C3.3: PROJECT SPECIFICATIONS

AMENDMENTS TO THE STANDARD AND PARTICULAR SPECIFICATIONS

In certain clauses in the standard, standardized and particular specifications, allowance is made for a choice to be specified in the project specifications between alternative materials or methods of construction, and for additional requirements to be specified to suit a particular contract. Details of such alternative or additional requirements applicable to this contract are contained in this part of the project specifications. It also contains the necessary additional specifications required for this particular contract.

The number of each clause and each payment item in this part of the project specifications consists of the prefix PS followed by a number corresponding to the relevant clause or payment item in the standard specification.

The number of a new clause or payment item, which does not form part of a clause or a payment item in the standard specifications and which is included here, is also prefixed by PS, but followed by a new number which follows on the last clause or item number used in the relevant section of the standard specifications.

PART A: GENERAL

A1 SERVICES

Provision is made in the bill of quantities for payment for searching and exposing of known or unknown services.

PS2 PROGRAMME OF WORK

(a) General requirements

The bar-chart programme to be provided by the contractor shall show the various activities in such detail as may be required by the Employer's Agent. Progress in terms of the programme shall be updated monthly by the contractor in accordance with the progress made by the contractor.

In compiling the programme of work, the contractor shall indicate and make due allowance for the following:

a. Construction works as per the tender drawings, Bill of Quantities and Scope of Works;
b. Mechanical & Electrical (M&E) Contract. For the M&E contractor, a provision of 12 months from appointment to successful completion of the 28-day Trial Operational Period must be provided. Thereafter the civil contractor and the M&E contractor will be involved with the 2-months operation and training period.

PS3 WORKMANSHIP AND QUALITY CONTROL

The Employer's Agent shall, however, undertake acceptance control tests for the judgement of workmanship and quality, without accepting any obligations vested with the contractor in terms of the contract with specific reference to quality of materials and workmanship. Such acceptance control test done by the Employer's Agent shall not relieve the contractor of his obligations to maintaining his own quality control system.

The Employer's Agent shall, for the purpose of acceptance control on products and workmanship, assess test results and measurements.

Where small quantities of work are involved, a lot shall mean a full day's production for a specific item of work subject to acceptance control testing.

PS4 PAYMENT

(b) Rates to be inclusive

VAT shall be excluded from the rates and provided for as a lump sum in the Summary of Bill of Quantities.

(e) Materials on the site

In addition, the Employer's Agent may at his sole discretion also allow payments under "Materials on Site" in respect of any construction materials if stored off-site providing that:

(a) The site selected for this purpose is approved by the Employer's Agent;
(b) Such land is physically separated from any production plant or operation;
(c) Only materials for use under this contract is stockpiled on such land;
(d) The contractor has provided proof of an agreement with the owner of such land that the owner has no claim whatsoever on any materials stockpiled on such land;
(e) Materials obtained by the contractor for or on behalf of emerging subcontractors (SMME's) shall remain the responsibility of the contractor after payment has been made in respect of materials on site;
(f) A cession form for the material has been provided to the approval of the Employer.

(f) Payments Certificates

With reference to Sub-Clause 6 of the General Conditions of Contract, the Employer's Agent's certificate will be issued only after receipt by him of a draft certificate prepared by the Contractor in the form prescribed by the Employer's Agent.

The cost of duplicating and delivering copies of the Employer's Agent's Certificate to the Contractor, the Employer's Agent and the Employer shall be borne by the Contractor. A total of three copies of the certificate (A-4 size) will be required by the Employer's Agent and the Employer.

PS4 EXTENSION OF TIME RESULTING FROM ABNORMAL RAINFALL

Extension of time will not be considered for normal rainfall but only for abnormal rainfall or saturated conditions and will be calculated in accordance with the following method:

a) The Contractor shall, in his programme, allow for the anticipated number of working days on which work could be delayed - as given in the Schedule below.

b) Extension of time will be calculated for each calendar month or part thereof over the full period for the completion of the Work, plus any approved extension thereof, as follows:

i) A delay caused by abnormal rainfall will only be accepted for extension of time if, in the opinion of the Employer's Agent, it delays an item or items which lie on the critical path determined by the Contractor's programme. Only delays on working days will be considered;

ii) Abnormal rainfall will be days, as approved, on which rain delayed operations, less the anticipated number of days given in the Schedule below;

iii) The net extension of time determined for each month, which may be negative, shall accumulate algebraically to determine the net number days for extension of time due to abnormal rainfall, but a negative total at the end of the construction period will not be considered;

iv) Where a portion of a month is involved, a pro rata number of days shall be calculated.

SCHEDULE:

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

Month	**Days**	**Month**	**Days**
January	6		
February	9		
March	3		
April	2		
May	2		
June	1		
July	0		
August	0		
September	0		
October	1		
November	2		
December	5		
Total	**31**		

PART B PROJECT SPECIFICATION

PSA GENERAL (SABS 1200 A)

PSA 1 STANDARDISATION MARK (CLAUSE 3.1)

Add the following to the Clause:

All material delivered to the site shall bear the Official Standardization Mark.

PSA 2 CONTRACTOR'S CAMP (CLAUSE 4.2)

PSA 2.1 Restrictions on employee accommodation (Sub-clause 4.2)

No housing is available for the Contractor's employees. The Contractor shall make his own arrangements to house his employees.

The Employer shall place an area at the disposal of the Contractor to enable him to erect his site offices, workshops and stores. Any temporary housing and facilities shall comply with the requirements of the local authority. The Contractor shall provide his own fencing and site security.

PSA 3 DEALING WITH WATER (SUBCLAUSE 5.5)

In addition to the items as set out in Subclause 5.5 the contractor shall also provide pumping equipment, pipes and other equipment as may be necessary.

PSA 4 MEASUREMENT AND PAYMENT

PSA 4.1 Fixed charge and Value Related Items (Sub-clause 8.2.1)

Replace the sub-clause with the following:

Payment shall be a lump sum to provide for the Contractor's expenses in connection with:

(a) setting up and maintaining his organisation, camps and plant on the site;
(b) effecting the insurances and indemnities required in terms of the General Conditions of Contract
(c) meeting all other general obligations and liabilities which are not specifically measured for payment in these contract documents.

The lump sum total of items (a), (b) and (c) as measured and Fixed Charge Items and time Related Items shall not exceed 15% of the nett total Tender Amount. If the Tenderer should tender a higher amount for this item it shall be reduced to the amount allowed above and all other tendered prices increased in the proportion required to retain the same Nett Total Tender Amount.

The tendered lump sum shall not be subject to any variation if the actual value of work done under the Contract exceeds, or falls short of, the Tender Amount, or as a result of an extension of time for completion in terms of Clause 5.12 of the General Conditions of Contract.

Any payment made under this item shall not be taken into account when determining whether the value of a certificate complies with the "minimum amount of monthly certificate" laid down in the Appendix.

Before any payment is made under this item the Contractor shall satisfy the Engineer that he has provided on site an establishment and plant of good quality and in value exceeding that of the first installment. The Contractor may be asked to furnish documented proof that he owns the offices and plant on site, the value of which should exceed the amount claimed in the first certificate. In the event that the Contractor cannot satisfy the Engineer as to the value or ownership, the Engineer shall have the right to withhold part of any payments to be made under this item, until the Works have been completed.

Payment of the lump sum shall be made in three separate installments as follows:

(a) The first installment, 50% of the lump sum, will be paid in the first payment certificate after the Contractor has met all his obligations under this sub-clause and has made a substantial start on construction in accordance with the approved programme.

(b) The second installment, 35% of the lump sum, will be paid when the value of the work done reaches one half of the Nett Total Tender Amount.

(c) The third and final installment, 15% of the lump sum, will be paid when the works have been completed and the Contractor has fulfilled all requirements of this sub-clause. No payment for the scheduled Fixed Charge Items for this contract will not be made until the requirements regarding and the erection of name boards have been met.

PSA 4.2 <u>Time-Related Items</u> (Sub clause 8.2.2)

Replace this sub clause with the following:

Subject to the provisions of 8.2.3 and 8.2.4, payment of item 8.4.1 (time-related item) will take place in equal monthly amounts, calculated on the tendered amount for the item, divided by the contract period in months, with the understanding that the total of the monthly payments which was paid for this specific item does not exceed the proportion that the progress of the works to date bears in relation to the works as a whole.

Should the Engineer grant an extension of time, the Contractor is entitled to an increase in the amount tendered for time related items, and this increase must be kept in the same proportion to the original tender amount as the extension of time is to the original time of the completion of the works.

Payment for such increased amounts will be considered as full compensation for all time related, provisional and general costs which arise as a result of the extension of time.

PSA 4.3 Facilities for Engineer (Sub clause 8.3.2.1)

Change the item descriptions of the following items as follow:

PSA 4.3.1 Item:

a) Engineer's office Unit: sum

The specifications for the items listed below should be provided in accordance with the "Facilities provided by the Contractor" in C3.1 Scope of Works:

The tendered sum shall provide for the following:

Provide the following units:
- 2 x Airconditioned Offices (minimum 10 m²)
- 1 x Airconditioned Boardroom (minimum 20 m²)
- 1 x Kitchen (7 m²)
- 2 x WC units (male and female)
- 6 x carports with crushed stone floor

Note that the areas surrounding the units in the Engineer's camp must be covers with gravel as specified in Section C3.1 Scope of Works

The Boardroom shall each be furnished with the following:
- Air conditioner
- 1 x conference table to seat 20 people
- 20 x new chairs
- White board mounted to wall (Minimum 1.2 x 2m)
- 1 x 10 kg Fire Extinguisher

The office shall be furnished with:
- Air conditioner
- 2 x office desks and 2 x chairs
- 1 x drawing table
- 2 x steel cabinets
- 1 x A1 drawing rack
- 1 A4/A3 Colour laser printer/Scanner/Copier
- 1 x 10 kg Fire extinguisher

The kitchen shall be furnished with:
- 2 Min 300 l fridge/freezer combination fridge
- Microwave of min 36 l and 1 000 W
- Cordless kettle
- 2 x 1.8 m steel folding table
- A set of 12 x each of knifes, forks, spoons and teaspoons
- A set of 12 x each of white ceramic crockery including dinner plates, side plates, bowls, coffee mugs, tea cups and saucers
- A set of 24 x beer glasses
- 1 x large wooden cutting board
- 1 x kitchen knife set in knife block which includes at least a large carving knife, bread knife, medium knife, pairing knife and kitchen scissors

- 2 x braai tongs
- 1 x meat casserole with lid
- 1 x 10 kg Fire extinguisher

The contractor must supply the following equipment:

- New Dumpy Level and Staff
- New Dynamic Cone Pentrometer (DCP)
- Measuring wheel with electronic display
- Rain gauge
- 2 x 1m spirit level
- 2 x First Aid Kit

The contractor will provide the following additional services

- Uncapped WIFI coverage for the offices and boardroom (min 6 mbs speed)

PSA 4.3.2 Item:

c) Name board Unit: sum

The tendered sum shall provide for two contract nameboards as specified by the detail drawings.

PSA 4.4 <u>Exposing of existing services</u>

Add the following new pay item:

PSA 4.4.1 Item:

Excavation by hand in all materials to expose existing services Unit: cubic meter (m^3)

The tendered sum must include full compensation for all hand excavation as per the dimension approved by the Engineer for the locating, exposing and moving of existing services. Excavation outside of approved dimensions will not be paid. The rate must also include for backfill and compaction to 90% of mod AASHTO density and, if applicable, the removal of excess material not used for backfill, the securing of excavations, for handling surface and subsurface water, for protection of existing services and for any other activity necessary to complete the work. Free haul of 1,0 km will be applicable on the transport of excess material.

No distinction will be made between classes of material or types of services.

<u>Note:</u> The Contractor must provide sufficient supervision over labourers when services are exposed."

PSA 4.5 <u>Occupational Health and Safety</u>

Add the following new pay items:

Provision for the cost related to the Occupational Health and Safety Act, 85 of 1993, and the relevant Regulations:

a) Preparation of a Health & Safety Plan. Unit: Sum

b) Compilation of a Risk Assessment prior to Construction. Unit: Sum

c) Health & Safety induction Training of employees. Unit: Sum

d) Compilation and keeping up to date the Health & Safety file which shall include all documentation required in terms of the act. Unit: Sum

e) Implementation of the Health and Safety Plan over the entire construction period. Unit: Sum

The tendered sum shall include full compensation for providing the above services as required from the Occupational Health & Safety Act. The rate shall include all related costs incurred by the Act, remuneration of personnel, trainers, etc. and equipment required for the execution of the required services as depicted by the Act. The tendered amount for items a, b, c, d and e shall only be paid on the successful completion of the task as approved by the client. The tendered amount for item shall be paid on a monthly basis.

PSA 4.6 SUMS STATED PROVISIONALLY BY THE ENGINEER

Add the following new pay items:

PSA 4.6.1 Item:

Project Liaison Officer Unit: Prov Sum

The total cost is for the duration of the project.

PSA 4.6.2 Item:

Project Liaison Committee Unit: Prov Sum

The total cost is for the duration of the project.

PSA 4.6.3 Item:

Additional laboratory testing Unit: Prov Sum

PSA 4.6.4 Item:

AS BUILT Survey Unit: Prov Sum

The rate shall cover the cost for a surveyor to conduct an AS BUILT survey of the works as required by the Clients Agent

PSC SITE CLEARING (SABS 1200 C)

PSC 1 GENERAL

The areas where work is to be carried out must be kept clean for the duration of the contract. All rubbish must be removed without delay and the site must be left clean and tidy on completion of the service.

PSC 2 DUMPING SITE

No dumping is allowed on site other than at the designated and approved fill areas. Dumping will only be allowed for filling sinkholes and dolines and may not be detrimental to the natural storm water drainage of the area. Only soil, rock, clean masonry and concrete rubble may be dumped in the designated dump areas.

PSC 3 REMOVAL OF TREES

No trees may be removed without written permission from the Engineer.

PSC 4 MEASUREMENT AND PAYMENT

PSC 4.1 Item:

Clear & Grub (Clause 8.2.1) Unit: ha or m or km

Add the underlined text to the second sentence of the item description to read as follow:

"The rate shall cover the cost of clearing the surface, removing boulders of size up to 0,15 m³, grubbing of trees and tree stumps (except large trees (**with girth over 1m**) and stumps as specified in 8.2.2 below), cutting of trunks and branches exceeding 0,5m **up to 1,0m** in girth into transportable lengths....."

Add the following to the pay item description:

"The rate shall include for transport and disposal of material and debris to unspecified site and disposal thereof."

"The area (in ha) shall comprise the entire site to be cleared and grubbed within the limits to be indicated by the engineer on site in writing.

The area of clear and grub measured in linear meter (or km) shall be the sections outside the initial cleared area (measured in hectares), specifically applicable to pipeline routes outside the original cleared site area. The width and length shall be indicated by the engineer on site in writing."

PSD SABS 1200 D: EARTHWORKS

PSD 1 MATERIALS (CLAUSE 3)

PSD 1.1 Classification (Clause 3.1)

Notwithstanding the provisions of Sub-clause 3.1 of SANS 1200 D, the unit rate for excavation shall cover excavation in all materials other than hard rock.

PSD 2 CONSTRUCTION (CLAUSE 5)

PSD 2.1 Excavations (Subgrade Preparation) (Sub-clause 5.2.2)

The Contractor shall allow 6 weeks in his programme for when bulk excavation has been completed for the Engineer to review the founding conditions and to instruct the Contractor to commence with soil improvement and implement these soil improvements, if required, before commencing with construction activities.

Bulk and restricted excavations shall be taken down to the underside of the concrete blinding layers for the various structures. After the earthworks operations have been carried out, the surface shall be watered so that the top 300mm is at optimum moisture content, and this layer shall then be compacted to 100% Mod AASHTO density. The subgrade shall then be carefully levelled and prepared to receive the concrete blinding. Surplus excavated materials shall be removed and spoiled as indicated by the Engineer. Payment for preparation of subgrade and compaction shall be included in the rate for excavations.

PSD 2.2 Excavation for working space (Sub-clause 5.2.2.1 b) and c))

Add the following to the clause:

Other than for the sides of strip or pad footings or where specifically authorized by the Engineer, no concrete shall be placed against the sides of excavations.

For external concrete faces below ground level, (other than concrete placed against the sides of excavations as above) the Contractor shall over-excavate to provide sufficient working space for the erection of formwork.

Tenderers shall allow in their rates for excavation for any over-excavation required for working space.

Excavation volumes for structures will be calculated as the nett volume of the structure below ground level after general site excavations have been completed. No additional payment shall be made for working space.

All water retaining structures shall be shuttered externally on vertical and on other faces inclined within 45º from the vertical.

PSD 2.3 Inspection (Sub-clause 5.2.2.1 d))

Add the following to the clause:

Excavation to final level soil improvement, ready to achieve a binding 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 or his Representative of all surfaces immediately before casting concrete.

PSD 2.4 Over-excavation to sides of excavation (Sub-clause 5.2.2.1 e))

Add the following to the clause:

Where the sides of excavations are over-excavated to establish safe slopes, provide access to excavations, or for other purposes not specifically required by the Engineer, such over-excavation shall be backfilled with material as required by the Engineer and compacted to a minimum density of 95% Mod AASHTO.

No separate payment will be made for this work.

PSD 2.5 Over-excavation (Sub-clause 5.2.2.1 e))

Add the following to the clause:

If the material in the bottom of an excavation is loosened, or if there is any over-excavation, any loose or disturbed soil shall be removed, and the over-excavation shall be replaced by mass concrete mix 15 MPa.

No separate payment will be made for replace over-excavation with concrete. No separate payment will be made for over excavation as defined in PSD 2.4 and PSD 2.5.

PSD 2.6 Trimming of surface of bulk earthworks (add the following sub-clause 5.2.2.1 f))

Where blinding, mass or structural concrete is to be cast or where precast elements are to be placed on surfaces established by bulk earthworks, the Contractor shall:

a) Arrange his bulk excavation operation so that over-excavation is avoided, taking into account the requirements in PSD 2.4.
b) Over-fill embankments while placing fills as necessary to allow for trimming and arrange his compaction operations to ensure that the specified density is achieved throughout the finally trimmed embankment; and
c) Shortly before casting concrete or placing precast elements, carefully remove the final layer and trim such surfaces to the design levels and profiles within Grade II degree of accuracy.

PSD 2.7 Disposal of surplus material (Sub-clause 5.2.2.3)

Add the following to the clause:

All surplus material from bulk excavation for concrete units and for pipework shall be dumped, leveled and spread on site at the areas as indicated by the Engineer. No dumping shall be undertaken prior to obtaining detailed instructions from the engineer.

PSD 2.8 Freehaul (Sub-clause 5.2.5.1)

Replace the sub-clause with the following:

All haul within the site of works or within a distance of 1.0 km outside the extremities of the boundaries of the contract as indicated on the drawings shall be regarded as freehaul.

PSD 3 MEASUREMENT AND PAYMENT (CLAUSE 8)

PSD 3.1 Restricted excavation (add the following to sub-clause 8.3.3)

Add the following to this item:

The volume of restricted excavation will be calculated from the net plan dimensions and the difference between the original ground profiles (or terraces), and the blinding layer (or no-fines) levels shown on the drawings. On the sides, the volume will only be calculated to the outside dimensions of the concrete structures. No additional payment will be made for the provision of working space, although it will be provided.

PDS 3.2 Additional Lateral Support / Shoring (Sub-clause 8.3.7)

The contractor must at all times ensure that excavations are safe to work in. Should the excavations exceed 2 meters and appear unstable shoring must be installed. Allowance in the Bill of Quantities has been made for shoring. No claims for extension of time, additional costs or damages for doing shoring will be entertained.

The unit in the Bill of Quantities is m2.d. the Contractor shall submit his shoring design proposal to the Engineer for approval. The unit rate shall cover the product of the surface area of the shoring and the number of days it is required.

PSDB SABS1200DB: EARTHWORKS - PIPE TRENCHES

PSDB 1 CONSTRUCTION

PSDB 1.1 Freehaul Distance

All haul within the site of works or within a distance of 1.0 km outside the extremities of the boundaries of the contract as indicated on the drawings shall be regarded as freehaul.

PSDB 2 MEASUREMENT AND PAYMENT

PSDB 2.1 Dewatering (Sub clause 8.1.1)

Add the following to this item:

The scheduled rates for excavation shall include dewatering of trenches.

PSDB 2.2 Excavations (Sub clause 8.3.2b)

Replace the clause with the following:

Extra-over item:

Only two types of excavations are defined and paid for under this contract. These items are soft excavation and hard rock excavation. No intermediate excavations will be paid for. Hard rock excavations qualifies when blasting or mechanical breaking are applied to break the rock.

PSDB 2.3 Shoring (Sub-clause 8.3.4(a))

The contractor must at all times ensure that excavations are safe to work in. Should the excavations exceed 2 meters and appear unstable shoring must be installed. Allowance in the Bill of Quantities has been made for shoring. No claims for extension of time, additional costs or damages for laying pipes in shored trenches will be entertained.

PSG **SABS 1200 G: CONCRETE (STRUCTURAL)**

PSG 1 **SCOPE OF WORKS**

This specification covers the construction of all structural concrete elements.

PSG 2 **MATERIALS (CLAUSE 3)**

PSG 2.1 **Concrete**

PSG 2.1.1 **Cement (Sub-clause 3.2.1)**

Add the following to the sub-clause:

The type of cement to be used for concrete structures shall be approved by the Engineer.

PSG 2.1.2 **Storage of cement (Sub-clause 3.2.3)**

Add the following to the sub-clause:

Cement shall not be kept in storage for longer than eight weeks without the Engineer's permission.

Cement which has been damaged in any way or which has been stored on site for a period exceeding three months shall be condemned and removed from site.

PSG 2.1.3 **Aggregates (Sub-clause 3.4)**

Add the following to the sub-clause:

Concrete with reactive aggregates:

The Contractor shall supply a test certificate for the aggregate confirming that it is not reactive.

With each delivery of materials under this clause the Contractor shall supply acceptable written evidence that this clause is being complied with.

PSG 2.1.5 **Use of plumbs (Sub-clause 3.4.2)**

Add the following to the sub-clause:

The use of plumbs shall not be permitted.

PSG 2.1.6 **Admixtures (Sub-clause 3.5)**

Replace this sub-clause with the following

Admixtures may only be used with the prior approval of the Engineer. No air-retaining properties will be tolerated.

PSG 2.2 Joint materials (add the following new sub-clause 3.9)

All primers, fillers, sealers, admixtures and breakers shall be suitable for use on potable water.

PSG 2.2.1 Primer

An approved primer, fully compatible with and/or manufactured for the specified jointing and sealing materials shall be applied to the joint surfaces.

PSG 2.2.2 Filler

Fillers shall be closed-cell expanded polyethylene.

Fillers shall be pre-cut to suit the application with a tear-out strip for forming the specified recess for the bondbreaker and sealant.

PSG 2.2.3 Sealer and breaker

The elastomeric sealant shall be a two-pack polyurethane type (gun grade for vertical joints) generally conforming with the physical properties specified in SABS 110, and used with primers as specified above.

The bondbreaker placed immediately prior to application of the sealant shall be a self-adhesive vinyl type (or similar approved material) with a width the same as the joint recess into which it is to be applied.

PSG 3 CONSTRUCTION (CLAUSE 5)

PSG 3.1 Classification of finishes (Sub-clause 5.2.1)

Add the following to the sub-clause:

Concrete surfaces which will be in contact with the natural ground or which will otherwise be covered on completion of the works, shall have a rough finish as specified in sub clause 5.2.1 (a).

Horizontal surfaces and surfaces with a slope not exceeding one vertical to two horizontal shall be finished to a woodfloat finish. For this finish the surface must be given a finish as specified in sub-clause 5.5.10.1 and after the concrete has hardened sufficiently, it shall be floated to a uniform surface free of trowel marks.

The finished concrete surfaces shall be accurate to degree 1 as defined in sub-clause 6.2.

The visible vertical or near vertical surfaces of valve chambers, and culvert head walls or parapets shall be finished to a smooth surface, repaired and rubbed to remove projections.

The bagging of concrete surfaces to repair defects will not be permitted.

All concrete edges shall be provided with 25 mm x 25 mm chamfers.

PSG 3.2 Cover (Sub-clause 5.1.3 and 5.5.1.5)

Add the following to the sub-clauses:

The exposure conditions for all structures in the works shall be deemed to be "severe". The minimum cover to reinforcement shall be 50 mm for water retaining concrete and 50 mm for all other concrete, unless otherwise specified on the Engineers drawings and bending schedules.

PSG 3.2.1 Spacers for reinforcement (sub-clause 5.1.3)

Add the following to the sub-clause:

Spacers of approved design include purpose made precast mortar blocks. No plastic spacer blocks will be allowed.

Where mortar blocks are used, they shall be properly shaped so as not to slip out of position and shall be made of the same mix as the mortar of the concrete in which they are to be placed.

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; and which are free from honeycombing. They shall be cured in water for at least seven days. Mortar 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.

PSG 3.3 Holes, Chases and Fixing Blocks (Concrete Boxouts) (Sub-clause 5.3)

Where pipes are to be cast into concrete, the Contractor shall provide a box-out in the wall and grout the unit in at a later stage. When constructing such a 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 box-outs for pipes/specials have been provided in the walls, the Contractor shall be responsible for the grouting in of such pipes/specials regardless of whether or not these have been supplied by himself.

An approved non-shrink grout shall be used for the grouting in of pipes and specials after they have been positioned. The details and method statement are to be submitted to the Engineer for approval prior to the commencement of any grouting. The approval by the Engineer shall not relieve the Contractor from his obligation to provide a watertight joint between the concrete and grout used.

PSG 3.4 Strength concrete (Sub-clause 5.5.1.7)

Add the following sub-clause:

The grade of strength concrete for each portion of the works will be indicated on the drawings and/or specified in the Schedule of Quantities. The grade of concrete will be designated as "Class S/A", where "S" is the characteristic strength in Mpa and "A" is the maximum nominal size of coarse aggregate in mm.

With the exception of mixes weaker than 15 Mpa, all concrete for the Works shall be considered to be strength concrete in terms of Sub-clause 5.5.1.7.

No concrete shall be cast until the mix designs have been approved by the Engineer. The Engineer may call for revised mix designs at any stage during the contract.

Contractor to supply and test 6 No. cube test results for approval prior to commencement of the works.

Unless otherwise specified on the drawings or in the Schedule all structural concrete shall have a strength of 35/19 Mpa.

The concrete to be used on this contract shall be as follows:

(a) For all water retaining structures (including reservoir roofs), 35/19 MPa. The slump limits shall be 75 mm. The water/cement ratio shall not be greater than 0,5. A waterproofing agent (Crystalline Admix) shall be added as per supplier's specification to a minimum of 1% by weight of cement.
(b) For all other structures not in contact with water 25/19 MPa concrete.
(c) For anchor blocks, benching and mass concrete, 20/19 MPa concrete.
(d) For no-fines concrete 15/19 Mpa concrete
(e) All sizes of aggregate used shall be 19 mm granite.

These mixes shall be designed for vibration. All data reports prepared by the Institute shall be submitted to the Engineer for information and approval.

DESIGN OF CONCRETE MIX:

The concrete mix design shall be prepared by an approved independent laboratory and submitted to the Engineer for approval. Historical data shall be provided for a similar mix design to the same strength.

The successful Tenderer will be required to submit samples of the fine and coarse aggregate which he proposes using, to an approved laboratory for tests regarding the suitability of such aggregates. The laboratory shall prepare trial mixes of the two stronger grades of concrete required for the contract to establish acceptable design mixes.

PSG 3.5 <u>Formwork and finishes</u> (Sub-clause 5.2)

Add the following to the sub-clause:

FORMWORK TIES

The use of sleeves through the concrete for formwork ties will not be permitted. Ties, when cast in, shall have some form of positive shear key to prevent any rotation when loosening formwork.

The formwork ties and bolt holes shall be placed with regularity and precision.

The finish of exposed concrete surfaces of concrete structures shall be "smooth" as detailed in (b) of sub-clause 5.2.1.

FILLETS AND CHAMFERS

All internal and external angles in concrete works shall have 25 mm x 25 mm fillets and chamfers unless shown otherwise on the drawings.
The units rate tendered for formwork shall cover the cost of forming these chamfers and fillets.

PSG 3.6 Joints (Clause 5.5.7)

Add the following to the sub-clauses:

PSG 3.6.1 General

Notwithstanding Sub-clause 2.4.3 “designated joints” shall only be joints shown on the drawings and in the Schedule. Further joints required by the Contractor because of construction limitations or any other reason, shall be deemed to be “undesignated joints”.

The position and pattern of all joints (designated or undesignated) shall be to the Engineer’s approval.

All joints (designated or undesignated) except expansion and contraction joints shall be treated in accordance with Sub-clause 5.5.7.3.

Joints between tank bottoms, floors or wall bases and the walls and columns standing on them, shall not be made flush with the supporting surface, but shall be made in the wall or the column a distance of 140 mm above the base. The 140 mm high “riser” shall be cast as an integral part of the bottom, floor or base, i.e. the concrete in the riser shall be deposited at the same time as the concrete in the bottom, floor or base adjacent to it.

In cases where there is a fillet at the bottom of the wall or column, the construction joint shall be made 140 mm above the fillet.

The Contractor should note that the details of the undesignated joints shall be identical to the designated joints shown on the drawings where the joint is in a similar situation and performs the same duty.

The Contractor shall further note that the position and the type (where no identical designated joints exist) of undesignated joints shall be subject to the Engineer’s approval.

PSG 3.6.2 Construction joints (Sub-clause 2.4.3 and 5.5.7)

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

As soon as practical, but not before 15 hours after placing, the joint surface shall be prepared to receive fresh concrete.

This preparation, as specified in Sub-clause 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 and sand blasting shall be such as to produce a roughened surface all over.

Concrete surfaces, where concreting is interrupted, shall be protected from the sun as specified in Sub-clause 5.5.8 (d).

Floor slab concrete shall be cast in one continuous pour. Should the Contractor wish to deviate from this requirement for the larger pours, a water bar shall be placed in the centre of the joint. This deviation should first be discussed with the Engineer before construction commences.

A kicker joint shall be formed at all external floor/wall intersections. The kicker shall be formed with the floor pour and shall include a 200mm PVC water bar, of the dumbbell kind. The water bar shall be provided with eyelets so that the water bar can be held in its correct position. A rate item for construction joints is provided in the Bill of Quantities.

PSG 3.6.3 Construction joints (Sub-clause 5.5.7.3)

No vertical construction joints other than those shown on the Drawings may be formed without prior approval. Horizontal construction joints may be formed if the method of construction does not allow for one continuous pour. However, these construction joint will be indicated to and approved by the Engineer. It must be noted that should the Contractor wish to form a construction joint in water retaining concrete, the watertightness of this joint will remain the responsibility of the Contractor. In addition to the precautions to be taken as prescribed under clause 5.5.7.3, the Contractor may ensure watertightness by providing additional means (such as a bandage on the joints or wet to dry epoxy) to the approval of the Engineer. No additional payment will be made to the Contractor for ensuring that construction joints are watertight and the Contractor will have to include such costs in the rate for the concrete.

PSG 3.6.4 Expansion and construction joints

Expansion and contraction joints shall be made in the position and to the details shown on the drawings.

The specified filler strips shall be attached to the complete side of the straight or grooved concrete joint by means of an approved adhesive.

PSG 3.7 Items to be casted in or grouted into concrete (sub-clause 5.4)

Add the following to the sub-clauses:

PSG 3.7.1 Fixing for equipment and pipe specials supplied under this Contract

a) The Contractor will be responsible for the forming of pockets and grouting in of pipe items and/or holding down bolts for equipment supplied under the contract.

b) Upon completion of the positioning and alignment of equipment, the Contractor shall, grout up pipe items, pockets and base plates (subject to (c) below) necessary for the permanent installation of the equipment.

c) Only after the Engineer is satisfied with the alignment and the level of each item of plant shall the Contractor grout up the base plates/pipe specials with an approved non-shrink grout.

PSG 3.7.2 Fixing for equipment supplied under this contract

Holding down bolts or other fixings required for the installation of handstops, crane beams, ladders, handrails and other items supplied under the 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 a type approved by the Engineer.

All anchor bolts shall be stainless steel grade 316.

PSG 3.7.3 Pipes and conduits embedded in concrete

Except with the written approval of the Engineer, no pipes other than those shown on the drawings shall be embedded in concrete and the approval of the Engineer for the position of all services to be embedded shall be obtained before concreting commences.

The clear space between pipes of any kind embedded in reinforcement concrete and the clear space between such pipes and reinforcement shall not at any point be less than:

(a) 40 mm, or

(b) 5 mm plus the maximum size of coarse aggregate, whichever is the greater.

PSG 3.8 Curing and protection (Sub-clause 5.5.8)

Add the following to the sub-clauses:

Level or gently sloping surfaces shall be cured by one of the methods described in Sub-clause 5.5.8 (a) or (b) and vertical surfaces by the methods described in Sub-clause 5.5.8 (e) for a period of five days after casting for an ambient temperature of 5ºC or above and for eight days for an ambient temperature of below 5ºC.

PSG 3.9 Concrete surfaces (Sub-clause 5.5.10)

Add the following to the sub-clauses:

PSG 3.9.1 Screed 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 3.9.2 Wood float finish

Where wood floating is ordered or scheduled, the surface shall first be given a finish as specified in PSG 3.6. 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 screed marks.

PSG 3.9.3 Steel float finish

The surface of tank bottoms, floors and roof slabs, etc. shall be given a steel float finish in accordance with Sub-clause 5.5.10. To Degree 1 accuracy.

PSG 3.9.4 Power floated finish

Where power floating is required the surface shall be treated as specified in PSG 3.11.2 to a degree necessary.

PSG 3.10 Screeds (add the following sub-clause 5.5.16)

GRANOLITHIC SCREED

Granolithic screed shall consist of: Cement - 1 part; Sand - 1.25 part; Coarse aggregate - 2 parts.

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

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

PSG 3.11 Repairs and defects (add the following sub-clause 5.5.14)

All defects to the concrete shall be attended to, in full, as soon as possible after the formwork is removed. Further concreting of the element concerned may be prohibited by the engineer until he is satisfied that this remedial work has been satisfactorily attended to.

PSG 3.12 Porous Concrete

Porous concrete shall be laid under foundations and floor slabs, and behind walls, etc., where shown on the drawings and where directed by the Engineer.

Porous concrete shall be placed behind shuttering to form a vertical layer against the external face of foundations, etc. where shown on drawings and where directed by the Engineer.

The thickness of the horizontal, sloping and vertical layers shall not be less than that shown on the drawings.

The exposed faces, both horizontal and vertical, of the porous concrete shall be finished with a cement mortar seal, as specified in Clause PSG2.11.3, where reinforced concrete is to be cast against it.

The schedule rates for porous concrete shall include the cost of the mortar seal and steel float finish.

Porous concrete shall comprise water, cement, coarse aggregate and not more than 5 % by mass of fine sand. Every size of aggregate shall be a single size aggregate, graded in accordance with SABS 1083.

The voids ratio of porous concrete shall not be less than 27,5 %.

No-fines concrete shall be classified by the prefix NF and the size of the aggregate to be used. Class NF19 means a no-fines concrete with a 19 mm nominal size. The volume of aggregate per 50 kg of cement is to be as follows:

Class	Aggregate Size	Aggregate per 50kg cement	Minimum Average Strength of a set of three test cubes after 28 days (MPa)
NF38	38	0.33 m^3	5.5
NF19	19	0.30 m^3	5.5
NF13	13	0.27 m^3	5.5

PSG 3.12.1 Batching and Mixing

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

Mixing shall be carried out in an approved batch type mechanical mixer. The whole batch of aggregate together with half of the water shall be placed into the mixer and mixed together for at least half a minute. The cement, followed by the balance of water, shall subsequently be added and the mixing shall continue for at least 1,5 minutes or as much longer as is necessary to ensure that all aggregates are uniformly coated with cement grout.

Testing of porous concrete shall be carried out in accordance with test method 3 of BS 1881 Part 3 : 1970.

PSG 3.12.2 Placing

The Engineer shall be timeously advised to enable him to inspect the excavations or form work before no-fines concrete is placed.

After the placing of the concrete has commenced, it shall be continued uninterrupted and may only be halted at the construction joints approved by the Engineer. Control shall be exercised to ensure that no placed green concrete lies for longer than 30 minutes before being covered with fresh concrete and that the concrete is placed in its final position within 20 minutes after the cement has been loaded into the mixer.

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

PSG 3.12.3 Mortar seal over porous concrete

Where concrete is to be cast against previously cast porous concrete, the surface of the porous concrete shall be sealed with a 5 mm thick layer of mortar composed of one part normal Portland cement to two parts of fine aggregate by mass, trowelled on before screed to provide a dense, smooth, uniform plane surface without filling any of the internal voids of the porous concrete. The surface of the seal shall have a steel float finish.

PSG 3.12.4 Protection

All no-fines concrete shall be protected from the elements, particularly from strong wind, flowing water, damage to the surface and loss of moisture. Protection against loss of moisture shall be accomplished by one or more of the following methods :-

(a) Keeping form work in place.

(b) Covering exposed surfaces with sacking or other approved material that is kept continuously wet.

(c) Covering exposed surfaces with plastic sheeting.

PSG 3.12.5 Sealing of surface of no-fines concrete

Where indicated on the drawings or instructed by the Engineer, the surface of the no-fines concrete shall be sealed with a layer of 1:8 cement mortar to prevent loss of moisture from the structural concrete.

This seal shall be placed after the no-fines concrete has hardened and must be leveled off to the same level as the top of the no-fines concrete.

PSG 3.13 Water tightness testing and cleaning (add the following sub-clause 5.5.11)

On completion of concreting and when the concrete has attained its required strength, all structures shall be tested for water tightness. As a result, structures shall not be backfilled until the water test has been successfully completed. No water is available on site and the contractor must make his own arrangements for water for water tight testing of all the structures.

Each structure shall be filled with water and shall be allowed to stand for 48 hours. Thereafter the water level in the structure shall be monitored over a period of 10 days. The effects of evaporation shall be taken into account during this period. The structure will be deemed to have passed the test if it loses no more than 5mm of water after the drop due to evaporation is deducted.

Where there are visible signs of sweating, seepage or leakage, the affected areas shall be brought to standard. Where it is obvious that there is harmful leakage, the test shall be discontinued and the tank emptied without delay. The Contractor shall then, at his own expense, rectify the leak and re-test that tank. After the said tank has successfully passed the water tightness testing the tank shall be emptied again.

In order to conserve water, it shall be sequentially pumped from structure to structure as successful testing is completed. The rate tendered for testing shall include for the cost of testing as described above and the supply and operation of any pumping equipment required.

After the watertight test the water retaining structures shall be disinfected by applying water containing 20mg/liter free chlorine residual for a period of 24 hrs. The water retaining structures will not be accepted and cleaning of the water retaining structures have been passed by Engineer.

PSG 4 TOLERANCES (CLAUSE 6)

PSG 4.1 Permissible deviations (Sub-clause 6.2)

Add the following to the sub-clause:

The degrees of accuracy of construction shall be as follows:

(a) All structures (including water retaining structures) – Degree I accuracy.

(b) All weirs (concrete) and weir plates shall have a tolerance of +1/-1 mm

PSG 5 TESTING (CLAUSE 7)

PSG 5.1 Grouting (add the following new sub-clause 7.4)

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 bedplate similar in configuration to that which is to be grouted, but not exceeding 1 m^2 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 Sub-clause 7.2.1 to 7.2.3.

PSG 6 MEASUREMENT AND PAYMENT (CLAUSE 8)

PSG 6.1 Grouting / casting in of pipe specials (add the following sub-clause 8.10)

Add the following pay item:

Item:

Grouting / casting in of pipe pieces in the following diameter Unit: No

The rate shall include all labour, plant and material for the grouting/casting in of pipes of the above items as per PSG 2.6.4. The actual pipe/item to be cast in is measured elsewhere.

PSG 6.2 <u>Step irons</u> (add the following sub-clause 8.16)

Add the following pay items:

Item:

Step irons (Calcamite or similar approved) Unit : No

The rate shall cover all costs to supply and install the step iron. The rate shall include for the drilling into the concrete, supplying and installing chemical anchors as well as the setting out of the step irons in the correct position.

PSHA SABS 1200 HA: STRUCTURAL STEELWORK (Sundry Items)

PSHA 1 MATERIALS (CLAUSE 3)

PSHA 1.1 Structural Steel (Clause 3.1)

Add the following to this clause:

All structural steelwork, including pipe supports and ladders will be to SANS 1421 Grade 300 W. The Contractor must allow in his rates to provide for shop details. Corrosion protection to be hot dipped galvanising to the requirements of EN 10240:1997 and SANS ISO 1461:1999 unless indicated differently.

All handrails and flooring, including supports and fasteners shall be manufactured from hot dipped galvanised mild steel to the requirements of EN 10240:1997 and SANS ISO 1461:1999 unless indicated differently.

PSHA 1.2 Bolts, Nuts and Washers (Clause 3.3)

Add the following:

All bolts, nuts and washers shall be AISI 316 stainless steel.

All sleeve anchors shall be AISI 316 stainless steel.

All fixings shall be AISI 316 stainless steel and this will also apply to any bought out item. An approved molybdenum disulphide anti seize compound shall be applied on all bolts and nuts.

PSHA 2 CONSTRUCTION (Clause 5)

Add the following:

All surfaces shall be abrasive blast cleaned to Swedish standard SIS 05 59 00 of 1967 to SA 2½ finish. The blast profile shall be between 40 and 70 microns.

PSHA 2.1 Holes for Fasteners (Clause 5.2.3)

Add the following to this clause:

Holes for holding-down bolts shall not be flame-cut.

PSHA 2.2 Welding (Sub-clause 5.2.4) (site welding)

Add the following to this clause:

Manual flame-cutting is allowed only where authorised. Edges shall be grinded to be free of unevenness, defects and distortions.

Welding shall comply with SABS 044 Part III, SABS 044 Part iv and SABS 0162.

Welding shall be minimum grade B welding.

The qualification of welders shall be in accordance with the relevant clauses of the above standards, and specifically SABS 044 Part III and shall be Grade 1 welders. Grade 2 welders will be permitted only with the Engineers written approval.

The Contractor shall provide evidence, acceptable to the Engineer, that welding procedures and welders have been tested in accordance with the requirements of AWS D1.1-81.

No welding shall be permitted on site without the express approval of the Engineer, with the exception of those details shown on the drawings as Site Welded.

PSHA 2.3 Handrails (Clause 5.2.6)

Handrails shall be of the two rail type, ball and stanchion, top mounted, type Mentis MT 90 or similar approved.

Add the following:

Handrails and stanchions shall be hot dipped galvanised and painted to the following specification:

(a) Hot dip galvanise in accordance with Table 2 of SANS 763.

(b) Clean with Galvkleen or similar approved to achieve a water break free surface and allow to dry.

STEP	PREPARATION/COATING METHOD	Minimum dft (µm)
1	After hot-dip galvanizing, do not passivate.	
2	Coat epoxy primer (two part for HDG surfaces)	75
3	Coat polyurethane enamel (two part)	50
		Total = 125 µm

Where handrails are specified as stainless steel, the handrails shall be AISI 316 stainless steel.

PSHA 2.4 Prefabricated open and chequer plate floors (clause 5.2.8 & 5.2.9)

Open grid steel covers and floor panels shall be pressure locked and welded as “Maclock” type “Eggcrate” or similar approved. All span bars shall have a depth of 40mm and be of such a width and at such a spacing that the maximum deflection of any bar under a 10 kN/m^2 uniformly distributed load shall not exceed 1/360 of the clear span. Under no circumstances will cutting and welding be permitted on site.

Framing to open grid “Maclock” or “Eggcrate” covers or panels shall be assembled and welded to the detail as shown on the drawings.

Chequer-plate flooring shall be of 6mm minimum thickness “treadplate” flooring or similar approved with raise 5-bar pattern and lifting key holes at each end of each plate.

Frames shall be angle and bar welded together and as detailed on the drawings.

PSHA 4.3 Open grid/chequer plate flooring (clause 8.3.4)

Replace sub-clause 8.3.4 with the following:

Item:

Open grid flooring

Supply and install HDG floor grating, bearer bar=40mm Unit: m^2

Supply and install cast-in HDG 45 x 45 x 5 mm angle support complete with fishtail lugs Unit: m

Add the following to the clause:

The open grid or chequer plate flooring covers or panels will be measured by area, and the unit rates will be held to include for all cutting, welding, galvanising, etc. The cast-in angle support will be measured separately per linear meter. This rate will include for installation, galvanising, fixing complete with cement mortar and/or bolts/fishtail lugs which may be required to secure the frame. The rate shall include for supply and installation.

PSLSABS 1200 L: MEDIUM PRESSURE PIPELINE

PSL 1 SCOPE

All water pipelines in this contract shall be deemed to be medium pressure pipelines.

PSL 2 MATERIALS (CLAUSE 3)

PSL 2.1 General (Sub-clause 3.1)

Add the following to the sub-clause:

Pipes

All pipes shall be of class as indicated on the drawings. The corrosion protection to the flanged steel pipe material shall be either Epoxy Coated or Hot dipped galvanized to SABS specifications

PSL 2.2 Steel Pipes, Fittings and Specials (Sub-clause 3.4)

Add the following to 3.4:

a) Steel pipes with normal bore up to 150mm diameter shall be manufactured to conform to all the requirements of SANS 62 whereas steel piping of larger diameter shall be manufactured to conform to all the requirements of SANS 719.

b) BUTT WELD FITTINGS: Steel butt welding pipe fittings shall be to ANSI B 16.9, BS 1965 or BS 1640 of the same schedule as the piping or heavier. Butt weld fittings in stainless steel shall be to ASA B 36.19 for schedule 5S and 10S and ASA B 16.9 for schedule 40S and 80S. Alternatively, fittings may be to BS 1640

PSL 2.3 Other types of pipes (Sub-clause 3.7)

Add the following to 2.3:

a) PLASTIC PIPING: uPVC piping shall comply with the requirements of SANS 966 mark for pressure pipes and shall be fitted with spigot and socket joints with rubber sealing rings.

b) GRP PIPING: GRP piping shall comply with the requirements of SANS 1748 mark for pressure pipes and shall be fitted with suitable couplings where the GRP piping connects to non-GRP piping or equipment. Joints between GRP pipes shall be GRP couplings (Flowtite double bell coupling or equal approved). Above ground GRP pipes shall be coated with 300 microns of UV resistant polyurethane or equal supplier-recommended coating. GRP pipes cast into concrete shall comply with manufacturer guidelines on floatation. The GRP piping installation of GRP pipes larger than dia. 800 mm shall be done by (or under the supervision of) a specialist field technician endorsed or provided by the GRP pipe manufacturer. The GRP pipe manufacturer shall be ISO 9001:2015 certified.

PSL 2.4 Isolating valves (Sub-clause 3.10)

Add the following to the sub-clause:

Except where otherwise specified, isolating valves shall be of the resilient seal gate type, with a non-rising spindle and shall be arranged for clockwise closing. All valves shall be standard coated and shall receive a final coat of light blue enamel paint after installation. All valves shall be flanged and drilled to the specification.

Materials shall comply to the following specifications:

Materials of Construction (minimum specifications)

Component	*Specification*
Body	Cast Iron to BS 1452 Gr 14
Bonnet	Cast Iron to BS 1452 Gr 14
Spindle seal housing	Cast Iron to BS 1452 Gr 14
Hand wheel	Cast Iron to BS 1452 Gr 14
Cap top	Cast Iron to BS 1452 Gr 14
Gate	Spheroidal Graphite Iron to BS 2789 Gr 17 covered with nit rile rubber
Spindle	EN57 Stainless Steel
Spindle seal "O" rings	Nit rile rubber
Seal housing "O" rings	Nit rile rubber
Seal bush "O" rings	Nit rile rubber
Wiper ring	Nit rile rubber
Seal housing	Nylon
Spindle nut	Bronze to SABS 200 Code 30

A copy of the relevant valve specification of the proposed valves shall be attached to this tender document.

PSL 2.4.1 Marking of valves

The design pressure in Megapascal (MPa) shall be engraved on the side of the valve where it is legible. Valves shall be marked with the item number of the schedules when delivered to site.

PSL 2.4.2 Handwheels and closure

Where handwheels are specified edges shall be machined to a smooth surface. Wording "OPEN" and "CLOSE" will be casted into handwheels. Valves will close clockwise except where it is otherwise specified. Spindles will be of the non-rising type.

PSL 2.4.4 Protection of valves

Valves shall be painted externally with a zinc chromate primer according to SABS 679 Type 1. (Dry film thickness of 50 mnc) After installation damaged primer shall be made good with compatible primer in accordance with valve suppliers specifications.

Subsequently to making good of the primer the valve shall be painted with two layers of alkide based enamel according to SABS 630 Grade 1 (dry film thickness of 250 micro meter per layer) to match the colour of adjoining pipe work.

PSL 2.4.5 Handling, delivery and installation

All valves and related items shall be handled with the necessary care throughout all processes of manufacture, testing, delivery and installation. Valves furnished with lifting eyes shall be handled only by those eyes and other valves shall be handled solely with slings that will cause no damage.

In particular the inlet and escape orifices of air valves and special valves shall be effectively sealed after manufacture until completion of installation and this sealing shall be examined regularly to ensure that it is still effective.

Valves shall be effectively supported, packed or fastened down for transporting and care taken to avoid valves knocking together during transport.

Valves shall be stored in a safe place above ground and shall be protected against the ingress of foreign matter.

PSL 2.5 Fittings (Sub-clause 3.12)

Add the following sub-clause:

Generally all special fittings are to be manufactured in mild steel as applicable. No aluminum fitting shall be permitted. Fittings shall be compatible in respect of working and test pressure to those of the pipelines.

PSL 3 CONSTRUCTION

PSL 3.1 Laying Depths and Cover (Sub-clause 5.1.4)

Add the following to sub-clause 5.1.4.1:

Water mains shall be laid to follow the grades of the existing adjoining roads, except where otherwise instructed by the Engineer. The depth from finished sidewalk level to the top of the pipe barrel shall be as follows, except where otherwise directed:

a) on sidewalks = 900 mm

b) below carriageways = 1 000 mm

c) outside road reserves = 900 mm

PSL 3.2 Jointing Methods (Sub-clause 5.2)

Notwithstanding the provisions of sub-clause 5.2 of SANS 1200L, jointing of pipes and specials of all diameters shall be as follows:-

i. uPVC pipes - by rubber ring spigot and socket.

ii. Steel pipes - by welding except where pipes are connected to flanged fittings or elsewhere as shown on the drawings or as instructed by the Engineer.

iii. GRP pipes – by coupling (Flowtite double bell coupling or equal approved) except where stainless steel and GRP pipes are connected using flanges or elsewhere as shown on the drawings or as instructed by the Engineer. Anchors for above ground pipe shall be designed as cradles with high friction cradle liners and a pretensioned steel clamp pressing the pipe against the cradle. The pretension of the clamp shall be sufficient to prevent the pipe from moving in the cradle. The clamp shall allow for thermal expansion of the GRP pipe.

iv. Steel pipes shall connect to uPVC and GRP pipes using a steel flange adaptor or couplings. All pipes and fittings shall be suitable for a test pressure of 1200kPa.

PSL 3.3 Anchor / thrust blocks and pedestals (Sub-clause 5.5)

Add the following to the sub-clause:

Dimensions of all anchor / thrust blocks shall be supplied by the Engineer as and when required. The Contractor shall request such information not less than 14 seven calendar days in advance.

PSL 3.4 Crossing existing services (Sub-clause 5.1.4.3)

There will be existing services that will be crossed. Generally these areas can be identified and careful hand excavation will be required to expose these services.

PSL 3.5 Pipe laying personnel (Sub-clause 5.1.1)

The laying of pipes and ancillary fittings shall be performed only by a qualified person who is registered as an artisan in the pipe fitting or drain laying trades, or is qualified by reason of having attended and passed the course on pipe laying of the Civil Engineering Industry Training Board.

PSL 3.6 Steel pipes, specials and fittings scope

This specification covers the manufacture, corrosion protection, delivery, erection, installation, making good of corrosion protection as well as over-coating as may be required, site-testing and commissioning of steel pipes, specials and fittings mostly for the conveyance of water, but also for air, at normal ambient temperatures between 5ºC and +70ºC.

PSL 3.6.1 Manufacture of steel pipes

Steel pipes with normal bore up to 150mm diameter shall be manufactured to conform to all the requirements of SABS 62 whereas steel piping of larger diameter shall be manufactured to conform to all the requirements of SABS 719, all as may be amplified or amended below.

The requirements regarding pipe sizes and grades, wall thicknesses, pipe lengths and pipe and requirements are specified in the Pipe Schedule and / or stated in the Schedule of Quantities.

The following minimum wall thicknesses shall apply:

External Diameter (mm)	Minimum wall thickness (mm)
168 – 406	4,5mm
419 – 508	5,9mm
570 – 864	6,0mm

With regard to Sub-clause 4.2.2.1 in SABS 719 the Contractor shall, before commencing with pipe manufacture, satisfy the Engineer that the welding methods to be used in the pipe manufacture are adequate by:

a. The preparation of a weld sample employing precisely the same welding process, equipment and artisans by which the pipe shall be manufactured.

b. The preparation and destructive testing of the sample in (a) above, as laid down in Clause 7.2 of SABS 719.

The results of the tests on the test pieces shall comply with the requirements of Clause 7.2 of SABS 719 in all aspects.

Such destructive testing shall be carried out for each grade of steel and for each thickness of steel in that grade.

With regard to sub-clause 4.2.2.2 and 4.2.2.3 in SABS 719 the height of the inner weld reinforcement shall not exceed 1mm.

PSL 3.6.2 <u>Manufacture of pipe specials</u>

Only pipe conforming to the requirements of Clause PSL 3.5.1 above, may be used for the manufacture of pipe specials.

For pipes of nominal bore, up to 150mm diameter T-pieces shall be heavy class pipe only, with the same wall thickness for both main and branch pipes. The manufacturing process and quality requirements are as specified in the relevant section of BS 806 (Section 3).

Dimensions and joint types for pipes specials are specified in the Pipe Schedule and / or stated in the Schedule of Quantities.

Welding shall be done by a welder holding a valid competence certificate (Grade 1) in terms of SABS 044 – Part V. Butt-welded joints shall conform to the requirements for welding for pipes, and the Contractor shall prove all butt and fillet welded joints to be crack-free by carrying out dye penetrant tests, following the procedure laid down in BS 4416.

If at all practicable, pipe specials shall be subjected to hydraulic pressure tests as specified. Where this is not feasible, butt-welds must be subjected to radiographic inspection over their full length, with inspection procedure and acceptability limits for defects as specified in API 1104, keeping a record of all weld inspection and repair.

Where working pressures allow the use of malleable cast iron fittings for nominal bore up to 150mm diameter, these shall conform to the requirements of SABS 509.

PSL 3.6.3 <u>Pipe flanges, bolts and jointing</u>

PSL 3.6.3.1 Material and dimensions for flanges

The requirements for the materials and dimensions for flanges are in all respects as specified in SABS 1123.

A raised joint face shall be provided on all flanges of pressure rating higher than 2,5 MPa unless otherwise agreed to by the Engineer or as stated in the Schedule of Quantities, and the backs of cast of forged flanges shall be machined.

The machined surfaces of flanges shall be covered immediately after machining by a temporary rust preventative film of a suitable type as specified in BS 1133 (Section 6).

All flanges shall be drilled to SABS 1123 (Table 1600/3) or otherwise to the class as stated in the Schedule of Quantities or on drawings.

PSL 3.6.3.2 Welding on of flanges

The procedure for the welding-on of flanges, shall comply with the requirements of BS 806 (Section 3).

The proficiency of the welder and the quality requirements for the weld are the same as those specified in Clause PSL 3.6.3 above.

As a rule, the bolt holes in flanges for pipe specials shall not be on the vertical centre line.

When so specified in the Schedule of Quantities, flanged pipes shall be hydraulically tested after the welding-on of the flanges to a test pressure of 1,5 times the pressure rating of the respective flange.

PSL 3.6.4 <u>Bolts</u>

Materials and dimensional requirements of bolts and nuts are specified in SABS 135 or 136. These requirements shall correspondingly be prescribed by the Contractor when ordering.

The threaded length shall be adequate to allow two full threads to protrude beyond the nut after the latter is fully tightened.

Each bolt shall be fitted with a nut and steel washer and bolts, nuts and washers shall be cadmium plated in accordance with and to a thickness specified for Class A in BS 1706.

Unless otherwise indicated in the Pipe Schedule, the number of bolts to be supplied shall be determined on the basis that each flange is to be supplied with half the number of bolts required for that flange.

PSL 3.6.5 <u>Jointing</u>

Gaskets for flanges shall be recommended by the Contractor's supplier and shall be submitted to the Employer's Agent for approval.

PSL 3.6.6 Pipe joints and coupling other than flanges

Pipe ends shall be prepared for the type of jointing and coupling as specified in the pipe schedule and / or stated in the Schedule of Quantities with the requirements for and preparations as specified in SABS 62 and 719 as applicable.

Standard couplings and flange adapters shall be of the Viking Johnson type or equivalent and all loose bolts with nuts and washers shall be cadmium plated in accordance with and to a thickness specified for Class A in BS 1706 and shall be lined and coated as specified in Clause PSL 3.6.8 below.

PSL 3.6.7 Lining and coating of steel pipes, specials and fittings

All pipes, specials and fittings, including couplings and flange adapters, shall be fully lined and coated by fusion bonded epoxy on the outside and liquid epoxy on the inside with a minimum of three coats to a minimum total dry film thickness of 400 micrometres on a steel surface that has been prepared by sandblasting to Grade SA 2.5 as specified in SIS 055900, with a delay of not more than four hours between sandblasting and the application of the first paint coat.

Successive paint coats shall be of different colours, and the colour of the final coat shall be approved by the Engineer prior to painting. Over-coating time between the applications of successive coats shall not exceed 24 hours.

The epoxy product and process shall be presented to the engineer prior to the ordering of any pipe fittings applicable.

The coating and lining applied shall be as per the Standard Specification DWS 9900 Section C1 unless specified otherwise in the text above. The Specification is attached under C5 Annexures.

Tape wrapping

All underground steel pipes joints (flanged, flexible coupling, etc.) shall be tape wrapped in accordance with this specification. No additional payment shall be made as the rate for the coupling shall include for the tape wrapping.

External steel pipe coating and wrapping specification:

A Denso Corroklad 750 tape or equivalent should be applied to the external surface of the steel pipeline.

The tape consists essentially of a specially formulated polyethylene film laminated to a pressure sensitive, non-hardening thermoplastic adhesive. The adhesive layer is generally one and a half times thicker than the polyethylene film.

The composite wrapping system provides a durable impact and cut resistant rockshiled for normal and rugged service conditions.

Technical Data

The following information pertains to the Corroklad 750 tape:

- The base layer is made of polyethylene and is 0,3mm thick.
- The adhesive layer consists of rubber modified bitumen and is 0,45mm thick.
- The product thickness is 0,75mm.
- The tape has a minimum tensile strength of 15 MPa.

- The minimum elongation at failure is 300%.
- The adhesive and peel strength of the tape at 25°C is 2,2N/mm and 1,65N/mm respectively.
- The minimum dielectric strength of the tape is 25 KV.
- Cathodic disbondment by ASTM G8 Method B is 425mm².
- The service temperature of the tape is –10°C to 65°C.

Application Procedure
Corroklad tape can be successfully wrapped by hand (maximum tape width 100mm) and by machine. The general application is detailed below.

Surface Preparation

- All dirt, loose ruste/mill scale and grease must be removed from the pipe surface.
- The minimum surface preparation acceptable for tape wrapping with Corroklad is ST2 (Swedish Standard SIS 055900-1967, Mechanical wire brushing).

Priming the Pipe Surface

- The primer to be used is Denso Primer D or equivalent Polymer Bitumen Solution, and is to be applied by means of a medium pressure cop gun.
- The primer may be thinned for application with white spirits or toluene.
- The primer should nominally cover 9m² liter.
- The minimum drying period at 20°C is 20 minutes.
- The flash point occurs above 23°C.
- If the pipes are prepared and primed off site, it may be necessary to apply a second coat of primer on site in order to rejuvenate the first application. This is only required if the pipe is being wrapped on site.
- The primer should be dust free prior to the application of the tape wrap system. Should the primer be contaminated, the surface must be reprimed.
- The primer should be allowed to dry for approximately 30 minutes at 20°C to 25°C prior to the application of the tape system.

Tape Application

- The Corroklad tape or equivalent should be spirally wrapped onto the primed pipe, utilising a 55% overlap.
  55% Overlap will ensure a minimum of two layers of tape at any point.
- Ensure that a constant web tension of 10 to 15kg/100mm is maintained during wrapping.
- At no time is the shrinkage of the total width of tape to exceed 2%.

Pipe Handling

- Non-metallic slings are to be utilised when handling the wrapped pipe sections or pipe, in order to ensure that no mechanical damage occurs to the tape.

PSL 3.6.8 Making good and over-coating of steel pipes, specials and fittings

PSL 3.6.8.1 Steel pipes, specials and fittings

After erection, all damage to the Epoxy coatings or Linings, shall be made good strictly in accordance with The DWS 9900 Specification which is attached under C5 Annexures.

PSL 3.6.8.2 Handling, delivery and installation

All pipes, pipe specials and fittings shall be handled throughout the processes of manufacturing, corrosion protection, delivery and installation with all care necessary to prevent any damage.

After the corrosion protection of the outside of pipes and specials has been carried out, these items must be handled only by means of straps that will in no way damage the protection.

After completion of corrosion protection at the place of manufacture, all pipe ends shall be effectively closed off by at least a sheet of plastic held fast to the pipe and by binding wire.

This seal shall be checked specifically during delivery and after off-loading on site to confirm that it is still fully effective and shall immediately be repaired or replaced if damaged. Should there be the slightest danger of the ingress of foreign matter into the pipework during installation, the ends shall be kept sealed off all the time.

Pipes shall be supported during travelling on shaped and padded cradles while pipe specials shall be adequately supported and separated from each other to prevent any damage.

Steel pipes will only be offloaded with the aid od a spreader boom of 6m length to spread the point load and minimize the deflection in the pipe.

At the delivery points on site, pipes, pipe specials and fittings shall be supported by plastic sandbags of sufficient strength, such that the under sides of the pipes and pipe specials are at least 200mm off the ground. The number and positioning of supports under the pipes, shall be such as to prevent any undue pipe deflection.

Bolts, nuts, washers and jointing, shall be packed in strong metal or wooden containers with effective lids, with each different sizes of bolts grouped separately in hessian bags all clearly labelled as to their contents.

Pipe work shall be securely clamped in its final position by means of galvanised fittings.

PSL 3.7 <u>Flexible couplings at structures</u>

Flexible couplings shall be provided at the point where pipelines enter all structures.

PSL 3.8 <u>Valves</u> (Sub-clause 3.10)

PSL 3.8.1 <u>Scope</u>

This specification covers the requirements for material, manufacture, delivery, installation, over-coating as may be required, site-testing and commissioning for gate valves for use in pipe work, mainly for the delivery of raw and purified water, but also for air supply, at ambient temperatures up to 70°C.

PSL 3.9 <u>Testing of pipelines</u> (Sub-clause 7.3)

PSL 3.9.1 Test pressure (Sub-clause 7.3.1(a))

Replace the Sub-clause 7.3.1 with the following:

All pipes shall be tested at 1.25 the working pressure at the specific point where the pressure test be executed. The Contractor shall identify the points on the pipeline where the hydrostatic pressure test be executed and shall notify the Engineer in advance in order for the Engineer to be able to furnish the Contractor with the required test pressure at the specific test point.

PSL 3.9.2 Method of testing (Sub-clause 7.3.1(b))

Add the following new clauses:

a) The Contractor shall provide an approved test pump, an accurate water meter, sealed pressure gauge, tested and certified by an independent testing organisation, and all other equipment, materials and labour required for the test.

b) The section of pipeline to be tested shall be clean and closed off at the ends by isolating valves, end caps or approved end-closure pieces

c) During the initial filling stage, the pipe section joints and all specials, fittings and valves shall be visually inspected for visible leaks and same rectified before proceeding with the test.

d) The pressure shall be maintained for one hour and if a pressure drop occurs, more water shall be added to reinstate the test pressure and the valve closed again. The quantity of water added shall be measured by recording the readings before and after pumping. This procedure shall be repeated for a period of 24 hours, with water added at hourly intervals where necessary to reinstate pressure and water meter reading recorded. At the end of the 24 hour period, the aggregate quantity of water required to reinstate pressure over 24 hours shall be determined.

e) The Contractor shall give the Engineer 48 hours written notice of his intention to commence pressure testing and the Engineer may attend and supervise all or any part of tests. All records and recording charts shall be handed to the Engineer as soon as tests over any section have been completed.

f) All valves, specials, fittings and exposed joints, shall be inspected visually during the 24 hours pipeline test and all visible signs of leaks, sweating and distress shall be reported and attended to without delay.

g) Immediately after completion of the prescribed 24 hours hydrostatic test, all air valves shall be tested in turn before test pressure in the pipeline is released. Each air valve shall be isolated and the drain plug removed. The air valve shall work freely without restraint. The isolating valve shall be checked for leakage before replacing the plug. Finally, the automatic resealing of the air valves shall be checked by re-opening the isolating valve.

h) After completion of tests on air valves, the section of pipeline under test shall be completely refilled with water, if necessary, and pressured to the static head shown on the drawings or indicated by the Engineer. Each scour valve shall be checked by opening isolating valves where applicable for a duration sufficient to check the complete opening and closing cycles. If necessary, the pipeline shall be refilled after each individual test and re-pressurised to the prescribed static pipeline head in order to test all scours within the section under test.

PSL 3.9.3 Remedial measures (Sub-clause 7.3.1 (c))

Add the following new clauses:

a) Should the maximum leakage limits as specified be exceeded, the Contractor shall determine the position and cause of the leaks and shall take remedial measures at his own expense and to the satisfaction of the Engineer to stop such leaks and ensure the specified degree of water tightness.

b) If during the contract period of maintenance, the number of leaks and other defects is considered by the Engineer to be more than could reasonably be expected from a well laid pipeline operating under normal conditions, he may order the Contractor to re-test parts or the whole of the pipeline at the Contractor's own expense and no claims for escalation in costs or for whatever other reasons the Contractor might consider to submit claims shall be considered, except where such re-tests are the result from damages caused to the pipeline by the Employer."

PSL 3.10 Concrete work (Sub-clause 5.13)

Add sub-clause 5.13 as follows:

PSL 3.10.1 Encased pipe work

a) Where pipes and / or specials are permanently encased in concrete, e.g. in thrust blocks, walls of concrete valve chambers, stream crossings, etc., the coating over the portion to be so encased shall be to the same standard as the rest of the pipeline, except where indicated to the contrary in the Schedule of Quantities or on the drawings.

b) Whenever it is necessary to encase pipes in concrete, the flexible joints shall not be encased and the concrete shall terminate 300 mm from the flexible joint.

c) All specials encased in concrete shall be painted with one coat of bitumen primer and two coats of bit mastic paint to a dry film thickness of 180 micrometers.

PSL 3.10.2 Brickwork (Sub-clause 5.14)

Add sub-clause 5.14 as follows:

a) Brickwork is to be built to the dimensions, thicknesses and heights as shown on the drawings.

b) All exposed brickwork shall be plastered and shall have joints raked out to a depth of 12 mm to ensure good plaster fond.

c) Mortar shall consist of one part cement to four parts approved sand by volume and shall be used within one hour of mixing.

d) Brickwork shall be built in stretcher bond and all common bricks shall be well wetted before being laid.

PSL 4 MEASUREMENT AND PAYMENT

PSL 4.1 Steel specials and fittings (sub-clause 8.2.1)

Add the following clause to the payment item:

The rate shall also cover the cost of the coating and lining as specified in this contract as well as repairing or making good damaged coatings and linings on site.

PSL 4.2 Steel specials and fittings (sub-clause 8.2.2)

Add the following payment item:

Item:

Fabrication, supply, transport and install and test the following pipe fittings. All items to be approved by Engineer prior to ordering. Unit: number (no)

The unit of measurement for payment for the manufacture, corrosion protection and final over-coating as may be required, delivery, installation of pipes, site-testing and commissioning of pipes, pipe specials and fittings conforming with this Specification shall be measured by number for each type, class and size as stated in the Schedule of Quantities.

The rates tendered and paid for valves and fittings must include the cost of the provision of an approved coating and the cost of any additional couplings other than those listed in the Schedule of Quantities to connect to the water mains.

All adapters and distance pieces required for the extension to the specified level and length as shown on the drawings for air and scour valves must be included in the rates for the units. All underground pipe fittings shall be wrapped in an approved isolating material as specified in PSL 3.5.7

The cost of providing couplings, cutting pieces, etc. shall be allowed for in the rate tendered for pipe work.

PSL 4.3 Reinstate Road Surface

Add the following payment item:

Item:

Reinstate road surface as per detail drawings:

a) Cut and remove existing gravel layer in windrow and stockpile Unit: m^3

b) Reinstate existing gravel layers to original state (98% MAMDD) Unit: m^3

The above item covers the complete repair of the road surface where the pipeline trench exaction is required over an existing gravel or surfaced road. The rate shall cover all materials, plant, watering, stabilizing, labour and tests to repair the road surface and related layer works back to its original state.

PSLB SABS 1200 LB: BEDDING (PIPES)

PSLB 1 MATERIALS

PSLB 1.1 Selected granular material (Sub clause 3.1)

Add the following to this sub-clause:

Granular materials shall be selected from trench excavations. If the contractor elects not to apply selection of material from excavations, he shall provide suitable material from any other approved source at his own expense.

Bedding material shall be either of the following type:

a) Type A : Finally graded, composed of material with the following properties:

i) Percentage by mass passing:

4,75 mm screen - 100 %
0,425 mm screen - 80 to 100 %
0,002 mm screen - 0 to 45 %

ii) Liquid limit (LL) as determined in accordance with SABS Method 852 shall not be more than 15, when performed on all the material passing the 0,425 mm sieve.

iii) Plasticity index (PI) as determined in accordance with SABS Method 852 shall not be more than 15, when performed on all the material passing the 0,425 mm sieve.

iv) Linear shrinkage (LS) as determined in accordance with SABS Method 853 shall not exceed 5 %, when performed on all the material passing the 0,425 mm sieve.

b) Type B : Medium graded, composed of material with the following properties:

i) Percentage by mass passing:

4,75 mm screen - 80 to 100 %
0,425 mm screen - 60 to 80 %
0,002 mm screen - 0 to 40 %

ii) Liquid limit (LL) as determined in accordance with SABS Method 852 shall not be more than 35 %, when performed on all the material passing the 0,425 mm sieve.

iii) Plasticity index (PI) as determined in accordance with SABS Method 852 shall not be more than 18, when performed on all the material passing the 0,425 mm sieve.

iv) Linear shrinkage (LS) as determined in accordance with SABS Method 853 shall not exceed 7 %, when performed on all the material passing the 0,425 mm sieve.

c) Type C : Granular, composed of material with the following properties:

i) Percentage by mass passing:

9,5 mm screen - 100 %
4,75 mm screen - 70 to 100 %
0,425 mm screen - 30 to 60 %
0,002 mm screen - 0 to 45 %

ii) Liquid limit (LL) as determined in accordance with SABS Method 852 shall not be more than 40 %, when performed on all the material passing the 0,425 mm sieve.

iii) Plasticity index (PI) as determined in accordance with SABS Method 852 shall not be more than 20, when performed on all the material passing the 0,425 mm sieve.

iv) Linear shrinkage (LS) as determined in accordance with SABS Method 853 shall not exceed 10 %, when performed on all the material passing the 0,425 mm sieve.

Items a), b) and c) are conveniently summarised in the following table:

Material	**PERCENTAGE BY MASS PASSING SCREENS**				**ATTERBERG LIMITS SHALL NOT EXCEED**		
	9,5 mm	**4,75 mm**	**0,425 mm**	**0,002 mm**	**Liquid Limit (LL) %**	**Plasticity Index (PI)**	**Linear Shrinkage (LS) %**
Finely graded / A	100	100	80 - 100	0 - 45	30	15	5
Medium graded / B	100	80 - 100	60 - 80	0 - 40	35	18	7,5
Granular / C	100	70 - 100	30 - 60	0 - 35	40	20	10

PSLB 1.2 <u>Bedding</u> (Sub-clause 3.3)

Add the following to this sub-clause:

All steel pipes in the works shall be classed as “rigid” with flanged joints and shall be bedded on Class C bedding as described in sub-clause 5.2 of SABS 1200 LB, unless otherwise specified or instructed by the Engineer.

PSLB 1.3 <u>Backfilling of pipe trenches</u> (Sub-clause3.5)

Add sub-clause 3.5 as follows:

No backfilling of pipe trenches on top of the selected fill layer may commence without the written consent of the Engineer or his Representative.

PSLB 2 CONSTRUCTION

PSLB 2.1 <u>Waterlogged trench bottoms</u> (Sub-clause 5.5)

Add sub-clause 5.5 as follows:

a) Where trench bottoms are too soft and waterlogged to permit placement and compaction of bedding material in the normal manner, such trench bottoms shall be excavated to a depth of

at least 300 mm below the underside of pipes and specials for the full width and length of the trench affected.

b) The full width and length of the trench bottom and at least 500 mm height of both sides of trench walls shall be covered by an unwoven approved geotextile, similar to Kaymat U24.

The full width and length of the trench shall thereupon be covered by a 300 mm thick layer of coarse gravel, coarse sand or 19 mm nominal size crushed stone, fully compacted within the confines of the geotextile to take the mass of the pipe filled with water and all loads on the pipe without settlement.

The free drainage layer shall be covered over the full width of the trench by a single layer of geotextile with the cloth on trench walls folded over and overlapping to completely seal off the free drainage layer against ingress of sand or fine soil particle.

Pipes shall be laid directly on the bed prepared as above and pipe bedding and selected backfill completed as specified.