3 to include payment for:**

PSD 2.3	Restricted excavation
PSD 3.1.2	Classes of excavation

**PSD 8.3.5      Extra excavation in all materials to provide working space around structures**

**Add the following to SANS 1200 D, sub-clause 8.3.5:**

“Excavation for workspace will be measured to the net vertical area of the structure below ground level, except in the case of footings for brick walls where no payment will be made.”

**PSD 8.3.6      Overhaul**

**Replace SANS 1200 D, sub-clause 8.3.6 with the following:**

“All movement of cut to fill material shall be regarded as freehaul. In addition, all movement of topsoil, overburden soil or any other material within the boundary of the site and less than 5 km from the site boundary shall be regarded as freehaul.

Overhaul will only be paid in disposal of topsoil, overburden, spoil or any other material where the transportation is beyond 5 km of the boundary of the site.”

**PSD 8.3.7      Additional lateral support**

**SANS 1200 D, sub-clause 8.3.7 to include payment for:**

PSD 5.1.1.2	Safeguarding of excavations
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“The rate shall cover all the cost of the design, supply, placing, maintenance and removal of the lateral support system and other support measures together with any cost that results from the inconvenience of working in the supported excavation and the cost of any risks inherent in the operation.”

**PSD 8.3.10      Topsoiling**

**SANS 1200 D, sub-clause 8.3.10 to include payment for:**

PSD 5.2.4.2	Topsoiling
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**Add the following to SANS 1200 D, sub-clause 8.3.10:**

“The topsoiling will be measured by surface area covered.

The rate for topsoiling shall cover the cost of loading, hauling, spreading, compacting and making suitable provision to avoid the topsoil slipping down the slopes of embankments and cut-slopes, all to the approval of the Engineer.”

**Add the following new payment item to SANS 1200 D, sub-clause 8.3:**

**\*PSD 8.3.14 Shoring..... Unit: m<sup>2</sup>**

“Trenches must be safeguarded as per clause PSD 5.1.1.2, as amended.

The area of shoring measured for payment will be the actual area of excavation side shored, calculated from the perimeter of structure plus adequate working space and the height of shoring actually used. (The maximum additional working space for shoring measurement will be 1.5 m.)

The rate shall cover all the cost of the design, supply, placing, maintenance and removal of the shoring system and other support measures together with any cost that results from the inconvenience of working in the supported excavation and the cost of any risks inherent in the operation.”

## **PSDB EARTHWORKS (PIPE TRENCHES) (SANS 1200 DB)**

### **PSDB 3 MATERIALS**

#### **PSDB 3.6.1 Subbase and base**

**Replace SANS 1200 DB, sub-clause 3.6.1 with the following:**

“Where trenches cross existing surfaced roads the following will apply:

- a) The service (pipe, cable etc.) shall be laid on a bedding cradle, and covered with a fill blanket, as specified in SANS 1200 LB Bedding (Pipes) or in the Project Specification.

The rate for placing and compacting bedding and blanket material shall be included in the rate for excavation and backfilling. No additional payment will be made for placing and compacting bedding and blanket using material selected from trench excavations. Where material excavated from trenches is unsuitable for backfill bedding or blanket material and suitable material cannot be reasonably selected from adjacent trench excavations or stockpiles within free haul distance on the site, then the Engineer will order the use of material from commercial sources.

- b) The remaining portion of the trench, from the top of the fill blanket to the underside of the road wearing layer, shall be filled with soilcrete (G6 gravel mixed with 3% cement) compacted mechanically in 150 mm layers to 98% of modified AASTHO density.”

#### **PSDB 3.7 Selection**

**Add the following to SANS 1200 DB, sub-clause 3.7:**

“Notwithstanding SANS 1200 DB, sub-clause 3.7, in terms of which the Contractor has a choice regarding methods of selection, the Contractor is required to use selective methods of excavation. The Contractor shall selectively remove and keep separate the sandy material from unsuitable material and place it adjacent to the trench for reuse as backfill, selected fill, selected granular material or for other use as ordered by the Engineer.

Material which, in terms of SANS 1200 D, sub-clause 6.2 or SANS 1200 LB, sub-clause 6.1, is too wet for immediate use in the trench (but which is otherwise suitable) will not be regarded as "unsuitable" material and, if so ordered by the Engineer, the Contractor shall spread such material in a suitable area until it has dried sufficiently for later use. Should the material which is replaced in the trench become too wet again, due to the fact that the Contractor made insufficient provision for the handling and removal of groundwater in accordance with SANS 1200 A, sub-clause 5.5, the Contractor shall replace the material at his own cost with material which is, in the opinion of the Engineer, suitable.

When preparing his programme and construction methods, the Contractor shall make allowance for selective excavation and the handling and drying out of material which is too wet for immediate use.

Unless otherwise ordered by the Engineer, all excavated material shall be kept within the pipe servitude. The toe of the bank of excavated material shall be trimmed well back from the edge of the

trench so as to leave a minimum 600 mm clearance between the toe of the bank and the edge of the trench. The Contractor shall keep this strip clear of excavated material at all times.

The Contractor shall take steps to avoid burying or contaminating topsoil which shall be set aside for replacing, as far as practical, on the surface from which it was excavated.”

## **PSDB 5 CONSTRUCTION**

### **PSDB 5.1.2 Stormwater, seepage and dewatering of excavations**

#### **PSDB 5.1.2.1 Throughout the works**

**Add the following to SANS 1200 DB, sub-clause 5.1.2.1:**

“In addition to the Contractor’s responsibilities for dealing with water, the Engineer may order the Contractor to place a crushed stone bedding layer (minimum thickness 150 mm) on the trench bottom. Should the trench bottom conditions remain unstable due to the nature of the soil and the degree of saturation, the Engineer may order the Contractor to install a filter fabric on the trench bottom prior to the provision of the stone layer.

Should the material in the trench bottom or the bedding material be of such a nature that it can penetrate the stone layer, the Engineer may instruct the Contractor to enclose the stone layer completely within a geotextile filter blanket which shall comply with the requirements below, and shall have overlaps of at least 300 mm.

The Contractor will only be paid by providing and laying the stone bedding layer and filter fabric after receipt of a written order to do so from the Engineer.

#### **Stone bedding in water-logged conditions:**

Where the use of a layer of crushed stone in the trench bottom has been authorized by the Engineer, it will be measured by volume calculated according to length multiplied by the minimum base width and specified thickness. The tendered rate shall cover the cost of preparation of the trench bottom to accommodate the layer of stone, the supply and placing of the layer of stone over at least the specified width and all related activities in order to produce a stable platform.

#### **Geotextile filter fabric:**

Where the Engineer has authorised the use of geotextile filter fabric, this shall be measured by area as: width x nett length, where the width shall be the full or half-width supplied by the manufacturer which conforms closest to the specified minimum base width + 2 x height of bedding. The tendered rate shall include the cost of supply, placing and losses as a result of overlaps and over excavated trench widths.

The synthetic fibres of a geo-textile blanket shall consist of at least 85% by mass of polypropylene, polyethylene, a polyester, a polyamide, or a copolymer of vinyl chloride and vinylidene-chloride, or any combination of these polymers, and shall contain such additives as are necessary to render the

filaments resistant to the effects of ultra-violet radiation and heat. The amount of water absorbed by the geo-textile after 24 hours soaking in water at 20°C shall be less than 1% by mass.

**In addition to the requirements of Sub-clause 3.1.3 of SANS 1200 DK the geo-textile shall comply with the following:**

Mass : 150 g/m<sup>2</sup> (minimum)  
Strength in all directions : 6 kN/m (minimum)  
Equivalent opening size (EOS) : 105 micrometres (maximum)"

#### **PSDB 5.4 Excavation**

**Add the following to SANS 1200 DB, sub-clause 5.4:**

"The maximum allowable length of open pipe trench, at any given time during the execution of this Contract, shall not exceed:

- a) 250 meters per section of the pipeline under construction and/or,
- b) 500 meters in aggregate, for all sections of pipeline
- c) At any time during the contract the aggregate length of completed sewer, without successful testing, will be restricted to 250 metres

Please note that any portion of the pipeline being laid and backfilled, which has not been fully backfilled, is deemed to be an open pipe trench. Open trenches are to be regularly (at least once a day) checked in compliance with the Occupational Health and Safety Act, as well as the Employer's Health and Safety Specification requirements by the Contractor's appointed construction Safety Officer."

#### **PSDB 5.5 Trench bottom**

**Add the following to SANS 1200 DB, sub-clause 5.5:**

"Where the Contractor's method of working results in quagmire conditions in the trench bottom, the Contractor shall excavate and stabilize the trench at their own cost to the approval of the Engineer."

**Replace the 10<sup>th</sup> and 11<sup>th</sup> lines of SANS 1200 DB, sub-clause 5.5 with the following:**

"All areas in cut shall be ripped, sacrificed to a depth of 150mm and re-compacted to 93% MOD AASHTO to a depth on 150mm, unless noted otherwise."

#### **PSDB 5.6.3 Disposal of soft excavation material**

**Replace SANS 1200 DB, sub-clause 5.6.3 with the following:**

"All surplus material and unsuitable material not required for backfilling shall be disposed of at disused borrow pits or other suitable sites to be located by the Contractor. All such sites shall require

the approval of the Engineer and the local Authority and community. No additional payment will be made for the transportation of such material.

Dumping shall proceed in an orderly manner with coarse material placed at the bottom and covered with finer material, where possible. Upon completion of dumping the material shall be shaped to provide free-draining surfaces and slopes and finished off to the satisfaction of the Engineer."

**PSDB 5.6.6      Completion of backfilling**

**Replace SANS 1200 DB, sub-clause 5.6.6 with the following:**

"The Contractor shall bring on to the site sufficient resources for pipe laying so that trenches do not remain open for longer than one week ahead or behind the pipe laying team."

**PSDB 5.7.2      Areas subject to traffic loads**

**Add the following to SANS 1200 DB, sub-clause 5.7.2:**

"All trenches within the sewage works site will be considered to be subject to traffic loads and the backfill material and compaction in these trenches shall comply with the requirements of SANS 1200 DB, sub-clauses 3.5 (b) and 5.7.2."

**PSDB 7            TESTING**

**PSDB 7.1        Testing**

**Add the following to SANS 1200 DB, sub-clause 7.1:**

"The Contractor is to allow in his rates a minimum of one compaction test per 50 meters for every completed layer of blanket and backfill."

**PSDB 8           MEASUREMENT AND PAYMENT**

**PSDB 8.3.2      Excavation**

**Add the following to SANS 1200 DB, sub-clause 8.3.2:**

"No extra over payment will be made for excavation in material classified in terms of SANS 1200 D, sub clause 3.1.2 as intermediate excavation and boulder excavation Class A and B. The tendered rate for excavation in all materials shall include for the cost of such excavation. Rock quantities are to be measured and agreed with the Engineer prior to backfilling. In the event that backfilling has taken place before rock quantities have been agreed with the Engineer then no rock payment will be made."

**SANS 1200 DB, sub-clause 8.3.2 to include payment for:**

PSDB 3.7	Selection
PSDB 5.4	Excavation

PSDB 5.5	Trench Bottom
PSDB 5.6.3	Disposal of soft excavation material
PSDB 5.6.6	Completion of backfilling
PSDB 5.6.8	Transport for earthworks
PSDB 7.1	Testing

#### PSDB 8.3.6.1 Reinstate road surfaces

SANS 1200 DB, sub-clause 8.3.6.1 to include payment for:

PSDB 3.6.1	Subbase and base
PSDB 5.7.2	Areas subject to traffic loads

#### PSDB 8.3 Schedules items

Add the following new payment items to SANS 1200 DB, sub-clause 8.3:

**\*PSDB 8.3.8 Crushed stone bedding layer**  
 .....Unit: m<sup>3</sup>

"The rate shall include payment for PSDB 5.1.2.1."

**\*PSDB 8.3.9 Geofabric blanket**  
 .....Unit: m<sup>2</sup>

"The rate shall include payment for PSDB 5.1.2.1."

## **PSDM EARTHWORKS (ROADS, SUBGRADE) (SANS 1200 DM)**

### **PSDM 3 MATERIALS**

#### **PSDM 3.1 Classification for Excavation Purposes**

**Replace SANS 1200 DM, sub-clause 3.1 with the following:**

“The Contractor may use any method he chooses to excavate any class of material but the chosen method of excavation shall not determine the classification of the excavation. The Engineer will decide on the classification of the materials. In the first instance the classification will be based on inspection of the material to be excavated and on the criteria given in PSD 3.1.2.

All material encountered in any excavations for any purpose including restricted excavations will be classified as follows:

1. Excavation in all materials, excluding hard rock. This category of excavation includes excavation in all sandy and disturbed material; excavation in Clay; excavation in undisturbed and weathered Shale (clay); Sandstone; Mudstone and excavation in rippable rock.
2. Excavation in hard rock will require blasting or rock splitting. Areas where rock splitting is required will be indicated on site by the Engineer.

Extra-over payment will be made for hard rock excavation provided the surface levels of the hard rock have been recorded on drawings signed by the Engineer before it is excavated. No extra over payment will be made for excavation in material classified in terms of SANS 1200 D, sub clause 3.1.2 as intermediate excavation and boulder excavation Class A and B. The tendered rate for excavation in all materials shall include for the cost of such excavation. Rock quantities are to be measured and agreed with the Engineer prior to backfilling. In the event that backfilling has taken place before rock quantities have been agreed with the Engineer then no rock payment will be made”

#### **PSDM 3.2.3 Selected Layer**

**Add the following to SANS 1200 DM, sub-clause 3.2.3:**

“The Contractor shall obtain selected sub-grade material from a source of his own choice. The unit rate tendered shall include all procurement related costs, including haulage. The material quality shall comply with that of G7 or G6 natural gravel as specified in SANS 1200 and shall be compacted to the specified MOD AASHTO Density.”

### **PSDM 5 CONSTRUCTION**

#### **PSDM 5.2.3.3 Treatment of roadbed**

**Substitute the first paragraph of SANS 1200 DM, sub-clause 5.2.3.3 (a) with the following:**



“The roadbed shall be scarified to a depth of 150 mm, watered, shaped and compacted to 93% mod. AASHTO density (100% for sand), except where otherwise ordered by the Engineer.”

#### **PSDM 5.2.8.1 Freehaul**

**Replace SANS 1200 DM, sub-clause 5.2.8.1 with the following:**

“All movement of cut to fill and cut and spoil material on site shall be regarded as freehaul. In addition, all movement of topsoil, overburden soil or any other material within the boundary of the site or a distance of 5 km, whichever is the greatest, shall be regarded as freehaul.”

### **PSDM 7 TESTING**

#### **PSDM 7.3.2 Routine inspection testing**

**Add the following to SANS 1200 DM, sub-clause 7.3.2:**

“No single test result which is below the specified density will be accepted.

The cost of all routine testing done by the Engineer, and of which the results do not comply with the specified minimum requirement for the material, shall be borne by the Contractor and will be subtracted for the monthly payment certificates”

### **PSDM 8 MEASUREMENT AND PAYMENT**

#### **PSDM 8.3.3 Treatment of road-bed**

**SANS 1200 DM, sub-clause 8.3.3 to include payment for:**

PSDM 7.3	Routine inspection and testing
PSDM 5.2.3.3	Treatment of roadbed

#### **PSDM 8.3.4 Cut to fill, borrow to fill**

**SANS 1200 DM, sub-clause 8.3.4 to include payment for:**

PSDM 5.2.8.1	Freehaul
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**Add the following to SANS 1200 DM, sub-clause 8.3.4:**

“No extra over payment will be made for excavation in material classified in terms of SANS 1200 D, sub-clause 3.1.2 as intermediate excavation and boulder excavation Class A and B. The tendered rate for excavation in all materials shall include for the cost of such excavation. Rock quantities are to be measured and agreed with the Engineer prior to backfilling. In the event that backfilling has taken place before rock quantities have been agreed with the Engineer then no rock payment will be made.”

**PSDM 8.3.5 Selected layer**

**SANS 1200 DM, sub-clause 8.3.5 to include payment for:**

PSDM 3.2.3 Selected layer

**PSDM 8.3.6 Extra-over items 8.3.4 and 8.3.5 for excavating and breaking down material in**

**Delete item a) of SANS 1200 DM, sub-clause 8.3.6 and add the following:**

“No payment shall be made for intermediate excavation. Excavation normally classified as Intermediate excavation shall be paid as per the rate for normal excavation (8.3.4 or 8.3.5 as appropriate). No payment shall be made boulder excavation class A or boulder excavation class B.”

**PSDM 8.3.7 Cut to spoil or stockpile from**

**Delete item b) of SANS 1200 DM, sub-clause 8.3.7 and add the following:**

“No payment shall be made for intermediate excavation. Excavation normally classified as Intermediate excavation shall be paid as per the rate for soft excavation (8.3.7(a)). No payment shall be made boulder excavation class A or boulder excavation class B.”

**PSDM 8.3.12 Overhaul**

**SANS 1200 DM, sub-clause 8.3.12 to include payment for:**

PSDM 5.2.8.1 Freehaul

## **PSG CONCRETE (STRUCTURAL) (SANS 1200 G)**

### **PSG 1 SCOPE**

**Add the following:**

“This specification also covers concrete pavements.”

### **PSG 2 INTERPRETATIONS**

#### **PSG 2.4 Explanation of terms**

##### **PSG 2.4.3 Joints**

**Add the following to SANS 1200 G, sub-clause 2.4.3**

“Notwithstanding SANS 1200 G, sub-clause 2.4.3, "designated joints" will only be joints that are shown on the drawings. Any other joints that are required by the Contractor as a result of his construction constraints or for any other reason, whether approved by the Engineer or not, will not be considered to be designated joints as defined in SANS 1200 G, sub-clause 2.4.3, i.e. they will be considered to be "non-designated" joints.”

### **PSG 3 MATERIALS**

#### **PSG 3.2 Cement**

##### **PSG 3.2.1 Applicable specifications**

**Add the following to SANS 1200 G, sub-clause 3.2.1:**

“With the exception of non-structural concrete, all binders used in the works shall be either an approved blend of CEM II/A 52,5N and PFA, or CEM III/A 42,5N. Cement type CEM II 32,5N may be used for non-structural concrete. In all cases the cements shall comply with SANS 50197-1.

With the exception of the standard SANS approved cement blends supplied by the primary cement producers, the blending of CEM1 and extenders shall not be permitted unless specifically approved by the Engineer on the basis of an acceptable quality assurance procedure and subject to the extender complying with SANS 1491.

The source of supply for each type of approved cementitious material shall not be changed during the contract period without approval of the Engineer.

Test certificates from an approved laboratory shall be furnished by the Contractor for all cements and prior to their use in the works, indicating the alkalinity of the cement expressed as the equivalent sodium monoxide content (calculated as Na<sub>2</sub>O). Cement with such an alkalinity content in excess of 0,60% shall only be used with the written authority of the Engineer regardless of whether or not the aggregates are considered to be potentially alkali reactive.”

Pulverised fly ash (PFA) shall conform to the requirements of SANS 1491-2.”

**PSG 3.2.3 Storage of cement**

**Add the following to SANS 1200 G, sub-clause 3.2.3:**

“Cement shall be used in the order in which it is received (first in, first out basis)

Cement kept in storage for longer than 6 weeks shall be removed from site and not used in the Works.

Any cement that shows signs of hydration, such as the formation of lumps, may not be used and is to be immediately removed from site.”

**PSG 3.3 Water**

**Replace SANS 1200 G, sub-clause 3.3 with the following:**

“Only potable quality water from an approved source may be used for mixing concrete. Water from a river or stream may only be used for curing.”

**PSG 3.4 Aggregates**

**PSG 3.4.1 Applicable specification**

**Add the following to SANS 1200 G, sub-clause 3.4.1:**

“The maximum aggregate size shall be 20 mm. The nominal stone size specified in the concrete grade shall mean stone conforming to SABS 1083 for the nearest equivalent size.

Notwithstanding the provisions of SANS 1200 G, sub-clause 3.4 the aggregates shall be obtained from approved commercial source.

Dolomitic aggregate must be used in concrete for all water retaining structures.

Aggregates with a high potential for influencing the alkali silica reaction (ASR) shall not be used. The alkali content in aggregate shall be less than 1.8 kg of active  $\text{Na}_2\text{Oe}$  per  $\text{m}^3$ . Aggregate tests shall be performed by the Contractor and results submitted to the Engineer in time before implementing work. Payment shall be for concrete with low potential for ASR, either by using the above aggregate, or by adding admixtures, as per SANS 10100-2.

The fineness modulus of the sand delivered to the mixer shall lie between 1,7 and 2,8 and the standard deviation of fineness moduli of samples of sand that is delivered to the mixer during one shift shall be not more than 0,10.

At least one month before commencement of concrete work the Contractor shall supply at his own cost representative samples to the Engineer of the aggregates he intends using, together with certificates from an approved laboratory indicating that the aggregates comply with the specifications. Approximately 50 kg of each sample of aggregate shall be supplied.

After approval these samples shall be taken as standard for the agreed aggregates to be used in the Works. If at any time during the course of the Contract the Engineer considers that there has been any deviation from the approved standard the Contractor shall submit further tested samples of material to the Engineer for approval."

**PSG 3.4.2      Use of plums**

**Replace SANS 1200 G sub-clause 3.4.2 with the following:**

"The use of plums will not be permitted."

**Add the following to new sub-clause to SANS 1200 G, sub-clause 3.4:**

**\*PSG 3.4.4      Aggregates on roof**

"Quartzite stone chips with a nominal size of 25mm shall be placed on top of the reservoir roof in a 75mm layer."

**PSG 3.5      Admixtures**

**PSG 3.5.1      Approval of admixtures requirements**

**Add the following to SANS 1200 G, sub-clause 3.5.1:**

"The use of admixtures will be subject to the approval of the Engineer. The information listed in SANS 1200 G, sub-clause 3.5.1 shall be provided.

In addition, all water retaining structures will include the following admixture: Engineer approved crystalline waterproofing additive (with the proven ability to seal concrete cracks of widths up to 0.4mm) added as per manufacturer's specification for concrete exposed to an aggressive chemical environment.

If two or more admixtures are to be used, the Contractor shall submit all necessary and available data for assessing the interaction and compatibility of the admixtures."

**Add the following new sub-clauses to SANS 1200 G, sub-clause 3.5:**

**\*PSG 3.5.3      Pulverized fly ash (PFA)**

**\*PSG 3.5.3.1      General**

“Concrete containing a percentage of PFA shall be termed PFA concrete. Pulverized fly ash (PFA) shall conform to the requirement of SANS 1491-2.

All concrete used shall be PFA concrete unless otherwise shown on the drawings or ordered by the Engineer.

PFA concrete shall conform to the requirements of SANS 1200 G for concrete and the additional requirements specified below.”

**\*PSG 3.5.3.2 Source and quality**

“Fly Ash shall be procured from an approved source and shall be of a consistent quality conforming to SANS 1491-2. In particular it shall be tested for and shall conform to the following:

- a) the loss on ignition shall not exceed 5%
- b) the percentage by mass retained on 45 micron screen shall not exceed 12.5%”

**\*PSG 3.5.3.3 Cementitious material**

“The cementitious material used for PFA concrete shall consist of a mixture of ordinary Portland cement and of between 20% and 40% by mass of PFA.”

**\*PSG 3.5.4 Crystalline Waterproofing Additive**

“The Contractor shall be responsible for furnishing all labour, materials, services and equipment necessary for the supply and installation of crystalline waterproofing additive to concrete structures as indicated on the drawings, and as specified herein. The crystalline waterproofing material shall be added to concrete during the mixing cycle, and shall be used in above and below grade walls and slabs including liquid retaining structures where enhanced chemical resistance is required.

The concrete waterproofing system shall be of the crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the set concrete. The system shall cause the set concrete to become sealed against the penetration of liquids from any direction, and shall protect the concrete from deterioration due to harsh environmental conditions.

Prior to installation of waterproofing, the Contractor shall conduct a meeting with the Engineer, concrete supplier, concrete placer and waterproofing manufacturer’s representative to verify and review the project requirements for waterproofing as well as the manufacturer’s product data including application instructions and to ensure that the alkali silicate reaction of the concrete with the additive does not exceed the maximum allowable limit specified in clause PSG 3.5.3.

After this meeting, the Contractor shall obtain approval to install the crystalline waterproofing additive in writing from the product manufacturer, which written approval shall be given to the Engineer. This requirement shall not absolve the Contractor of his/her obligations in accordance with the contract and project requirements.

The admixture shall be added to the concrete mix at the time of batching. The Contractor shall obtain a completely homogeneous mixture by thoroughly blending the admixture with the concrete mix."

**Add the following new sub-clauses to SANS 1200 G, clause 3:**

**\*PSG 3.9 Materials for movement joints**

**\*PSG 3.9.1 General**

"The various jointing materials, the manufacturers of the materials and the methods of application shall be as approved by the Engineer. Materials shall be stored and protected to avoid damage, degradation, distortion or contamination.

The joint materials shall be resistant to ultraviolet light and to biological degradation."

**\*PSG 3.9.2 Waterstops**

"Waterstops shall be of approved manufacture and of the pattern and the material and widths scheduled and specified and shown on the drawings. They shall comply with the tolerances specified. They shall conform to Specifications CKS 388 or 389, for natural rubber or PVC respectively, and have the appropriate physical properties as set out below:

	<b>PVC</b>	<b>Rubber</b>
Tensile strength (@ 25°C)	12,2 MPa	20,7 MPa
Elongation at break (@ 25°C)	250%	500%
Hardness BS degrees (IRHD @ 25°C)	-	60 to 65°
Softness (BS)	28 to 52°	-

All intersections between waterstops shall be prepared by mitring and welding/vulcanising intersection pieces in the factory in accordance with the manufacturer's instructions and to approval of the Engineer. Only straight lengths of waterstop may be field welded using the appropriate jigs and tools.

Where required, waterstops shall have eyelets so that they may be tied securely to the adjacent reinforcement. "Rearguard"-type waterstops shall have flanges or cleats that grip effectively."

**\*PSG 3.9.3 Fillers**

"Closed cell expanded polyethylene fillers shall comply with the following:

<b>Property</b>	<b>Unit</b>	<b>Value Test Method</b>
Density	kg/m <sup>3</sup> 110	DIN 53420
Compression Stress at		
10%	kPa 175	DIN 53577
25%	kPa 210	DIN 53577
50%	kPa 340	DIN 53577
Compression set after 24 hours recovery	% 14	

Property	Unit	Value Test Method
Tensile Strength	kPa 680	DIN 53571
Elongation at Break	% 49	DIN 53571
Max. water absorption after 24 hours by volume	% 0,1	ASTM C-177

Fillers shall be pre-cut to suit the application with a tear-out strip for forming the specified recess for the sealant. If so required the filler shall be glued into position with an approved epoxy glue."

**\*PSG 3.9.4 Bond breakers, primers and sealants**

"The bond breaker between the top of the blinding layer or dry packed mortar screed and the underside of the floor slab shall be either a double coat of a spray grade bitumen emulsion complying with SANS 309 applied at a rate of 1,0 ℓ/m<sup>2</sup> of net bitumen or a 250 micrometre polythene sheet complying with SANS 952, Type D.

Where bitumen-impregnated resilient fibreboard is specified, it shall comply with American Federal Specification HH-F-341a for Type 1, Class B.

The bond breaker (if specified) shall be self-adhesive PVC tape (or equal, approved material) with a width the same as the joint recess into which it is to be applied.

The primer, if required for the sealant, shall be fully compatible with the sealing compound that is to be used.

The elastomeric sealant shall be either a two-component polysulphide liquid polymer base complying with the requirements of SANS 110 or a polyethylene based polyurethane "pouring grade" for horizontal or near horizontal joints or "gun grade" for vertical/overhead joints and joints steeper than 1 in 10 to the horizontal. All elastomeric sealants shall comply with BS 4254 Type A1 and shall have a movement tolerance of 25%.

Sealants shall have been tested to ensure that they are non-toxic and do not impart any odour or taste to, or otherwise taint, the water.

These sealants shall be suitable for indoor as well as outdoor applications and shall be UV resistant. The sealant shall be suitable for use at movements and connection joints in floors as well as for joints in contact with potable water.

Sealant samples shall be timeously submitted for testing upon the request of the Engineer."

**\*PSG 3.10 Precast paving slabs**

"The paving slabs shall comply with the requirements of SANS 541, shall be as scheduled and with patterned surface, or equal approved. Samples of the types which the Contractor proposes to use shall be submitted for approval prior to construction.



The area to be paved shall be compacted to a minimum of 93% Mod AASHTO density (100% for sand), trimmed and then treated with an approved weedkiller, with care being taken to avoid contaminating surrounding areas. The paving slabs shall be laid on a sand bed approximately 25 mm thick, which shall be graded to the required levels and slopes as approved by the Engineer. The joints between the slabs shall be 2 mm to 6 mm wide and shall be grouted with cement mortar. Gaps in the pattern of slabs shall be filled with Grade 15MPa/19 concrete and given a wood floated finish."

**\*PSG 3.11      Waterproofing slurry**

"An approved cementitious in-depth waterproofer shall be used on planned construction joints as indicated on the drawings. Surfaces shall be prepared and the product shall be applied as per the approved manufacturer's instructions.

The waterproofing slurry shall be suitable for use on concrete substrates and should be suitable for use in potable water structures.

The slurry shall have the following typical properties:

Appearance	Grey Powder
Workability at 20 °C	Approximately 30min
Setting time at 20 °C	1-2 hours"

**PSG 4            PLANT**

**PSG 4.3        Mixing plant**

**PSG 4.3.1      General requirement for mixing plant**

**Add the following to SANS 1200 G, sub-clause 4.3.1:**

"Stand-by mixers of adequate capacity and with an independent power unit shall be maintained on site for immediate use in the event of breakdown of the regular mixers failure of the power supply."

**PSG 4.4        Vibrators**

**Add the following to SANS 1200 G, sub-clause 4.4:**

"Stand-by vibrators of adequate capacity and with an independent power unit shall be maintained on site for immediate use in the event of breakdown of the regular vibrator failure of the power supply.

Vibrators for in-situ concrete shall be of the internal or immersion type."

**PSG 4.5        Formwork**

**PSG 4.5.1      Design**

**Add the following to SANS 1200 G, sub-clause 4.5.1:**

“Detailed drawings of the formwork shall be issued by the Contractor for its fabrication. All such design and drawings shall be available for inspection by the Engineer if so required.

No formwork which is in the opinion of the Engineer major formwork shall be erected without the Engineer’s prior written approval of the design and moving or handling arrangements. The Contractor’s proposed design and drawings shall be submitted to the Engineer in ample time to permit examination without delay to the works, and in any event not less than three clear days before the date when the Contractor proposes to commence fabrication of the formwork. The Engineer’s approval for use shall not be deemed to relieve the Contractor of his responsibility for the adequacy of the formwork.

Where smooth or special formwork is required, only new or as-new steel shuttering shall be used. Where steel is definitely impractical, an alternative may be used but only as approved by the Engineer.”

**PSG 4.5.2      Finish**

**Add the following to SANS 1200 G, sub-clause 4.5.2:**

“All exposed external angles in concrete work shall have 20 mm x 20 mm chamfers unless otherwise specified or ordered, but the top edge of a slab that is to receive an applied finish shall not be chamfered.

Internal corners in concrete work need not have fillets unless such fillets have been specified on the drawings or ordered by the Engineer.”

**PSG 4.5.3      Ties**

**Add the following to SANS 1200 G, sub-clause 4.5.3:**

“The use of sleeves for formwork ties through the walls of water retaining structures will not be permitted. Ties, when cast in, shall have some form of positive anchorage to prevent any rotation when loosening formwork and some form of water bar to restrict seepage along the tie.

A sample of the tie to be used must be submitted the Engineer for approval prior to construction.

Where practical, cone recesses shall be plugged with well-rammed dry 3:1 mortar within 48 hours of casting the concrete. Surfaces of the recesses shall first be roughened by wire brushing.

Tie cone recessed which cannot be plugged within 48 hours of casting shall be roughened by scabbling and a wet to dry epoxy shall be applied before plugging the recesses with mortar.”

**Add the following new sub-clause to SANS 1200 G, clause 4:**

**\*PSG 4.6      Water-bath**

"A temperature-controlled water-bath with a capacity to cure two hundred cubes shall be provided on site. The water-bath shall be located under cover."

## **PSG 5 CONSTRUCTION**

### **PSG 5.1 Reinforcing**

#### **PSG 5.1.2 Fixing**

**Add the following to SANS 1200 G, sub-clause 5.1.2:**

"Fixing of reinforcing bars by welding and heating of bars will not be permitted.

Fixing blocks for the attachment of fixtures may be embedded in concrete provided that the strength or any other desirable feature (such as appearance of the member) is not, in the opinion of the Engineer, impaired thereby.

Supports shall be of approved precast concrete blocks properly shaped to maintain position or proprietary supports of an approved type. Concrete blocks shall be made of the same mix as the mortar of the concrete in which they are to be placed and adequately cured as specified. The mortar shall be well compacted by approved means into the moulds to result in blocks with a density of at least 2 300 kg/m<sup>3</sup> and which are free from honeycombing. The blocks shall be cured in water for at least 7 days. Blocks which have not been manufactured and cured strictly in accordance with these requirements or which are in any other way considered unsatisfactory by the Engineer, will be rejected and shall be removed from the Site. Wooden supports shall not be used nor shall bars be placed in succeeding layers of fresh concrete nor shall bars be adjusted during the placing of concrete. Tie-wire shall point away from the nearest formwork face.

Where clips, stools and other supports are not shown on the drawings and are structurally not required, the Contractor shall provide those supports he deems necessary to ensure the correct positioning of the reinforcement, to the satisfaction of the Engineer. The cost of such steel, labour, and other fixing materials shall be inclusive in the rate for the scheduled reinforcement and no additional payment shall be made."

#### **PSG 5.1.3 Cover**

**Amend SANS 1200 G, sub-clause 5.1.3 as follows:**

**The words "bar or stirrup" to read:** "bar, secondary reinforcement, stirrup, tying-wire knots or wire ends".

**Add the following to SANS 1200 G, sub-clause 5.1.3:**

"Tying wire may not encroach on the specified minimum cover by more than a single strand thickness."

## **PSG 5.2 Formwork**

### **PSG 5.2.1 Classification of finishes**

#### **Add the following to SANS 1200 G, sub-clause 5.2.1:**

“Rough formwork may be used on the outside faces where the concrete is more than 500 mm below the final ground level. Smooth formwork will be used elsewhere. All honeycombing shall be repaired by cutting back to sound concrete and patching with a suitable epoxy mix to the approval of the Engineer

All concrete surfaces that will be exposed above the final ground levels shall have a special smooth finish to a Degree of Accuracy I. The formwork used shall be high-grade, unblemished and regular in size. Formwork ties shall be placed in a regular pattern. The special smooth finish shall be an off-shutter finish to the concrete such that no after treatment is required other than at the positions of formwork ties.

All honeycombing shall be repaired by cutting back to sound concrete and patching with a suitable epoxy mix to the approval of the Engineer.

Concrete for manholes shall be finished with a steel float or against a steel shutter which has been cleaned and oiled before use.”

### **PSG 5.2.2 Preparation of formwork**

#### **Add the following to SANS 1200 G, sub-clause 5.2.2:**

“All exposed external angles in concrete work shall have 20 mm x 20 mm chamfers unless otherwise specified or ordered, but the top edge of a slab that is to receive an applied finish shall not be chamfered.”

## **PSG 5.5 Concrete**

### **PSG 5.5.1.1 General**

#### **Add the following to SANS 1200 G, sub-clause 5.5.1.1:**

“Supervision:

The Contractor shall be responsible for ensuring that the erection of the concrete work is carried out under the supervision of a person with adequate knowledge of the mixing, transporting, placing and curing of concrete.

Programme and Plant:

Prior to carrying out any concrete work, the Contractor shall obtain the approval of the Engineer in respect of:

- a) Structural programme,
- b) Concrete plant details,
- c) Materials to be used in concrete,
- d) Details of concrete,
- e) Construction joints"

#### **PSG 5.5.1.4 Chloride content**

**Add the following to SANS 1200 G, sub-clause 5.5.1.4:**

"With reference to Table 4, Efflorescence will not be acceptable on any exposed concrete surface."

#### **PSG 5.5.1.5 Durability**

**Add the following to SANS 1200 G, sub-clause 5.5.1.5:**

"Testing for durability shall be carried out using test panels which are constructed with the same concrete mix, formwork type, and compaction and curing methods as the actual concrete structures. The test panel shall be 150 mm thick, and of at least 0.5 m sides. Samples for testing shall be obtained from the face of the test panel that mimics the cast face of a drum, after a period of 28 days curing. The test panels required for durability testing shall be constructed:

- a) At the start of production
- b) Initially for the first 50m<sup>3</sup> batch of concrete.
- c) Thereafter 2 sets for every discreet element namely floors, sloped floors and walls.

The durability tests are to be carried out by an accredited laboratory approved by the supplier in terms his Quality Management System and shall be:

- a) Oxygen permeability index test (OPI)
- b) Water sorptivity index test (including porosity)
- c) Chloride conductivity index test

The test procedures for these tests are obtained from the University of Cape Town Durability Index Test Manual.

Two sets of four cores each (70 mm diam) are required from a test panel: four cores for the oxygen permeability and water sorptivity tests; four cores for the chloride conductivity test.

The required target values for the tests are summarized in the table below. (These are the average values for the four core specimens used for the testing on each occasion). These values are required to be met simultaneously for both sets of cores, i.e. the cores must pass the requirements for both OPI and chloride conductivity.

#### **Durability Test Parameters**

DURABILITY INDEX TEST	TARGET VALUE
Oxygen permeability index	$\geq 10$ (log scale)
Chloride conductivity index	$\leq 0.6$ m.sec/cm
Water Sorptivity	$\leq 8$ mm / hr0.5

In the case that the results do not comply with the above values in the above table, another set of cores shall be drilled from the test panel. Where the second set of cores fails to comply with target values, a drum from that batch of concrete shall be sampled by way of drilling four cores for each of the oxygen permeability test and the chloride conductivity test. If these sets of cores fail either of the target values for OPI or chloride conductivity, all drums from that batch of concrete shall be discarded. The Contractor shall keep records of all tests results relating to the samples tested.

The Contractor shall ensure that site testing is carried out by a trained person. The Contractor shall ensure that all off-site laboratory testing is performed in an approved laboratory approved in terms of their Quality Management System.”

#### **PSG 5.5.1.6 Prescribed mix concrete**

##### **Add the following to SANS 1200 G, sub-clause 5.5.1.6:**

“Notwithstanding the requirements of SANS 1200 G, sub-clause 5.5.1.6, samples of aggregates will not be made available by the Engineer. The Contractor shall supply aggregates from commercial sources located by him, complying with the requirements of PSG 3.4.1, as amended, for the production of prescribed mix concrete.”

#### **PSG 5.5.1.7 Strength concrete**

##### **Add the following to SANS 1200 G, sub-clause 5.5.1.7:**

“With the exception of mixes weaker than 15 MPa, all concrete for the Works shall be considered to be strength concrete.

Unless otherwise specified on the drawings or in the Bill of Quantities,

- all structural concrete shall be Grade 35 MPa/20.
- Where blinding layers are specified, the concrete shall be grade 15 MPa/20 placed and finished off to the final level.
- Headwalls, manholes etc: Grade 30 MPa/20mm
- Concrete pavement: Grade 35 MPa/20mm with a minimum flexural strength of 4.2MPa.

The concrete mix design for strength concrete must be prepared in an approved laboratory and the results of actual test mixes must be submitted for approval together with 7-day and 28-day strength test results. Special attention is drawn to the fact that the concrete mix must provide a very dense and impervious concrete.

The Contractor shall submit details of the proposed concrete aggregates, design mix and casting procedures to the Engineer for approval prior to casting, after which he shall be required to make a trial mix and obtain cube test results to validate the proposed mix. Only after receipt of satisfactory

cube test results shall the Contractor be permitted to use the mix in the construction of water retaining structures. The cost of designing and proving the proposed concrete mix shall be deemed to be included in the tendered rates.

In order to avoid the possibility of Alkali Silica Reaction (ASR), the following shall be taken into account when designing the mixes:

1. Where the cementitious contents is less than  $350\text{kg/m}^3$ , the maximum equivalent sodium monoxide content (calculated as  $\text{Na}_2\text{O}$ ) permitted shall be 0.60%, unless a test certificate from the CSIR (Built Environment) is provided stating that the long term testing has proved the aggregate to be non-reactive.
2. Where the cement content exceeds  $350\text{kg/m}^3$ , the maximum equivalent sodium monoxide ( $\text{Na}_2\text{O}$ ) content permitted shall be  $2.1\text{kg/m}^3$  of concrete.
3. Where potentially ASR reactive aggregate is used, the maximum cement content shall be  $400\text{kg/m}^3$  and the maximum equivalent sodium monoxide ( $\text{Na}_2\text{O}$ ) content permitted shall be  $2.4\text{kg/m}^3$  of concrete.
4. The Contractor shall prior to the use of cement provide test certificates from an approved laboratory confirming the equivalent sodium monoxide ( $\text{Na}_2\text{O}$ ) content of the batch of cement to be used.
5. Special literature should be consulted e.g. Fulton's Concrete Technology.

The Engineer may call for revised mix designs at any stage during the Contract.

Any mix for use in the wall or floor of a water-retaining structure shall have a water/cement ratio not exceeding 0,5, shall contain a cement content not less than  $325\text{kg/m}^3$  and not more than  $400\text{kg/m}^3$  and the proportions of the various aggregates shall be such as to produce a density of at least  $2\,400\text{kg/m}^3$ . For concrete containing PFA the maximum binder content shall be  $450\text{kg/m}^3$ .

In order to facilitate or increase the workability of concrete in the fresh/plastic state, to ensure watertightness without increasing the water/cement ratio, the Engineer may approve the use of an additive.

The workability of concrete shall be assessed by means of the slump test. The slump of each batch of concrete shall be taken and recorded directly before casting.

**"No-fines" concrete:**

A nominal aggregate size of 20 mm shall be used in the manufacture of "no-fines" concrete.

No-fines concrete shall be laid under where specified and shall consist of coarse aggregate, cement and water only. No fine aggregate shall be used. Sandwiching or layering of pours will not be permitted. The Contractor shall cast to the profile depth in one pour.

The mixing of the cement and water paste shall have the consistency of paint capable of coating each coarse aggregate particle uniformly and sufficiently to form a small fillet at all the contact points of each stone in the aggregate.

Between 24 and 48 hours after the no-fines layer has been laid it shall be covered with 1:4 cement and mortar layer 20 mm thick. The mix shall be comparatively dry to ensure that it does not penetrate and block the cavities in the no-fines concrete. The surface shall be steel floated to form a plane surface.

The mortar skim shall be cured in the same manner as concrete for a period of not less than 2 days.”

#### **PSG 5.5.2        Batching**

**Add the following to SANS 1200 G, sub-clause 5.5.2:**

“Batching of all strength concrete shall be by mass. Prescribed concrete may be batched by volume. Batching shall not be done by wheelbarrow.

All concrete shall be mechanically mixed.

Stand-by mixers of adequate capacity and with an independent power unit shall be maintained on site for immediate use in the event of breakdown of the regular mixers failure of the power supply.”

#### **PSG 5.5.3.2 Ready-mixed concrete**

**Replace SANS 1200 G, sub-clause 5.5.3.2 with the following:**

“Concrete from a central concrete production facility other than on the construction site will be permitted if the facility is within a 40 km radius of the site and, apart from test results in terms of SANS 1200 G, sub-clauses 7.3.1, 7.3.2 and/or 7.3.3, test results obtained by such a production facility as part of its quality control system will be accepted for evaluation in terms of SANS 1200 G, sub-clause 7.3.4, provided the cubes are stored and cured on site. All tests to be done by an independent approved laboratory.”

#### **PSG 5.5.5        Placing**

**Add the following new sub-clause to SANS 1200 G, sub-clause 5.5.5:**

##### **\*PSG 5.5.5.10 Casting of concrete in excavation**

“Structural concrete shall not be cast directly against the side of any excavation without the use of formwork unless prior approval has been obtained in writing from the Engineer.

Concrete used in pipe trenches for encasement and for the thrust / anchor blocks may be cast directly against the side of the excavation.

After vibration, the concrete shall be spaded in corners, in angles and against forms to release air bubbles which may have been trapped in these positions.”

#### **PSG 5.5.6        Compaction**



**Add the following to SANS 1200 G, sub-clause 5.5.6:**

“All concrete shall be vibrated with approved internal vibrators of minimum 65 mm diameter and ample power to maintain a speed of at least 7000 rpm when immersed. Electrically driven vibrators shall be used when practicable. Smaller diameter vibrators may be used subject to the approval of the Engineer where areas of rebar congestion restrict the use of large diameter vibrators.

Vibrators shall be inserted only at a sufficient distance from the sloping face of an advancing layer to prevent undue slumping or flow of the face.”

**PSG 5.5.7 Construction joints**

**PSG 5.5.7.1 General**

**Add the following to SANS 1200 G, sub-clause 5.5.7.1:**

“The edge of joints, exposed to view in the finished structure, shall be formed with suitable beads to provide a straight edge true to line and level.

All joints, other than expansion, contraction and other movement joints shall be treated as follows:

As soon as practical, but not before 15 hours after placing, the construction joint surface shall be prepared to receive fresh concrete. This preparation, as specified in SANS 1200 G, sub-clauses 5.5.7.3 (a) to (d), shall be such as to remove all laitance or inert and strengthless material which may have formed and the specified chipping or sand blasting shall be such as to produce a roughened surface all over.

When concreting is interrupted concrete surfaces shall be protected from the sun as specified in SANS 1200 G, sub-clause 5.5.8 (d) or by means of hessian kept damp until concreting is resumed.

All constructional joints shall be dealt with as specified in PSG 5.5.7.3, as amended.

Unless construction joints between designated joints shown on the drawings are authorized by the Engineer in writing, concrete in the floor and wall shall be cast continuously between the designated joints shown on the drawings.”

**PSG 5.5.7.2 Formed joints (generally vertical or near vertical)**

**Add the following to SANS 1200 G, sub-clause 5.5.7.2:**

“Formed joints will be considered to be designated joints as defined in SANS 1200 G, sub-clause 2.4.3. The forming of a straight edge to a construction joint as specified in PSG 5.5.7.1, as amended, does not constitute a formed joint.

Each joint shall be formed as shown on the drawings, complete with shear key rebates, waffle formwork, V-feature, waterstops, "Flexcell" or equal, approved joint filler, dowel bars and their PVC tubes, etc. as indicated.

(a) Construction joints in walls and footings

Walls shall not have vertical joints.

The pump station foundation floor shall be cast without construction joints.

(b) Construction joints in floor

Construction joints in the floor are only permitted where indicated on the drawings.

(c) Expansion and contraction joints

Expansion and contraction joints shall be constructed as detailed on drawings using PVC or rubber water stops. Water stops extruded from recycled material shall not be permitted.

Prior to bandaging, concrete surfaces shall be scabbled with a mechanical scabbler and water jetted with a 120 bar water jet. All joints shall be butt jointed and patched over.

The waterproofing bandage shall comprise of either a 150mm (w) x 2mm (t) or a 200mm (w) x 2mm (t) Modified Polyolefin (FPO) waterproofing bandage bonded to the concrete (for both expansion joints and contraction joints), where indicated on drawings.

The bandage shall be applied by coating the concrete and underside of the Modified Polyolefin (FPO) waterproofing bandage with an epoxy adhesive, all trapped air shall be eliminated by hand rolling the bandage until the epoxy is fully cured. The bandage shall be installed by an experienced Contractor that has been certified for installation by the supplier of the bandage.

Payment shall be per linear meter. The rate shall cover all costs for the supply and application of water stops and bandaging.

Expansion and contraction joints shall be formed true to line in smooth formwork.

All surfaces shall be thoroughly cleaned of all accretions of concrete or other foreign matter by scraping or other approved means.

Particular care shall be taken to compact the concrete around water stops, edges, etc.

For the construction of concrete pavements, no construction joints other than those indicated on the drawings will be allowed. Sufficient concrete shall be on site prior to casting a panel. Where there is insufficient concrete to complete a panel, the surplus concrete shall be removed from site and shall not be paid for"

**PSG 5.5.7.3 Non-designated joints**

**Add the following to SANS 1200 G, sub-clause 5.5.7.3:**

"Any non-designated joints shall be identical to designated joints, as shown on the drawings, which would be used in similar positions and shall perform the same function."

**Add the following new sub-clause to SANS 1200 G, sub-clause 5.5.7:**

**\*PSG 5.5.7.4 Joints between footings or floors and walls or columns**

“Construction joints between foundations, footings or floors and walls, columns or piers connected to them, shall not be made flush with the supporting surface, but shall be made at a distance above the footing or floor shown as on the drawings or approved by the Engineer. The "kicker" shall be cast as an integral part of the foundation, footing or floor.”

**\*PSG 5.5.7.5 Application of primers and adhesives**

“The concrete to which the primer or adhesive is to be applied shall be dry and shall be cleaned of all dust, grit, grease, surface laitance and foreign matter by compressed air and/or water, solvents, or other suitable approved means. The Contractor shall provide on Site an approved moisture meter to measure the degree of dryness of the joint. This meter shall be made available to the Engineer for testing. The joint shall be approved for the application of the primer and adhesive if the moisture content of the concrete is less than or equal to 5%. It may be necessary to dry the concrete surfaces locally to reduce the moisture content to 5% or less.”

**\*PSG 5.5.7.6 Contraction and expansion joints**

“Contraction and expansion joints shall be formed true to line in smooth formwork.

All surfaces shall be thoroughly cleaned of all accretions of concrete or other foreign matter by scraping or other approved means.

Particular care shall be taken to compact the concrete around waterstops, edges, etc.

Rebates for seals shall be formed to required dimensions and lines, or cut true to line and size after floating the surface and before the final set of the cement has taken place. All rebates, etc., shall be adequately protected against damage until the completion of the work; accidental damage which in the opinion of the Engineer will impair the performance or appearance of the joint shall be made good by reconstructing the work as directed by the Engineer. Rebates for seals shall be grit blasted or wire brushed on all faces to remove surface laitance and thoroughly cleaned with soft brushes and/or compressed air jets, and, if necessary, dried by blow-lamp or other approved means before priming.”

**\*PSG 5.5.7.7 Installation of waterstops in joints**

“Waterstops shall be held in the formwork so as to prevent air pockets forming underneath them. Special precautions shall be taken, to the approval of the Engineer, to ensure that all flexible waterstops are in perfect contact with well compacted void-free concrete. The Contractor shall provide satisfactory supervision of such vital operations.”

**\*PSG 5.5.7.8 Installation of joint filler in expansion joints**

“Joints in the filler shall be neatly butted so as to exclude mortar from the joint. Edges of filler strip against waterstops, concrete, formwork, projections, etc., shall also be closely fitted to exclude mortar, so that there is no resistance (other than the compression of the filler) to the expansion movement for which the joint is designed.

Joint filler shall be fixed to the first cast of concrete with an approved adhesive and as directed by the Engineer.”

**\*PSG 5.5.7.9 Application of joint seals**

“Rebates shall be cleaned, Application of primers and adhesives, and shall be inspected and approved by the Engineer before filling.

Joint sealants and primers shall be applied strictly in accordance with the manufacturer's instructions. Flow and non-slumping grades shall be used for horizontal and vertical joints respectively.

Immediately after the compound is applied the joint shall be protected against damage until completion of the Contract.

**\*PSG 5.5.7.10 Contraction and expansion joints to Concrete Pavements**

“The following types of joint shall be constructed in the positions indicated on the drawings:

- a) Construction joint with dowel bar
- b) Construction joint without dowel bar
- c) Contraction joints

All joints shall be formed or cut (as appropriate) true to line.

Construction joints shall be formed using smooth formwork. Rebates shall be formed to required dimensions and lines. All rebates, etc., shall be adequately protected against damage until the completion of the work; accidental damage which in the opinion of the Engineer will impair the performance or appearance of the joint shall be made good by reconstructing the work as directed by the Engineer. Dowels for construction joints shall be placed horizontally and shall be perpendicular to the joint. The dowels shall be coated with the specified bond breaker to allow movement of the panels.

Rebates shall be cleaned and shall be inspected and approved by the Engineer before applying the bond breaker.

Contraction joints shall either be formed in the concrete or shall be cut within 24 hours of casting the concrete.

The joints shall be sealed using an approved highway sealant where indicated on the drawings.”

**PSG 5.5.8 Curing and protection**

**Add the following new sub-clauses to SANS 1200 G, sub-clause 5.5.8:**

**\*PSG 5.5.8.1 Post-Crystallization (Concentrate & Modified) slurry coat and curing**

“The Concrete surfaces to receive a concentrate slurry coat treatment shall have an open capillary system to provide ‘tooth and suction’, and shall be free from scale, excess form oil, laitance, curing compounds and foreign matter.

In order to improve the effectiveness of the crystallization treatment, the specified minimum time for the removal of the formwork shall be three days. All surfaces shall be pressure cleaned in accordance to the product manufacturer’s requirement to remove all oil, laitance, curing compound and foreign matter.

Concrete surfaces must be thoroughly saturated with clean water prior to application in order to ensure the growth of the crystalline formation deep within the pores of the concrete. Wetting to be done must be at least 1hr before application. If concrete surface dries out before application, it must be re-wetted.

The concentrate slurry is applied at a coverage rate of 1kg/m<sup>2</sup> using a semi-stiff nylon bristle block brush – work slurry well into the surface, filling surface pores and hairline cracks. The coating must be uniformly applied at approximately 1.25 mm thickness. The second modified slurry coat with the same application rate must be applied within 48 hours of the first coat. Light pre-watering between coats may be required when drying out signs appear. Detail coating applications shall be confirmed by the manufacturing.

Cure by spray for minimum of 3 days must be established once the final coat has been applied. Protect from rainfall, puddling of water, wind & frost for at least 48 hours after application. When plastic sheeting is used as protection allowance must be made for the coating to breathe.”

**\*PSG 5.5.8.2 Curing for normal concrete surfaces**

“The use of membrane curing compounds will be allowed on vertical faces or steeply inclined faces (i.e. steeper than 45° to the horizontal) of cast in situ members of the structures subject to the Contractor producing sufficient, satisfactory cube crushing strength test results where the crushing strength of cubes which have been cured with the proposed curing membrane and left exposed to the elements are compared with those of an equal number of water cured cubes. The crushing strength of cubes cured with the proposed membrane shall be at least 85% of the crushing strength of the water cured cubes.

Before any membrane curing compound is used, each batch shall be tested on a trial surface to ensure that it forms a satisfactory membrane, and any compound which is unsatisfactory in the opinion of the Engineer, shall be rejected. Curing membranes will be disallowed if permanent discolouration of the concrete takes place. Surfaces where curing membranes are used shall be treated in such a manner that the final concrete texture and colour blends in with the rest of the concrete work. Furthermore, the Engineer shall, at his discretion, require the Contractor immediately to adopt an effective alternative means of curing any area of the structure to which a

membrane has been applied which, in the opinion of the Engineer, is unsatisfactory. The curing compound used shall be to the approval of the Engineer. Wax based curing compounds will not be permitted.

The curing compound shall be applied immediately as formwork is progressively stripped or, in the case of unformed surfaces, when the concrete has taken its initial set. It shall preferably be applied by spraying and the rate of application shall be strictly in accordance with the manufacturer's recommendations. A method of monitoring the area to which curing compound has been applied and the application rate shall be as approved by the Engineer and rigidly applied by the Contractor.

Surfaces of joint rebates, where elastomeric sealant is to be applied, shall be protected from contamination by curing compound by the use of masking tape."

#### **PSG 5.5.9 Adverse weather condition**

**Replace SANS 1200 G, sub-clause 5.5.9.2 with the following:**

"No placing of concrete shall take place if the ambient temperature is below 5°C, or exceeds 32°C, or is likely to drop below 5°C or is likely to rise to above 32°C during the casting period or within eight hours after casting is completed.

If concrete is to be cast during times of high ambient temperature or hot drying winds, the Contractor shall be responsible for taking the necessary steps to keep the placement temperature as low as possible. Such steps include the spraying of the coarse aggregate with water, the painting of silos with a reflecting aluminium paint, the insulation of tanks and pipelines, and the protection of concrete ingredients against the direct rays of the sun. The area of the pour shall be shaded before and during concreting and the concrete shall be shaded from the time of mixing until eight hours after placing.

Windbreaks shall be erected if necessary."

#### **PSG 5.5.10 Concrete surfaces**

**Replace SANS 1200 G, sub-clause 5.5.10 with the following:**

##### **PSG 5.5.10.1 Screeded finish**

"After placing and compacting the concrete on a top (unformed) surface shall be struck off with a template to the designated grades and tamped with a tamping board to compact the surface thoroughly and to bring mortar to the surface, leaving the surface slightly ridged but generally at the required elevation. No mortar shall be added, and noticeable surface irregularities caused by the displacement of coarse aggregate shall be made good by re-screeding after the interfering aggregate has been removed or tamped."

##### **PSG 5.5.10.2 Wood-floated finish**

“Where wood-floating is ordered or scheduled, the surface shall first be given a finish as specified in PSG 5.5.10.1, Screeded finish, as amended, and, after the concrete has hardened sufficiently, it shall be wood-floated, either by hand or machine, only sufficiently to produce a uniform surface free from screeding marks.”

#### **PSG 5.5.10.3 Steel-floated finish**

“Where steel-floating is specified or scheduled, the surface shall be treated as specified in PSG 5.5.10.1, Screeded finish, as amended, except that, when the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance from being worked to the surface, the screeded surface shall be steel-trowelled under firm pressure to produce a dense, smooth, uniform surface free from trowel marks.”

#### **PSG 5.5.10.4 Brushed finish**

“Where brushed finish is specified or scheduled, the surface shall be treated as specified in Sub-clause PSG 5.5.10.1, as amended, Screeded finish except that, when the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance from being worked to the surface, the screeded surface shall be finished/brushed by dragging a broom across the surface of the concrete in order to obtain a non-slip surface.”

#### **PSG 5.5.10.5 Power-floated finish**

“Where a power-floated finish is specified, the surface shall be trowelled smoothly with a well-balanced power trowel. Care shall be taken to ensure the surface is trowelled when it is at the optimum trowelling consistency.”

#### **PSG 5.5.10.6 Rough finish**

“In certain special cases where a rough finish is desired or specified on the drawings, the surface shall be screed-tamped to an approximately even dense surface, and shortly after final set of cement the surface shall be wire broomed and washed down to remove any laitance, leaving a clean rough surface with coarse aggregate partially exposed, but not disturbed.”

#### **PSG 5.5.10.7 Granolithic screeds**

“Granolithic screed shall consist of:

Cement	1 part by mass
Sand	1,25 parts by mass
Coarse aggregate	2 parts by mass

The coarse aggregate shall consist of granite or other approved chips which shall pass a 10 mm sieve and be retained on a 5 mm sieve.

The cement/water ratio of the mix shall be at least 2,0.

Before placing any granolithic screeds the base concrete shall be chipped to expose the aggregate over 100% of the area to be screeded and soaked with water for at least 24 hours.

The base concrete shall be thoroughly cleaned by scrubbing and all standing water removed after soaking. A 1:2 cement/sand grout shall then be brushed into the prepared surface followed by the granolithic screed before the grout sets. The granolithic screed shall be of the driest feasible consistency with a slump not exceeding 50 mm and shall be formed true to profile and shape as required and shown on drawings. Before placing granolithic screed against an adjacent band of granolithic screed, the edge of the latter shall be prepared by chipping back to firm material, wire brushing and brushing with grout as for the base concrete.

Granolithic screed shall be compacted to remove all air and shall be screeded and finished with a steel trowel to Degree of Accuracy 1.

The trowelling shall be carried out in the following stages:

- a) First - as soon as the granolithic screed has been compacted and screeded.
- b) Second - after 2 hours to close the surface and remove laitance.
- c) Third - after a further 4 hours.

The time intervals are estimated as appropriate to normal temperature conditions and shall be varied by the Contractor to ensure a smooth dense finish.

Granolithic screed shall be cured as specified in PSG 5.5.8, as amended, but shall additionally be protected from direct sunlight and drying winds as it is being placed.

All screeding necessary to accommodate mechanical equipment shall be done under the equipment supplier's supervision and in strict accordance with his instructions. It shall be commenced as soon as the equipment supplier gives notice on completion of erection and shall be finished expeditiously."

#### **PSG 5.5.11 Watertight concrete**

**Add the following to SANS 1200 G, sub-clause 5.5.11:**

"The floors, walls below ground level and roofs of all water retaining structures shall be considered to be watertight concrete structures.

Ground water excluding structures such as dry wells shall also be watertight concrete structures.

Concrete to manholes shall be watertight concrete."

#### **PSG 5.5.13 Grouting**

**Add the following new sub-clause to SANS 1200 G, sub-clause 5.5.13:**

**\*PSG 5.5.13.1 Grouting in pipe specials after core drilling of existing structure**



“All stainless steel pipe specials to be grouted into position must be to line and level as shown on drawings. The level of the pipe special must be verified on site with the Engineer before grouting in may commence.

Prior to the placing of any grout, the surface of the existing concrete shall be prepared as specified in the application requirements of the grout. Non-shrink grout shall be used and a water tight seal must be guaranteed. The grout must also be able to withstand the corrosive environment of raw sewage. The Contractor must submit product details and a method statement regarding the grouting, for the approval of the Engineer, before any grouting may commence.

The Contractor shall, where so ordered, carry out a site test for each grouting procedure and each grouting gang to be used. The tests shall be carried out on a dummy core drilled opening similar in configuration to that which is to be grouted, but not exceeding 1 m<sup>2</sup> in area unless otherwise ordered. The test shall show evidence of good workmanship and materials and the results shall be to the satisfaction of the Engineer.

The Contractor shall, when so ordered, make standard test cubes from various grout mixtures and also subject them to compression tests to determine whether the specified strength has been achieved.

Test procedures shall comply with the relevant requirements of SANS 1200 G, sub-clause 7.2.1 to 7.2.3.”

#### **PSG 5.5.14 Defects**

##### **Add the following to SANS 1200 G, sub-clause 5.5.14:**

“All defects shall be repaired as soon as possible after the formwork has been removed and the Engineer has inspected the concrete. A statement of the method to be used for each repair shall be submitted to the Engineer for his approval before any work is carried out. The Engineer may prohibit the further placing of concrete in the particular area concerned until he is satisfied that the repair has been satisfactorily executed.

Honeycombed or otherwise defective concrete shall be cut out, together with part of the sound concrete, as directed by the Engineer; anchor reinforcement drilled into holes into sound concrete shall be provided if and as ordered by the Engineer. The cavities shall then be filled in flush in accordance with a repair procedure as approved by the Engineer.

Exposed corners, etc., which are patched shall be bonded to sound concrete by approved epoxy resin or similar bonding agents applied in accordance with the manufacturer’s instructions. An approved experienced specialist sub-Contractor shall be employed for critical work, such as the above, if directed by the Engineer.

Special care shall be taken to ensure that any repair exactly matches the formed surface in colour and texture.

No patching or filling of surface defects other than air holes shall be permitted. If the exposed surface has defects which are in the opinion of the Engineer detrimental to the desired architectural effect, that cast of concrete shall be removed and reconstructed at the Contractor's cost; any adjacent casts damaged in this process shall also be reconstructed."

**Add the following new sub-clauses to SANS 1200 G, sub-clause 5.5:**

**\*PSG 5.5.16 Items to be cast in or grouted into concrete**

**\*PSG 5.5.16.1 Casting pipes and specials in concrete**

"Where the pipe or special is supplied by others or where ordered by the Engineer, the Contractor shall provide a box-out in the wall and cast the unit in at a later stage. When constructing such box-outs reinforcement shall not be cut but shall run through the opening. Reinforcement shall be cut and/or bent out at a later stage to suit the item being cast in. After installation of the item the remaining reinforcement shall be bent back in position.

Where entry holes for pipes/specials have been provided in the walls, the Contractor shall be responsible for the concreting in of such pipes/specials regardless of whether or not these have been supplied by himself.

Before commencing the positioning in holes of any pipes/specials the Contractor shall:

- a) remove all formwork and boxing remaining in the holes;
- b) make any alternations required to the position and shape of the holes and cut reinforcement to suit the item, as directed by the Engineer; and
- c) thoroughly scabble the sides of the holes so as to obtain a satisfactory bond surface for the new concrete and treat the surface as specified.

Immediately prior to the placing of mortar and concrete around the pipes, the surface of the existing concrete shall be saturated with water. All surplus water shall be removed and the surface covered with a layer, approximately 12 mm thick, of mortar made of the same mix as the concrete in which the pipes/specials are to be placed.

The concrete ingredients shall be mixed and placed as dry as possible to obtain a dense, waterproof concrete. The concrete shall be carefully worked around the puddle flange, if any, and the pipe barrel or body of the special, and shall be vibrated in layers so as to obviate a falling away from pipe/special surfaces of the concrete already placed. The whole shall, when set, form a dense, homogeneous, and waterproof mass."

**\*PSG 5.5.16.2 Fixings for equipment supplied under separate contract**

- a) The Contractor will be responsible for the forming of pockets to the details shown on the drawings to accommodate holding down bolts for equipment supplied under a separate contract. Holding down bolts will be supplied by and positioned by others.

- b) After casting of the concrete all shuttering shall be removed and the sides of the bolt holes and surface on which the machine base is to be placed shall be scabbled to remove all defective concrete, laitance, dirt, oil, grease and loose material.
- c) Upon completion of the positioning and alignment of equipment and when instructed by the Engineer the Contractor shall in collaboration with the mechanical Contractor, grout up pockets and baseplates by filling pockets and voids under the baseplates with an approved non-shrink grout.

**\*PSG 5.5.16.3 Fixings for items supplied under this Contract**

“Holding down bolts or other fixings required for the installation of items supplied under this Contract shall be provided by the Contractor. These fixings shall be cast in or grouted into pockets or installed by other means as approved by the Engineer.

Where anchor bolts are used which are installed into holes drilled into concrete or masonry these shall be of a type approved by the Engineer. All such bolts used shall be manufactured from stainless steel or a metal with a resistance to corrosion equal to that of grade 304 stainless steel. The metal used for bolts shall be compatible with galvanized mild steel.

Anchor bolts shall have minimum pull-out forces and minimum ultimate lateral loads at least equal to those specified below:”

Specified Size	Anchor	Minimum Pull-out Force (kN)	Minimum Ultimate Lateral Load (kN)
M6		10,35	7,60
M8		13,70	11,15
M10		19,44	15,95
M12		31,85	26,90
M16		50,45	45,80
M20		60,50	71,20

**\*PSG 5.5.16.4 Plastic puddle pipe items supplied under this Contract**

“Plastic puddle pipe cast-in fittings as indicated per drawing required for the installation of items supplied under this Contract shall be provided by the Contractor. These fittings shall be cast in or grouted into pockets or installed by other means as approved by the Engineer.

All such fittings shall be manufactured from uPVC CLASS 16 according to the drawings in accordance with SANS 966. The welded puddle shall be governed in accordance with standards DVS 2207 and SANS 10268. All welded items shall be issued with an accredited quality certificate from an accredited manufacturer.”

**\*PSG 5.5.17 Supervision**

“The Contractor shall be responsible for ensuring that the erection of the concrete work is carried out under the supervision of a person with adequate knowledge of the mixing, transporting, placing and curing of concrete.”

**\*PSG 5.5.18 Programme and Plant**

“Prior to carrying out any concrete work, the Contractor shall obtain the approval of the Engineer in respect of:

- a) Structural programme,
- b) Concrete plant details,
- c) Materials to be used in concrete,
- d) Details of concrete
- e) Construction joints”

**\*PSG 5.5.19 Core drilling into existing structures to fix pipe specials**

**\*PSG 5.5.19.1 Core drilling into existing structures**

“The existing structures shall be core drilled to the line and level as indicated on the drawings. The position of the core must be verified on site with the Engineer before drilling may commence. The diameter of the core to be drilled shall be 100mm more than the diameter of the pipe special’s puddle to be grouted into place. This shall ensure adequate space for the insertion of the grouting material. The size of the pipe’s puddle to be verified on site after manufacture and the size of the core to be drilled must also be verified on site with the Engineer before drilling may commence.”

**\*PSG 5.5.19.2 Substrate preparation**

“In general, the substrate surface must be sound and clean. All loose material shall be removed mechanically with a wire brush or by high pressure water jetting or blasting. The sides of the holes shall thoroughly be scabbled to obtain a satisfactory bond surface. Embedded reinforcement steel shall be free from scale, rust, oil and grease and shall be treated with a suitable protective coating and bonding agent.”

**\*PSG 5.5.19.3 Reinforcement repair systems**

“The exposed reinforcement steel shall be treated with SikaTop Armatec 110 EpoCem (or similar approved product) for protection against corrosion and to act as a bonding agent. The product shall be applied in two phase:

- a) Two layers of 1 mm thick layers for corrosion protection
- b) 1.5 – 2.0 kg/m<sup>2</sup> as a bonding agent

The product shall be applied in accordance with the manufacturer’s specifications.”

**\*PSG 5.5.19.4 Breaking into, cutting and removal of existing structures**

“The existing structures shall be saw cut carefully to the extremities indicated on the drawings plus allowing for an additional 25 – 50 mm to ensure that the cover to reinforcement is maintained.”

## **PSG 6 TOLERANCES**

### **PSG 6.2 Permissible deviations**

#### **PSG 6.2.3 Specified permissible deviations**

**Add the following sub-clause:**

“h) For the concrete slabs of concrete pavements, the permissible tolerances shall be as specified for asphalt surfacing in SABS 1200 MH: Asphalt base and surfacing in the following subclauses:

- SABS 1200 MH, subclause 6.3.5: Cross section
- SABS 1200 MH, subclause 6.3.6: Smoothness (Degree of accuracy II)

## **PSG 7 TESTS**

### **PSG 7.1.2 Frequency of sampling**

**Add the following to SANS 1200 G, sub-clause 7.1.2.1:**

“One sample shall consist of three concrete test cubes.

For each sample taken the position in the structure shall be recorded where the batch represented by that sample is placed as also the date sampled.”

**Replace SANS 1200 G, sub-clause 7.1.2.2 with the following:**

“At least 2 samples shall be taken per day from every 0 m<sup>3</sup> to 10 m<sup>3</sup> of concrete of each grade placed. At least 4 samples shall be taken per day from every 10 m<sup>3</sup> to 20 m<sup>3</sup> of concrete of each grade placed. At least 6 samples shall be taken per day from concrete of each grade placed in excess of 20 m<sup>3</sup>.”

### **PSG 7.2 Testing**

**Add the following new sub-clause to SANS 1200 G, sub-clause 7.2:**

#### **\*PSG 7.2.5 Testing watertight concrete**

“The watertightness of the water retaining structures shall be tested as follows:

On completion of a water retaining structure it shall be cleaned and shall be filled with water at an approved rate. After allowing a period of absorption of 3 days, the depth of water shall be recorded and the water allowed to stand for a further 7 days during which the total permissible drop in water level after allowing for evaporation should not exceed 10 mm.

In the event of any leakage or dampness being evident at any stage of the filling or testing or in the event of the Engineer considering the final degree of watertightness to be unsatisfactory, the Contractor, when ordered by the Engineer, shall discontinue such filling or testing and shall, at his own expense, take approved steps immediately to rectify the leakage and to make the work thoroughly sound to the complete satisfaction of the Engineer. All such work of rectification shall be continued assiduously until a satisfactory test is obtained, which shall prove to the Engineer that watertightness has been obtained.

If required by the Engineer, the structure shall be retested before the expiry of the Defects Liability Period.

The Works will not be certified complete until the structure has been proved by testing to be watertight to the satisfaction of the Engineer."

### **PSG 7.3            Acceptance criteria for strength concrete**

**Add the following new sub-clause to SANS 1200 G, sub-clause 7.3:**

#### **\*PSG 7.3.6        Grouting**

"The Contractor shall, where so ordered, carry out a site test for each grouting procedure. The tests shall be carried out on a dummy bedplate similar in configuration to that which is to be grouted, but not exceeding 1 m<sup>2</sup> in area unless otherwise ordered. When the dummy bedplate is dismantled, the underside shall show a minimum grout contact area of 80% with reasonably even distribution of the grout over the surface grouted except that, in the case of expanding grout, the minimum grout contact area shall be 95%. The test shall show evidence of good workmanship and materials and the results shall be to the satisfaction of the Engineer.

The Contractor shall, when so ordered, make standard test cubes from various grout mixtures and also subject them to compression tests to determine whether the specified strength has been achieved. Test procedures shall comply with the relevant requirements of SANS 1200 G, sub-clauses 7.2.1 to 7.2.3."

### **PSD 8            MEASUREMENT AND PAYMENT**

#### **PSG 8.1.1        Formwork**

**SANS 1200 G, sub-clause 8.1.1 to include payment for:**

PSG 4.5.3	Ties
PSG 5.2.1	Classification of finishes
PSG 5.2.2	Preparation of formwork

**Add the following new sub-clauses to SANS 1200 G, sub-clause 8.1.1:**

#### **\*PSG 8.1.1.7    Edges of blinding layer**

“No separate payment will be made for formwork to the edge of the blinding layer. The rates tendered for concrete to the blinding layer shall cover the cost of such formwork.”

**\*PSG 8.1.1.8 Chamfers and fillets**

“No additional payment will be made for chamfers and fillets up to 40 mm wide. Larger fillets and chamfers will be measured by length in accordance with SANS 1200 G, sub-clause 8.2.5.”

**PSG 8.1.2 Reinforcement**

**SANS 1200 G, sub-clause 8.1.2 to include payment for:**

PSG 5.1.2 Fixing

**Add the following to SANS 1200 G, sub-clauses 8.1.2.2 and 8.1.2.3:**

“Notwithstanding the method of measuring and paying for reinforcement specified in SANS 1200 G, sub-clauses 8.1.2.2 and 8.1.2.3, reinforcement will be measured and paid for as scheduled.”

**PSG 8.1.3 Concrete**

**SANS 1200 G, sub-clause 8.1.3 to include payment for:**

PSG 3.2.1 Cement: Applicable specifications  
 PSG 3.2.3 Storage of cement  
 PSG 3.3 Water  
 PSG 3.4.1 Aggregates: Applicable specification  
 PSG 3.4.2 Use of plums  
 PSG 3.5 Admixtures  
 PSG 4.3.1 General requirement for mixing plant  
 PSG 4.4 Vibrators  
 \*PSG 4.6 Water-bath  
 PSG 5.5.1.1 Quality: General  
 PSG 5.5.1.4 Chloride content  
 PSG 5.5.1.5 Durability  
 PSG 5.5.1.6 Prescribed mix concrete  
 PSG 5.5.1.7 Strength concrete  
 PSG 5.5.2 Batching  
 PSG 5.5.3.2 Ready-mixed concrete  
 PSG 5.5.5.10 Casting of concrete in excavation  
 PSG 5.5.8.2 Curing for normal concrete surfaces  
 PSG 5.5.9 Adverse weather conditions  
 PSG 5.5.11 Watertight concrete  
 PSG 5.5.14 Defects  
 PSG 7.1.2 Frequency of sampling

**PSG 8.2            Scheduled formwork items**

**Add the following new payment item to SANS 1200 G, sub-clause 8.2:**

**\*PSG 8.2.7           Kickers .....Unit: m<sup>2</sup>**

“Formwork to the edges of kickers will be measured as plane (or circular) vertical (not as narrow widths).”

**\*PSG 8.2.8                    Form slots for sluice and channel gates.....Unit: No**

“Where a sluice or channel gate is to be installed with a flush invert, slots or rebates as per the manufacturer’s specifications, shall be formed in the concrete.

The rate shall cover for the installation of all formwork to form the specified slots or rebates.”

**PSG 8.4            Scheduled concrete items**

**PSG 8.4.4            Unformed surface finishes**

**Add the following to SANS 1200 G, sub-clause 8.4.4:**

“The rates for unformed surface finishes shall cover the cost of providing the respective surface finish as specified in PSG 5.5.10, as amended, Concrete Surfaces.”

**PSG 8.5            Joints**

**Add the following to SANS 1200 G, sub-clause 8.5:**

“Only designated joints as shown on the drawings will be measured for payment according to the length of each type of joint constructed. The rate shall cover the cost of all materials, labour and plant required to construct each type of joint specified on the drawings, including the cost of all shuttering, treatment of the joint as specified in SANS 1200 G, sub-clause 5.5.7.3 and PSG 5.5.7.3, as amended, the provision of chamfers as specified where concrete is exposed, as well as testing and repairing where necessary.

Non-designated joints will not be measured for payment.”

**SANS 1200 G, sub-clause 8.5 to include payment for:**

*PSG 3.9	Materials for movement joints
PSG 5.5.7	Construction joints

**Add the following new payment items to SANS 1200 G, sub-clause 8.5:**

**\*PSG 8.5.1           Formed joints .....Unit: m**



“Formed joints will be measured by the length of the joint.

The rates shall cover the cost of all operations and materials specified in PSG 5.5.7, as amended, and PSG 5.5.7.2, as amended, and detailed on the drawings such as joint filler, dowel bars and tubes, bitumen coats, waterstops or waterbars, etc.”

#### **PSG 8.7            Grouting**

**Add the following to SANS 1200 G, sub-clause 8.7:**

“Grouting of base plates and equipment bases will be measured by the volume of grout used.

The rate shall cover the cost of the supply and floating in of grout under the plates to ensure solid and complete filling of the gap.

Grouting in of pipe specials after core drilling of existing structure will be measured by volume of grout used.

The rate shall include all necessary costs for the supply and floating in of grout for the sealing of the pipe specials to line and level, as described in PSG 5.5.13.1.”

**SANS 1200 G, sub-clause 8.7 to include payment for:**

- \*PSG 5.5.13.1    Grouting in of pipe specials after core drilling of existing structure
- \*PSG 5.5.16.2    Fixing of equipment supplied under separate contract
- \*PSG 5.5.16.3    Fixing for items supplied under this Contract
- \*PSG 7.3.6        Grouting

#### **PSG 8.8            HD Bolts and miscellaneous Metal Work**

**Add the following to SANS 1200 G, sub-clause 8.8:**

“Fixing of holding down bolts will be measured by number. The rate shall cover the cost of all things necessary to ensure that the bolts are effectively and rigidly held in position during casting, complete with sleeved pockets, all as detailed on the drawings.”

**Add the following new payment items to SANS 1200 G, clause 8:**

**\*PSG 8.9            No-fines concrete .....Unit: m<sup>2</sup>**

“No-fines concrete will be measured by area.

The rate shall cover the cost of supplying materials, constructing and placing in position and compaction of the no-fines concrete as specified in PSG 5.5.1.7, Strength concrete, as amended, and shall include for the steel floated 20 mm mortar skim to the approval of the Engineer.”

**\*PSG 8.10      Items cast in concrete .....Unit: No.**

“Items cast in concrete will be measured by number separately for each type of item.

Notwithstanding SANS 1200 G, sub-clause 8.2.6, the rate shall cover the cost of fixing in position and casting in the item as construction proceeds, irrespective of whether the Contractor chooses to fix the item in the formwork and cast it in directly or to box out a hole and grout the item in subsequently. The rate is to include payment for \*PSG 5.5.16.1, Casting pipes and specials in concrete, and \*PSG 5.5.16.4, Plastic puddle pipe items supplied under this Contract.

The rate for the puddle pipes shall cover the cost of all things necessary to ensure that the fitting are effectively and rigidly held in position during casting including the certification and all as detailed on the drawings. Repairs for leaking cast in items will not be paid for.”

**\*PSG 8.11      Granolithic screeds.....Unit: m<sup>2</sup>**

“Special floor finish will be measured by area. The rate shall cover the cost of the supply and application of the specified material, complete as specified by the manufacturer and to the approval of the Engineer. Repairs to unsatisfactory work will not be paid for.

Measurement of granolithic screeds will be by the surface area covered.

The unit rate or lump sum shall cover the cost of all materials, labour and equipment required to provide the screed as specified in PSG 5.5.10.7, Granolithic screeds. The rate shall include the steel float finish.”

**\*PSG 8.12      Precast paving slabs.....Unit: m<sup>2</sup>**

“Precast paving slabs will be measured by the area paved.

The rate shall cover the cost of compacting the area, application of weed-killer, supplying, laying and bedding the slabs, grouting the joints and filling any gaps, all as specified in \*PSG 3.10, Precast paving slabs.”

**\*PSG 8.13      PFA concrete.....Unit: m<sup>3</sup>**

“Measurement and payment for PFA concrete shall be as specified in PSG 8.1.3, Concrete, as amended.

The tendered rate shall cover all costs in connection with the supply, storage, handling on site and mixing in of PFA.”

**\*PSG 8.14      Watertightness test.....Unit: No.**

“The watertightness test will be paid by a lump sum separately for each structure.

The sum shall cover the cost of all labour, equipment and materials including provision of water to carry out the tests, as specified in \*PSG 7.2.5, Testing watertight concrete, to rectify faults and to achieve a test result to the satisfaction of the Engineer."

**\*PSG 8.15 Bond Breaker.....Unit: m<sup>2</sup>**

"Where a 250 micron black plastic continuous layer is to be laid over the no-fines concrete under floor slabs, the side and end laps shall not be less than 100mm. Just before casting the sheeting shall be perforated in a grid pattern at 1 m centres.

Care shall be taken not to rip or tear the sheeting. All repairs shall be at the Contractor's expense.

The rate shall include payment for \*PSG 3.9.4, Bond breakers, primers and sealants."

**\*PSG 8.16 Core drilling into existing structures to fix pipe specials .....Unit: No.**

"The core drilling into existing structures shall be measured per number of cores required. The Bill of Quantities shall state the size of the pipe special which requires core drilling.

The rate shall include all costs for drilling, equipment, substrate preparation, reinforcement repair systems, maintaining the operation of the existing structure, health and safety requirements to work in close vicinity of raw sewage, environmental requirements to prevent, contain and manage any spillages as described in PSG 5.5.19.1, 5.5.19.2 and 5.5.19.3."

**\*PSG 8.17 Breaking into existing structures.....Unit: m**

"The breaking into existing structures shall be paid per meter length of cutting required. The Bill of Quantities shall state thickness of concrete surface to be cut into. The rate shall include all costs for saw cutting and substrate preparation as described in PSG 5.5.19.2, 5.5.19.3 and 5.5.19.4."

**\*PSG 8.18 Durability test.....Unit: Sum**

"The durability test will be paid by a lump sum separately for each structure.

The sum shall cover the cost of all labour, equipment and materials to carry out the tests, as specified in PSG 5.5.1.5, to rectify faults and to achieve a test result to the satisfaction of the Engineer. Durability tests will include tests for Sorptivity, Oxygen Permeability, Chloride conductivity, Concrete Cover and Shrinkage as specified in PSG 5.5.1.5."

**\*PSG 8.19 Slurry coat and curing .....Unit: m<sup>2</sup>**

"Supply & apply waterproof treatment with Xypex Concentrate and Xypex modified to all areas as specified.

The rate shall cover for the supply and surface treatment of specified concrete surfaces according to \*PSG 5.5.8.1, Post-Crystallization (Concentrate & Modified) slurry coat and curing."



## **PSH STRUCTURAL STEELWORK (SANS 1200 H)**

### **PSH 3 MATERIALS**

#### **PSH 3.3 Steel used for cold formed sections**

**Add the following to SANS 1200 H, sub-clause 3.3:**

“The minimum thickness of cold form section shall not be less than 2mm.

Cold formed sections shall only be used for purlins and sheeting rails.”

#### **PSH 3.4 Structural tubular and hollow steel sections**

**Add the following to SANS 1200 H, sub-clause 3.4:**

“The minimum thickness of cold form section shall not be less than 4mm.”

### **PSH 5 Construction**

#### **PSH 5.3 Assembly**

##### **PSH 5.3.4 Welding**

**Add the following to SANS 1200 H, sub-clause 5.3.4:**

“All welds shall be fully continuous and not less than 6 mm across the throat.

No welded connections shall be subjected to moments. Only tensile and shear forces may be applied to welds.”

##### **PSH 5.3.5 Bolting (Other than Friction-grip)**

**Add the following to SANS 1200 H, sub-clause 5.3.5.1:**

“All bolts shall be grade 8.8.

Unless otherwise specified the minimum size of bolts used for holding down and for hot rolled steel connections shall be 16mm. For handrail connections 12mm diameter may be used. Connections to cold formed sections shall not be less than 10mm diameter.”

#### **PSH 5.6 Grouting of supports**

##### **PSH 5.6.2 Preparation**

**Add the following to SANS 1200 H, sub-clause 5.6.2:**

“All base plates shall be mounted a minimum of 20mm above the concrete surface and shall be grouted up using a high strength non-shrink mortar.”

## **PSH 7 TESTING**

### **PSH 7.1 Test Certificates**

**Add the following to SANS 1200 H, sub-clause 7.1:**

“All welds shall be crack tested using die indicators.”

## **PSHA STRUCTURAL STEELWORK (SUNDRY ITEMS) (SANS 1200 HA)**

### **PSHA 3 MATERIALS**

**Add the following under SANS 1200 HA, clause 3:**

“Where the words "Structural Steelwork" appear in the heading and in other relevant Clauses, amend to read "Aluminium, Stainless Steel and Structural Steel".”

#### **PSHA 3.1 Structural steel**

**Add the following to SANS 1200 HA, sub-clause 3.1:**

“All stainless steel items shall be Grade 316 material.

Structural steelwork shall comply with Grade 43 of BS 4360. All steel pipes and specials, irrespective of diameter, shall be fabricated from plain ended pipes. The use of screwed flanges and fittings shall not be permitted, except for use on air-valve assemblies. All fabrication shall take place in a suitable workshop prior to galvanizing, and no cutting or welding of pipes on site shall be permitted.

All aluminium items shall be grade M57S material anodized in accordance with SANS 999 Grade 25.”

#### **PSHA 3.3.1 Bolts and nuts**

**Add the following to SANS 1200 HA, sub-clause 3.3.1:**

“All bolts, nuts and washers within water retaining structures or exposed to the rain, or with a diameter of 10 mm or less, all anchor bolts of any size in concrete or brickwork and all bolts of any size used in conjunction with stainless steel items, shall be manufactured from Grade 316 stainless steel.

All other bolts, nuts and washers with a diameter of 12 mm or greater shall be hot dip galvanized to SANS 10684. Nuts shall be tapped before galvanizing, taking into consideration the extra clearance necessary to allow for the thickness of galvanizing on the bolts. If, after installation, there is any indication that galvanising has been stripped from either the nut or the bolt, both nut and bolt shall be removed and replaced.”

### **PSHA 5 CONSTRUCTION**

#### **PSHA 5.1 Drawings and Shop Details**

##### **PSHA 5.1.2 Contractor to Provide Shop Details**

**Add the following to SANS 1200 HA, sub-clause 5.1.2:**

“The Contractor shall prepare his own shop details based on the dimensions and details given on the drawings and will be required to submit his shop details to the Engineer at least 3 weeks prior to

fabrication. Written consent must be obtained from the Engineer, prior to commencing fabrication. The Contractor is still responsible for ensuring that the shop details are dimensionally correct.”

## **PSHA 5.2 Fabrication And Assembly**

### **PSHA 5.2.5 Bolting**

**Add the following to SANS 1200 HA, sub-clause 5.2.5:**

“All bolts must be of equal length and the length of each bolt shall be such that, after the nut has been tightened, the end of the bolt shall project above the nut by not less than one full thread and not more than three full threads.”

### **PSHA 5.2.6 Handrails**

**Add the following to SANS 1200 HA, sub-clause 5.2.6:**

“Handrails shall also comply with SANS 10104 and shall be designed for access for maintenance purposes.

Handrails shall be designed to resist the loadings set out below in clause 5.4.4.1 of SANS 0160. In accordance with the requirements of SANS 0160, the guard rails shall withstand a nominal design loading which is the more severe of the following:

- a) A force of 1 000 Newtons in any direction (concentrated over a length of 100 mm).
- b) A distributed horizontal force of 500 Newtons per metre applied at the top of the railing.

Handrailing shall be of tubular construction in Hot Dipped Galvanised Mild Steel of an approved proprietary make. Fabrication and welding shall comply with the General Specifications “Fabrication of Steels” and “Welding”. All anchor fasteners, including nuts and washers shall be Hot Dipped Galvanised Mild Steel. Fastener diameter shall not be less than M16.

On platforms, walkways, landings or around dangerous areas the vertical height, measured from the top of the hand rail to the floor or surface, shall be 1 000 mm, with knee rails located approximately midway between. On stairways and fixed ladders the rails shall be parallel to the strings, and the vertical height, measured from the top of the hand rail to the nosing of the tread, shall be not less than 900 mm. No opening between rails shall allow the passage of a ball of diameter 600 mm.

Hand and knee rails shall be not less than 38 mm O.D. (wall thickness not less than 2,5 mm). Stanchions shall be not less than 48 mm O.D. (wall thickness not less than 4,0mm) and shall have ball type or spun and flared connectors to suit horizontal or angled handrailing as required. Stanchions which are hollow shall be self-draining. Stanchions and rails shall be smoothly finished and free from sharp corners, edges and projections which may injure persons or damage clothing. Stanchion bases shall have the corners rounded or sheared off.



Welded handrail installations are preferred. Installations which incorporate bolted sections shall be secure and tight under loading. "Pop" riveted installations will not be acceptable. Joints shall be smoothly finished, without shoulders. Handrails shall be either side or top mounted and shall be fastened with Hot Dipped Galvanised Mild Steel nuts, bolts and washers.

Stanchion feet which are attached to metallic surfaces shall have minimum dimensions of 150 mm X 60 mm X 8 mm. Two fasteners, of minimum size M16, shall be used to secure each foot. Neatly fitting packing, Denso tape or equivalent, shall be fitted under stanchion feet to prevent the formation of crevices.

Stanchion feet which are attached to non-metallic surfaces shall have minimum dimensions of 150 mm X 80 mm X 10 mm. In instances where the horizontal surface to which the foot is to be fastened is less than 150 mm wide, the foot shall be designed to be seated on at least two surfaces. Four fasteners, of minimum size M16, shall be used to anchor the foot. Non shrink, cementitious grout shall be applied under the foot just prior to final tightening of nuts.

Where kickplates are required by legislation, these shall extend to 150 mm above the walkway level.

In general all bends in the hand and knee railing shall be 140 mm radius. Railings shall be ended off with positively fixed closure bends i.e. all ends shall have closures joining the hand and knee railing. At corners, short radius bends with stanchions on both ends shall be employed or, alternatively, stanchions specifically designed for such a position shall be employed. No sharp ends will be permitted.

Spacing between stanchions shall be determined by site conditions but in no case shall it exceed 1 400 mm c/c. At bends, stanchions shall be provided on either side at a distance of 300 mm from mid-bend. Finished handrailing shall be true to line and level and shall be securely fixed.

The rate quoted per metre is to include for the supply and installation of the handrail, knee rail, portion of a stanchion, footing, holding down bolts and nuts and all bends required and is to be inclusive of all cutting, mitring, welding, grinding and waste."

#### **PSHA 5.2.7 Ladders**

**Add the following to SANS 1200 HA, sub-clause 5.2.7:**

"Stairs and ladders are to be provided in accordance with the details shown on the drawings.

The cat ladder to be installed in the Connection Chamber shall be manufactured from stainless steel Grade 316, including all fittings, bolts, nuts, washers, etc. required for fixing the ladder into position."

#### **PSHA 5.2.8 Open Grid Floors**

**Add the following to SANS 1200 HA, sub-clause 5.2.8:**

“Open grid steel flooring i.e. walkway gratings is to be cut and framed to the required panel shapes and sizes all in accordance with the details shown on the drawings.

Open grid steel flooring i.e. walkway gratings to be RS40 gratings, bearer bar 3mm x 40mm (on the short span) and manufactured from Hot Dipped Galvanised Mild Steel. The frame to be cast into the concrete with all associated fittings, etc. shall also be manufactured from Hot Dipped Galvanised Mild Steel.”

#### **PSHA 5.2.10 Protective treatment**

**Replace the last sentence of SANS 1200 HA, sub-clause 5.2.10 with the following:**

“The open grid and chequer plate flooring panels and frames, handrails, ladders and similar items shall be hot-dip galvanized in accordance with the requirements of SANS 1200 HC, sub-clause 5.9.

In addition handrails shall be degreased, primed and painted yellow with two coats of recoatable polyurethane to a minimum total dry film thickness of 70 micrometers after installation.”

**Add the following to SANS 1200 HA, sub-clause 5.2.10:**

“All mild steel shall be hot-dip galvanised except where shown to the contrary on the drawings or in the schedule of quantities. Hot-dip galvanising shall conform to SANS 121:2000 for heavy duty coatings or equivalent. Screwed and socketed tubing shall be galvanised in compliance with BS 1387. Galvanised malleable cast iron fittings shall comply with SABS 509.”

**Add the following new sub-clause to SANS 1200 HA, sub-clause 5.2:**

#### **\*PSHA 5.2.11 Fluid Control Equipment**

“Stainless Steel 316 hand stops shall close drop tight and be manufactured to the dimensions shown on drawings. Fabrication details of hand stops and stop logs shall be submitted to the Engineer for approval before manufacture commences. Hand stops with daylight openings exceeding 0,5 m<sup>2</sup> shall be supplied in equal 250mm stop logs with a neoprene interface seal. The hand stops and stop logs shall be supplied with Stainless Steel 316 frames which are suitable for casting into concrete, and shall, where necessary, be provided with strengthening plates to withstand the pressure of the full water depth. The stop logs shall be provided with resilient water seals under each unit to provide a drop-tight seal.

Channel gates shall be three sided sealing and shall be manufactured from stainless steel, pickled and passivated. Channel gates shall be drop-tight, the side seals shall be Neoprene angle type seals and the bottom seals shall be rectangular compression type seals. Spindles shall be of the rising type. Channel gates shall have flush inverts. The frames shall have embedded sections and separate bolt-on headframes to facilitate transport and erection. Fabrication details of channel gates shall be submitted to the Engineer for approval before manufacture commences.

Sluice gates shall be four sided sealing and manufactured from stainless steel, pickled and passivated. The side seals shall be Neoprene “J” type seals and the bottom seals shall be Neoprene “J” type seals

for standard inverts and Neoprene rectangular type seals for flush inverts. Spindles shall be of the rising type. Fabrication details of sluice gates shall be submitted to the Engineer for approval before manufacture commences."

**\*PSHA 5.2.12 Air vents**

"The air vents to be installed in the Connection Chamber are to be provided in accordance with the details shown on the drawings.

The air vents shall be manufactured from Hot Dipped Galvanised Mild Steel, including all fittings, bolts, nuts, washers, etc. required for fixing the air vents into position."

**\*PSHA 5.2.13 Pipe Clamps and Brackets and/or Supports**

"Clamps and brackets around pipes and supports under pipes and valves are to be constructed to the details shown on the drawings and are to be provided with all necessary bolts for fixing to concrete.

Where pipes and valves are supported on top of pedestals or inside concrete chambers on concrete footings or fabricated steel pipe supports, a layer of 6 mm thick GP rubber sheet (Shore hardness 65) shall be attached to the top surface of the steel support by contact adhesive prior to receiving the pipe or valve to be supported. The rubber is to extend 20mm beyond the edges of the plate."

**PSHA 5.3.6 Grouting**

**Add the following to SANS 1200 HA, sub-clause 5.3.10:**

"The Contractor will be fully responsible for all grouting work under this Contract."

**PSHA 6 TOLERANCES**

**PSHA 6.1 Fabrication And Assembly Tolerances**

**PSHA 6.1.3 Accuracy of Erection**

**Add the following to SANS 1200 HA, sub-clause 6.1.3:**

"The accuracy of erection shall be the degree of accuracy II as tabulated but amended as follows:

In items d)1) and d)2) of the table the Degree of Accuracy given as "+ 5" shall be read as "+ 3".

**PSHA 7 TESTING**

**PSHA 7.1 Test Certificates**

**Delete the part sentence "in terms of the project specification" from the wording of the sub-clause and add the words "when so requested by the former" at the end of the sentence.**

**PSHA 8            MEASUREMENT AND PAYMENT**

**PSHA 8.3.1       Structural steel**

**SANS 1200 HA, sub-clause 8.3.1 to include payment for:**

PSHA 3.1	Structural steel
PSHA 3.3.1	Bolts and nuts

**PSHA 8.3.2       Handrails**

**Add the following to SANS 1200 HA, sub-clause 8.3.2:**

"Handrails will be measured according to SANS 1200 HA, sub-clause 8.3.2 (a) and the relevant drawing. The rate shall include for PSHA 5.2.6, Handrails, as amended."

**PSHA 8.3.6       Corrosion protection**

"Notwithstanding the requirements of SANS 1200 HA, sub-clause 8.3.6, corrosion protection will not be measured separately, the rates tendered for the steel items being held to include for the cost of corrosion protection as specified in PSHA 5.2.10, Protective treatment, as amended."

**Add the following new payment item to SANS 1200 HA, sub-clause 8.3:**

**\*PSHA 8.3.7       Fluid control equipment .....Unit: No.**

"The tendered rate shall cover the cost of supply, delivery, corrosion protection and complete installation of fluid control equipment including frames. The rate shall also make provision for \*PSHA 5.2.11, Fluid control equipment."

**\*PSHA 8.3.8       Air vents .....Unit: No.**

"The tendered rate shall cover the cost of supply, delivery, corrosion protection and complete installation of air vents. The rate shall also make provision for \*PSHA 5.2.12, Air Vents."

**\*PSHA 8.3.9       Pipe Clamps and Brackets and/or Supports .....Unit: No.**

"The tendered rate shall cover the cost of supply, delivery, corrosion protection and complete installation of pipe clamps and brackets and/or supports. The rate shall also make provision for \*PSHA 5.2.13, Pipe Clamps and Brackets and/or Supports."

**PSHC            CORROSION          PROTECTION          OF          STRUCTURAL          STEELWORK  
(SANS 1200 HC)**

**PSHC 5 CONSTRUCTION (EXECUTION OF WORK)**

**PSHC 5.9            Application of metal coatings (hot-dip galvanizing, metal spraying)**

**Add the following to SANS 1200 HC, sub-clause 5.9:**

“All structural steel members shall be hot-dip galvanized, except stainless steel members.”

## **PSL MEDIUM-PRESSURE PIPELINES (SANS 1200 L)**

### **PSL 1 SCOPE**

**Replace SANS 1200 L, sub-clause 1.1 with the following:**

“This specification covers the supply and installation of pipelines, specials and fittings for rising mains, gravity mains and pipework for pumping installations.”

### **PSL 2 INTERPRETATIONS**

#### **PSL 2.4 ABBREVIATIONS**

**Add the following to SANS 1200 L, sub-clause 2.4:**

“HDPE	:	High Density Polyethylene
mPVC	:	Modified Polyvinyl Chloride
oPVC	:	Orientated Polyvinyl Chloride
DI	:	Ductile Iron
GRP	:	Glass Reinforced Polyester
CML	:	Cement Mortar Lining
FBMDPE	:	Fusion Bonded Medium Density Polyethylene”

### **PSL 3 MATERIALS**

#### **PSL 3.1 General**

**Add the following to SANS 1200 L, sub-clause 3.1:**

“The materials and construction of all pipes, fittings, valves and specials shall comply with the appropriate SANS, BS or other appropriate specification, whether stated or not, and shall be approved by the Engineer. Only full-length pipes bearing the relevant standard’s mark will be acceptable. Cut pipes shall only be used at pipe junctions to position valves and specials as shown on the drawings, and at connections to structures. When laying the pipes the markings shall be visible from above.

The Contractor shall be responsible for the structural and hydraulic design of all fabricated steel pipe specials (puddle pipes in hydraulic test point anchor blocks, offtake chambers, isolating valve chambers, meter chambers, non-return valve chambers etc.) where these are not standard off-the-shelf items designed and guaranteed by the manufacturer for the purpose intended (see also PSL7 for quality control requirements for specials). Acceptance of the Contractor’s design will be subject to the Engineer’s approval.

The Engineer shall at all reasonable times have free access to the place where the goods are manufactured for the purpose of examining and sampling the materials and goods, and if necessary for supervising the testing and marking of goods. The manufacturer shall supply free of charge every facility and all labour required for such examination, sampling, inspection, testing and marking

before delivery and shall provide and maintain in good order suitable, convenient and accurate apparatus for testing goods.

Mild steel specials shall have a minimum wall thickness of 4,5 mm, and shall be hot dipped galvanised.

Stainless steel pipes and specials shall be manufactured from Grade 316 stainless steel as scheduled. Wall thicknesses of stainless steel pipes and specials shall be to ASME B36.19 Schedule 10S or as specified on the drawings. All welds shall be pickled and passivated.

**Add the following new sub-clauses to SANS 1200 L, sub-clause 3.1:**

**\*PSL 3.1.1 Materials Control**

**\*PSL 3.1.1.1 Checking Material Lists and Drawings**

“All pipes, specials and valves arriving on site shall be marked clearly with the item number appearing in the Bill of Quantities. Furthermore the nuts, bolts, washers and other ancillary equipment for each individual item shall be kept separate in a bag which shall also bear the respective reference number of that item. The cost of such marking will be held to have been included in the rates tendered for the items.

If any variations in the contract are authorised, the Contractor shall ensure that any additional items to be supplied by the Contractor (or the Employer where applicable) are ordered in good time so as not to cause delay to the works.

The Contractor shall check the delivery timing of all items and ensure that it is in line with the Contract program. Any critical items that could be delivered late are to be brought to the attention of the Engineer.

The delivery status of materials is to be checked and followed up upon by the Contractor throughout the contract.”

**\*PSL 3.1.1.2 Materials Control – General**

“The Contractor is held responsible for the inspection and control on site of all the materials and equipment for the duration of the Contract. Once material and equipment has been accepted, any subsequent damage shall be made good to the satisfaction of the Engineer at the expense of the Contractor. Damage to internal linings and external coatings that are necessary and incidental to good welding practices and the manufacturing of pipe specials are excluded.

Any item damaged beyond repair shall, at the discretion of the Engineer, either be replaced at the Contractor’s expense or the value reimbursed in full to the Employer as appropriate.”

**\*PSL 3.1.1.3 Acceptance of Pipes, Fittings and Materials**

“The Contractor is to ensure that the manufacturer makes available a full-time field technician to supervise the offloading, stacking and protection of the pipes to ensure that all the manufacturer’s specifications and requirements regarding stacking and storage are met.

Before acceptance of any pipes, fittings or other items of equipment the Contractor together with the field technician is to carry out a thorough inspection to ensure that the materials have been delivered undamaged and are as ordered.

Pipes shall be checked for:

1. Identification
2. Certification
3. Soundness and Internal lining
4. Ends bevelled correctly
5. Circumference according to specification and within tolerance

Inspection of pipe fittings, valves and other equipment shall include, but is not limited to:

1. Identification
2. Certification
3. Material schedule and rating
4. Lining, where specified
5. Coating where specified
6. Circumference according to specification and tolerance
7. Damage to items – example flange faces

Defective items shall not be accepted, but marked, quarantined and immediately reported to the Engineer.

If accepted, the Contractor shall take the required steps to ensure that all delivery documentation together with signed acceptance notes is filed in the Construction Dossier.”

**\*PSL 3.1.1.4 Material Storage**

“The Contractor shall store all items so that no damage occurs whilst awaiting installation. Where practical, items are to be stored in lockable containers for protection from the weather and pilferage.

All piping, pipe fittings and equipment stored outside or awaiting installation are to be protected from the weather, stormwater and soil wash and stored on pre-prepared surfaces. Pipes taken over from the Employer shall receive the required attention in order to ensure safe storage in yards, protected from fires, vandalism and incidental damage that can reasonably be prevented.”

**\*PSL 3.1.1.5 Handling Pipe, Fittings and Equipment**

“Strict supervision shall be maintained at all times when handling pipes and equipment. Particular attention is to be given to correctly rated lifting gear, slings and lifting beams. All lifting gear is to be inspected regularly for signs of wear and tear in terms of the relevant Safety Legislation and Clauses. Equipment is to be lifted at the recommended points specified by the manufacturer. Pipe is to be



lifted with a lifting beam and slings, which shall be fitted at quarter points around the pipe. Due care shall be taken when fitting and placing slings to ensure that ancillary items do not get crushed during lifting. Pipe coating is to be protected by padding or otherwise from scuffing damage during lifting.

Steel pipes shall be transported and stacked in such a manner that the pipe barrel is not deformed by more than 2% of its diameter. Dents which cause a protrusion of more than 1 mm on the inside of the steel special, may result in the special being rejected.

The equipment utilized for lifting pipes is subject to approval by the Engineer, which approval shall in no way absolve the Contractor of any responsibility in this regard, and all equipment judged unsuitable according to this specification or found to be unsuitable in practice shall be removed from site and replaced at the Contractor's expense. It is prohibited to handle pipes using chains or any other device involving metal contact with the pipe coating.

The Contractor shall ensure that all lifting equipment complies with the relevant safety regulations at all times.

Wet sponge tests shall be done to detect holidays on coatings and linings (where appropriate) of the pipes.

The Contractor shall, at his own expense, test each and every surface area, internal lining (where appropriate) as well as external coating during construction as per this specification. Testing for holidays shall be done after inclusion of materials, manufactured specials and equipment, as well as pipes, into the permanent works. Any defects found shall be repaired and the costs for remedial work shall be deemed to be included in the tendered rates for the construction of the pipeline. These tests and results shall be recorded on the Quality Control Plan as approved by the Engineer."

### **PSL 3.4 Steel pipes, fittings and specials**

#### **PSL 3.4.1 General**

##### **Add the following to SANS 1200 L, sub-clause 3.4.1:**

"All steel pipes and specials, irrespective of diameter, shall be fabricated from plain ended pipes. The use of screwed flanges and fittings shall not be permitted, except for use on air-valve assemblies. All fabrication shall take place in a suitable workshop prior to galvanising, and no cutting or welding of pipes on site shall be permitted.

The Contractor shall, when called upon to do so, make available to the Engineer the manufacturer's certificates covering the chemical analysis and physical properties of the steel used in the manufacture of the pipes. The pipes shall be hydraulically tested before leaving the factory to the test pressure specified in sub-clause 7.3 of SANS 1200 L. The methods of sampling and testing of the manufactured pipes shall comply with Sections 6 and 7 of SANS 719. Tests shall be carried out at the place of manufacture and at the expense of the Contractor. On delivery of the goods concerned the Contractor shall supply a signed certificate giving results of the tests and certifying that the goods have been manufactured in accordance with the Specification.

**PSL 3.4.2      Pipes of NB up to 150mm**

**In the second and third lines of SANS 1200 L, sub-clause 3.4.2 delete “medium class, shall be screwed” and substitute with “heavy duty class, shall have plain ends, and be hot dipped galvanised.”**

**PSL 3.4.3      Pipes of nominal bore over 150mm**

**Replace SANS 1200 L, sub-clause 3.4.3 with the following:**

“Steel pipes of nominal bore over 150 mm shall comply with the applicable requirements of SANS 719 and shall be Grade B. Stainless steel pipes and specials shall be manufactured from Grade 316 as scheduled.

The minimum wall thickness of steel pipes, fittings and specials up to 660mm external diameter shall be 6 mm, and above 660mm external diameter shall be 8mm.

The wall thicknesses of stainless steel pipes and specials shall be to ASME B36.19 Schedule 10S or as specified on the drawings. All welds shall be pickled and passivated.

Pipes shall be longitudinally and circumferentially butt-welded by the submerged arc welding process. Spirally welded pipes will also be accepted. The welding processes and materials used for the fabrication of the pipes shall conform to SANS 044. The Contractor shall, when called upon to do so, provide written confirmation that welding has been carried out by coded welders.

The Contractor shall be responsible for the structural design of all steel bends, tees, fittings and specials, which design shall be carried out by a registered Professional Engineer. Costs for design shall be included in the rates for design, supply and laying. The Contractor shall submit certification of the designs and manufacture to the Engineer for approval prior to delivery to site.

For the internal lining, a solvent free epoxy lining suitable for contact with raw sewage with a minimum thickness of 450 microns is to be applied.

The coating shall be EITHER a 2LPE system comprising a fusion bonded medium density polyethylene material in accordance with SANS 4427 such as Sintakote (2.3mm DFT) OR a visco-elastic polyisobutene corrosion protection coating layer – double-sided (Stopaq Basecoat) minimum 0.85mm thickness + polyethylene outer sheath of 2 layer polyethylene coating (Borealis HE3450 Extrusion material) minimum 2mm total thickness for completed coating.

Any damage to the coatings prior to or during laying/fixing of the pipes will be cause for the pipes to be rejected by the Engineer unless the damage is repaired to the approval of the Engineer.”

**PSL 3.4.4      Fittings and Specials**

**Add the following to SANS 1200 L, sub-clause 3.4.4:**

“All bends, fittings and specials shall be manufactured from straight pipe specified elsewhere unless

otherwise stated in the Bills of Quantities

The lengths of the pipes shall be as dimensioned on the drawings but shall be verified on site prior to fabrication.

The sides of taper pieces shall diverge at an angle of not more than 11° to each other.

Individual bends, fittings and specials smaller than DN 200 shall be hot-dip galvanised to heavy duty grade in accordance with SABS 121:2000 after fabrication. Where a hot dipped galvanised fitting is to be welded to a coated and lined pipe, the galvanising is to be abraded off prior to welding. The external coating at the welded joint is to be primed and coated with an approved anti corrosion system.

Bends, fittings, and specials of DN 200 and larger shall have the internal lining and external coating made continuous ("made good") as specified elsewhere for welded joints on coated and lined pipes.

Bends, fittings and specials shall be manufactured and tested in accordance with the specification for straight pipe and additionally with Section 8 of BS EN 10311: 2005 and BS 10224: 2002. All plain ends on bends, fittings and specials shall have the plain ends prepared for butt welding except those plain ends that are to be jointed with adaptor joints or bell ends.

Bends shall generally be of the formed type except where otherwise stated or shown on the drawings.

The bend, fitting, and special fabricator shall supply written confirmation that all hand welding was carried out by coded welders.

**The Contractor will be responsible for the design and provision of strengthening webs, crotch plates, gussets etc. as may be necessary to prevent excessive deflection or deformation of fittings and specials when subjected to hydraulic pressure tests, and the tendered rates for the work will be deemed to include for the design and provision of this reinforcing wherever necessary.** All calculations are to be submitted to the Engineer prior to fabrication. All crotch plates, wrappers, collars and gussets to be provided by the Contractor under this Contract are to be manufactured from SANS 719 Grade B steel, or of the same grade as the main pipe.

Bends shall be fabricated in accordance with the Table below.

Angle	
Up to and including 3 °	One pipe end scarfed on site
Exceeding 3 ° and up to and including 9 °	Mitre cut (two pipe ends scarfed on site)
Exceeding 9 ° but less than 15 °	2 segment bend
15 ° and larger but less than 45 °	3 segment bend
45 ° and larger but less than 60 °	4 segment bend
60 ° and larger but less than 75 °	5 segment bend
75 ° and larger but less than 90 °	6 segment bend

Long radius bends shall have a centre to face radius of at least 2.5 times the pipe diameter.

Bends greater than 90° shall be fabricated from combinations of items from the table above.

All steel specials shall be internally protected with a solvent free epoxy lining suitable for contact with raw sewage with a minimum thickness of 450 microns or approved equivalent to the manufacturer's specifications unless otherwise indicated on the drawings or scheduled. They shall be externally coated with a 2LPE system comprising a fusion bonded medium density polyethylene material in accordance with SANS 4427 with a 2.3mm minimum DFT.

Shop drawings of bends, fittings and specials shall be submitted to the Engineer for approval prior to manufacture.

All flanged bends, fittings and specials shall be hydraulically tested at the fabricator's premises to the same pressure that they will be subjected to during the hydraulic testing of the completed pipeline. No visible signs of leakage will be permitted. Cutting and welding of flanged bends, fittings and specials will not be permitted on site. Any adjustments required due to on site conditions will have to be made at the fabricator's premises and all coating and lining repairs and tests completed prior to being returned to site."

**Add the following new sub-clauses to SANS 1200 L, sub-clause 3.4:**

**\*PSL 3.4.5      Puddle Collars and Anchoring Flanges**

"Puddle collars and anchoring flanges used as pipe anchorages shall be of the same dimensions as corresponding flanges but those cast into concrete walls are to be undrilled. The collar/flange shall be capable of transmitting a longitudinal force 33% greater than the internal hydraulic pressure to be applied when testing, multiplied by the area of the bore and, under that condition, the stress in the material shall not exceed its yield stress."

**\*PSL 3.4.6      Welding Tests at fitting Fabrication Shop(s)**

**\*PSL 3.4.6.1      Qualification Tests for Welding Procedures**

"Only appropriately coded welders may be used.

The qualification tests for welding procedures shall be carried out generally in accordance with the requirements of the American Petroleum Institute API 1104. The detailed procedure to be adopted during manufacture shall be established and the quality of the welds so produced shall be determined by carrying out one transverse tensile weld test and two guided cold bend tests on suitable coupon plates.

The tests are to be carried out before fabrication of fittings is commenced.

The coupon plates shall be prepared either from plates of the same material as the pipe and welded in a similar manner to that to be used during production, or by cutting suitable specimens from a pipe selected at random by the Engineer from the first production. The coupon plate for the tensile

weld test and those for the guided cold bend tests shall be prepared in accordance with the requirements of SANS 719.

The qualification tests shall be considered satisfactory if:

- a) The weld has a joint efficiency greater than 95% of the minimum specified tensile strength of the parent metal and,
- b) The bend test specimens are capable of being bent around a former with a diameter equal to six times the nominal thickness of the plate to an angle of 180 degrees without developing a crack, except at the arises of the specimen, of length or width greater than 3 mm.

Failure to pass the above qualification tests shall result in the rejection of any pipes welded with the procedure used and the preparation of a new qualification of procedure test.

Any changes in the electrode case type used or change of flux used shall require a qualification test before approval of the procedure is granted.”

**\*PSL 3.4.6.2 Radiographic Examination of Shop Welds**

“The Contractor shall include in his prices for the supply of fittings and specials, the cost of carrying out, under the supervision of the inspector appointed by the Employer, examination of shop welds on the following basis:

- a) One hundred percent radiographic examination of all welds deposited manually or semi-automatically in fittings and specials which cannot be hydraulically tested prior to the fittings and specials being installed in the pipeline.
- b) Ten percent radiographic examination of all welds deposited manually or semi-automatically in specials and fittings that are to be tested hydraulically prior to the fittings and specials being installed in the pipeline.

The Engineer shall in all cases determine which welds are to be radiographed on the quantity basis specified above. All radiographs and records thereof made by the Contractor shall be made available to the Engineer to enable him to determine whether the welds are acceptable or not and no coating, lining or wrapping of pipes shall be permitted until the welds have been accepted by the Engineer. To avoid unnecessary delays, at the option of the manufacturer, radiographs may be approved by the manufacturer's inspectors subject to them being subsequently approved by the Engineer.

When a section of the weld is shown by radiography to be unacceptable, and if the limits of the deficient weld are not defined by the radiograph, additional radiography shall be carried out at the Contractor's expense until the limits of the deficiency are determined.

Repairs shall be made to defective welds at the Contractor's expense. All repair welds shall be identified with a stamp marking, indicating which welder conducted the repair. Repaired welds shall be radiographed at the Contractor's expense but after any repair welder has had ten consecutive

repairs approved, the extent of the radiography of the repairs conducted by the welder may be decreased by agreement between the Engineer and the Contractor.”

### **PSL 3.7 Other types of pipes**

#### **PSL 3.7.2 Polyethylene Pipes**

**Replace the contents of SANS 1200 L, sub-clause 3.7.2 with the following:**

"Polyethylene pipes shall be HDPE and shall comply with SABS ISO 4427 PE 100, PN10 or PN16, as specified. All HDPE pipes shall be fusion butt welded unless otherwise shown on the drawings."

All pipe and fittings are to be PE-100, compliant to SANS ISO 4427 Part 1 unless otherwise specified. Pipe must be supplied from a SABS and ISO 9001 approved manufacturer and member in good standing with SAPPMA (South African Plastic Pipe Manufacturers Association), and will meet the following:

<i>Pipe Characteristics</i>	<i>Applicable Standard</i>
Outer Diameter	ISO 11922-1 (Grade B)
Min Wall Thickness at any point	ISO 11922-1 (Grade U) – ISO 4065
Ovality	ISO 11922-1 (Grade N)

All HDPE Pipes shall be indelibly marked at 1 metre intervals in accordance with the applicable SANS / ISO standard:

TRADE NAME	Manufacturer/Supplier Name
SPECIFICATION	SANS ISO 4427
PIPE OD	e.g. 630
PIPE OD TOLERANCE	Grade B
WALL THICKNESS	e.g. 51.4
NOMINAL PRESSURE	e.g. PN 12.5
MATERIAL DESIGNATION	PE 100
BATCH No.	Manufacturer/Supplier Trace ability
PROJECT NAME	XXXXXXX"

**Add the following new sub-clauses to SANS 1200 L, sub-clause 3.7.2:**

#### **\*PSL 3.7.2.1 Unreinforced PE pipes**

"Unreinforced PE pipes and fittings shall comply with the relevant requirements of SANS/ISO 4427."

#### **\*PSL 3.7.2.2 Steel-mesh-reinforced Polyethylene (PE) pipes**

"Steel-mesh-reinforced PE pipes shall comply with the requirements of SANS 370."

### **PSL 3.8 Jointing material**

#### **PSL 3.8.2 Flexible couplings**

##### **Replace SANS 1200 L, sub-clause 3.8.2.1 with the following:**

“Detachable couplings shall be of the "Klamflex" or similar approved type. Coupling flanges shall be designed to withstand the hydrostatic test pressures and all stresses due to tightening of the bolts, and the rubber rings shall generally comply with BS 2494 Class D. Detachable couplings shall suit the outside dimensions of pipe-work complying with either BS 2035 or the relevant SANS specification as the case may be.

All cast iron pipes, specials and valves shall be given two coats of approved epoxy paint except where cast into concrete. The cost of this work shall be included in the rates tendered for supplying and fixing pipes, specials and valves.”

#### **PSL 3.8.3 Flanges and accessories**

##### **Add the following to SANS 1200 L, sub-clause 3.8.3:**

“All flanges shall be to SANS 1123 Table 1000/3 or Table 1600/3 unless otherwise specified or shown on the drawings. The Contractor shall be responsible for ensuring that the flange drillings on all pipeline components including valves, fittings, specials and fixtures etc. are compatible.

Where used with mild steel pipes underground, the connections shall be packed with a bitumen or tar based mastic and wrapped with "Denso Tape" or an equivalent approved product.

All gaskets for flanged joints shall be minimum 3 mm thick, full face rubber insertion in accordance with the requirements of BS 3063.

For polyethylene pipes, generally, non-asbestos type gaskets not less than 3 mm thick and suitable for aggressive, corrosive or potable water and raw sewage, shall be supplied for flanges.

Where services are relocated or connected to existing pipes, the dimensions of existing flanges and pipes shall be verified by the Contractor prior to ordering of materials.

Any item of pipework or special or valve of which the flanges are incorrectly drilled, will be rejected. The reaming of bolt-holes to oversized dimensions to enable a particular item to fit will not be allowed.

All flanges shall be provided complete with bolts, nuts, washers and rubber O-rings as appropriate. Rubber O-rings dimensioned in accordance with DIN 2514 specification shall be supplied to suit suitably machined flanges.

All bolts, nuts and washers used in the jointing of mild steel pipes shall be hot-dip galvanised in accordance with SANS 121:2011. Under no circumstances shall electro-plating be accepted as an alternative means of corrosion protection.

For polyethylene pipes, all bolts shall be class 8.8 to SANS 135 or 1700, nuts shall be to SANS 1700 and washers to DIN 126. The class of a nut shall always be at least equal to the first digit of the class of the bolt with which it is used.

All bolts, nuts and washers for jointing of stainless steel pipes shall be stainless steel all in accordance with SANS 1700.”

#### **PSL 3.8.4      Loose flanges**

##### **Add the following to SANS 1200 L, sub-clause 3.8.4:**

“Flange jointing material, when installed in the complete pipeline, shall be capable of withstanding transient pressures of up to the specified field test pressure. Under this condition no damage shall be caused or leakage shall occur through the joint. Bolts and nuts shall be galvanised to SANS 121: 2011 and shall comply with the relevant requirements of SANS 135: 2011 and SANS 136: 2008 where applicable. Upon completion, bolt heads, washers and nuts shall be wrapped with the “Denso Mastic Blanket System” comprising of a priming solution, mastic blanket, petrolatum tape and lay-flat sheeting as described below.

(Note: This specification is based on a “Denso” system. Alternative products may be used, subject to approval by the Engineer).

##### Surface Preparation:

The entire surface area of the flange/adaptor/anchoring joint, and its bolts, nuts and washers, up to no less than 250 mm either side of the joint, shall be cleaned of all dirt and other deleterious matter. The cleaned area, up to 200 mm either side of the flange/adaptor/anchoring joint, shall then be wire brushed.

##### Priming:

The cleaned flange/adaptor/anchoring joint, bolts, nuts, washers and the adjoining 200 mm length either side shall be primed with “Denso Priming Solution”, or if moisture is present, with “Denso S105 Paste”.

##### Application of Mastic Blankets:

Narrow strips cut from “Denso Mastic Blanket” shall be applied to the flange/ adaptor/anchoring joint to achieve a smooth profile with a 50 mm splayed fillet being formed at the joint/pipe interface. Care shall be taken, particularly at bolts, to avoid the formation of air pockets. Complete “Denso Mastic Blankets” shall then be applied (mastic side down) to the flange/adaptor/anchoring joint until the flange/adaptor/anchoring joint is completely enveloped.

The blanket shall be overlapped at least 50 mm and shall extend at least 150 mm along the pipe barrel on each side of the flange/adaptor/anchoring joint. The ends of the blanket shall be bound to



the barrel of the pipe on each end with 100 mm wide “Denso Tape”. The “Denso Tape” overlaps shall be 50 mm and shall extend 100 mm onto the blanket and 150 mm onto the pipe barrel.

Application of Protective Sheeting:

The entire flange/adaptor/anchoring joint shall then be wrapped with 350 micron polyethylene sheeting which shall end 400 mm beyond the joint. The protective sheeting shall be secured to the pipe barrel and along the seam with 48 mm wide “Denso Adhesive Tape.”

**Add the following new sub-clause to clause 3.8:**

**\*PSL 3.8.8      Couplings for polyethylene pipes**

**“a) Pipe couplings**

- i) Polyethylene pipes and specials shall be joined by means of butt fusion welding.
- ii) Slip-on couplings and slip-on flange adaptors shall mean “Viking Johnson” or “Klamflex” type couplings. All stainless steel slip-on couplings shall have a harness arrangement to prevent pipe separation. The end flange (compression flange) shall be such that the tie bolts clear the end flange. Bending of tie bolts will not be allowed. The couplings shall be fusion bonded epoxy coated and lined with a dry film thickness of not less than 275µm.
- iii) Couplings shall be rated as a minimum to the same class as the pipe.

**b) Couplings between pipe materials and specials**

- i) HDPE/rigid (stainless steel) pipe:

The HDPE pipe shall be fitted with a butt fusion welded HDPE stub and 316 stainless steel flange, which shall be bolted to the flange fitted to the steel special. Mechanical steel couplings (e.g. Klamflex) shall not be considered to join plain ended HDPE and stainless steel pipes.

**c) Storage of couplings and fittings and stacking of pipes**

The Contractor shall provide adequate storage facilities for pipes, couplings and specials as recommended by the manufacturer.”

**PSL 3.9 Corrosion protection**

**PSL 3.9.2      Steel Pipes**

**Delete Sub-Clause 3.9.2.1 and replace with:**

“Steel pipes, fittings, flanges and specials shall have their surfaces thoroughly cleaned by Grit blasting to a finish complying with the requirements of SIS 05 59 00 for a Sa 2½ finish. Grit for blast cleaning shall be in accordance with SABS 064.

Surfaces shall, within 4 hours after cleaning, be primed with the specified primer or if no primer is specified, with the first coat of the specified system.

All materials used shall be of the highest quality and in accordance with the manufacturer's requirements. Particular care shall be taken to ensure compatibility of all materials used with others forming part of the corrosion protected system. Manufacturer's application and overcoating times and specific instructions relating to curing periods and humidity limitations shall be strictly adhered to.

Corrosion protection systems shall not be applied over any surface containing traces of grit, grease, oil, loose rust, millscale or any contaminants or corrosion products. All surfaces shall be absolutely dry.

Welds and adjacent parent metal shall be ground smooth and all weld spatter removed. Sharp edges shall be avoided and where they are evident the removal shall be effected by grinding to a radius of not less than 3 mm.

The Contractor shall arrange for the Engineer to be present during surface preparation and coating application to ensure compliance with the specification."

**Delete Sub-Clause 3.9.2.2 and replace with:**

#### **3.9.2.2 Hot Dip Galvanising**

"Where ordered or specified, galvanised steel pipework shall comply with SABS 934 and 763 and be entirely coated with zinc after fabrication by complete immersion in a zinc bath. The finished surface shall be clean and uniform and any excess being removed. The zinc deposit shall exceed the following:-

Coastal areas : 0.735 kg / m<sup>2</sup>

Inland areas : 0.400 kg / m<sup>2</sup>

Inland areas shall apply to this contract."

#### **PSL 3.9.3 Protection against Electrolytic Corrosion**

**Change the heading of this sub-clause to:**

#### **PSL 3.9.3 Protection against Electrolytic Corrosion and general repair and making good procedures for linings and coatings**

**Add the following new sub-clauses:**

##### **\*PSL 3.9.3.1 Preparation of Steel Surfaces for Repairs and/or Reinstatement of Internal Lining and/or External Coating**

“The following method is applicable to the preparation of exposed steel surfaces prior to the carrying out of any repair procedure to internal linings and/or to external coatings. This specification is applicable to all steel surfaces that have been stripped of its corrosion protection layer, internally or externally, as a result of the manufacturing of specials, construction activities or pipe laying, welding and/or damages caused by handling or latent defects in application.

Degreasing:

All bare metal surfaces shall be degreased in order to remove grease and oil from the pipe surface as a first step in the preparation process i.e. before grit blasting and/or power brushing starts. Degreasing shall be carried out using an approved water based solvent degreaser such as that complying with SANS 1216 or, for use in enclosed systems, with SANS 1365. The surface shall then be cleaned with potable water and left to dry completely before the next step is taken.

Grit Blasting – Internal Lining Repair:

Grit blasting of bare metal surfaces shall take place after degreasing of the area. Abrasive material used for blast cleaning shall be free from oil or grease, as shall be the compressed air used in air blast cleaning.

The finished grit blasted surface shall be to Sa 2½ of ISO 8501-1 with a 75 micron angular profile. Hackles shall be removed with coarse abrasive paper.

Transition areas from internal lining to bare metal which has been grit blasted, shall be smooth without rough edges or flaking appearances.

All grit blasting within the pipe line that is under construction, shall be performed by way of a “vacuum blast” process in order to limit the generation of dust. Grit blasting shall, under all circumstances, be carried out using equipment suitable for the size of the work to be undertaken.

Damp hessian sacking or other suitable material is to be temporarily fixed around the pipe on both sides of the work areas to prevent damage to the adjoining pipe coating/lining.

All residual dust and debris shall be removed.

Before work commences, the Contractor shall provide the Engineer with a method statement for approval for each type/location of grit blasting.

Power Brush – External Coating Repair:

Power brushing of bare metal surfaces shall take place after degreasing of the area as specified. The area that has been power brushed shall be free from rust, laitance, dust, oil or other deleterious matter before the application of primer. Any areas in the region where power brushing took place shall be free from signs of disbonding of lining and/or coating. The surface finish, once power brushing has been completed, shall conform to minimum St 2 standard.”

**\*PSL 3.9.3.2 Preparation Mixing and Application of Epoxy Compounds**

“When mixing two part epoxies the base and activator shall be mixed in accordance with the manufacturer’s instructions. Mixing in the original container will only be permitted by means of methods that ensure full integration of different parts of the compound into a homogeneous compound with the characteristics as intended by the manufacturer. The different parts of the compound shall not be diluted. Mixing shall only be allowed with full batches and reduction of volumes from mixing packs by means of weight or volume measurement, which will result in smaller portions to be mixed, will not be allowed. In the application of the epoxy the following shall be strictly in compliance with the manufacturer's instructions:

- Method of application (Type of brush or roller.)
- Over coating time.
- Temperature range for application.
- Method of mixing base and activator.
- Number of coats to achieve the specified thickness.
- Safety aspects e.g. Eye and hand protection, ventilation, fire precautions, etc.
- Note that roller and brush applicators shall be replaced once the product application expiry time has been reached on any specific applicator tool.

Uncured epoxy must be regarded as being toxic and shall be handled in accordance with the manufacturer’s instructions. Adequate lighting and ventilation shall be provided whilst working within the pipeline.

Only solvent free epoxy repair kits shall be utilized to repair the internal linings of the pipe line. This specification refers to “two part epoxy” as an epoxy repair kit which consists of a base and an activator approved by the Engineer and could be products similar to “Denso ST100”, “Sigma SF 523”, “Nordbak”, etc.

The Contractor’s tendered rates for the laying of the pipe shall be deemed to include for all the repairs and make-goods that have to be effected in order to deliver a serviceable and acceptable pipe line.

Two-part epoxy may only be applied on steel surfaces prepared as specified in PSL3.9.3.1.”

**\*PSL 3.9.3.3 Repair and Making Good of Solvent Free Epoxy Linings**

“All making good of internal solvent free epoxy linings at damaged areas and at welded and flanged joints that is required to ensure continuous internal corrosion protection to steel surfaces shall be carried out strictly in accordance with the solvent free epoxy manufacturer’s specifications. The surfaces are to be prepared as specified in PSL3.9.3.1.

The epoxy material shall be sufficiently thixotropic that 500 micrometers dry film thickness can be achieved in one application without sagging. The material shall be applied to the clean, dry, abraded area so as to fully cover it and extend to no less than 50 mm of the edge of the abraded area. A "halo" of abraded area shall be visible around the repair material.

After curing, the repaired section and at least 250 mm of the surrounding area, shall be tested for electrical insulation defects as specified elsewhere. There shall be no electrical insulation defects.

The Contractor shall ensure that repairs and particularly the making good of linings at welded joints, is carried out progressively as the pipe is being laid and shall not be permitted to lag behind for more than three pipe lengths at each working front."

**\*PSL 3.9.3.4 External Corrosion Protection of Welded Joints and Coating Repairs**

"All factory coated steel pipes will be supplied with the external coating cut back 100 mm from each pipe end. Where pipes are to be cut, either on site, or for the purpose of fabricating bends, fittings and specials, or in the event of the pipe coating being damaged, the pipe coating shall be cut back 100 mm from the intended cut area before the pipe is cut. Damp hessian sacking or other suitable material is to be temporarily fixed around the pipe to prevent damage to the pipe coating during welding operations. Once welding is complete, and all weld splatter and burnt coating has been removed, the welded pipe joints shall be wrapped in the following manner.

The following specification is based on "Denso" products and systems. Alternative products and procedures may be proposed by the Contractor and, if approved by the Engineer, they may be used. Irrespective of which products are approved by the Engineer and used by the Contractor, all procedures shall be carried out strictly in accordance with the Contractor's method statements which must conform to the manufacturer's recommendations.

A fundamental outcome is a sound and continuous coating that is free from wrinkles and that does not have any entrapped air pockets or any air bubbles.

Surface Preparation:

The bare metal shall be cleaned and wire brushed to minimum St 2 standard and, degreased with white spirit. The adjacent pipe coating shall be cleaned to a minimum of 300 mm either side of the joint and the edges "feathered" to achieve a tapered transition over a distance of 100 mm. The sound, parent coating surface shall be roughened with sandpaper over an area 250 mm either side of the joint.

Priming:

The entire pipe and coating surface over a length of 250 mm on either side of the joint shall be primed using "Denso Primer D" (or equivalent approved). Care shall be taken to obtain a thin even film with no runs or sags. The primer shall be allowed to cure until "tack dry" before the application of the tape commences. Priming may only be carried out on those areas that are to be wrapped that same day. If primed areas are to be left overnight, those areas shall be re-primed before wrapping.

Profiling Tape:

A 1,5 mm thick x 50 mm wide "Denso Mastic Sealing Tape" (or equivalent approved) shall be applied to the full circumference of the weld bead in accordance with the manufacturer's specifications. Care shall be taken to ensure a smooth profile and to avoid air bubbles being trapped beneath the tape.

(Note: The profiling tape may be omitted at the discretion of the Engineer. Tenderers shall nonetheless allow for the profiling tape in their tendered rates).

Tape Wrapping:

The joint shall then be wrapped (minimum 55 % overlap) with “Denso CPT 1250/300 Polyethylene/Bitumen” tape starting at the roughened section (250 mm from the welded joint) in accordance with the manufacturer’s requirements to create a 500 mm wide wrapping, centred over the welded joint. A 100% overlap is required on the first and last revolutions of the tape wrapping operation. It is important that tension in the tape be released when the wrapping of the last half circumference of the pipe. The Contractor shall ensure that the wrapping overlaps or covers a minimum of 150 mm of the pipe coating. A secondary or outer tape wrap layer is then to be applied over the first layer with a 10% tape overlap.

An alternative tape wrapping system that may be used is the “Densotherm 35 Hot Applied Bitumen Tape” system. The procedures are similar to those for the “Denso” system described above except that the underside of the tape shall be heated as it is applied and the overlaps and seams of the tape are to be sealed by means of a heated tool.”

**\*PSL 3.9.3.5 External Corrosion Protection of Shop-Fabricated Pipe Bends and Fittings**

“The external coating of shop fabricated bends and fittings shall be carried out as follows:

- Where a substantial part of the external coating on the parent pipe is intact, the coating repairs/make good shall be carried out in accordance with PSL 3.9.3.4 or
- Where black (uncoated pipe has been used), the coating shall be carried out with an approved solvent-free epoxy (SFE) system such as "Nordbak 1" or similar approved system or
- Where only a relatively small proportion of the external coating on the parent pipe remains, all of the remaining coating shall be removed and the entire bend/fitting shall be coated with an approved solvent-free epoxy (SFE) system such as "Nordbak 1" or similar approved system.

All crotch plates and wrappers/collars shall be coated with an approved solvent-free epoxy (SFE) system such as "Nordbak 1" or similar approved system.

After application of the SFE coatings to the crotch plates and collars/wrappers, approved mastic (refer PSL3.9.3.7) shall be placed in all crevices that may become moisture traps.

No additional payment will be made for any of this work as the costs are deemed to be included in the scheduled rates for bends and fittings.”

**\*PSL 3.9.3.6 External Corrosion Protection of Site-Fabricated Pipe Bends and Fittings**

“The coating repairs/make good shall be carried out in accordance with PSL 3.9.3.4.”

**\*PSL 3.9.3.7 Corrosion Protection of Flanges and Flexible Adaptor/Anchoring Joints in Chambers**

"All flanges and flexible joints and adaptor/anchoring joints and their associated bolts, nuts and washers, shall, notwithstanding that the flexible and adaptor/anchoring joints will be epoxy coated as specified elsewhere, be protected as described below.

(Note: This specification is based on a "Denso" system. Alternative products may be used, subject to approval by the Engineer).

Surface Preparation:

The entire surface area of the flange/adaptor/anchoring joint, and its bolts, nuts and washers, up to no less than 250 mm either side of the joint, shall be cleaned of all dirt and other deleterious matter. The cleaned area, up to 200 mm either side of the flange/adaptor/anchoring joint, shall then be wire brushed.

Priming:

The cleaned flange/adaptor/anchoring joint, bolts, nuts, washers and the adjoining 200 mm length either side shall be primed with "Denso Priming Solution", or if moisture is present, with "Denso S105 Paste".

Application of Mastic Blankets:

Narrow strips cut from "Denso Mastic Blanket" shall be applied to the flange/ adaptor/anchoring joint to achieve a smooth profile with a 50 mm splayed fillet being formed at the joint/pipe interface. Care shall be taken, particularly at bolts, to avoid the formation of air pockets. Complete "Denso Mastic Blankets" shall then be applied (mastic side down) to the flange/adaptor/anchoring joint until the flange/adaptor/anchoring joint is completely enveloped.

The blanket shall be overlapped at least 50 mm and shall extend at least 150 mm along the pipe barrel on each side of the flange/adaptor/anchoring joint. The ends of the blanket shall be bound to the barrel of the pipe on each end with 100 mm wide "Denso Tape". The "Denso Tape" overlaps shall be 50 mm and shall extend 100 mm onto the blanket and 150 mm onto the pipe barrel.

Application of Protective Sheeting:

The entire flange/adaptor/anchoring joint shall then be wrapped with 350 micron polyethylene sheeting which shall end 400 mm beyond the joint. The protective sheeting shall be secured to the pipe barrel and along the seam with 48 mm wide "Denso Adhesive Tape".

**\*PSL 3.9.3.8 Wrapping of Permanently Exposed and Cast-in Pipes and Fittings**

"All coated and/or galvanised steel pipes which are to be permanently exposed or encased in concrete shall, in addition to the specified corrosion protection at flange/adaptor/anchoring joints, be protected with the "Denso Acrylic Pipeline Tape (Steelcoat 500)" system or similar approved UV resistant coating. The pipe surface shall be prepared and the coating applied in strict accordance

with the manufacturer's instructions. In the case of cast-in pipes, the wrapping shall extend for at least 150mm on either side of the soil/concrete/air interface.

Surface Preparation:

- I. Remove all Grit and/or dust before priming at the average spread rate as specified by the manufacturer.
- II. The adjacent coating shall be cleaned to a minimum of 300 mm beyond the section to be wrapped.
- III. Grease and oil shall be removed with a non-volatile solvent. The surface shall then be cleaned with potable water and allowed to dry completely.

Priming:

- I. "Denso Primer D" shall be applied to the prepared surfaces extending 300 mm on either side of the area to be wrapped at a nominal coverage rate of 8 m<sup>2</sup> per litre. Care shall be taken to obtain an even film with no runs or sags. Only those areas that are to be wrapped the same day shall be primed to avoid any recontamination to the pipe. If primed areas are to be left overnight, these areas shall be re-primed before wrapping. Any surface oxidation, or other foreign agents shall be removed by reprocessing through the necessary cleaning steps.
- II. The flow of primer shall be regulated so that the pipe surface is entirely covered. Solvents shall be allowed to flash off for a minimum of 30 minutes before application of tape or mastic. Uncoated, flooded, or areas primed over improperly cleaned pipe, shall be cleaned to the satisfaction of the Engineer and re-coated.

Tape Wrapping:

The joint shall be spirally wrapped (minimum 55% overlap) with "Denso Acrylic Tape" (or approved equivalent) in accordance with the manufacturer's requirements, to at least 150mm beyond the concrete/soil or concrete/air interface and at least 1 000mm beyond the soil/air interface in the case of pipes extending above ground. A 100% overlap is required on the first and last revolutions of the tape wrapping operation. Care shall be taken to ensure a smooth profile and to avoid air bubbles being trapped beneath the tape. The tape shall not be stretched and it is important that tension in the tape be released when the wrapping of the last half circumference of the pipe.

In the case of pipes cast in to concrete, the profiling tape shall stop 20mm short of any puddle flange.

Final Coating:

One coat of "Densoflex Fire Retardant" shall be applied to the exposed pipe at a nominal application rate of 3 m<sup>2</sup> per litre."

**PSL 3.9.5      Joints, bolts, nuts and washers**

**Replace SANS 1200 L, sub-clause 3.9.5 with the following:**



"All bolts, nuts and washers shall be hot-dip galvanised in accordance with SANS 121:2011. Under no circumstances shall electro-plating be accepted as an alternative means of corrosion protection."

**PSL 3.9.6 Corrosive soils**

**Replace SANS 1200 L, sub-clause 3.9.6 with the following:**

"All buried cast iron/steel coupling, joint, flange, and valve, or pipe, shall be treated with a compatible primer, packed with a bitumen or tar based mastic and wrapped with "Denso Tape" or an equivalent approved product. The cost of this work shall be included in the rates tendered for supplying and fixing pipes and specials."

**PSL 3.10 Valves**

**Add the following to SANS 1200 L, sub-clause 3.10:**

"All valves (other than those manufactured from non-corrodible material such as stainless steel or brass) shall be coated with fusion bonded epoxy.

Fusion bonded epoxy (FBE) coating shall comply with the provisions of SANS 12176 as for a Type 2 powder coating which shall apply mutatis mutandis to the coating of fittings.

Such coating may only be done in a shop with a known or proven proficiency in such type of work.

- The entire surface to be coated must be free of dust and moisture and must comply with the provisions of Sub-clause 4.1.1 of SANS 12176. The total dry film thickness shall be at least 400 micrometres ( $\pm 50$  micrometres).
- The sealing area of the flanges shall be treated to a dry film thickness of 150 micrometres ( $\pm 25$  micrometres) (i.e. masked off before the second coat is applied).
- The painting shall be such that all trimmings are covered by paint for a distance of at least 5 mm to discourage bi-metal corrosion.

No field repairs of damaged paint areas (if any) are allowed. Where parts may become distorted because of their large size when heated the Contractor shall provide full details of the alternative proposal to the Engineer's approval."

**Add the following new sub-clauses to SANS 1200 L, sub-clause 3.10:**

**\*PSL 3.10.1 Gate valves**

"Gate valves shall be of the knife gate type subject to approval. Approval shall only be given for the specified or equivalent valves from well-established and well known manufacturers with a proven record of supply and service of equivalent products within the southern African region.

The design of the knife gate valve shall be of a type suitable for the operation environment and fluid medium described elsewhere in the document.

Knife gate valves shall be double flanged and shall conform to all relevant sections of SANS 664 or BS 5163, specifications and subsequent amendments. Flanges shall be drilled to SANS 1123 for 10 or 16 bar working pressure as specified elsewhere, and compatible with pipework flanges.

Valves and their method of actuation shall be designed to operate under the full pressure rating of the valve.

Valves shall have ductile iron bodies unless otherwise specified. The knife gate shall be of stainless steel (AISI 316) construction. The handwheels shall be of cast iron, or of stainless steel (where specified).

The valves shall have chamfered blade edges and resilient body seals. Blade faces shall be surface ground or otherwise provided with two flat, parallel surfaces.

The blade seal shall be protected by a non-metallic scraper or similar device.

It shall be possible to adjust the blade seal while the valve is in line under pressure.

All fasteners on the body of the valve shall be of EN Grade 1.4401 (316), or better (this does not necessarily apply to flange bolts).

Valves shall be droptight. Blade seals shall not leak. Within the requirements of BS 5163

The valve shall be capable of operating reliably at any point in the specified range.

The valve shall be provided with manual handwheel operation or shall be provided with electric actuation with manual override, as specified elsewhere. The operation shall be smooth and handwheels shall not require a peripheral force greater than 250N (i.e. the sum of the forces on both sides shall not be greater than 250N).

All gate valves of 600mm and larger shall be fitted with an integral bypass valve.

Valves shall be grit blast cleaned to S15 standard and a solvent-free sintered epoxy powder applied in one coat by the use of arc-spray machines to provide a dry film thickness of not less than 450 micron.

Flanged valves shall be complete with galvanised or titanium coated bolts and nuts, gaskets and insertion rings."

**\*PSL 3.10.2 Air valves**

"Air release and vacuum break valves shall be double orifice with anti-shock orifice mechanism, of type "Vent-O-Mat Series RGX II" or similar approved with flanged inlets and rated for a minimum working pressure as specified for the pipeline.

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.

Relief mechanisms shall activate at a maximum differential pressure of 5kPa between the inside and outside of the valve.

Where specified, the air valve shall be fitted with a stainless steel spring or similar device to immediately activate the air release function to the surge alleviation mechanism.

The intake/discharge orifice area shall be equal to the nominal size of the valve.

The inlet shall be fitted with an isolating valve with vertical spindle, key operated from above.

Air valves shall be able to withstand twice the maximum rated pressure and must provide a positive drop tight closure from a minimum pressure of 50 kPa up to the maximum rated pressure.

The valve design shall be proven and performance criteria shall have been confirmed by a recognized independent authority.

The selected air valve range shall have factory test results which verify the claimed air intake and air release performance characteristics.

Air valve ranges without verified factory performance tests will not be accepted."

**\*PSL 3.10.3 Non-return valves**

"Non-return valves shall comply with the requirements of BS 5153 or the relevant SANS specification for working pressures as specified for each application. They shall be double flanged and of general construction details as specified for gate valves with anti-shock closing characteristics. Flanges shall be drilled to SANS 1123 suitable for the specified pipe pressure rating, and compatible with pipework flanges.

Check valves shall be resilient, flexible disc check valves. The valve shall be fitted with a disc accelerator. The disc accelerator shall be of one piece construction and provide rapid closure of the valve to ensure minimal slam. The disc accelerator shall be enclosed within the valve and shall be field adjustable and replaceable without removal of the valve from the line. The disc accelerator shall be securely held in place captured between the cover and disc."

**\*PSL 3.10.4 Scour valves**

"Scour valves to be wedge gate type, AVK or similar approved. Scour valves to be installed with scour tees."

**\*PSL 3.10.5 Isolating valves**

“Valves shall conform to all relevant sections of SANS 664 (2011) and SANS 665 (2011) specifications and subsequent amendments.

Valves shall be anti-clockwise closing and have rising spindles of high quality tensile manganese bronze fitted with caps suitable for use with a key in the vertical position. The direction of rotation shall be permanently marked on the cap top or wheel.

All isolating valves for air valves shall be supplied with a cast iron hand wheel.”

**PSL 3.11 Manholes and Surface Boxes**

**Add the following new sub-clause to SANS 1200 L, sub-clause 3.11:**

**\*PSL 3.11.7 Pipeline Markers**

“Where so instructed by the Engineer or as shown on the drawings, the Contractor shall erect pipeline markers. These markers will be precast concrete units manufactured out of 25 MPa concrete to the dimensions shown on the drawings and shall comply with SABS 1200 G Concrete.”

**PSL 4 PLANT**

**PSL 4.1 Handling and Rigging**

**Add the following to SANS 1200 L, sub-clause 4.1:**

“The plant and rigging equipment used for the handling of pipes shall be such that no pipe shall be overstressed during any operation.

In the transportation, loading and unloading of pipes, the Contractor shall at all times operate and maintain an adequate fleet of vehicles to ensure that pipes or their protective linings and coatings are not damaged. In particular, the use of excavation equipment for handling of pipes will not be permitted.

Pipes shall be moved 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 liable to damage the coating shall not be used. Slings shall be suitably rated for the loads to be handled and in good condition. The use of deteriorating and frayed slings is prohibited.

All pipes are to be lifted and handled with the aid of a “spreader” lifting beam. Special care shall be taken to ensure that no damages occur to pipes or coatings as a result of pipes sliding on or hitting adjacent pipes. The dragging or skidding of pipes and specials in contact with the ground shall not be permitted.

Whenever pipes are stacked, or otherwise stockpiled, or are transported, use shall be made of suitable resilient material as dunnage which shall not disintegrate or deteriorate when exposed to the elements for prolonged periods or under loads from adjacent pipes (See PSL 4.1.1 below). Pipes shall be stacked with a minimum clearance of 50 mm between adjacent pipe walls and a minimum of 75 mm clear of the ground.

The ends of the pipes should be kept covered by suitable end pieces to prevent damage through the intrusion of foreign matter. Level, cleared ground, free of vegetation should be chosen for the stacking site.

Fire breaks are essential, and pipes must be protected from damage by vandals or animals"

**Add the following new sub-clause to SANS 1200 L, sub-clause 4.1:**

**\*PSL 4.1.1      Stacking and Storage of HDPE Pipes**

"All pipes shall be delivered in 9m or 12m lengths.

Pipes of different PN designations shall not be transported or stacked together. Stacks shall be kept separate and carefully marked.

PE pipes must be evenly supported in order to prevent distortion. All bearing surfaces must be free from contact with sharp objects. Any projecting sections such as stub flanges must be supported to prevent damage.

The pipes shall be stacked in uniform stacks, as described below:

The area for stacking of pipes shall provide a suitably regular surface onto which to place the pipes.

Care should be taken to ensure that, prior to commencement of stacking, the area is free of rocks and other debris that may cause damage to the pipes.

Pipes shall be stored on timber planks (dunnage) of minimum dimension 75mm x 75mm placed directly on the prepared surface at a maximum 1.5m centers. The planks shall be of sufficient length that, once the pipe or multiples of pipes are chocked, the plank extends to at least 100mm beyond the outside edge of the outside chock. Every pipe shall be chocked, regardless of whether it is constrained by pipes on either side and pipes shall be chocked such that a gap of at least 50mm is maintained between pipes. All chocks are to be secured (screwed/nailed) to the spacer plank to ensure that they cannot be moved/removed.

Pipes shall not be stored more than 3 (three) high and all the requirements for stacking and chocking between layers of pipes shall be as set out above."

**Add the following new sub-clause to SANS 1200 L, sub-clause 4:**

**\*PSL 4.4      Packing**

“Goods should be suitably packed in such manner as will ensure safe and efficient transport by road or rail, and the Contractor shall include in his prices for whatever packing may be necessary in this respect. Small items particularly liable to damage or loss in transit should be crated. All crates and packing material shall, after use, become the property of the Employer, unless distinctly specified otherwise, or if returnable, shall be so at the Contractor's expense.”

## **PSL 5 CONSTRUCTION**

### **PSL 5.1 Laying**

#### **PSL 5.1.1 General**

**Add the following to SANS 1200 L, sub-clause 5.1.1:**

“Pipes shall be handled and laid in accordance with the manufacturer's specifications.

Large changes in horizontal or vertical alignment of the pipeline will be accommodated by special bends as detailed on the drawings.

Small changes in horizontal or vertical alignment will be accommodated at the pipe joints. In no case shall the deflection exceed two thirds of the recommendations of the relevant SANS, BS or other relevant specification, or of the pipe manufacturer.

The Contractor will be responsible for clearing the areas required for pipe storage that shall include the removal of rock, stones and all combustible material. He/she shall also be responsible for maintaining the area in a clean and tidy condition for the duration of the Contract.

The Contractor is to allow for any and all costs in regard to the storing of pipes in his tendered rates for supply and delivery in the case of pipes supplied by the Contractor or the rates for collect from storage and transport to site in the case of free issue pipes should he require secondary storage of the free issue pipes.

Upon delivery of the pipes, fittings, specials and valves, these will be inspected jointly by the Engineer and the Contractor. Any items found to be damaged shall be returned to the factory for repair or replacement, in which case the costs of additional transport, repair or replacement shall be borne by the Contractor if the pipes were supplied by the Contractor and not by the Employer.

The Contractor will be held fully responsible for the care and safety of all pipes and fittings, etc. on site, and shall bear the cost of all renewals, which may be necessary to make good losses, damages or breakages. Furthermore, he shall be fully responsible for handling and re-loading material at the storage areas and for transporting and offloading of all such materials to the Site of the Works.

Before commencing pipelaying, the Contractor shall properly distribute pipes, fittings and specials, along the trenches. Valves and couplings shall not be distributed until they are actually required for laying in their designed position.”

#### **PSL 5.1.2 Damage**

**Add the following to SANS 1200 L, sub-clause 5.1.2:**

"The Contractor shall be responsible for protecting pipes fittings and valves from grass fires at all times and shall keep grass cut short in the vicinity of all pipework items.

Should trenches be inundated by water, there is a risk of movement of the pipes by flotation. The Contractor shall ensure that trenches are not flooded by stormwater and that pipes laid in the trench are backfilled as soon as possible after laying, except at joints made with couplings or flanges which must be kept visible until the pipeline has been satisfactorily tested.

Steel pipes with welded joints may, after all specified testing and corrosion protection has been satisfactorily completed and with prior approval from the Engineer, be backfilled at the same time as backfilling the pipeline.

Should movement of the pipes occur, the Contractor shall remove the pipes from the trench and thoroughly clean and relay the pipes. This work shall be carried out at the Contractor's expense."

**PSL 5.1.3      Keeping Pipelines Clean**

**Add the following to SANS 1200 L, sub-clause 5.1.3:**

"The Contractor shall take all of the steps necessary to prevent flooding of the Works and hence ensure that all work is carried out in the dry, and that the ingress of dirt and or dirty water into the pipes is pro-actively prevented. The ends of all laid pipes must be closed at all times when work is not being carried out."

**Add the following new sub-clause to SANS 1200 L, sub-clause 5.1.3:**

**\*PSL 5.1.3.1      Cleaning Pipe Internals**

"The Contractor shall ensure that all pipe work installed is free from any internal contaminants. All traces of dirty water, slag, splatter, swarf, cuttings, coupons, welding rod ends, grinding dust, dirt and other debris are to be removed from the inside of the pipe as it is installed.

The relevant safety procedures are to be followed when entering pipes.

The Contractor shall ensure that all dust, grit and powder that accumulates in the pipe as a result of grit blasting for the repair of internal linings, be removed from the pipe in an acceptable manner before the internal lining repairs are carried out.

Once the lining repair has been completed, cleaned off and inspected, that specific section of the pipe shall be blocked off to prevent any further access by workers.

The Contractor shall take note that flushing of the completed pipeline may not be allowed after construction has been completed and therefore clean house keeping practices will be required under all circumstances during construction. The tendered rates for pipe laying shall include for the clean

house keeping practices required.

Each section of the pipeline is to be internally inspected and passed by the Engineer once construction has been completed. If the pipework is not satisfactory, the Contractor shall re-clean the pipe at his own expense until the pipe is passed by the Engineer. The Engineer reserves the right to utilize cameras or any other means to inspect inaccessible areas."

**\*PSL 5.1.3.2      Cleaning of Valves and Fittings**

"All flanges, valves, fittings and equipment may only be installed in pipe work after they have been thoroughly cleaned. Flange faces shall be checked for damage before being incorporated into the permanent works and any damage shall be reported to the Engineer."

**PSL 5.1.4            Depth and cover**

**Add the following to SANS 1200 L, sub-clause 5.1.4.1:**

"During construction there shall be not less than 900 mm of cover over the pipes where construction traffic is liable to cross the pipeline. Road crossings shall not be utilised until the construction of the road layers has reached the stage where 900 mm cover over the pipe is available.

Where the actual clearance between pipe crossings or other services is less than the minimum clearance of 150 mm the main shall be laid beneath the service crossed at an invert level which allows for the minimum clearance. The main shall be laid horizontally at this level for a distance of at least 3.0 m on either side of the centreline of the service crossed and then gradually revert to the minimum cover as specified above.

No decrease in cover or clear space between the pipe barrels as specified will be permitted unless otherwise instructed by the Engineer in writing.

A minimum cover of 900 mm from natural ground level shall be maintained throughout, unless otherwise specified or shown on the drawings."

**Add the following new sub-clause to SANS 1200 L, sub-clause 5.1:**

**\*PSL 5.1.5            Working Inside Pipes and Protection of Internal Lining**

"All possible care shall be exercised during construction in order to avoid damage being inflicted to the pipe lining as a result of the installation and welding activities, and the following procedures shall always be adopted:

- Placing of rubber protection mats in the pipeline to ensure that no damage occurs as a result of foot traffic, falling tools and equipment, weld splatter and or grinding spray.
- On steep slopes, the mat is to be restrained from sliding down the pipe.
- Labourers working inside the pipe are to wear soft soled shoes.
- Wet sacking or rubber matting shall be placed on the pipe invert in the areas where welding or flame cutting operations are in progress to minimise the extent of damage to the lining



from weld splatter or molten metal from flame cutting. This requirement shall be strictly enforced.

- Tools shall be placed on rubber foam or resilient rubber matting to protect the pipe lining against mechanical damage. Care must also be taken on steep slopes to restrain equipment and hand tools from sliding down the pipe during construction.
- Particular care is to be taken inside the pipe when tie-ins into the pipe are done for the purpose of fitting air valves, scour valves, by passes and other tie-ins.

Once internal work in a specific pipe sections has been completed and the pipe has been successfully cleaned, holiday detected and approved as being constructed to the satisfaction of the Engineer, the Contractor shall block off that section of pipe to prevent any further man entry into same.

The rates tendered in the Bills of Quantities shall include for all the measures required under this clause.

Detection of holidays in the internal epoxy lining will only commence once all internal activities in the pipe line have been completed. That is welding of joints, preparation of joints for epoxy reinstatement, as well as epoxy reinstatement in terms of the requirements of this specification. This excludes repair of epoxy lining as a result of damage incurred before the pipe is transported to the construction site as these defects will be repaired in the pipe yard.

Once all work is complete in a particular length of pipe, the Contractor shall arrange for the pipe to be thoroughly swept of all dust and debris. The pipe lining and joint repair will then be tested with a "wet sponge" detector set at 90 Volts in order to detect any electrical insulation defects."

The Contractor shall take note that flushing of the completed pipeline may not be allowed after construction has been completed and therefore clean house keeping practices will be required under all circumstances during construction. The tendered rates for pipe laying shall include for the clean house keeping practices required.

Each section of the pipeline is to be internally inspected and passed by the Engineer once construction has been completed. If the pipework is not satisfactory, the Contractor shall re clean the pipe at his own expense until the pipe is passed clean. The Engineer reserves the right to call for the use of cameras or any other means to inspect inaccessible areas; all at the Contractor's expense."

## **PSL 5.2 Jointing methods**

### **PSL 5.2.2 Flanges (Steel and stainless steel pipelines)**

**Add the following to SANS 1200 L, sub-clause 5.2.2:**

"All flanges shall be installed with bolt holes off-centre and symmetrically off-set from the vertical centre line of the flange. Flanges shall be installed truly square to the axis of the pipe.

The Contractor shall ensure that the correct jointing materials, i.e. gaskets, bolts and nuts are available when required. Only correct diameters and lengths of bolts and studs shall be used. Flat washers shall be used under all nuts. The length of bolts and studs shall be such that at least two threads protrude from the nut when fully tightened. The threads of bolts, studs and nuts shall be

thoroughly cleaned and then coated with a graphite/grease compound immediately prior to assembly.

Flanged fittings shall be so installed that there are no stresses induced into the pipe work, specials or fittings by forcing ill-fitting units into position or by bolting up flanges with faces not uniformly in contact with their gaskets over their whole faces."

**Add the following new sub-clause to SANS 1200 L, sub-clause 5.2:**

**\*PSL 5.2.5 Polyethylene (PE) Pipes and Fittings**

**\*PSL 5.2.5.1 Unreinforced PE pipes**

Unless otherwise specified, any of the following may be used to joint pipes together:

- a) Mechanical joint compression fittings that comply with the requirements of SANS 14236
- b) Suitable push-fit fittings recommended by the pipe manufacturer
- c) Heated-tool socket weld or electrofusion fittings that comply with the requirements of SANS 4427-3
- d) Butt fusion as per SANS 10268
- e) Ductile iron fittings that comply with the requirements of SANS 52824;
- f) Mechanical jointing systems that comply with the requirements of SANS 4427-3. Note that the use of standard stub ends for PE pipes shall not be permitted. (PSL 3.8.3)

**\*PSL 5.2.5.2 PE Pipe Welding Requirements**

**\*PSL 5.2.5.2.1 Applicable Standards**

"All pipes, fittings, welding processes and equipment are to comply with the relevant standards:

- SANS 10270 - Welding of Thermoplastics – Approval of welding Procedures and Welds
- SANS 10268-1 – Welding of Thermoplastics – Part 1: Heated Tool welding
- SANS 10268-2 – Welding of Thermoplastics – Part 2: Electrofusion welding
- SANS 10268-10 – Welding of Thermoplastics – Part 10: Weld defects
- SANS 10269 – Welding of Thermoplastics – Testing and approval of welders
- 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 6269 – Welding of Thermoplastics – Test Methods for Welded Joints

**\*PSL 5.2.5.2.2 General Welding Requirements**

"Welding must take place in a dry and protect site. Suitable measures must be taken to protect the welding operation from adverse ambient conditions (rain, high humidity, wind). Ambient temperature must be recorded for each weld. The welding machine and the supports of the pipes must be erected so that they cannot move in any direction during welding.

The Contractor must apply for approval of welding procedures and welds in accordance with SANS 10270. The Welding Procedure Specification Qualification Report must be signed by the inspector with one copy handed to the Engineer. The Qualification file as described in Clause 9 of SANS 10270 must be handed to the Employer prior to commencement of any production / construction site welding activities.

Welding is to be carried out only by welders certified by the National approved training body (Thermoplastics Joining Committee – National Panel of Examiners). The operator's current and valid welding certificate must be presented to the Engineer before any welding commences."

**\*PSL 5.2.5.2.3 Butt Fusion Welding**

"Butt Fusion Welding may only be used to join pipes of the same SDR (Standard Dimension Ratio).

Only automated, approved, and calibrated welding machinery will be permitted. A calibration certificate must be presented to the Engineer before any welding commences. Every welding machine shall be marked in accordance with Clause 4.7 of SANS 1671-1, with the following items:

- a) The manufacturer's name
- b) Type of welding machine
- c) Manufacture date
- d) Serial number of machine
- e) Safety information for the operation of the machinery

The welding machinery shall allow for control and adjustment of the various welding parameters in accordance with Clause 4.5 of SANS 1671-1.

Instructions for the safe and correct operation, maintenance, servicing and calibration of the welding machinery must be supplied and shall include, as a minimum, the items a) to e) in Clause 4.8. of SANS 1671-1.

Process reports for each weld with the information listed in items a) to m) of Clause 4.5.4.1 of SANS 1671-1 must be complied and handed to the Engineer prior to commencement of any welding activities.

Heated tools shall comply with Clause 5.4 and the specific requirements of Clause 6 in SANS 1671-1. Surface coatings for heated tools are permitted to allow for easy cleaning with the exception of PTFE spray and galvanic coatings containing copper and cuprous material. The requirements of Clause 5.4.3 in SANS 1671-1 shall be adhered to should PTFE be used as a surface coating. The heating plate shall be cleaned with an appropriate non-oil based cleaning solvent using the method described in Clause 5.1 of SANS 10268-1.

Pipe joint ends shall be prepared using the method described in Clause 5.2 of SANS 10268-1. This includes proper alignment of the joint (maximum offset limited to 10% of pipe wall thickness), machine facing to ensure a smooth joint end and cleaning with an appropriate solvent such as isopropyl alcohol. All measures shall be taken to prevent contamination of the joint surface by

grease, dirt and dust.

The Butt Welding jointing process shall comply with Clause 5.4 of SANS 10268-1. Should the pipe manufacturer's specification and instruction differ from Clause 5.4, the manufacturer's instructions shall apply."

**\*PSL 5.2.5.2.4 Electrofusion Welding**

"Electrofusion welding may be used to join pipes of different SDR. Only automated, approved, and calibrated welding machinery is permitted. A calibration certificate shall be presented to the Engineer before any welding activities commence.

Only bar coded fittings and Electrofusion Control Units shall be used. The computerised printouts of the weld parameters and information for each weld shall be compiled and handed to the Engineer upon his/her request. Every welding machine shall be marked in accordance with Clause 8 of SANS 1671-2, with the following items:

- a) Manufacturers name
- b) Serial number of machine
- c) Type of machine
- d) Input and outlet voltages
- e) Frequency
- f) Insulation protection class (to SANS 60529) and
- g) Duty cycle

Instructions for the safe and correct operation, maintenance, servicing and calibration of the welding machinery must be supplied and shall include, as a minimum, the items a) to e) in Clause 9 of SANS 1671-2.

Joint surfaces must be prepared in accordance with Clause 6.1 of SANS 10268-2. The pipe must be cut square and all oxidation shall be removed using a purpose made reaming/scraping tool, suitable for the outside diameter of the pipe to be reamed, immediately before welding. The external surfaces of the pipes to be joined and the inside surface of the electrofusion coupling shall be wiped clean with a suitable solvent such as isopropyl alcohol as described in Clause 6.1.4.2 of SANS 10268-2.

The manufacturer's instructions for the electrofusion welding process must be strictly adhered to and only approved, certified and calibrated machinery may be used. Welding is to be carried out only by welders certified under the Thermoplastics Welding Institute of South Africa (TWISA) or the Plastics Federation of South Africa.

The Electrofusion welding jointing process must comply with Clause 6.3 of SANS 10268-2. Should the pipe manufacturer's specification and instruction differ from Clause 6.3, the manufacturer's instructions shall apply. All completed welds will be visually inspected and will be recorded on an appropriate weld defects check sheet in accordance with SANS 10268-10. Weld assessment Class III will be applicable."

**\*PSL 5.2.5.2.5 Fittings**

**(a) “Tees and Bends**

Injection moulded fittings shall be used wherever possible. Where factory fabricated fittings are to be used for tees and bends their pressure class shall be de-rated in accordance with the appropriate standard. Injection moulded fittings are deemed to be fully rated and need not be de-rated as in the case of fabricated fittings.

**(b) Saddles**

Only electrofusion type saddles are permitted. Electrofusion saddles shall comply with ISO 4427 – 3 and ISO 4427 – 5.

**(c) Compression Fittings**

Compression fittings may be used to join pipes with diameter size smaller than DN 100. Compression fittings shall comply with SABS 533 and shall conform to ISO 4427.

**(d) Mechanical Couplings**

Mechanical couplings must be of the tension resisting type to counter the shortening of the pipe and resultant induced longitudinal stresses when pressurised due to Poisson effect and thermal contraction. External restraints must be provided for anchorage of the pipes to be joined, and specialist suppliers of pipes and fittings should be consulted for suitable jointing solutions.

**The use of flexible couplings (“V.J couplings”) is expressly prohibited under all conditions and circumstances.**

**(e) Flanged Connections**

Flanged connections comprised of butt welded HDPE stub flanges and steel backing rings which are bolted to other flanges. The body of the PE fitting must be manufactured in the injection moulding Process or from a piece of homogeneous Semi-finished material. **Semi-Finished Materials Manufactured From Wound Rods Or The Subsequent Application Of Other Forms Of Reinforcing Are Not Permitted.** Bolts are to be numbered and tightened in a cross pattern sequence. Bolt torque must be as per the guidelines of the supplier of the stubs. Bolts are to be re-torqued 24 to 48 hours after initial tightening in accordance with the manufacturer's specification to counteract reduced tension in the tie bolts resulting from visco-elastic relaxation of the HDPE material under stress thus maintaining sealing pressures and ensuring leak free joints. Gaskets are not required provided that the mating faces of the HDPE stub flanges have not been damaged.”

**PSL 5.6 Valve and hydrant chambers**

**Add the following to SANS 1200 L, sub-clause 5.6:**

“The Contractor shall provide the Engineer with all relevant dimensions of valves fittings and specials for the purposes of finally sizing chambers and the designing of the reinforcement at least 40 working days prior to such sizes and reinforcement schedules being required. No extensions of time for delays resulting from failure to supply this information on time will be entertained. Any redesign costs due to supply of incorrect information will be to the Contractor’s account.”

**Add the following new sub-clause to SANS 1200 L, clause 5:**

**\*PSL 5.11 Cement Stabilising Bedding and Selected Fill around Pipes**

“Where shown on the drawings or directed by the Engineer, the bedding and selected material around the pipe shall be stabilized with 8% by mass of OPC. This is applicable to water course crossings, under trafficked areas and on steep slopes.

In all cases, the cement shall be added to the bedding / selected fill material outside the trench and in such a manner so as to achieve full dispersion of the cement in the material and achieve Optimum Moisture Content when placed and compacted around the pipe. Excess water content is to be avoided so as not to create a ‘concrete encasement’ of the pipe.”

**PSL 6 TOLERANCES**

**PSL 6.2 Control Points**

**Add the following to SANS 1200 L, sub-clause 6.2:**

“On completion of the contract, the Contractor shall provide the Engineer with a list of as built coordinates (Accurate to 0.1 m) for all air valves, scour valves, isolation valves and standpipes. The cost of providing this information shall be deemed to be included in the rates tendered for the individual items.”

**PSL 7 TESTING**

**PSL 7.1 General**

**Add the following to SANS 1200 L, sub-clause 7.1:**

“The price for testing the pipeline must be included in the scheduled items for supply and installation.”

**PSL 7.3 Standard hydraulic pipe test**

**PSL 7.3.1 Test pressure and time of test**

**Add the following to SANS 1200 L, sub-clause 7.3.1:**

“The sections in which the pipeline may be tested will be at the discretion of the Contractor, except that the pipeline shall be tested in sections not exceeding a maximum allowable length of 2 000 m unless otherwise agreed by the Engineer. The Contractor shall make due allowance in the construction program and in the tendered rates for the entire testing operation including for the provision of temporary end stops (flanges or bullnoses) and any other costs incurred associated with testing the pipeline.

The pipe shall not be tested until the associated structural concrete for anchorage has cured for 28 days or until such concrete has attained the specified design strength. In the case of cement mortar lined pipes, once filled, the pipe shall be left for 24 hours to permit maximum saturation of cement mortar linings.”

**Delete the contents of SANS 1200 L, sub-clause 7.3.1.2 and replace with the following:**

“Subject to the provisions of 7.3.1.3 and 7.3.1.4, the test pressure for field testing shall be 1.25 times the designated working pressure at any point on the longitudinal section of the pipeline up to a maximum of 1.0 MPa, above which it shall be the designated working pressure plus 0.5 MPa.

For the purposes of this calculation, the designated working pressure shall be taken as the pressure rating of the pipe.”

**Delete the contents of SANS 1200 L, sub-clause 7.3.1.4 and replace with the following:**

The field test pressure shall not exceed the appropriate of the values in the following table.

Type of pipe	Applicable standard materials	Maximum field pressure at any point of the pipeline
Steel	SANS 62-1, SANS 62-2, SANS 719	50% of the hydraulic test pressure
Ductile iron	SANS 50545	Allowable site test pressure (PEA)
Reinforced concrete	SANS 676	75% of hydraulic test pressure
Prestressed concrete	SANS 975	75% of hydraulic test pressure
Fibre cement	SANS 1223	75% of hydraulic test pressure
GRP	SANS 1748-1	1.5 times the rated pressure class
Polyethylene (PE)	SANS 4427	1.5 times the rated pressure of the pipe
Steel-mesh-reinforced PE	SANS 370	1.5 times the rated pressure of the pipe
Polypropylene	SANS 15874-2 and SANS 15874-3	1.5 times the rated pressure of the pipe
uPVC	SANS 966-1	1.5 times the rated pressure of the pipe
mPVC	SANS 966-2 or SANS 1283	1.5 times the rated pressure of the pipe

Type of pipe	Applicable standard	materials	Maximum field pressure at any point of the pipeline
oPVC	SANS 16422		1.5 times the rated pressure of the pipe

**Add the following new sub-clauses to SANS 1200 L, sub-clause 7.3:**

**\*PSL 7.3.4 Initial Filling of Pipeline**

“The entire process for filling the pipeline at any time during testing or disinfection shall be carried out under the supervision of the Engineer and will also be monitored by the Engineer and/or the Employer's personnel. Under no circumstances will the Contractor be allowed to carry out filling of the pipeline without the supervision of the Engineer, neither shall he/she permit any other persons to carry out such filling without the written permission of the Engineer.

Any damage to the pipeline caused by non-compliance with this Sub-Clause shall be rectified at the Contractor's expense.”

**\*PSL 7.3.5 Connections after Testing**

“The connections of the new pipework to the existing pipework shall only be carried out after the pipeline testing has been completed and accepted by the Engineer. For this reason, testing must be carried out against a blank flange or bullnose end cap at these locations.”

**\*PSL 7.3.6 Remedial Measures**

“In the event that a pipe section fails a test, the Contractor shall carry out all remedial measures necessary to obtain a successful test of each individual section and the entire pipeline, at his/her own expense. Such remedial measures shall in no way compromise the original pipeline specifications.”

**\*PSL 7.3.7 Draining of the Pipeline**

“The pipeline may have to be drained to carry out remedial measures and it must be drained before the disinfection process commences. The pipeline shall be drained via the scour valves in a manner that does not cause erosion of the streambeds or negatively impact on the environment in any way. All such drainage of the pipeline shall be carried out under the supervision of the Engineer. Removal and disposing of material drained from pipelines will be done in line with the Contract and Specifications and will be for the Contractor's account”

**Add the following new sub-clauses to SANS 1200 L, clause 7:**

**\*PSL 7.5 Testing of Valves**

“All valves shall be pressure tested according to SABS 664 or other applicable code at the appropriate test pressure. Test certificates shall be issued to the Engineer upon delivery to site.



No separate payment shall be made for testing of valves and hydrants and the scheduled rates for the supply and installation of valves shall include for all costs in respect of testing."

**\*PSL 7.6           Commissioning**

"The pipeline will be considered to have been commissioned and practically complete once all the associated structures are sufficiently complete to carry out their structural and hydraulic function and the hydraulic test of the entire pipeline has been successfully completed."

**\*PSL 7.7           Testing of PE pipes and materials**

**\*PSL 7.7.1       Raw Material Acceptance Tests**

"The material used for the production of the pipes and fittings shall be a high density polyethylene PE 100 complying to SANS ISO 4427 Part 1. To ascertain the quality of this product the following tests shall be performed, prior to manufacture of the pipes or fittings.

- Density
- Melt Flow Index
- Carbon Black Content
- Thermal Stability

Copies of all test schedules and manufacturer's quality control records shall be available for examination by the Employer and/or the Engineer.

The following documents are required:

- Certificate of Registration – SANS ISO 9001:2008 or National Equivalent
- Permit Certification – SANS 4427 for PE 100
- the Quality Control Plan (QCP shall include Raw Material and Product Test Certificates)
- SABS or National Equivalent Quality Systems Audit Reports – Last 2 Audits"

**\*PSL 7.7.2       Testing of Pipes**

"Testing as contained in the SANS 4427:1996/ ISO 4427:1996 specification Part 1 and 2 will be used as guidelines. Tests shall also be conducted ad-hoc by a registered and authorised testing authority."

**\*PSL 7.7.3       Destructive Testing of Welds**

"The testing of welds shall comply with the requirements of SANS 6269 Edition 1.1.

The standard destructive tests described are as follows:

- Tensile test;
- Tensile-creep test; (not required unless specified normally for chemical high end applications only)
- Bend test; and
- Peel test for electrofusion joints only."

**\*PSL 7.7.4 Non-Destructive Testing of Welds**

“The testing of welds by non-destructive testing will be conducted by the Engineer on site and before any production weld is made by the Contractor on site. The following procedure shall be followed:

- The Contractor shall not undertake any welding without the presence of Engineer;
- The testing machinery shall be checked and approved by the Engineer before testing commences”

**\*PSL 7.7.5 Field Pressure Testing Procedure for HDPE pipes**

“The method described below describes the procedure to be followed for field pressure testing of HDPE pipe:

- Fill the pipe with water
- Bleed off any trapped air
- Over a period no longer than 10 minutes, increase the pressure at a constant rate to the specified field test pressure (the Field Test Pressure Horizon is shown on the small scale long section drawing)
- Maintain the test pressure by continuous pumping for 10 minutes, then stop pumping
- Close the shut-off valve to the pipe and monitor the pressure for a period of 60 minutes. Inspect the pipe visually for leaks during this time.
- If the pressure has dropped more than 30% at the end of the 60 minute period, the pipe shall not have passed the pressure test. Continue to look for leaks and repair as necessary.
- If the pressure has dropped less than 30% at the end of the 60 minute period, rapidly decrease the pressure in the pipe by 2,0 bar (200 kPa) by releasing water from the pipe.
- Monitor the pressure for 60 minutes. If the pressure remains constant or increases during this time the pipe is deemed to have passed the pressure test.

If the pipeline does not pass the pressure test:

- Remove the test pressure
- Permit the test section to ‘relax’ for not less than 8 hours
- Repeat the above procedure.”

**PSL 8 MEASUREMENT AND PAYMENT**

**PSL 8.2.1 Supply, lay and bed pipes**

**SANS 1200 L, sub-clause 8.2.1 to include payment for:**

PSL 3.1	General
PSL 3.4	Steel pipes, fittings and specials
PSL 3.4.1	General
PSL 3.4.2	Pipes of NB up to 150mm

PSL 3.4.3	Pipes of nominal bore over 150mm
PSL 3.4.4	Fittings and Specials
*PSL 3.4.5	Puddle Collars and Anchoring Flanges
*PSL 3.4.6	Welding Tests at fitting Fabrication Shop(s)
*PSL 3.4.6.1	Qualification Tests for Welding Procedures
*PSL 3.4.6.2	Radiographic Examination of Shop Welds
PSL 3.7	Other types of pipes
PSL 3.7.2	Polyethylene Pipes
*PSL 3.7.2.1	Unreinforced PE pipes
*PSL 3.7.2.2	Steel-mesh-reinforced Polyethylene (PE) pipes
PSL 3.8	Jointing material
PSL 3.8.2	Flexible couplings
PSL 3.8.3	Flanges and accessories
PSL 3.8.4	Loose flanges
*PSL 3.8.8	Couplings for polyethylene pipes
PSL 3.9	Corrosion protection
PSL 3.9.2	Steel Pipes
PSL 3.9.3	Protection against Electrolytic Corrosion and general repair and making good procedures for linings and coatings
PSL 3.9.5	Joints, bolts, nuts and washers
PSL 4.1 H	handling and Rigging
*PSL 4.1.1	Stacking and Storage of HDPE Pipes
*PSL 4.4	Packing
PSL 5.1	Laying
PSL 5.1.1	General
PSL 5.1.2	Damage
PSL 5.1.3	Keeping Pipelines Clean
*PSL 5.1.3.1	Cleaning Pipe Internals
*PSL 5.1.3.2	Cleaning of Valves and Fittings
PSL 5.1.4	Depth and cover
*PSL 5.1.5	Working Inside Pipes and Protection of Internal Lining
PSL 5.2	Jointing methods
PSL 5.2.2	Flanges (Steel and stainless steel pipelines)
*PSL 5.2.5	Polyethylene (PE) Pipes and Fittings
*PSL 5.2.5.1	Unreinforced PE pipes
*PSL 5.2.5.2	PE Pipe Welding Requirements
*PSL 5.2.5.2.1	Applicable Standards
*PSL 5.2.5.2.2	General Welding Requirements
*PSL 5.2.5.2.3	Butt Fusion Welding
*PSL 5.2.5.2.4	Electrofusion Welding
*PSL 5.2.5.2.5	Fittings
PSL 6.2	Control Points
PSL 7.1	General
PSL 7.3	Standard hydraulic pipe test
PSL 7.3.1	Test pressure and time of test
*PSL 7.3.4	Initial Filling of Pipeline
*PSL 7.3.5	Connections after Testing

- \*PSL 7.3.6 Remedial Measures
- \*PSL 7.3.7 Draining of the Pipeline
- \*PSL 7.5 Testing of Valves
- \*PSL 7.6 Commissioning
- \*PSL 7.7 Testing of PE pipes and materials
- \*PSL 7.7.1 Raw Material Acceptance Tests
- \*PSL 7.7.2 Testing of Pipes:
- \*PSL 7.7.3 Destructive Testing of Welds
- \*PSL 7.7.4 Non-Destructive Testing of Welds
- \*PSL 7.7.5 Field Pressure Testing Procedure for HDPE pipes

**PSL 8.2.5 Supply and place pipes, valves and specials**

**SANS 1200 L, sub-clause 8.2.5 to include payment for:**

- PSL 3.4.4 Fittings and Specials
- PSL 3.9.3 Protection against Electrolytic Corrosion and general repair and making good procedures for linings and coatings
- PSL 3.10 Valves
- \*PSL 3.10.1 Gate valves
- \*PSL 3.10.2 Air valves
- \*PSL 3.10.3 Non-return valves
- \*PSL 3.10.4 Scour valves
- \*PSL 3.10.5 Isolating valves

Change the unit of measurement of this item to: "Sum or No".

"Where the unit is scheduled as a Sum, the scope and detail of the relevant pipes, valves and specials shall be shown on the drawings and/or described in the Bills of Quantities or specifications. In that case the sum shall cover the collective cost of all the relevant pipes, valves and specials.

Where "DESIGN" is added to the description of this payment item in the Bills of Quantities, the rate shall include the cost of design services as specified for this contract. The detail of the pipework that is given on the drawings is deemed to be adequate for tendering and planning purposes. Any changes deemed necessary by the Contractor to provide a fully reliable and functional system in accordance with the specifications shall be included in the tendered rates. No variations in payment will be entertained during the construction stage.

Where additional supports or brackets are schematically shown on the drawings or deemed necessary by the Contractor, the rate shall include the design, manufacture and construction required for the supports."

**PSL 8.2.13 Valve and hydrant chambers**

**SANS 1200 L, sub-clause 8.2.13 to include payment for:**

- PSL 5.6 Valve and hydrant chambers

**PSL 8.2.15 Special Wrapping in Corrosive Soils.**

**Add the following to this payment clause:**

“The specification for wrapping shall be as specified in PSL 3.9.6 for corrosive soils.”

**Add the following new payment item to SANS 1200 L, sub-clause 8.2:**

**\*PSL 8.2.18 Connect into existing main .....Unit: No**

“Connections to existing pipework will be measured by number of connection points.

The rate shall cover the cost of locating, exposing and backfilling the main, liaising with the (authority concerned) to arrange for turning off the supply, cutting into the pipe, dealing with water, cutting pipes to fit, including turning if necessary, dealing with water, and the supply and fitting of long collar repair couplings to complete the connection and, if required, the temporary sealing and anchoring of pipe ends for testing purposes and subsequent removal of seals and anchors. The specials, including the couplings, required to make the connection will be measured separately.”

**\*PSL 8.2.19 Pipeline markers complete .....Unit: No**

“The rate shall provide full compensation for the erecting of pipeline markers as specified in the schedule of quantities. The rate will include for all labour and materials to erect pipeline markers and will include payment for \*PSL 3.11.7.”

**PSLB BEDDING (PIPES) (SANS 1200 LB)**

**PSLB 3 MATERIALS**

**PSLB 3.1 Selected granular material**

**Add the following to SANS 1200 LB, sub-clause 3.1:**

“Wherever the words “Selected Granular Material” are used in the specification, these shall be replaced with “Selected Bedding Material”. In the case of flexible pipes the selected granular material shall consist of sand.

Wherever practicable, the Contractor shall use suitable material selected from the excavations for selected bedding and selected fill material.”

**PSLB 3.2 Selected fill material**

**Replace SANS 1200 DM, sub-clause 3.2 with the following:**

“Selected fill material shall be free from vegetation and from lumps and stones of diameter exceeding 30mm, and shall be obtained from the trench excavations or other necessary excavations on the site, all to the approval of the Engineer.”

**PSLB 3.3 Bedding**

**Add the following to SANS 1200 LB, sub-clause 3.3:**

“Selected bedding material shall comply with the following requirements:

- A maximum particle size of 30 mm
- A minimum grading modulus of 0,5
- A minimum CBR of 15% at 93% of modified AASHTO maximum density
- A maximum plasticity index of 12

The Bedding shall be compacted to at least 93% of modified AASHTO maximum density (100% for sand).

All medium pressure pipes shall be classed as flexible pipes and shall be bedded in accordance with Drawing LB 2 of SABS 1200 LB.

All concrete pipes shall be classed as rigid and shall be bedded in accordance with Drawing LB 3 of SABS 1200 LB.

Depending on the actual material supplied by the Contractor, the moisture content may be critical to enable satisfactory placing and compaction and the Contractor will be deemed to have allowed in his tendered rate for any and all adjustments required to the moisture content of the bedding material at all times.

No extra payment will be made for forming or filling joint holes (pockets)."

#### **PSLB 3.4        Selection**

##### **PSLB 3.4.1      Selection from trench excavation**

**Add the following to SANS 1200 LB, sub-clause 3.4.1:**

"The excavation of a pipe trench shall comply with the requirements of Sub-Clause 5.4 of SABS 1200 DB and the provisions of Sub-Clause 3.7 of SABS 1200 DB (in terms of which, for the purposes of providing bedding materials, the Contractor is not required to use selective methods of excavating) shall apply. Nevertheless the Contractor shall take every reasonable precaution to avoid burying or contaminating material that is suitable and is required for bedding or covering the pipeline. If, in the opinion of the Engineer, bedding or selected fill material can be produced from the excavated material, the Contractor shall, if so ordered by the Engineer, screen or otherwise treat (as scheduled) the excavated material in order to produce material suitable for bedding or backfill (see also Sub-Clause PSLB 8.2.1)."

#### **PSLB 5        CONSTRUCTION**

##### **PSLB 5.1      GENERAL**

##### **PSLB 5.1.4    Compacting**

**Delete the second line and replace with:** "top of the pipeline) shall be 93% mod AASHTO".

**Add the following to SANS 1200 LB, sub-clause 5.1.4:**

"Steps will have to be taken by the Contractor to ensure that flexible pipes do not deform excessively in cross-section during and after construction and backfilling operations. The maximum deflection which will be acceptable at any stage during or after construction is 2% of the pipe diameter horizontally or vertically. The Contractor will be required to provide the necessary apparatus and to monitor deflection during construction.

Pipe deformations will only be maintained within the specified tolerances by correct backfilling practice. No heavy compaction equipment will be permitted for compaction of any pipe bedding, only pneumatic or hand rammers being acceptable. To this end, and to achieve the 93% compaction specified it is required that the bedding material be brought up evenly on either side of the pipe. The use of complete saturation of the material as a method of achieving the specified compaction may,

subject to the Engineer's approval, be used. However, in this regard, Tenderers are advised that the presence of excessive quantities of water in the pipe trench could lead to flotation of the pipe.

Prior to the commencement of pipe laying the Contractor will be required to submit, to the Engineer, for his approval, his proposed methods of placing, and compacting methods which he proposes to implement in order to ensure compliance with the specification."

**Add the following new sub-clauses to SANS 1200 LB, sub-clause 5.1:**

**\*PSLB 5.1.5 Testing**

"Flexible and flanged joints shall be left exposed with a minimum of 300 mm clearance around the bottom of the pipe during hydraulic pressure testing of the pipe to facilitate inspection."

**PSLB 6 TOLERANCES**

**PSLB 6.1 Moisture Content and Density**

**Add the following to SANS 1200 LB, sub-clause 6.1:**

"The permissible deviations applicable are to be those for Degree of Accuracy II class of work."

**PSLB 8 MEASUREMENT AND PAYMENT**

**PSLB 8.1.2 Sources of bedding material**

**Add the following to SANS 1200 LB, sub-clause 8.1.2:**

"Payment for the provision of imported bedding materials will only be made where they cannot be selected from the excavation within 5km of the point where it is required, and where it is ordered in writing by the Engineer."

**PSLB 8.1.3 Volume of bedding material**

**Add the following to SANS 1200 LB, sub-clause 8.1.3:**

"The volume of bedding material will be measured net, excluding the volume occupied by the pipe. The volume of bedding material will be computed from:

- the trench width specified or scheduled, and
- the depth of each bedding layer as shown on the drawings, and
- by deducting the volume occupied by the pipe."

**PSLB 8.2.1 Provision of bedding from trench excavation**



**SANS 1200 LB, sub-clause 8.2.1 to include payment for:**

PSLB 3.1	Selected granular material
PSLB 3.2	Selected fill material
PSLB 3.3	Bedding
PSLB 3.4.1	Selection from trench excavation

## **PSLD SEWERS (SANS 1200 LD)**

### **PSLD 3 MATERIALS**

#### **PSLD 3.1 Pipes, fittings and pipe joints**

##### **\*PSLD 3.1.2 Reinforced concrete pipes**

##### **Add the following to SANS 1200 LD, sub-clause 3.1.2:**

“Concrete pipes shall be the spigot / socket type manufactured by means of **vertical casting** and be supplied with a 3mm thick light green anchor knob sheet (AKS) (integral suitable anchors) high density polyethylene (HDPE) liner, cast into the pipe internally along the full length, and the full circumference of the internal diameter of the pipe. Factories manufacturing these pipes must have an ISO 9001:2009 Certification.

The joints between the concrete pipes are to be covered internally with 3mm thick HDPE capping strips. The capping strips are to be standard light green HDPE lining, manufactured using matching resin to that of the 3mm thick AKS lining cast into the inner walls of the pipes. Capping strips are to be at least 200mm wide and are to be heat tacked to the HDPE lining of the pipes, after which they are to be welded by the extrusion welding technique on both edges, to ensure a proper joint of the HDPE capping strip to the HDPE/AKS lining of the pipes. For each joint the welding of the capping strips are to be continuous for 360 degrees (full circumference) on both sides of the capping strip. HDPE welding rods of the same colour and matching resin are to be used for the extrusion welding. The fitting of the capping strips, extrusion welding and testing procedures shall comply with SANS 10409. Each joint is to be marked with a unique number/mark. Welder is to have a certificate of competence.”

##### **Add the following new sub-clauses to SANS 1200 LD, sub-clause 3.1:**

##### **\*PSLD 3.1.8 Mild steel pipes (SANS 719 Grade B) epoxy coated (UV resistant)**

###### **\*PSLD 3.1.8.1 Description**

“Mild steel specials shall have a nominal diameter of 900mm with a minimum wall thickness of 12.7 mm, and shall be epoxy coated of SANS 719 Grade B. The epoxy coating must be UV resistant.

The materials and construction of all pipes, specials and fittings shall comply with the appropriate SANS, BS or other appropriate specification, whether stated or not, and shall be approved by the Engineer. Only full length pipes bearing the relevant standard’s mark will be acceptable. Cut pipes shall only be used at connections to structures, as shown on the drawings. When laying the pipes on top of the pedestals the markings shall be visible from the right side.

Pipes and fittings shall be of the types specified in the schedule or in the project specification and, unless otherwise required in terms of the project specification, their couplings shall be capable of withstanding the applicable test pressure. All pipes and fittings shall be supplied complete with couplings and jointing material.

The Contractor shall be responsible for the structural and hydraulic design of all bends and fittings where these are not standard off the shelf items designed and guaranteed by the manufacturer for the purpose intended. Acceptance of the Contractor's design will be subject to the Engineer's approval.

The Engineer shall at all reasonable times have free access to the place where the goods are manufactured for the purpose of examining and sampling the materials and goods, and if necessary for supervising the testing and marking of goods. The manufacturer shall supply free of charge every facility and all labour required for such examination, sampling, inspection, testing and marking before delivery and shall provide and maintain in good order suitable, convenient and accurate apparatus for testing goods.

All steel pipes and specials, irrespective of diameter, shall be fabricated from plain ended pipes. All fabrication shall take place in a suitable workshop prior to galvanising or other corrosion protection, and no cutting or welding of pipes on site shall be permitted without approval of the Engineer.

The Contractor shall, if so instructed, make available to the Engineer the maker's certificates covering the chemical analysis and physical properties of the steel used in the manufacture of pipes and specials, and shall provide written confirmation that welding has been carried out by coded welders.

The pipes shall be hydraulically tested before leaving the factory to the test pressure specified in Sub-Clause 7.3 of SANS 1200 L. The methods of sampling and testing of the manufactured pipes shall comply with Sections 6 and 7 of SANS 719.

The tests shall be carried out at the place of manufacture and at the expense of the Contractor. Upon delivery of the goods concerned the Contractor shall submit a signed certificate giving results of the tests and certifying that the goods concerned have been manufactured in accordance with this specification."

**\*PSLD 3.1.8.2 Flanges**

"The dimensions of all flanges and their drilling shall conform to the dimensions of SANS 1123, Table 1000/3. The use of screwed flanges and fittings shall not be permitted. All flanges shall have a raised face.

Temporary end covers shall be provided by the Contractor for protection of flanges, and prepared plain ends of pipes and fittings to prevent damage during transportation and during handling on site.

All piping and flanged surfaces shall be cleaned before connections are made. The (raised) faces of flanges that are in to be in contact with gaskets shall be masked and shall not be painted or coated. The mating flange shall then receive one coat of rust inhibitor (Plascon Rustix 84 or equal approved). Care shall be exercised to ensure that after the application of all coatings there are no runs or drips on the mating surfaces of the flanges and that the flange profiling is clearly visible over the entire face. Excessive coating build up in flange bolt holes that could snag bolts will not be permitted.

Flanged joints shall be connected with the specified bolts, nuts and washers all of which are to be supplied by the Contractor. Where flanges are beneath ground surface they shall be packed with a bitumen or tar based mastic and wrapped with "Denso Tape" or an equivalent approved product"

**\*PSLD 3.1.8.3 Flange gaskets, bolts, nuts and washers**

"Generally, non-asbestos type gaskets not less than 3 mm thick and suitable for aggressive, corrosive or potable water and raw sewage, shall be supplied for flanges. All bolts, tie-bolts, nuts and washers shall be galvanised to SABS 121:2000 and shall comply with the relevant requirements of SABS 135 – 1985 and SABS 136 – 1985 where applicable.

The length of each bolt shall be such that after the bolt has been tightened, the end of the bolt shall project beyond the outer face of the nut, but not by more than two threads. Tie-bolts on restrained/anchoring couplings shall be fitted with "backing nuts" and washers.

Each flanged joint is to be fitted with an approved and suitably rated gasket and sealed watertight such that there will be no visible sign of leakage under the specified factory and field test pressures and under the in-service working conditions (pressures).

All bolts are to be tightened in a predetermined pattern with opposing bolts being tightened sequentially. When all bolts are tight, each bolt is to be torqued to the required/recommended torque in a predetermined pattern with opposing bolts being tightened sequentially.

All bolt threads shall be liberally coated with "Copper slip" or similar approved compound prior to assembly."

**\*PSLD 3.1.8.4 Couplings for polyethylene pipes**

**"a) Pipe couplings**

- i) Slip-on couplings and slip-on flange adaptors shall mean "Viking Johnson" or "Klamflex" type couplings. All stainless steel slip-on couplings shall have a harness arrangement to prevent pipe separation. The end flange (compression flange) shall be such that the tie bolts clear the end flange. Bending of tie bolts will not be allowed. The couplings shall be fusion bonded epoxy coated and lined with a dry film thickness of not less than 275 µm.

- ii) Couplings shall be rated as a minimum to the same class as the pipe.

**b) Storage of couplings and fittings and stacking of pipes.**

The Contractor shall provide adequate storage facilities for pipes, couplings and specials as recommended by the manufacturer."

**\*PSLD 3.1.8.5 Puddle Collars**

"Puddle collars used as pipe anchorages shall be of the same dimensions as corresponding flanges but those cast into concrete walls are to be undrilled. The collar shall be capable of transmitting a longitudinal force 33% greater than the internal hydraulic pressure to be applied when testing, multiplied by the area of the bore and, under that condition, the stress in the material shall not exceed its yield stress.

Where puddle collars are shown on the drawings as being 10 mm thick, those collars are not required to transmit thrust, their purpose being to assist with the waterproofing of the concrete chambers by increasing the path that ground water might have to take to enter the chambers."

**\*PSLD 3.1.8.6 Corrosion Protection**

**\*PSLD 3.1.8.6.1 Steel Pipes**

"For all exposed steel pipes:

Unless otherwise scheduled, all mild steel specials shall be factory coated with a solvent free UV-resistant multi-purpose epoxy with a minimum dry film thickness of 350 micron. After installation the pipe shall be painted with re-coatable polyurethane enamel with a minimum DFT of 40 microns to the Employer's colour coding specification. Epoxy paint shall comply to SANS 1217 and in accordance with the epoxy manufacturer's specifications for preparation of the receiving surface and application of the product.

Unless otherwise scheduled, all mild steel specials shall be factory lined with a fusion bonded epoxy with a minimum dry film thickness of 350 micron. Epoxy paint shall comply to SANS 1217 and in accordance with the epoxy manufacturer's specifications for preparation of the receiving surface and application of the product."

**\*PSLD 3.1.8.6.2 Preparation of Steel Surfaces for Repairs and/or Reinstatement of  
External Coating**

"The following method is applicable for the preparation of all exposed steel surfaces prior to the carrying out of any repair procedure to external coatings. This specification is applicable to all pipe steel

surfaces which have been stripped of their corrosion protection layers, internally or externally, as a result of the manufacturing of specials, construction activities or pipe laying, welding and/or damages caused by handling or latent defects in application.

Degreasing:

All bare metal surfaces shall be degreased in order to remove grease and oil from the pipe surface as a first step in the preparation process i.e. before grit blasting and/or power brushing starts. Degreasing shall be carried out using a non-volatile solvent (e.g. "Aquasolve", "Chesterton Nr. 261 Safety Solvent Cleaner" or similar approved substance). The surface shall then be cleaned with potable water and left to dry completely before the next step is taken.

Power Brush – External Coating Repair:

Power brushing of bare metal surface shall take place after degreasing of the area as specified. The area that has been power brushed shall be free from rust, laitance, dust, oil or other deleterious matter before the application of primer. Any areas in the region where power brushing took place shall be free from signs of disbonding of lining and/or coating, once power brushed. The surface finish, once power brushing has been completed, shall conform to minimum St2 standard."

**\*PSLD 3.1.8.6.3 Holiday Testing – Epoxy Linings and Coatings**

"All Holiday Testing of epoxy linings and coatings shall be carried out with an instrument approved by the Engineer. The sparking detection test shall conform to the standards as set out in SANS 1217:2001 and BS 3003 Part 1. The Contractor shall familiarise himself with the dielectric strength (breakdown strength) of all the coatings and linings he works with for the different pipe sizes. The Contractor shall also have an in depth knowledge of the Holiday Testing equipment he works with, in order to calculate the Corona discharge effect for the typical brush being utilised, with reference to the specific ambient conditions for any specific test.

All Holiday Testing shall be executed at a voltage which is set at 50% of the value of the dielectric strength of the lining or coating being tested. The Contractor shall carefully analyse the loss in test voltage as a result of the Corona Effect, specific to the ambient conditions surrounding the test. The test voltage of the Holiday Testing equipment shall be adjusted such that the voltage drop as a result of the Corona Effect will be taken into account when the actual 50% threshold of the dielectric strength is calculated.

The Holiday Test equipment shall be calibrated by an approved supplier and checked every 30 minutes or every time a test at a different location is started. Each piece of equipment shall have a unique identification number with calibration certificates and detail of equipment utilized shall be submitted to the Engineer for approval. Method statements for the process of holiday testing shall be submitted to the Engineer for approval.

The correct equipment for the type of application shall be utilized. For example, where pin holes have been repaired and re-testing for effectiveness of repair work being done, the Contractor shall utilize the correct equipment to effect same and this shall include the use of a pencil brush which concentrates the efforts of holiday testing at the repair. Where spark tests are performed on Tape Wrap systems, the minimum brush width shall be 300 mm. The brushes utilized shall be brass bristle cone brushes. The typical brush speed shall be 200 to 300 mm/sec when doing spark tests

The Contractor shall, at his expense, test each and every surface area, that is internal lining as well as external coating, during construction as per this specification. Testing for holidays shall be done after inclusion of materials, manufactured specials and equipment, as well as pipes, into the permanent works. Any defects found shall be repaired and the costs for remedial work shall be deemed to be included in the tendered rates for the construction of the pipeline. These tests and results shall be recorded on the quality control plan as approved by the Engineer."

**\*PSLD 3.1.8.6.4 Preparation Mixing and Application of Epoxy Compounds**

"When mixing two part epoxies the base and activator shall be mixed in accordance with the manufacturer's specifications. Mixing in the original container will only be permitted by means of methods that ensure full integration of different parts of the compound into a homogeneous compound with the characteristics as intended by the manufacturer. The different parts of the compound shall not be diluted. Mixing shall only be allowed with full batches and reduction of volumes from mixing packs by means of weight or volume measurement, which will result in smaller portions to be mixed, will not be allowed. In the application of the epoxy the following shall be strictly in compliance with the manufacturer's instructions:

Method of application (Type of Brush or roller.)

- Over coating time.
- Temperature range for application.
- Method of mixing base and activator.
- Number of coats to achieve the specified thickness.
- Safety aspects e.g. Eye and hand protection, ventilation, fire precautions, etc.

Note that roller and brush applicators shall be replaced once the product application expiry time has been reached on any specific applicator tool.

Uncured epoxy shall be regarded as being toxic and shall be handled in accordance with the manufacturer's instructions. Adequate lighting and ventilation shall be provided whilst working within the pipeline.

Only solvent free epoxy repair kits shall be utilized to repair the internal linings of the pipe line. This specification refers to "two part epoxy" as an epoxy repair kit which consists of a base and an activator

approved by the Engineer and could be products similar to “Denso ST100”, “Sigma SF 523”, “Nordbak”, etc.

The Contractor’s tendered rates for the laying of the pipe shall be deemed to include for all the repairs and make-goods that have to be effected in order to deliver a serviceable and acceptable pipe line. (This excludes such repairs as instructed by the Engineer as a result of manufacturing defects, if any).

Two part epoxy may only be applied on steel surfaces prepared as specified in PSLD 3.1.8.6.2.”

**\*PSLD 3.1.8.6.5 Repair and Making Good of Solvent Free Epoxy Linings**

“Pipes with linings damaged prior to acceptance by the Contractor shall be marked and recorded by both the Contractor and the Engineer and then repaired by the Contractor. The payment rate for repair shall be made at the scheduled rate.

Once the Contractor has accepted pipes with undamaged linings from the Employer, any subsequent damage to the lining in the pipes shall be repaired by the Contractor at his expense.

All making good of internal solvent free epoxy linings at welded and flanged joints that is required to ensure continuous internal corrosion protection to steel surfaces shall be carried out strictly in accordance with the manufacturer’s specifications. The Contractor shall ensure that making good of linings is carried out progressively as the pipe is being laid and shall not be permitted to lag behind for more than three pipe lengths at each working front.”

**\*PSLD 3.1.8.6.6 External Corrosion Protection of Factory Welded Joints and Coating Repairs**

“All steel pipes that are to be field-welded shall be supplied with the external coating cut back 100 mm from each pipe end. Where pipes are to be cut, either on site, or for the purpose of fabricating bends, fittings and specials, or in the event of the pipe coating being damaged, the pipe coating shall be cut back 100 mm from the intended cut area before the pipe is cut. Damp hessian sacking or other suitable material is to be temporarily fixed around the pipe to prevent damage to the pipe coating during welding operations. Once welding is complete, and all weld splatter and burnt coating has been removed, the welded pipe joints shall be wrapped in the following manner.

The following specification is based on “Denso” products and systems. Alternative products and procedures may be proposed by the Contractor and, if approved by the Engineer, they may be used. Irrespective of which products are approved by the Engineer and used by the Contractor, all procedures shall be carried out strictly in accordance with the Contractor’s method statements which shall conform to the manufacturer’s recommendations.



A fundamental outcome is a sound and continuous coating that is free from wrinkles and that does not have any entrapped air pockets or any air bubbles.

#### Surface Preparation

The bare metal shall be cleaned and wire brushed to minimum St.2 standard and, degreased with white spirit. The adjacent pipe coating shall be cleaned to a minimum of 300 mm either side of the joint and the edges “feathered” to achieve a tapered transition over a distance of 100 mm. The sound, parent coating surface shall be roughened with sandpaper over an area 250 mm either side of the joint.

#### Priming

The entire pipe and coating surface over a length of 250 mm on either side of the joint shall be primed using “Denso Primer D” (or equivalent approved). Care shall be taken to obtain a thin even film with no runs or sags. The primer shall be allowed to cure until “tack dry” before the application of the tape commences. Priming may only be carried out on those areas that are to be wrapped that same day. If primed areas are to be left overnight, those areas shall be re-primed before wrapping.

#### Profiling Tape

A 1.5 mm thick x 50 mm wide “Denso Mastic Sealing Tape” (or equivalent approved) shall be applied to the full circumference of the weld bead in accordance with the manufacturer’s specifications. Care shall be taken to ensure a smooth profile and to avoid air bubbles being trapped beneath the tape. (Note: The profiling tape may be omitted at the discretion of the Engineer. Tenderers shall nonetheless allow for the profiling tape in their tendered rates).

#### Tape Wrapping

The joint shall then be wrapped (minimum 55 % overlap) with “Denso CPT 1250/300 Polyethylene/Bitumen” tape starting at the roughened section (250 mm from the welded joint) in accordance with the manufacturer’s requirements to create a 500 mm wide wrapping, centred over the welded joint. A 100% overlap is required on the first and last revolutions of the tape wrapping operation. It is important that tension in the tape be released when the wrapping of the last half circumference of the pipe. The Contractor shall ensure that the wrapping overlaps or covers a minimum of 150 mm of the pipe coating. A secondary or outer tape wrap layer is then to be applied over the first layer with a 10% tape overlap.

An alternative tape wrapping system that may be used is the “Densotherm 35 Hot Applied Bitumen Tape” system. The procedures are similar to those for the “Denso” system described above except that the underside of the tape shall be heated as it is applied and the overlaps and seams of the tape are to be sealed by means of a heated tool.”

#### **\*PSLD 3.1.8.6.7 External Corrosion Protection of Shop-Fabricated Pipe Bends and Fittings**

“The external coating of shop fabricated bends and fittings shall be carried out as follows:

Where a substantial part of the external coating on the parent pipe is intact, the coating repairs/make good shall be carried out in accordance with PSLD 3.1.8.6.5 or

Where black (uncoated pipe has been used), the coating shall be carried out in accordance Umgeni Water's specification for "Pipe Lining System 2: Solvent-Free Epoxy Lining" or

Where only a relatively small proportion of the external coating on the parent pipe remains, all of the remaining coating shall be removed and the entire bend/fitting shall be coated in accordance Umgeni Water's specification for "Pipe Lining System 2: Solvent-Free Epoxy Lining".

All crotch plates and wrappers/collars shall be coated in accordance with project specification for "Pipe Coating System 1: Solvent-Free Epoxy Lining".

After application of the SFE coatings to the crotch plates and collars/wrappers, approved mastic shall be placed in all crevices that may become moisture traps.

No additional payment will be made for any of this work as the costs are deemed to be included in the scheduled rates for pipelaying."

**\*PSLD 3.1.8.6.8 Coating of Permanently Exposed Pipes/Fittings**

"All pipes which are to be permanently exposed shall, in addition to the specified corrosion protection at flange/adaptor/anchoring joints, be protected with the "Denso Acrylic Pipeline Tape (Steelcoat 500)" system or similar approved UV resistant coating. The pipe surface shall be prepared and the coating applied in strict accordance with the manufacturer's instructions.

Surface Preparation:

The pipe surface to be wrapped shall be cleaned of dirt, grime, grease and other deleterious matter, using white spirit if necessary and then allowed to dry thoroughly.

Priming:

"Denso Primer D" shall be applied to the prepared surfaces at a nominal coverage rate of 8 m<sup>2</sup> per litre. Care shall be taken to obtain an even film with no runs or sags. Only those areas that are to be wrapped the same day shall be primed. If primed areas are to be left overnight, these areas shall be re-primed before wrapping.

Tape Wrapping:

The joint shall be spirally wrapped (minimum 55% overlap) with "Denso Acrylic Tape" (or approved equivalent) in accordance with the manufacturer's requirements such that the start and end points are located at buried sections of the pipe, before it daylights. A 100% overlap is required on the first and last revolutions of the tape wrapping operation. It is important that tension in the tape be released when the wrapping of the last half circumference of the pipe.

Final Coating:

One coat of "Densoflex Fire Retardant" shall be applied to the exposed pipe at a nominal application rate of 3 m<sup>2</sup> per litre."

**PSLD 3.5.2 Precast concrete sections**

**Add the following to SANS 1200 LD, sub-clause 3.5.2:**

"Precast concrete sections with an inside diameter of at least 1 250 mm and maximum of 2 450 mm shall be used for manholes. Where the angle between the inlet and outlet of the manhole deviates by more than 45 ° from the straight or where more than one inlet enters a manhole, the invert level of the outlet shall be 30 mm lower than the lowest inlet invert level.

Dolomitic aggregate and dolomitic sand shall be used for the manufacture of precast concrete sections and for precast concrete manholes."

**PSLD 3.5.7 Step irons**

**Replace SANS 1200 LD, sub-clause 3.5.7 with the following:**

"Step irons shall be installed in all manholes deeper than 1,2 m. Step irons shall consist of polypropylene coated 12 mm high tensile steel, such as Calcamite or similar. The installation of the step irons shall be in accordance with the specification of the manufacturer."

**PSLD 3.5.8 Manhole covers and frames**

**Replace SANS 1200 LD, sub-clause 3.5.8 with the following:**

**i) Concrete manhole covers and frames with 3mm HDPE lining according to SANS 558:1973**

All precast manholes with a 3mm HDPE lining shall be roofed with a special precast cover slab, which also has the 3mm HDPE internal lining. The precast concrete lid and frame shall be extra heavy duty with a 3mm HDPE lining. Both these components shall be manufactured according to SANS 558-1973 9 (3.5) specifications.

**ii) Polymer concrete manhole covers and frames according to SANS1882:2003**

Manhole covers and frames, for standard precast concrete manholes, are to be polymer concrete. Where specified manhole covers and frames shall be Type 2A (SANS 558) regardless of whether or not the manholes are subject to traffic loads.

**iii) Locking mechanism**

All Manhole Covers and Frames shall be equipped with an approved, cast in locking mechanism.

**PSLD 3.6          Marker posts**

**Add the following to SANS 1200 LD, sub-clause 3.6:**

“Marker posts shall be manufactured from 150mm diameter x 1,5m FC pipe filled with concrete. The half-length of pipe protruding above the ground shall be painted using approved exterior white enamel paint.”

**PSLD 5          CONSTRUCTION**

**PSLD 5.6          Manholes, inspection chambers, etc.**

**PSLD 5.6.1      General**

**Add the following to SANS 1200 LD, sub-clause 5.6.1:**

“Manholes shall generally be precast concrete rings with sealed joints as detailed on drawing and shall be installed according to the manufacturer's specifications. After the joints have been sealed with an approved sealant the joints shall be covered on the outside by a double wrapping of polyethylene adhesive tape.

Manhole cover levels are to be at least 200mm above natural ground level, except in carriage ways where they are to be flush with the surfacing, unless otherwise specified or ordered.

The flexible connections to the manholes shall be constructed as shown on Drawing SANS 1200 LD-2 (c) for concrete pipes.

Special concrete manholes will be cast on site as per the details on the drawings. These manholes will also be roofed with a special cover slab and concrete lid, which incorporates Xypex admixture as explained in the

PSG 3.5.1 specifications. The inside surface of the manhole walls (concrete and plastered), the underside of the cover and/or top slab, the concrete lid and the grooves of the cover slab shall be treated with two coats of high-build epoxy tar coating for chemical resistance (ABECOTE SF 356 or similar approved).

Benching shall be constructed at a slope of 1 (vertical):6 (horizontal) and finished off with a 20mm thick high alumina screed or two coats of water tightness sealant to protect benching from decaying (one coat Xypex concentrate, followed up with one coat Xypex Modified, or similar approved products). The inside surface of the walls and the underside of the top slab to be treated with two coats of bituminous coating to prevent decay due to methane gas build-up in manhole. Contractor

must discuss alternatives with the Engineer before any application. (ABE Ravenol or similar approved)."

**PSLD 5.9 Connecting sewers**

**PSLD 5.9.1 Location and details**

**Add the following to SANS 1200 LD Sub-clause 5.9.1:**

"Where new sewers connect into existing pipelines the Contractor shall ascertain the exact position and existing invert level at the connecting point before excavating the connecting pipe trenches upstream. Any apparent discrepancy in the design data shall be brought to the immediate attention of the Engineer.

Where required and after receiving the Engineer's approval of the proposed operation the Contractor shall interrupt or divert the sewage flow, excavate for and expose the existing pipe, construct the new manhole, cut into the pipe, remove the scrap material, or in the case of a manhole, break into the manhole, connect the new pipe and make good."

**PSLD 5.9.2 Marker posts**

**Add the following to SANS 1200 LD, sub-clause 5.9.2:**

"At the time of backfilling the marker posts shall be installed at each manhole vertically above the pipeline centreline and not more than 1,5m from the manhole. The post shall protrude 0,9m above ground level or as otherwise specified by the Engineer."

**Add the following new sub-clause to SANS 1200 LD, sub-clause 5.9:**

**\*PSLD 5.9.4 As-built information**

"The Contractor shall after completion of a section of pipeline submit the following as-built information:

- Inlet and outlet invert levels at manholes.
- Cover levels at manholes.
- Distances between manholes.
- Y,X Co-ordinates of manholes

The Engineer will issue a form for this purpose.

Non-compliance with this clause will constitute grounds for the withholding of payment from any certificate, at the sole discretion of the Engineer."

**Add the following new sub-clause to SANS 1200 LD, clause 5:**

**\*PSLD 5.11      Jointing Methods**

**\*PSLD 5.11.1      Flanges (Steel and stainless steel pipelines)**

“All flanges shall be installed with bolt holes off-centre and symmetrically off-set from the vertical centre line of the flange. Flanges shall be installed truly square to the axis of the pipe.

The Contractor shall ensure that the correct jointing materials, i.e. gaskets, bolts and nuts are available when required. Only correct diameters and lengths of bolts and studs shall be used. Flat washers shall be used under

all nuts. The length of bolts and studs shall be such that at least two threads protrude from the nut when fully tightened. The threads of bolts, studs and nuts shall be thoroughly cleaned and then coated with a graphite/grease compound immediately prior to assembly.

Flanged fittings shall be so installed that there are no stresses induced into the pipe work, specials or fittings by forcing ill-fitting units into position or by bolting up flanges with faces not uniformly in contact with their gaskets over their whole faces.”

**PSLD 7 TESTING**

**PSLD 7.2            Tests and acceptance / rejection criteria**

**PSLD 7.2.1        Air test**

**Add the following to SANS 1200 LD, sub-clause 7.2.1:**

“All acceptance tests shall be carried out in the presence of the Engineer in accordance with the air test.

Visual inspection of the finished lining and internal jointing of the pipeline shall include the provision of a video camera fitted with a fish-eye lens mounted on a suitable trolley which shall be so arranged as to make continuous record of the completed pipeline throughout. Suitable reference marks related to the pipe chainage which are legible on the video recording and from which the position of each joint can be identified shall be painted on the pipe lining before the video recording is made. Accurate records including exposure serial numbers and the relative pipe chainages shall be kept by the Contractor. All records shall become the property of the Employer. The Contractor shall supply all equipment, facilities and chemicals required for the processing of films. A full description of the equipment and method proposed must be submitted with tenders. Exposures of any completed section of lining shall be processed and be made available immediately after. The Engineer may order repeat tests at any point in the line due to the lack of good definition, lighting or focus, or because a defect in the lining is suspected. Repeat exposures shall be to the account of the Contractor.”

**PSLD 7.2.6        Watertightness of manholes**

**Add the following to SANS 1200 LD, sub-clause 7.2.6:**

“The following test is to be carried out on completed manholes after backfilling has been completed:

The manhole shall be completely filled with water and allowed to stand for 24 hours. At the end of this period enough water shall be added to refill the manhole and in the subsequent period of 24 hours the water level shall not drop by more than 75 mm per meter of depth of the manhole measured from the channel invert to the underside of the concrete cover slab. Manholes to be tested will be indicated on site by the Engineer. Rectification, if necessary, will be carried out at the Contractor’s expense.”

**PSLD 8 MEASUREMENT AND PAYMENT**

**PSLD 8.2.1 Supply, lay, joint, bed and test pipeline**

**SANS 1200 LD, sub-clause 8.2.1 to include payment for:**

- PSLD 3.1 Pipes, fittings and pipe joints
  - \*PSLD 3.1.2 Concrete pipes
  - \*PSLD 3.1.8 Mild steel pipes (SANS 719 Grade B) epoxy coated (UV resistant)
    - \*PSLD 3.1.8.1 Flanges
    - \*PSLD 3.1.8.2 Flange gaskets, bolts, nuts and washers
    - \*PSLD 3.1.8.3 Couplings
    - \*PSLD 3.1.8.4 Puddle Collars
    - \*PSLD 3.1.8.5 Corrosion Protection
      - \*PSLD 3.1.8.5.1 Steel Pipes
      - \*PSLD 3.1.8.5.2 Preparation of Steel Surfaces for Repairs and/or Reinstatement of External Coating
      - \*PSLD 3.1.8.5.3 Holiday Testing – Epoxy Linings and Coatings
      - \*PSLD 3.1.8.5.4 Preparation Mixing and Application of Epoxy Compounds
      - \*PSLD 3.1.8.5.5 Repair and Making Good of Solvent Free Epoxy Linings
      - \*PSLD 3.1.8.5.6 External Corrosion Protection of Factory Welded Joints and Coating Repairs
      - \*PSLD 3.1.8.5.7 External Corrosion Protection of Shop-Fabricated Pipe Bends and Fittings
      - \*PSLD 3.1.8.5.8 Coating of Permanently Exposed Pipes/Fittings
  - \*PSLD 5.9.4 As-built information
  - \*PSLD 5.11.1 Flanges (Steel and Stainless Steel Pipelines)
- PSLD 7.2 Test and acceptance / rejection criteria

**PSLD 8.2.3 Manholes**

**SANS 1200 LD, sub-clause 8.2.3 to include payment for:**

- PSLD 3.5.2 Precast concrete sections
- PSLD 3.5.7 Step irons

PSLD 3.5.8	Manhole covers and frames
PSLD 5.6.1	Manholes, inspection chambers, etc.: General
*PSLD 5.9.4	As-built information
PSLD 7.2.6	Water tightness of manholes

**Add the following to SANS 1200 LD, sub-clause 8.2.3:**

“For the purpose of measurement and payment, the depth of a manhole, inspection chamber, etc., is defined as the depth from the top of the cover to the invert level of the manhole, inspection chamber, etc.

The rate for manholes shall cover the supply and installation of the complete manhole castings, lockable polymer concrete and ‘normal’ concrete manhole covers and frames and concrete footings (as scheduled), for the prevention of filtration where applicable.”

**PSLD 8.2.11 Connecting to Existing Sewer at...**

**Add the following to SANS 1200 LD, sub-clause 8.2.11:**

“The rates shall cover the cost of location, excavation, exposure and surveying of the positions and levels of the connecting points, cutting into and the making good of the existing works, the cutting, fitting and building in of the new pipes, the additional/full cost of building the new manhole or structure on the existing sewer, as applicable, and any other costs of completing the connection as specified, including dealing with the sewage.”



## **PSLC CABLE DUCTS (SANS 1200 LC)**

### **PSLC 3 MATERIALS**

#### **PSLC 3.1 Ducts**

**Add the following to SANS 1200 LC, sub-clause 3.1:**

“Class 6 uPVC pipes (diameter 110 mm or 160 mm) shall be used as ducts for electric cables under streets. Ducts for Telkom shall be of pitch-impregnated fibre pipes.”

**Add the following new sub-clause to SANS 1200 LC, sub-clause 3.1:**

##### **\*PSLC 3.1.1 Supply of ducts by Telkom**

“Notwithstanding any provisions of the contract in terms of which the Contractor is required to provide all materials necessary for the construction of the works, Telkom will supply the ducts for telephone cables. Consequently, the Contractor's obligations under the contract shall include taking delivery, the construction, completion and maintenance of the works and the provision of all labour, materials (other than those that are to be supplied by Telkom), plant, temporary works, and everything, whether of a temporary or permanent nature, required in and for such construction, completion and maintenance, so far as the necessity for providing the same is specified in or reasonably to be inferred from the contract.

To assist Telkom in arranging for the goods to be supplied to suit the Contractor's construction program, the Contractor shall submit to the Engineer, at agreed intervals, lists of his requirements. These lists shall be submitted at least 6 weeks (or another approved period) in advance of the date by which the goods are required. The Engineer will ascertain in advance the actual dates of delivery of consignments and will advise the Contractor who shall adjust his construction program as necessary to minimise any disruption of his work.

In the event of supply being effected, the Contractor shall, provided that appropriate due notice of dispatch has been given, be responsible for taking immediate delivery of such goods as they arrive at the site. He shall be responsible for checking the actual deliveries against delivery notes. From the time of taking delivery the Contractor shall be responsible for the handling, transportation and storage of the goods and he shall at the same time accept the risk of damage to or loss of the goods.

Should any goods reach the point(s) of delivery in a damaged or an apparently damaged condition, the Contractor shall report this fact to the Engineer, and he shall, before removing the goods from the transport vehicle, to avoid demurrage or similar charges, afford the Engineer reasonable opportunity to inspect such damaged goods.

On receipt of the goods, the Contractor shall issue a receipt to Telkom in an approved form. The Contractor shall accept full responsibility for checking deliveries and ensuring that the goods supplied to him are in sound condition.

The Contractor's receipt will be deemed to indicate that he has satisfied himself that the goods enumerated on it are in sound condition. Unless the Contractor at the time of receipt advises the Engineer that goods have been short delivered or are defective and obtains the Engineer's approval to take delivery (which approval will not be unreasonably withheld), no subsequent claim for short deliveries or replacement of damaged goods will be considered by the Engineer."

**PSLC 3.2          Bedding**

**Replace SANS 1200 LC, sub-clause 3.2 with the following:**

"The provisions of SANS 1200 LB: Bedding (Pipes) and the relevant project specification shall apply mutatis mutandis and payment shall be made under the appropriate payment clauses of SANS 1200 LB."

**PSLC 3.3          Backfill**

**Replace SANS 1200 LC, sub-clause 3.3 with the following:**

"The provisions of SANS 1200 DB: Earthworks (Pipe Trenches) and the relevant project specification shall apply mutatis mutandis and payment shall be made under the appropriate payment clauses of SANS 1200 DB."

**PSLC 3.4          Cable duct markers**

**Add the following to SANS 1200 LC, sub-clause 3.4:**

"Cable duct markers shall be provided as specified in PSLC 5.10, Position to be marked, as amended."

**PSLC 5 CONSTRUCTION**

**PSLC 5.1          Excavation of trenches**

**PSLC 5.1.1        Trench widths and depths**

**Add the following to SANS 1200 LC, sub-clause 5.1.1:**

"Trench widths shall be in accordance with the provisions of SANS 1200 DB: Earthworks (Pipe Trenches).

The minimum depth of cover over ducts shall be 600 mm from the final road level."

**Add the following new sub-clause to SANS 1200 LC, sub-clause 5.1:**

**\*PSLC 5.1.3        Excavation of trenches at road crossings**

"The minimum depth of cover over ducts shall be 300 mm where construction traffic is liable to cross them. Road crossings shall therefore be constructed after the construction of the roadworks has reached the stage where the required cover is available."

**PSLC 5.2          Bedding and compaction of bedding**

**Replace SANS 1200 LC, sub-clauses 5.2.1 and 5.2.2 with the following:**

"All ducts shall be laid on a Class C bedding according to the provisions of SANS 1200 LB: Bedding (Pipes). Backfilling shall be according to the provisions of SANS 1200 DB: Earthworks (Pipe Trenches)."

**PSLC 5.4          Backfilling and compaction**

**Add the following to SANS 1200 LC, sub-clause 5.4:**

"Road crossings shall be backfilled with sand from designated borrow pits, the site or commercial sources, whichever is applicable, up to underneath the subbase, and compacted to a minimum of 100 % of MOD AASHTO density."

**PSLC 5.8          Road crossings**

**Substitute "0,5 m" in the last sentence of SANS 1200 LC, sub-clause 5.8 with "1,0 m" and add the following:**

"Ducts for road crossings shall be effectively sealed by means of end caps."

**PSLC 5.10        Position to be marked**

**Add the following to SANS 1200 LC, sub-clause 5.10:**

"The lettering height shall be at least 70 mm.

The positions of ducts shall be marked by means of incisions on top of the kerb. The dimensions of such incisions shall be at least 40 mm long, 3 mm wide and 5 mm deep and the spacing, where more than one incision is required, shall be 20 mm. Ducts for Telkom crossings and electrical crossings shall be marked with green and red painted incisions respectively.

The draw wire, as specified in SANS 1200 LC, sub-clause 5.3.3, shall be secured to a 150 x 150 x 150 mm grade 20 MPa/19 mm concrete marker, which shall be installed with a depth of cover of 50-100 mm below the top of kerb or sidewalk level."

**Add the following new sub-clause to SANS 1200 LC, clause 5:**

**\*PSLC 5.12        Draw and joint boxes for Telkom cables**

"Draw and joint boxes shall be constructed strictly in accordance with the positions and details given on the plans."

## **PSLC 7 TESTING**

### **PSLC 7.2          Compaction tests**

**Replace SANS 1200 LC, sub-clause 7.2 with the following:**

"The Contractor shall, for at least one out of every five road crossings, submit density tests to the Engineer at his own expenses. The decision as to which road crossing densities shall be tested, rests with the Engineer. The Contractor shall, if such densities fail to meet the minimum requirements, prove at his expense that all the other densities do comply with the specified minimum requirements."

## **PSLC 8 MEASUREMENT AND PAYMENT**

### **PSLC 8.2          Scheduled items**

#### **PSLC 8.2.5      Supply, lay, bed and prove duct .....Unit: m**

**Substitute "GPO" in SANS 1200 LC, sub-clause 8.2.5 (a) with "Telkom".**

**Add the following to SANS 1200 LC, sub-clause 8.2.5 (a):**

"The rates for the installation of Telkom distribution ducts parallel to streets shall first be submitted by the Employer to Telkom for approval. The installation of these ducts will only form part of this contract if approved by Telkom."

#### **PSLC 8.2.8      Cable markers.....Unit: No**

**Add the following to SANS 1200 LC, sub-clause 8.2.8:**

"The rate shall also cover the cost of the end cap and the incisions, concrete marker and draw wire, as specified in PSLC 5.8, Road crossings, as amended and PSLC 5.10, Position to be marked, as amended."

**PSLD SEWERS (SANS 1200 LD)**

**PSLD 3 MATERIALS**

**PSLD 3.1 Pipes, fittings and pipe joints**

**\*PSLD 3.1.2 Reinforced concrete pipes**

**Add the following to SANS 1200 LD, sub-clause 3.1.2:**

“Concrete pipes shall be the spigot / socket type manufactured by means of vertical casting and be supplied with a 3mm thick light green anchor knob sheet (AKS) (integral suitable anchors) high density polyethylene (HDPE) liner, cast into the pipe internally along the full length, and the full circumference of the internal diameter of the pipe. Factories manufacturing these pipes must have an ISO 9001:2009 Certification.

The joints between the concrete pipes are to be covered internally with 3mm thick HDPE capping strips. The capping strips are to be standard light green HDPE lining, manufactured using matching resin to that of the 3mm thick AKS lining cast into the inner walls of the pipes. Capping strips are to be at least 200mm wide and are to be heat tacked to the HDPE lining of the pipes, after which they are to be welded by the extrusion welding technique on both edges, to ensure a proper joint of the HDPE capping strip to the HDPE/AKS lining of the pipes. For each joint the welding of the capping strips are to be continuous for 360 degrees (full circumference) on both sides of the capping strip. HDPE welding rods of the same colour and matching resin are to be used for the extrusion welding. The fitting of the capping strips, extrusion welding and testing procedures shall comply with SANS 10409. Each joint is to be marked with a unique number/mark. Welder is to have a certificate of competence.”

**Add the following new sub-clauses to SANS 1200 LD, sub-clause 3.1:**

**\*PSLD 3.1.8 Polyethylene pipes**

**\*PSLD 3.1.8.1 Description**

“Polyethylene pipes shall be HDPE and shall comply with SABS ISO 4427 PE 100, class as specified. All HDPE pipes shall be fusion butt welded unless otherwise shown on the drawings.”

**\*PSLD 3.1.8.2 Flanges**

“The dimensions of all flanges and their drilling shall conform to the dimensions of SANS 1123, Table 600/3.

Loose flanges shall be manufactured from 316 stainless steel unless otherwise shown on drawings. Where flanges are beneath ground surface they shall be packed with a bitumen or tar based mastic and wrapped with "Denso Tape" or an equivalent approved product.”

**\*PSLD 3.1.8.3 Flange gaskets, bolts, nuts and washers**

“Generally, non-asbestos type gaskets not less than 3 mm thick and suitable for aggressive, corrosive or potable water and raw sewage, shall be supplied for flanges.

All bolts shall be class 8.8 to SANS 135 or 1700, nuts shall be to SANS 1700 and washers to DIN 126. The class of a nut shall always be at least equal to the first digit of the class of the bolt with which it is used.”

**\*PSLD 3.1.8.4 Couplings for polyethylene pipes**

**“a) Pipe couplings**

- iii) Polyethylene pipes and specials shall be joined by means of butt fusion welding.
- iv) Slip-on couplings and slip-on flange adaptors shall mean “Viking Johnson” or “Klamflex” type couplings. All stainless steel slip-on couplings shall have a harness arrangement to prevent pipe separation. The end flange (compression flange) shall be such that the tie bolts clear the end flange. Bending of tie bolts will not be allowed. The couplings shall be fusion bonded epoxy coated and lined with a dry film thickness of not less than 275µm.
- v) Couplings shall be rated as a minimum to the same class as the pipe.

**b) Couplings between pipe materials and specials**

- i) HDPE/rigid (stainless steel) pipe:

The HDPE pipe shall be fitted with a butt fusion welded HDPE stub and stainless steel flange, which shall be bolted to the flange fitted to the steel special. Mechanical steel couplings (e.g. Klamflex) shall not be considered to join plain ended HDPE and stainless steel pipes.

**c) Storage of couplings and fittings and stacking of pipes.**

The Contractor shall provide adequate storage facilities for pipes, couplings and specials as recommended by the manufacturer.”

**PSLD 3.5.2 Precast concrete sections**

**Add the following to SANS 1200 LD, sub-clause 3.5.2:**

“Precast concrete sections with an inside diameter of at least 750 mm and maximum of 2 450 mm shall be used for manholes.

Dolomitic aggregate and dolomitic sand shall be used for the manufacture of precast concrete sections and for precast concrete manholes.”

### **PSLD 3.5.7 Step irons**

**Replace SANS 1200 LD, sub-clause 3.5.7 with the following:**

“Step irons shall be installed in all manholes deeper than 1,2 m. Step irons shall consist of polypropylene coated 12 mm high tensile steel, such as Calcamite or similar. The installation of the step irons shall be in accordance with the specification of the manufacturer.”

### **PSLD 3.5.8 Manhole covers and frames**

**Replace SANS 1200 LD, sub-clause 3.5.8 with the following:**

#### **iv) Concrete manhole covers and frames with 3mm HDPE lining according to SANS 558:1973**

All precast manholes with a 3mm HDPE lining shall be roofed with a special precast cover slab, which also has the 3mm HDPE internal lining. The precast concrete lid and frame shall be extra heavy duty with a 3mm HDPE lining. Both these components shall be manufactured according to SANS 558-1973 9 (3.5) specifications.

#### **v) Polymer concrete manhole covers and frames according to SANS 1882:2003**

Manhole covers and frames, for standard precast concrete manholes, are to be polymer concrete. Where specified manhole covers and frames shall be Type 2A (SANS 558) regardless of whether or not the manholes are subject to traffic loads.

#### **vi) Locking mechanism**

All Manhole Covers and Frames shall be equipped with an approved, cast in locking mechanism.

### **PSLD 3.6 Marker posts**

**Add the following to SANS 1200 LD, sub-clause 3.6:**

“Marker posts shall be manufactured from 150mm diameter x 1,5m FC pipe filled with concrete. The half-length of pipe protruding above the ground shall be painted using approved exterior white enamel paint.”

## **PSLD 5            CONSTRUCTION**

### **PSLD 5.6            Manholes, inspection chambers, etc.**

#### **PSLD 5.6.1    General**

##### **Add the following to SANS 1200 LD, sub-clause 5.6.1:**

“Manholes shall generally be precast concrete rings with sealed joints as detailed on drawing and shall be installed according to the manufacturer's specifications. After the joints have been sealed with an approved sealant the joints shall be covered on the outside by a double wrapping of polyethylene adhesive tape.

Manhole cover levels are to be at least 200mm above natural ground level, except in carriage ways where they are to be flush with the surfacing, unless otherwise specified or ordered.

The flexible connections to the manholes shall be constructed as shown on Drawing SANS 1200 LD-2 (c) for concrete pipes.

Special concrete manholes will be cast on site as per the details on the drawings. These manholes will also be roofed with a special cover slab and concrete lid, which incorporates Xypex admixture as explained in the PSG 3.5.1 specifications. The inside surface of the manhole walls (concrete and plastered), the underside of the cover and/or top slab, the concrete lid and the grooves of the cover slab shall be treated with two coats of high-build epoxy tar coating for chemical resistance (ABECOTE SF 356 or similar approved).

Benching shall be constructed at a slope of 1 (vertical):6 (horizontal) and finished off with a 20mm thick high alumina screed or two coats of water tightness sealant to protect benching from decaying (one coat Xypex concentrate, followed up with one coat Xypex Modified, or similar approved products). The inside surface of the walls and the underside of the top slab to be treated with two coats of bituminous coating to prevent decay due to methane gas build-up in manhole. Contractor must discuss alternatives with the Engineer before any application. (ABE Ravenol or similar approved).”

### **PSLD 5.9            Connecting sewers**



**PSLD 5.9.1 Location and details**

**Add the following to SANS 1200 LD Sub-clause 5.9.1:**

“Where new sewers connect into existing pipelines the Contractor shall ascertain the exact position and existing invert level at the connecting point before excavating the connecting pipe trenches upstream. Any apparent discrepancy in the design data shall be brought to the immediate attention of the Engineer.

Where required and after receiving the Engineer's approval of the proposed operation the Contractor shall interrupt or divert the sewage flow, excavate for and expose the existing pipe, construct the new manhole, cut into the pipe, remove the scrap material, or in the case of a manhole, break into the manhole, connect the new pipe and make good.”

**PSLD 5.9.2 Marker posts**

**Add the following to SANS 1200 LD, sub-clause 5.9.2:**

“At the time of backfilling the marker posts shall be installed at each manhole vertically above the pipeline centreline and not more than 1,5m from the manhole. The post shall protrude 0,9m above ground level or as otherwise specified by the Engineer.”

**Add the following new sub-clause to SANS 1200 LD, sub-clause 5.9:**

**\*PSLD 5.9.4 As-built information**

“The Contractor shall after completion of a section of pipeline submit the following as-built information:

- Inlet and outlet invert levels at manholes.
- Cover levels at manholes.
- Distances between manholes.
- Y,X Co-ordinates of manholes

The Engineer will issue a form for this purpose.

Non-compliance with this clause will constitute grounds for the withholding of payment from any certificate, at the sole discretion of the Engineer.”

**Add the following new sub-clause to SANS 1200 LD, clause 5:**

**\*PSLD 5.11 Jointing Methods**

**\*PSLD 5.11.1 Flanges (Steel and stainless steel pipelines)**

“All flanges shall be installed with bolt holes off-centre and symmetrically off-set from the vertical centre line of the flange. Flanges shall be installed truly square to the axis of the pipe.

The Contractor shall ensure that the correct jointing materials, i.e. gaskets, bolts and nuts are available when required. Only correct diameters and lengths of bolts and studs shall be used. Flat washers shall be used under all nuts. The length of bolts and studs shall be such that at least two threads protrude from the nut when fully tightened. The threads of bolts, studs and nuts shall be thoroughly cleaned and then coated with a graphite/grease compound immediately prior to assembly.

Flanged fittings shall be so installed that there are no stresses induced into the pipe work, specials or fittings by forcing ill-fitting units into position or by bolting up flanges with faces not uniformly in contact with their gaskets over their whole faces.”

**\*PSLD 5.11.2 HDPE pipes**

**\*PSLD 5.11.2.1 HDPE jointing**

“HDPE pressure pipes shall be butt fusion welded. All welds required for joining the pipe lengths and for the installation of the puddle flanged specials shall be butt welds and shall be protected from dust. The end pieces of each pipe length shall be cut, prepared and cleaned as per the relevant SANS 10268 standard. All welding on the HDPE pipes shall also be carried out according to SANS 10268.

An extra one minute soak time should be allowed for PE100 pipe sizes above 500mm SDR11. This is designed to ensure that fully ductile welds are always obtained under all field conditions.

The Contractor shall also ensure that the pipe is free of waste materials and loose objects and test the pipe, joints, etc. for leaks in accordance with SANS 10268 before backfilling of the pipe trench is allowed. Such tests shall be approved by the Engineer. The Contractor shall provide the Engineer with a method statement prior to any painting, touch ups or testing carried out on the pipe.

Furthermore:

- A record shall be kept of the welding including date, pipe details, weather, welding conditions, welder, initial bead height, welding times, final position of joint in the ground and a record of inspections of completed welds.
- The welder shall have a Test Certificate for HS Welding (heated-tool butt welding) issued within the previous 12 months by an inspector approved by the SAQCC-NPE (Thermoplastics Joining Committee National Panel of Examiners) in accordance with SANS 10269.
- Joints shall be able to withstand without damage the longitudinal force to be transmitted by winching (and/or pushing) equipment.

- Pipework should be inspected before jointing and shall not have cuts, gashes, nicks, abrasions, or any such physical damage which is deeper than 10 % of the wall thickness. Such pipes shall be removed from site and replaced with undamaged pipes.
- Pipes shall be connected using electrofusion welded couplings to the Engineer approval, if joints between installed liner pipes cannot be made by butt welding.
- Welded joints shall be tested in accordance with SANS 6269.
- Before any production welding commences, the following shall be approved in accordance with SANS 10270 for heated-tool butt welding of pipe joints:
  - a Welding Procedure Specification (WPS) and
  - a qualification joint"

**\*PSLD 5.11.2.2 Equipment**

"The Contractor shall ensure that as a minimum the following equipment is available on site to undertake the welding:

- Generator to supply the heater plate, trimmer and hydraulic pump
- Butt-fusion machine fitted with the correct size clamp shells, trimmer, heater
- Plate, hydraulic pump and timer
- Pipe support rollers
- Welding tent
- Cleaning material, lint free cotton cloth or paper towel
- External/Internal debanding tool
- Bead gauge
- Digital thermometer with surface probe to check heater plate.
- Pipe end covers
- Baseboard
- Pipe cutters
- Air temperature thermometer
- Indelible marker pen
- Timer"

**\*PSLD 5.11.2.3 Pre-welding checks**

"Notwithstanding the requirements of SANS 10268 and WIS 4-32-08, the following minimum pre-jointing checks should be undertaken:

Before commencing a welding operation:

- Ensure that equipment used is clean, in good condition and regularly maintained
- Ensure that the correct jointing parameters for the machine type and pipe are known
- Check that the heater plate is clean and dry

- Check that the trimmer is clean and that the blades are not damaged and in the correct position for required pipe size
- Ensure clamp liners and securing screws are of the correct size
- Ensure that the generator is in good condition and has sufficient fuel
- A tent is available to provide shelter during welding and end caps are available. A non-slip ground sheet (or suitable anti-slip surface), should be used to minimise contamination.
- The pipes and/or fittings to be jointed are of the same size, SDR and material."

**\*PSLD 5.11.2.4 Dummy Welds**

"To remove any residual dust and other fine contaminants on the heater plate, a dummy joint shall be made at the start of each jointing session. This shall take place whenever the plate has been allowed to cool below 180°C, or at a change of pipe size. Two dummy joints must be made if the pipe size is greater than 180mm."

**\*PSLD 5.11.2.5 Post-welding Checks**

"Notwithstanding the requirements of SANS 10268 and WIS 4-32-08, the following minimum post-jointing checks should be undertaken:

- Examine the joint for cleanliness and uniformity and check that the bead width is within the specified limits.
- Remove the external bead and internal bead using suitable de-beading tools.
- The beads and joint shall be numbered/coded using an indelible marker pen to correspond with the joint details entered into the butt fusion machine data retrieval system.
- The beads shall be twisted at several positions and if a bead is seen to split at any point or deformities are present on the underside, then the joint should be cut out from the pipeline and remade. If a similar defect reoccurs, all further jointing should cease until the equipment has been thoroughly cleaned, examined and new trial joints made which are shown to be satisfactory.
- Each finished joint shall be marked with a number"

**\*PSLD 5.11.2.6 Health and Safety**

"Notwithstanding the requirements of the Occupational Health and Safety Act, the Contractor shall produce method statements and risk assessments for the butt welding, and should ensure that all staff are competent and fully trained."

**PSLD 7 TESTING**

**PSLD 7.2 Tests and acceptance / rejection criteria**

**PSLD 7.2.1 Air test**

Add the following to SANS 1200 LD, sub-clause 7.2.1:

"All acceptance tests shall be carried out in the presence of the Engineer in accordance with the air test.

Visual inspection of the finished lining and internal jointing of the pipeline shall include the provision of a video camera fitted with a fish-eye lens mounted on a suitable trolley which shall be so arranged as to make continuous record of the completed pipeline throughout. Suitable reference marks related to the pipe chainage which are legible on the video recording and from which the position of each joint can be identified shall be painted on the pipe lining before the video recording is made. Accurate records including exposure serial numbers and the relative pipe chainages shall be kept by the Contractor. All records shall become the property of the Employer. The Contractor shall supply all equipment, facilities and chemicals required for the processing of films. A full description of the equipment and method proposed must be submitted with tenders. Exposures of any completed section of lining shall be processed and be made available immediately after. The Engineer may order repeat tests at any point in the line due to the lack of good definition, lighting or focus, or because a defect in the lining is suspected. Repeat exposures shall be to the account of the Contractor."

**PSLD 7.2.6 Watertightness of manholes**

**Add the following to SANS 1200 LD, sub-clause 7.2.6:**

"The following test is to be carried out on completed manholes after backfilling has been completed:

The manhole shall be completely filled with water and allowed to stand for 24 hours. At the end of this period enough water shall be added to refill the manhole and in the subsequent period of 24 hours the water level shall not drop by more than 75 mm per meter of depth of the manhole measured from the channel invert to the underside of the concrete cover slab. Manholes to be tested will be indicated on site by the Engineer. Rectification, if necessary, will be carried out at the Contractor's expense."

**Add the following new sub-clause to SANS 1200 LD, clause 7:**

**\*PSLD 7.2.7 CCTV Survey of Sewer Lines**

**\*PSLD 7.2.7.1 Closed-Circuit Television Camera Inspection of Outfall Pipeline**

**a) Scope of Work**

The scope of work requires CCTV inspections on completed sewer gravity mains ranging in size from 500 mm to 1 500 mm.

**b) Specifications for Mainline CCTV Inspections**

**i) Inspection equipment**

The Contractor must give full details on their equipment, and their compliance or otherwise with all relevant specifications.

**ii) Camera on Tractor**

1. The camera must be transported through the pipe on a tractor system, to allow for smooth transportation of the camera through the pipe. The tractor must be controllable at various speeds in forward and reverse and must be able to operate in pipes from 100mm diameter upwards. The tractor speed must be displayed on the video at all times and should never exceed speeds as specified in \*PSLD 7.2.7.3.
2. Camera mounted on the tractor must be mounted in such a manner as to transport the camera within 10% of the centre of the pipe.
3. All inspections must be done with a pan-and-rotate camera. The pan-and-rotate camera must have the ability to execute “pre-programmed” commands for effective and efficient scanning of joints. The system must have the capability to down load to the database, the cameras relevant viewing angles. This camera must be fully remote control including remote focus, iris and light control. The camera must pan and rotate to view all critical incidents and laterals.

**c) Camera Vehicles**

1. All CCTV inspection equipment shall be neatly compartmentalised and transported in a suitable vehicles.
2. All vehicles must have the ability to determine their current location (X & Y GPS position of the vehicle on site) in order to prepare as-built plans.

**d) Inspection Range**

The Contractor shall ensure that the equipment used has a minimum range of inspection of 180 m allowing for two manhole lengths.

**e) Flow control equipment**

The Contractor shall have a range of flow control equipment to be able to block pipe diameter from 100 mm to 1 500 mm diameter.

**f) Recordings**

1. As a minimum requirement, recordings on DVD medium shall be accepted.
2. The format of the DVD video file format must be approved by the Engineer.
3. Correct adjustment of the recording apparatus and its associated electronic equipment shall be demonstrated by a recording, at the commencement of each new DVD, of a colour test

pattern showing colour definition and picture resolution for a minimum period of 30 seconds.

4. DVD's are to be labelled with the following information:

- Council name
- Contract number
- DVD number
- Contractor's name
- Date

Ownership of and copyright on the data will vest in the Employer.

**\*PSLD 7.2.7.2 Equipment Characteristics**

**a) Camera Equipment**

The Contractor shall make use of a push-pull type camera (ELS) with distancing device (sleigh, brushes, packing). The camera alone will have maximum dimensions of 70 mm x 100 mm long. The camera must be colour and can be fixed-focus forward looking. The flexible rod spool will have 100 m capacity and the system should be able to negotiate 90 degree bends in 100 mm private drains. On average the system should be able to negotiate at least 50 m in a 100 mm house drain.

The camera control unit must be portable and equipped with an integrated video unit. Video recordings must be made.

**b) Flow control equipment**

This will not normally be necessary provided the Contractor can make suitable arrangements with house owners but the equipment should be at hand to ensure a dry inspection.

**c) Linear Measurement**

1. The CCTV monitor display shall incorporate an automatically updated record in metres and tenths of metres of the camera location within the pipelines accurate to + 1% or 0.3 m whichever is the greater.
2. The metre reading entered onto the display at the start of the survey must represent the actual distance from the accepted start of the length of sewer or pipeline. This then requires that the meter reading can be zeroed from the control console as well as the ability to enter any distance that may be required. The meter-age shall start to register immediately the camera starts to move.
3. The Contractor shall ensure that precise location of defects or missing manholes can be made from the surface to a depth of at least 6 m.

The Contractor will be held liable for any inaccuracies in linear measurement beyond the allowed tolerances resulting in extra excavation, delays etc.

4. The accuracy of linear measurement shall be checked by plotting laterals (as inspected) and laterals (as-built) on a thematic map. In addition the Contractor shall be required from time to time to double inspect at random if the Employer is not satisfied as to linear accuracy by comparison between inspections before cleaning with inspections after cleaning and inspections after rehabilitation.
5. In addition, if on any specific section of pipe to be rehabilitated, laterals marked out according to CCTV reports are not found within the tolerances specified, then the CCTV Contractor will be asked to re-inspect at their cost, with radiosonar attached to the camera, and to mark the position of laterals on the surface.
6. A calibrated flexible rod system will be accepted.

**d) Slope Measurement**

1. The camera system must be capable of measuring the slope of the pipe being inspected. The instantaneous angle must be filtered and is to be displayed on the screen and recorded on DVD. Raw inclinometer data is also to be stored for downloading to the database for the purpose of pipe profiling. The camera system must be capable of down loading to the database, no less than three readings per meter of pipe inspected.
2. Where available as-built slopes on all sewerage pipes to be inspected will be provided to the Contractor. The “as-built” slopes must be installed into the database by the Contractor in order to enhance the accuracy of the resultant pipeline profile.
3. The as-built line on the display must be surrounded by buffer zones in different colours or shades representing at least where critical backfalls would start (where a critical backfall represents an invert level deviation of more than 50% of the internal diameter).
4. In addition, start and end backfall incidents must be displayed on the pipeline profile and the “depth” of backfall (fall in invert level) must be computed and displayed.
5. The start and end of a critical backfall as determined by inclinometer must be fed to the database and logged as an incident.
6. The system must be able to import and display manhole cover reduced levels (when available). This together with design/as-built slopes manhole depths determined at manhole inspections can then be used to control the accuracy of inclinometer readings displayed as pipeline profiles/control the value of as-built slopes etc. The measured manhole depths, design/as-built slope, manhole cover reduced levels or difference in reduced levels must all be displayed.

**e) Data Display (Viewed on the Monitor Screen and DVD)**



1. A data generator shall electronically generate and clearly display on the viewing monitor and video recording a continuous record of data in an alpha numeric form containing the following minimum information:
  - i) Automatic update of the camera's meter-age position in the pipeline from adjusted zero to relevant point.
  - ii) Pipe dimensions
  - iii) Pipeline, location, road name and manhole reference numbers.
  - iv) Instantaneous angle and upstream/downstream direction of inspections.
2. The size and position of all text including meterage must be such that it can be adjusted or moved anywhere on the screen, so as not to interfere with the main subject of the picture.
3. The text generator must have a function that will remove and replace all data on screen so as to allow an unobstructed view of the entire screen when required.
4. The text generator shall have a real time clock and calendar on screen to indicate the progress on the survey.

**f) Picture Quality Control (Minimum Standards)**

1. The electronic systems, television camera and monitor, shall provide a live picture of not less than 400 lines definition in real full colour and with no interference. The pictures shall be sufficiently sharp so that any fault can be seen clearly.
2. Pan-and-rotate cameras must have adjustable focus. The adjustment of focus and iris shall provide a focal range from 3 mm to infinity with at least 62° angle of view lens. The distance along the pipe in focus from the initial point of observation shall be a minimum of twice the vertical height of the pipe.
3. The combination of object illumination and light sensitivity of the camera shall be adequate to obtain an effective picture of the structure of the sewers or pipelines to be surveyed without loss of contrast or flare out of picture or shadowing.
4. The camera system must provide lighting to illuminate the pipe sufficiently to allow for the detection of cracks and other structural defects in the pipe. The lighting must be of such a nature that the natural colour of the pipe is recorded (No black & white CCTV will be acceptable).
5. Suitable test devices shall be provided and be available throughout the contract, to enable practical demonstration of the systems abilities.
6. For colour tube type cameras, the test card shall be the Marconi Regulation Chart No 1 or equivalent with a colour bar, clearly defined with no tinting to show the following:

- (i) Black
- (ii) Blue
- (iii) Cyan
- (iv) Green
- (v) Magenta
- (vi) Red
- (vii) White
- (viii) Yellow

7. The camera shall be positioned centrally and parallel to the test card at a distance where the full test card just fills the monitor screen. The card shall be illuminated evenly and uniformly without any reflection.

8. The electronic systems, television camera and monitor shall be of such quality as to enable the following to be achieved:

a. Shades of Grey

The grey scale shall show equal changes in brightness ranging from black to white with a minimum of five stages.

b. Linearity

A background grid shall show squares of equal size, without convergence/ divergence over the whole of the picture. The centre circle should appear round and have the correct height/width relationship.

c. Resolution

For colour tube type cameras, the live picture shall be capable of registering a minimum of 250 lines and can be clearly visible with no interference. The resolution shall be checked with the monitor colour turned down.

d. Colour

For colour CCTV, with the monitor control adjusted for correct saturation, the six colours plus black and white shall be clearly resolved with the primary and complementary colours in order of decreasing luminance. The grey scale shall appear in contrasting shades of grey with no tint.

e. Colour Contrasting

For colour CCTV, to ensure the camera shall provide similar results when used with its' own illumination source, the lighting shall be fixed in intensity prior to commencing the survey and the white balance set to the colour temperature

emitted. In order to ensure colour constancy, ideally no variation in illumination shall take place during the survey.

**g) Sample of DVD Medium**

The Contractor shall include with their tenders submission, a DVD medium of at least 100 m of sewer filmed with equipment intended for use on this contract. If the tender is accepted, these shall define the required standard of picture quality for the contract. Where the Engineer rejects any survey pictures, the Contractor shall take remedial action to provide that survey file of an acceptable standard.

**\*PSLD 7.2.7.3 Reporting and Quality Assurance Plan**

**a) Reporting**

All reporting shall be done according to the latest version of the Sewer Classification Manual as published by Sight Lines or concept Standardized Specifications for CCTV inspections, or similar specified by the Engineer/Employer/Emfuleni Local Municipality, when available. An abridged version with photographs shall be within the operator's sight within all times.

All CCTV operators must be able to present certification on request that they have within the last year completed successfully a CCTV Operator Training/Revision Course.

The Contractor shall maintain the following accuracies:

- Header accuracy: 100%
- Incident and grading accuracy: 90%

The maximum camera speeds wherefrom reporting is done shall be:

- 0.2 m/s for inspections on newly laid or newly replaced/rehabilitated pipe.

**\*PSLD 7.2.7.4 Report Specifications**

All inspections to be done according to the Pipe Inspection and Sewer Classification Manual as supplied by Sight Lines (Pty) Ltd or South African Standardized CCTV inspections (when available), or similar specified by the Engineer/Employer/Emfuleni Local Municipality, when available.

CCTV inspection report consisting of:

- Pipe Number (referenced to adjacent manholes)
- Pipe diameter
- Inclinator data
- Defects reported and graded
- Lateral identification (including orientation)
- End inspection data

- Digitised photographs representative of all major and critical faults in a section of pipeline.

## **PSLD 8 MEASUREMENT AND PAYMENT**

### **PSLD 8.2.1 Supply, lay, joint, bed and test pipeline**

#### **SANS 1200 LD, sub-clause 8.2.1 to include payment for:**

PSLD 3.1	Pipes, fittings and pipe joints
*PSLD 3.1.2	Concrete pipes
*PSLD 3.1.8	Polyethylene pipes
*PSLD 3.1.8.1	Flanges
*PSLD 3.1.8.2	Flange gaskets, bolts, nuts and washers
*PSLD 3.1.8.3	Couplings
*PSLD 5.9.4	As-built information
*PSLD 5.11.1	Flanges (Steel and Stainless Steel Pipelines)
*PSLD 5.11.2	HDPE jointing
*PSLD 5.11.2.1	Equipment
*PSLD 5.11.2.2	Pre-welding Checks
*PSLD 5.11.2.3	Dummy Welds
*PSLD 5.11.2.4	Post-welding Checks
*PSLD 5.11.2.5	Health and Safety
PSLD 7.2	Test and acceptance / rejection criteria

### **PSLD 8.2.3 Manholes**

#### **SANS 1200 LD, sub-clause 8.2.3 to include payment for:**

PSLD 3.5.2	Precast concrete sections
PSLD 3.5.7	Step irons
PSLD 3.5.8	Manhole covers and frames
PSLD 5.6.1	Manholes, inspection chambers, etc.: General
*PSLD 5.9.4	As-built information
PSLD 7.2.6	Water tightness of manholes

#### **Add the following to SANS 1200 LD, sub-clause 8.2.3:**

“For the purpose of measurement and payment, the depth of a manhole, inspection chamber, etc., is defined as the depth from the top of the cover to the invert level of the manhole, inspection chamber, etc.

The rate for manholes shall cover the supply and installation of the complete manhole castings, lockable polymer concrete and ‘normal’ concrete manhole covers and frames and concrete footings (as scheduled), for the prevention of filtration where applicable.”

**PSLD 8.2.9      Marker posts**

**SANS 1200 LD, sub-clause 8.2.9 to include payment for:**

PSLD 3.6	Marker Posts
PSLD 5.9.2	Marker Posts

**PSLD 8.2.11      Connecting to Existing Sewer at...**

**Add the following to SANS 1200 LD, sub-clause 8.2.11:**

"The rates shall cover the cost of location, excavation, exposure and surveying of the positions and levels of the connecting points, cutting into and the making good of the existing works, the cutting, fitting and building in of the new pipes, the additional/full cost of building the new manhole or structure on the existing sewer, as applicable, and any other costs of completing the connection as specified, including dealing with the sewage."

**Add the following new payment item to SANS 1200 LD, sub-clause 8.2:**

**\*PSLD 8.2.13 CCTV camera surveys..... Unit : m**

"The unit of measurement shall be the metre of each pipe inspected, measured centre to centre of adjacent manholes or to stopping point whichever is applicable.

The tendered rate shall include full compensation for, inter alia, the Closed-circuit television inspection lengths of sewer lines and any other related activity such as manhole inspections, reporting, etc. The tendered rate shall include for PSLD 7.2.7."

## **PSLE STORMWATER DRAINAGE (SANS 1200 LE)**

### **PSLE 3 MATERIALS**

#### **PSLE 3.4.1 Bricks**

**Replace the first sentence of SANS 1200 LE, sub-clauses 3.1.4 with the following:**

“Bricks used in stormwater structures shall be burnt clay engineering bricks, having a nominal compressive strength of 28 MPa, and complying with the requirements of SANS 227.”

**Add the following new sub-clause to SANS 1200 LE, clause 3:**

#### **\*PSLE 3.6 Composite drainage system**

“The fin drain system shall consist of a geonet drainage core and geopipe enclosed within a geotextile filter jacket. The fin drain shall be supplied prefabricated with geopipe for assembly on site. The fin drain shall have a minimum flow capacity of 0,19 l/s per metre (hydraulic gradient of unity and a pressure of 10 KPa) and shall not decrease in thickness by more than 20% under confining pressure of 10 kPa.

##### **(a) Geonet Drainage Core**

The core shall be non-corroding, rot-proof and manufactured from low density polyethylene with minimum characteristics as follows:-

Mass	:	822 g/m <sup>2</sup>
Thickness	:	5mm
Tensile Strength	:	2,4 kN/m
Discharge capacity	:	3,0 l/sec under 100 kPa at a hydraulic gradient of unity

##### **(b) Drainage Pipe**

The geopipe to be used in conjunction with the prefabricated fin drain shall be manufactured from high density polyethylene with not less than 60% of the surface perforated.”

### **PSLE 5 CONSTRUCTION**

#### **PSLE 5.2 Bedding and laying**

##### **PSLE 5.2.2 Pipe culverts**

**Add the following to SANS 1200 LD, sub-clause 5.2.2:**

“Pipes with ogee joints, where they pass under roads and also on curved pipelines in verges, shall be wrapped with two layers of hessian soaked in cementitious grout. The wrapping shall be 400mm wide and placed centrally over each joint.

Unless otherwise scheduled or indicated on the drawing, pipes with ogee joints shall be used.

Butt-ended pipes will not be permitted.

Lifting holes should be visible at the top of the pipe after laying and suitably closed off to prevent the ingress of soil.

Pipes may protrude up to 300mm into a manhole / catchpit. This relaxation will only be permitted if the pipe does not have to be cut. The “dead space” formed at the end of the manhole is to be suitably benched off to prevent the collection of silt and rubbish.”

#### **PSLE 5.5.6 Benching**

**Delete** “granolithic plaster” **of SANS 1200 LD, sub-clause 5.5.6 and replace by** “concrete topping consisting of a 1:2:3 cement, sand and 7mm stone mix by weight. The sand proportion may be varied between 1,5 and 2,5 to obtain ideal workability.”

**Add the following new sub-clause to SANS 1200 LE, clause 5:**

#### **\*PSLE 5.8 Installation of composite drainage system**

“The geopipe shall be placed at the bottom of the geonet with the channel section of the geopipe as the invert of the drain.

The geotextile filter shall then be wrapped around the geopipe and stapled/joined at 300mm intervals. The complete system shall then be placed in the trench ensuring that during the fin remains vertical. The system shall discharge into a manhole, catchpit or headwalls.”

### **PSL 8 MEASUREMENT AND PAYMENT**

#### **PSLE 8.2.1 Supply and lay concrete pipe culverts**

**SANS 1200 LE, sub-clause 8.2.1 to include payment for:**

PSLE 5.2.1	General
PSLE 5.5.6	Benching

**Add the following:**

“The payment description for item 8.2.2 shall also apply to item 8.2.1.”

**PSLE 8.2.9 (a) Brickwork**

**SANS 1200 LE, sub-clause 8.2.9 (a) to include payment for:**

PSLE 3.4.1      Bricks

**Add the following new payment items to SANS 1200 LE, sub-clause 8.2:**

**\*PSLE 8.2.14 Composite drainage system ..... Unit : m**

“The composite drain will be measured linearly on slopes overall as laid. Separate items will be scheduled for different diameters of pipes, where relevant.

The rate shall cover the cost of providing the composite drain and the cost of excavation, laying, bedding, backfilling, jointing and making connections into manholes. The rate shall include payment for \*PSLE 3.6, Composite drainage system, and \*PSLE 5.8, Installation of composite drainage system”



## **PSLG PIPE JACKING (SANS 1200 LG)**

### **PSLG 5 CONSTRUCTION**

#### **PSLG 5.1.1 Authority to jack pipeline under facility controlled by third parties**

**Replace the contents of SANS 1200 LG, sub-clause 5.1.1 with the following:**

"Prior permission and permits for the pipe jacking shall be obtained from the relevant authority e.g. Municipality, by the Contractor. The Contractor shall notify the relevant authorities at least six weeks prior to the commencement of the pipe jacking and apply for the necessary permissions. Proof of this is to be provided two weeks prior to work commencing.

Adequate warning signs and safety precautions shall be provided by the Contractor during the operations."

#### **PSLG 5.1.3 Design calculations by Contractor**

**In the fourth line of SANS 1200 LG, sub-clause 5.1.3, after the word "required", add: "two weeks" and after the word "commences", add "for the approval of the authorities concerned as also the Engineer."**

#### **PSLG 5.2.3 Recording of movements**

##### **PSLG 5.2.3.1 General**

**Add the following to SANS 1200 LG, sub-clause 5.2.3.1:**

"The Contractor shall, on a daily basis, record line and level of the road surface or railway track being traversed and submit them to the Engineer within 24 hours after being recorded."

**Add the following sub-clauses to SANS 1200 LG, sub-clause 5.2.3:**

##### **\*PSLG 5.2.3.3 Road Crossings**

"The Contractor shall ensure that a line of levels taken along lane centre lines (every panel centre) and at least 20 metres on either side of the jacking operation. The level points shall be marked by means of a stud and numbered clearly on the road. Two (2) concrete reference beacons shall be built in a safe place to serve as height datum for the levels.

The Contractor shall ensure that a final set of levels are taken six months after completion of the jacking to determine if any settlement has taken place. Each set of levels shall be forwarded to the Engineer and the relevant person within the authority responsible for the road being jacked under."

#### **PSLG 5.3 Sleeve pipes**

**Add the following to SANS 1200 LG, sub-clause 5.3:**

“Sleeve pipes are to be provided under all existing and proposed road reserves as specified on the drawings.”

**PSLG 5.4          Excavation**

**PSLG 5.4.2      Thrust pit**

**Add the following SANS 1200 LG, sub-clause 5.4.2:**

“The thrust pit shall be incorporated in the road reserve at the position indicated on the drawing. The thrust pit shall be of sufficient size to accommodate the jacking operation and any manhole structure to be constructed upon completion of the jacking. The approximate dimensions of the pit shall be agreed with the Engineer before work commences.

The Contractor shall design and construct all thrust blocks, bases and other temporary works required to execute the work and shall demolish and remove these from site on completion. A minimum clearance of 0.5m between the thrust pit and the fence around the thrust pit should be maintained at all times. The thrust pit shall be fenced off and the necessary warning signs shall be erect on the fence. The roads in the area of the pipe jacking must be kept clean of all excavated material. All water pumped out from the thrust pit must be discharged into the storm water system at an agreed position.”

**PSLG 5.5          Jacking procedure**

**Add the following new sub-clause to SANS 1200 LG, sub-clause 5.5:**

**\*PSLG 5.5.4      Pipe jacking to be done by experienced personnel**

“Unless the Contractor has satisfied the Engineer that he has suitable successful past experience in jacking operations similar to those required for this project and also that he has available all the necessary equipment in sound working order, the Contractor shall employ a suitably experienced specialist Sub-Contractor who shall be subject to the approval of the Engineer.”

**PSLG 5.6          Backfilling and disposal of excavated material**

**Add the following to SANS 1200 LG, sub-clause 5.6:**

“On completion of the pipeline, the jacking pit shall be backfilled with suitable material in layers not exceeding 150mm and compacted to 95% MOD AASHTO (100% MOD AASHTO for sand).”

**PSLG 6            TOLERANCES**

**PSLG 6.2          Permissible deviations**

**Replace the following tolerances in SANS 1200 LG, sub-clause 6.2:**

“The tolerance in the jacked sleeve will be  $\pm 100\text{mm}$  in the vertical direction and  $\pm 200\text{mm}$  in the horizontal direction.”

**PSLG 8          MEASUREMENT AND PAYMENT**

**PSLG 8.2          Scheduled items**

**Add the following new payment item to SANS 1200 LG, sub-clause 8.2:**

**\*PSLG 8.2.11 Sleeve pipes which do not require to be jacked.....Unit : m**

“The tendered rate shall include fabrication, supply, delivery and installation of the sleeve pipes. Excavation and backfill to be measured elsewhere.”

## **PSM ROADS (GENERAL) (SANS 1200 M)**

### **PSM 2 INTERPRETATIONS**

#### **PSM 2.2 Definitions**

**Add the following to SANS 1200 M, sub-clause 2.2:**

"The road construction material codes that are used in this Project Specification and drawings refer to TRH 14: 1985 - Guidelines for road construction materials".

### **PSM 5 CONSTRUCTION**

**Add the following new sub-clause to SANS 1200 M, clause 5:**

#### **\*PSM 5.1 Traffic control/safety measures**

"When roads to be constructed under this contract join onto existing surfaced trafficked roads, the Contractor shall take all the necessary precautions to ensure the safety of the traveling public. To this end, signs warning through traffic of vehicles encroaching into the travelled way shall be erected by the Contractor prior to such work being undertaken. In addition flagmen shall be installed along the through road. These control measures shall be checked and recorded on a daily basis.

Under no circumstances shall drums be permitted to be used as traffic demarcation devices.

All signs must comply with the latest edition of the South African Road Traffic Sign Manual."

### **PSM 6 TOLERANCES**

**Add the following new sub-clause to SANS 1200 M, clause 6:**

#### **\*PSM 6.4 Level control of road layers**

"The Contractor shall submit to the Engineer, at the time of requesting acceptance of a road layer, a record of the surface levels of that section, taken at metre intervals to coincide with the level pegs. A sample form will be obtainable from the Engineer."

### **PSM 7 TESTING**

#### **PSM 7.1 General**

**Add the following to SANS 1200 M, sub-clause 7.1:**

"The random sampling method of TMH 5, for the location of positions, for field density testing will not necessarily be applied by the Engineer. Density testing shall be carried out where, in his opinion, the density of the compacted layer is suspect. The Contractor shall present the full width of the layer, between the stated linear stake values, for acceptance. Only in exceptional cases will partial widths of a layer be accepted for testing."

#### **PSM 7.3.2      Routine inspections and tests**

##### **Add the following to SANS 1200 M, sub-clause 7.3.1:**

"The request for acceptance of a layer shall be submitted in writing, specifying the exact location of the section and type of layer. On receipt of all these details the Engineer will arrange for the necessary inspections and tests to satisfy himself that the road layer complies. Testing will be carried out as expeditiously as possible, and the results will be available within 24 hours of receipt of test request. The Contractor shall backfill the test holes left in the layer with a similar material to that of the layer tested and compact the material to a similar density. Concrete shall not be used."

##### **Add the following to SANS 1200 M, sub-clause 7.3.2:**

"Notwithstanding the requirements for minimum densities for single tests, as set out in the relevant standardized specification, no lot for which any single test result is below the specified density will be deemed to comply with the requirements for density."

The Contractor shall bear the cost of all tests carried out by the Engineer at the request of the Contractor or as specified for process control."

#### **PSM 7.4      Compaction control**

##### **Add the following to SANS 1200 M, sub-clause 7.4:**

"Density test shall be carried out by the Contractor on each layer of the selected subgrade, subbase, base-course and shoulders/layers as soon as possible but not later than twenty-four hours (24) after compaction of that layer has been completed, and the results of the test shall be submitted to the Engineer without delays and in any case not later than twelve hours (12 hours) after they become available."

The contractor shall locate and test any soft or wet areas evident in any layer and shall, if these tests fail, re-compact and retest such areas for density before requesting the Engineer to carry out check tests."

The Contractor shall provide adequate equipment and facilities for carrying out the tests required to be performed by him. Should the Engineer at any time consider that the equipment and facilities are inadequate for this purpose, he may instruct the Contractor to cease work on the completion of

subgrade, sub-base and base course until such time as the Contractor has remedied the deficiency of equipment, labour and facilities.

The results of the test carried out by the Engineer shall be regarded as final.”

**Add the following new sub-clause to SANS 1200 M, clause 7:**

**\*PSM 7.5      Engineer’s discretion**

“Notwithstanding the provision of SANS 1200 M, clause 7 and of PSM 7, testing of a section of completed work shall be at the sole discretion of the Engineer who may refuse to check test and consequently not approve a section of work which contains obvious defects such as loose patches, over-wet material etc.”

**PSM 8              MEASUREMENT AND PAYMENT**

**SANS 1200 M, clause 8 to include payment for:**

PSM 2.2	Definitions
PSM 5.1	Traffic control/safety measures
PSM 6.4	Level control of road layer
PSM 7.1	General
PSM 7.3	Routine inspection and testing
PSM 7.4	Compaction control
PSM 7.5	Engineer’s discretion

**Add the following new sub-clause to SANS 1200 M, clause 8:**

**\*PSM 8.1      Inspection and testing of a road layer**

“The cost of refilling and compacting the density test holes shall be included in the rate tendered for the construction of that layer.”

## **PSMJ SEGMENTED PAVING (SANS 1200 MJ)**

### **PSMJ 3 MATERIALS**

#### **PSMJ 3.3 Sand for bedding and jointing.**

**Add the following to SANS 1200 MJ, sub-clause 3.3:**

“The sand used for the bedding layer shall not contain proportions of silt and clay materials smaller than 0.075 mm that exceed 15%.”

### **PSMJ 5 CONSTRUCTION**

#### **PSMJ 5.3 Placing and compacting of sand bed.**

**Replace “compacted thickness of  $25 \pm 10$  mm” of SANS 1200 MJ, sub-clause 5.3 with “compacted thickness of 20mm.”**

**Add the following to SANS 1200 MJ, sub-clause 5.3:**

“The Contractor must make allowance for the penetration of the bedding sand layer into the compacted subbase layer. Only the 20 mm homogenous bedding sand layer will be measured for payment purposes.”

#### **PSMJ 5.4 Laying of units**

**Replace the first paragraph of SANS 1200 MJ, sub-clause 5.4 with:**

“Blocks shall be laid in the herringbone pattern.”

#### **PSMJ 5.6.2 Paving subject to wheel loads exceeding 30 kN**

**Add the following to SANS 1200 MJ, sub-clause 5.6.2:**

“The paving proposed will be subjected to wheel loads exceeding 30kN.”

## **PSMK KERBING AND CHANNELLING (SANS 1200 MK)**

### **PSMK 3 MATERIALS**

#### **PSMK 3.2 Precast kerbing and channelling**

##### **PSMK 3.2.1 General**

**Add the following to SANS 1200 MK, sub-clause 3.2.1:**

“Precast units as indicated on the drawings shall be required in 1m lengths. Lengths of 300 mm shall be used in bellmouths and for radii less than 20 m. These kerbs shall be cast and not saw-cut.”

##### **PSMK 3.9 Bedding material**

**Replace SANS 1200 MK, sub-clause 3.9 with the following:**

“The material on which precast kerbs and channels are bedded shall consist of Grade 15/19 concrete to SANS 1200 GA and to the dimensions indicated on the drawings.”

### **PSMK 5 CONSTRUCTION**

#### **PSMK 5.2 Precast concrete kerbing and channelling**

**Replace the second paragraph of SANS 1200 MK, sub-clause 5.2 with the following:**

“Provision shall be made for expansion joints of width 10 mm at intervals not exceeding 10 m for kerbing, channelling and edging. The joints shall be filled with a suitable silicone or polysulphide sealant.

Notwithstanding the fact that vertical curves have not been specified where changes to grade of up to 2% occur, the kerbs and channels shall be laid to levels based on a minimum vertical curve length of 20 m.

No change in grade shall be applied on kerbs in bellmouths unless specific levels are indicated.”

### **PSMK 8 MEASUREMENT AND PAYMENT**

#### **PSMK 8.1 Basic principles**

**Add the following new sub-clause 8.1.4 to SANS 1200 MK, sub-clause 8.1:**

“Measurement and payment for bedding as well as the backing of kerbs as specified in PSMK 5.2, as amended, shall be included in the separate items scheduled in terms of SANS 1200 MK, sub-clause



8.2.1 and 8.2.2. The rates shall cover the cost of supplying and installing the bedding as specified in PSMK 3.9, as amended. The rates shall include payment for PSMK 3.2.1, as amended.”

**PSMM ANCILLARY ROADWORKS (SANS 1200 MM)**

**PSMM 8 MEASUREMENT AND PAYMENT**

**PSMM 8.3.4 Excavation and backfilling and concreting (if any) for sign supports**

**Replace:** "Excavation and backfilling and concreting (if any) for sign supports.....Unit: m<sup>3</sup>"  
**with the following:**

**"PSMM 8.3.4** Excavation, backfilling and concreting (if any) for sign supports.....Unit: No."

**Add the following to SANS 1200 MM, sub-clause 8.3.4:**

"The unit of measurement shall be the number of sign post foundations excavated, backfilled and concreted as specified. The rate shall include for all plant, labour and materials needed to cast concrete surrounds and backfilling with soil for each sign post base."

## **Particular Specifications (Civil Works)**

### **PSPG HIGH SECURITY FENCES AND GATES**

#### **PSG 1 GENERAL**

##### **PSPG 1.1 Scope**

This specification covers material requirements and installation of security fencing and gates.

##### **PSPG 1.2 Work included**

Furnish and install fence and gates, and accessories as required and shown.

##### **PSPG 1.3 Reference codes and standards**

CSIR, SABS, North Atlantic Treaty Organization (NATO) and International Aviation Authority Organization (ICAO)

CSIR Test 050036, 050056, T09998

SABS Test 2536/YM139

Nato Stock 5660-99-458-7414

ICAO Security Manual

##### **PSPG 1.4 Submittals**

The following must be submitted for approval by the Engineer before the installation of the security fence commences.

- a) Certificate of compliance for materials and coatings.
- b) Shop drawing for gates.
- c) Quality control program shall be submitted to the Engineer for review prior to commencement of any work.
- d) 10 Year Guarantee on fencing system upon completion of the installation.

#### **PSPG 2 HIGH SECURITY FENCES AND GATES**

##### **PSPG 2.1 General**

- a) All steel materials shall be of good commercial quality, galvanized steel.
- b) All pipes shall be galvanized, one piece without joints. Furnish moisture proof caps for all posts.
- c) Zinc coating shall be smooth and essentially free from lumps, globs, or points.
- d) Miscellaneous material shall be galvanized.

##### **PSPG 2.2 Description of fence system**

###### **PSPG 2.2.1 Post**

The posts shall comply with the following specifications:

- a) Post shall be 2.7m long.
- b) Post width shall be 85mm tapering to 45mm with a depth of 85mm.
- c) Post shall include locking mechanism to secure panel edge.
- d) Post shall be sealed with a UV stabilized polymer cap.
- e) Post shall be galvanized.
- f) Post foundation shall be 600mm x 400mm<sup>2</sup> and minimum 15 MPa concrete (28-day compressive strength) concrete, 19mm aggregate; no air entrapment.

#### **PSPG 2.2.2 Panel**

The panel shall comply with the following specifications:

- a) Panel shall be 3.305m width and 2.1m high.
- b) Panel aperture size (centres) shall be 76.2mm x 12.7mm.
- c) The panel shall be reinforced with 4 x 50mm deep “V” formation horizontal recessed bands (rigidity).
- d) Panel shall have 2 x 70° flanges along sides (internal fixtures – all fixtures shall be on the inside of the fence line).
- e) Panel shall have 1 x 90° flanges along top and 1 x 30° flange along toe (integrated rigid angle).
- f) Panel post shall have a flush panel post finish with no climbing aid.
- g) Panel shall be affixed to post over 48 line wires using 8 x Double bolt comb clamps and 8 x Single bolt comb clamps using 24 x Anti vandal bolts.
- h) Panel and fixtures shall be galvanized.

#### **PSPG 2.2.3 Coating**

Coating to be Galvanized, Polymetic 6000 coated or Marine Fusion Bond coated.

#### **PSPG 2.2.4 Topping**

100mm high toughened steel Shark Tooth spike or Castle Spike shall be affixed to panel edge, internally at 150mm intervals using Anti-vandal bolts.

Spike finish shall be Galvanized, Polymetic 6000 coated or Marine Fusion Bond coated.

#### **PSPG 2.2.5 Anti-burrow**

The fence shall be equipped with the specified anti-burrow option.

### **PSPG 2.3 Gates**

#### **PSPG 2.3.1 Swing gates**

All connections and joints shall be welded to form rigid frames or assembled with corner fittings. Hinges shall not twist or turn under the action of the gate and shall be so arranged that a closed gate cannot be lifted off the hinges to obtain entry.

### **PSPG 2.3.2      Sliding gates**

Gate frame fabrication and miscellaneous items shall be similar to Swing Gates. All fittings, brackets and rear wheel tracks shall be standard manufactured products for the intended application.

## **PSPG 3 CONSTRUCTION**

### **PSPG 3.1          Clearing the fence line**

The fence line shall be cleared over a width of at least 1 m on each side of the centre line of the fence and surface irregularities shall be graded so that the fence will follow the general contour of the ground. Clearing the line shall include the removal of all trees, scrub, stumps, isolated boulders or stones and other obstruction which will interfere with the construction of the fence. Stumps within the cleared space shall be grubbed as described in SANS 1200C. The bottom of the fence shall be located at a uniform distance above the ground line in accordance with the requirements shown on the drawings. All material removed shall be disposed of by the Contractor.

### **PSPG 3.2          General**

Install all fencing and gates in accordance with the drawings, specifications, instructions, and as specified lines and grades indicated. Line posts shall be spaced at intervals not exceeding 3.3m. Terminal posts shall be set at abrupt changes in vertical and horizontal alignment.

### **PSPG 3.3          Posts**

Post holes shall be cleared of loose material. Waste material shall be spread where directed by the Engineer. The ground surface irregularities along the fence line shall be eliminated to the extent necessary.

Posts shall be set plumb, and follow the indicated alignment. All posts shall be set to the depth indicated on the design documents. Concrete shall be thoroughly consolidated around each post, free of voids, and finished with a domed shaped surface, with the base of dome at grade elevation. Concrete shall be allowed to cure prior to installing any additional components to the posts.

Concrete footings shall be carried down to at least the depth indicated on the design documents and shall not be smaller than the dimensions shown. Where a rock layer is encountered within the required depth to which the post is to be erected, a hole of a diameter slightly larger than the largest dimension of the post may be drilled into the rock and the post grouted in. Then the regular concrete footing shall be placed between the top of the rock and the top of the footing elevation as shown on the design documents. Posts shall be approximately centered in their footings. All concrete shall be placed promptly and consolidated by tamping or other approved methods. Where the ground is firm enough to permit excavation of the post hole to neat lines, the concrete may be placed without forms by completely filling the hole. Curing may be achieved by covering the concrete with not less than four inches of loose moist material immediately after placing concrete, or by using a curing compound. All excess material from footings, including loose material used for curing, shall be disposed of as directed by the Engineer.

Where the ground cannot be satisfactorily excavated to neat lines, forms shall be used to place concrete for footings. Under these conditions the earth and forms coming in contact with the concrete shall be moistened and all ponded water shall be removed from the hole prior to placing concrete. When forms are removed, the footing shall be backfilled with moistened material, and thoroughly tamped. The top of the concrete shall then be covered with not less than 100 mm of loose moistened material or use curing compound if the 7-days cure is not completed. All excess material from footings, including loose material used for curing, shall be disposed of as directed.

### **PSPG 3.4        Gates**

Gates shall be installed at the locations shown. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Slide gates shall be installed as recommended by the manufacturer.

Gates shall be erected at the positions indicated on the drawings. Gates shall be hung on gate fittings as indicated on the drawings and shall be erected such that they swing in a horizontal plane at right angles to the gate posts, clear of the ground in all positions. For double leaf gates the gap between the individual gates shall not exceed 20 mm when closed and shall not be further than 40 mm from the gate post when closed.

#### **PSPG 3.4.1      Adjusting**

Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

### **PSPG 8 MEASUREMENT AND PAYMENT**

#### **PSPG 8.1        Fence clearance**

Clearing the fence line, 2,0m wide strip ..... Unit : m

The rate shall cover clearing the fence line as specified including the removal of trees of girth less than 1,0 m, stones and other obstructions, the disposal of all waste material resulting from the clearing operations including all haul.

The removal of trees and stumps with a girth exceeding 1,0 m shall be paid for separately.

Clearing of the fence line shall be measured linearly along each fence line cleared as directed by the Engineer.

#### **PSPG 8.2        Security fence**

**Supply, fabricate, deliver and install security fence complete as detailed on drawing**  
.....Unit: m

The rate shall cover the supply of all materials and the full installation thereof to erect the security fence as per the drawing and the project specifications.

**PSPG 8.3      Security Gate**

**Supply, fabricate, deliver and install security gate as detailed on drawing..... . Unit : No.**

The rate shall cover the supply of all materials and the full installation thereof to erect the security gate as per drawing and the project specifications.

**PSER REVEGETATION****PSER 1 SCOPE**

This Specification covers the requirements for the planting and establishment of vegetation on Site.

**PSER 3 MATERIALS****PSER 3.1 Seed**

Seed species used for hydroseeding shall be *Lolium multiflorum*, *Eragrostis teff* and *Cynodon dactylon*.

**PSER 3.2 Mulch**

Mulch shall be Aquasorb, Stoscosorb, Synpol H or equivalent product approved by the Engineer.

**PSER 3.3 Soil stabilization**

Soil stabilization shall be carried out by the addition of a soil binder such as Wheat straw together with Flobond or equivalent product approved by the Engineer.

**PSER 3.4 Fertilizers**

The Contractor shall use 2:3:2 and Super phosphate as fertilizers.

**PSER 4 PLANT****PSER 4.1 Hydroseeder**

The hydroseeder shall be capable of pumping the specified seed mix, fertilizer and soil stabilizer (mixed in water) at the specified rates over the areas to be seeded. The slurry distribution lines shall be large enough to prevent stoppage, and the discharge line shall be equipped with a set of hydraulic spray nozzles suitable for the even distribution of the slurry on the various slopes to be seeded.

**PSER 5 CONSTRUCTION****PSER 5.1 Preparation of areas to be hydroseeded**

Prior to revegetation / rehabilitation of the stockpiles the Contractor shall remove all remnants of building materials and other foreign debris from the stockpiles. Embankments shall be shaped to the required slopes and levels.

**PSER 5.2 Hydroseeding**

The prepared area shall be hydroseeded using the following specification:

Seed mixture:



Lolium multiflorum	10 kg/ha
Eragrostis teff	10 kg/ha
Cynodon dactylon (Kweek)	20 kg/ha
Mulch (as directed by the Engineer)	20kg/ha
Soil stabilization (as directed by the Engineer)	12 kg/ha
Fertilizer: 2:3:2(30)	400 kg/ha
Super phosphate	200 kg/ha

Prior to spreading the seed mixture or laying the grass sods an approved fertilizer shall be applied evenly to the whole area to be grassed. The fertilizer shall be super phosphate applied at a rate of 200 kg per hectare plus 2:3:2 (30) mixture applied at a rate of 400 kg per hectare. The fertilizer shall be free flowing and suitable for application with approved equipment, delivered to site in bags or other convenient containers each fully labelled and bearing the name of the fertilizer and trade name of the producer.

Hydroseeding machines shall be thoroughly cleaned after each operation and the mixture shall be kept uniform during the seeding operation by means of a power-driven agitator.

### **PSER 5.3 Traffic on re-vegetated areas**

No construction equipment, vehicles or unauthorised personnel shall be allowed onto areas that have been vegetated.

### **PSER 5.4 Establishment**

Establishment shall consist of maintaining the surface to the required slopes and levels without erosion, watering, weeding, fertilizing, disease and insect pest control. As well as any other procedure consistent with good horticultural practice necessary to ensure normal, vigorous and healthy growth of the plant material on site. Establishment shall commence immediately after hydroseeding and shall continue until a satisfactory cover, as detailed in this Specification, has been achieved and the Taking-Over Certificate has been issued.

In the absence of adequate rainfall, all seeded areas shall be watered once weekly, during the first month, and once every two weeks during the second month. Rainfall of less than 60mm in the first month and less than 45mm in the second month is regarded as inadequate water supply. Watering should be carried out using a fine nozzle spray to avoid erosion and disturbance of the vegetation.

## **PSER 7 TESTING**

### **PSER 7.1 Acceptable cover**

Acceptable cover shall have been achieved when not less than 60% of the area seeded is covered with acceptable plants and there are no bare patches greater than 800 mm in maximum dimension through the area.

## **PSER 8 MEASUREMENT AND PAYMENT**

**PSER 8.1 Commercial seed****Commercial seed ..... Unit: kg**

The unit rate for commercial seed shall cover the cost of the supply of seed to the place of application, of labelling and certification, of sampling and testing, of labour, equipment and transport and of any other thing necessary for the proper execution of the work to the satisfaction of the Engineer.

**PSER 8.2 Mulch****Mulch (type stated)..... Unit: kg**

The unit rate for mulch shall cover the cost of supply and transport to the point of application, of all labour, tools, equipment, plant and of any other thing necessary for the proper execution of the work to the satisfaction of the Engineer.

**PSER 8.3 Soil stabilizer****Straw..... Unit: ha****Soil stabilizer (chemical)..... Unit: kg**

The unit rate for soil stabilizers shall cover the cost of supply and transport to the point of application, of all labour, tools, equipment, plant and of any other thing necessary for the proper execution of the work to the satisfaction of the Engineer.

**PSER 8.4 Fertilizer****Fertilizer (type stated)..... Unit: kg**

The unit rate for fertilizer shall cover the cost of supply and application of fertilizer whether by hand or mechanical means, of all labour, tools, equipment, plant and of any other thing necessary for the proper execution of the work to the satisfaction of the Engineer.

**PSER 8.5 Hydroseeding****Hydroseeding ..... Unit: m<sup>2</sup>**

The unit rate for hydroseeding shall cover the cost of mixing and agitating of all the materials including seed, fertilizer, and soil stabilizer required in the seed-cocktail, of applying the mixture, of watering, weeding and re-hydroseeding bare patches. As well as costs of all labour, tools, equipment, plant, transport and of any other thing, except mowing of grass, which may be necessary to establish acceptable cover. Also included is the maintenance of the grass during the establishment period to the satisfaction of the Engineer.

**PSER 8.6 Maintenance****Maintenance of planted area ..... Unit: m<sup>2</sup>**

The area which has been grassed shall be maintained by the Contractor for a period of eight weeks after grassing of the entire area has been completed to the satisfaction of the Engineer. Any areas which fail to grow or any sparse patches shall be replaced with fresh sods to obtain a uniform healthy state of growth over the entire area.

The rate shall cover the cost of providing transport, equipment, labour and materials for watering, mowing, weeding, topdressing and maintaining the grassed area in a lush and healthy condition for a period of eight weeks as specified.