Annexure B.1

SCOPE OF WORK

SCOPE

This Project Specification is set out in three portions:

Portion 1: PROJECT SPECIFICATION covers a general description of the project, the facilities available and the requirements to be met.

Portion 2: VARIATIONS AND ADDITIONS TO THE STANDARDISED SPECIFICATIONS covers variations to the standardized specifications for Civil Engineering Construction (SANS 1200), as amended, which are applicable to this Contract

Portion 3: PARTICULAR SPECIFICATIONS.

STATUS

In the event of any discrepancy between the Project Specifications and a part or parts of the Standardized Specification for Civil Engineering Construction (SANS 1200; SANS 10400-2011; SANS 10142-2011; SANS 204 Part 1, 2 &3-2008), the JBCC Series 2000: Principal Building Agreement, July 2007-Edition 5.0, the Schedule of Quantities or the Drawings, the Project Specifications shall take precedence.

DILIGENCE

a) Termination

If it is found that:

- The contractor does not install the correct material and work not according to the relevant specification and/or the instructions of the supplier of the equipment, material and/or system.
- The contractor and/or his workmen are found to dump rubble and/or waste illegally on any other place than legal dumping facilities.
- Allow unqualified persons carry out the works.

PORTION A: THE WORKS

PORTION A: THE WORKS

Overview of the works

The work to be carried out under this contract includes construction layerworks, stormwater and sewer reticulation

Extent of the works

The primary activities under this Contract consists of the following:-

(a) Preliminary and General Obligations (including security);
(b) Cleaning, grubbing, and finishing
(c) Bulk earthworks (including in a ground which is saturated with water),
(d) Concrete works
(e) construction of sewer pipeline

PORTION B: PROJECT VARIATIONS AND ADDITIONS TO THE STANDARDISED SPECIFICATIONS

PORTION B: PROJECT PARTICULAR SPECIFICATIONS AND ADDITIONAL SPECIFICATIONS TO SANS 1200

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

SANS 1200 C	:	Site Clearance
SANS 1200 D	:	Earthworks
SANS 1200 DB	:	Earthworks (pipe trenches)
SANS 1200 DM	:	Earthworks (Roads, Subgrade)
SANS 1200 G	:	Concrete (Structural)
SANS 1200 LB	:	Bedding (pipes)
SANS 1200 LD	:	Sewers
SANS 1200 LE	:	Stormwater Drainage
SANS 1200 ME	:	Subbase
SANS 1200 MF	:	Base

In addition, the following variations and additions to the Particular Specifications for work not covered by the Standardised Specifications shall apply and are bound in Part B of the Project Specifications

The prefix PS indicates an amendment to SANS 1200. The letters and numbers following these prefixes respectively indicate the relevant Standardized Specification and clause numbers in SANS 1200 to which the variation or addition thereto applies.

PSC 3 MATERIALS

PSC 3.1 Disposal of Material

Add to this Sub-clause:

Material obtained from clearing shall be disposed of offsite by the Contractor at his expense. Disposal of combustible material by burning will not be permitted. The Contractor will be held responsible for observing the by-laws and regulations of the local authority.

PSC 5 CONSTRUCTION

PSC 5.2.3.2 Individual Trees

Delete the second sentence of the Sub-Clause and substitute the following:

The amount of the penalty payable by the Contractor for the removal or damage by him of a tree designated for preservation shall be R10 000.00 for each tree having a girth of less than 1 000 mm and R20 000.00 for each tree having a girth of 1 000 mm or more.

PSC 5.3 Clearing

Add the following new Sub-Clauses:

PSC 5.3.1 Restoration of Fences onto Servitude Boundary (Sub-Clause 5.3.1)

Where existing fencing is encroaching the new servitude of the pipeline, such fencing shall be removed prior to construction and re-erected to a condition no worse than that pertaining prior to the removal, on the formal cadastral boundary all as indicated on the respective land plans. For the period that the fence or wall is dismantled and not yet re-erected, 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 unauthorised persons.

PSC 5.3.2 Temporary Fencing Closures (Sub-Clause 5.3.2)

Where the raw 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 unauthorised persons.

PSC 5.3.3 Demarcation Fencing (Sub-Clause 5.3.3)

The Contractor shall supply, install and maintain temporary fencing on around the working area (servitude) and around the perimeter of all agreed additional working areas during construction for prevention of unauthorised access and shall remove the fencing on completion of the works. The fencing shall comprise 2m high Bonnox 4 x 4 Mesh fencing, Bonnox pattern 1972/4, with straining posts and straining wires as required and according to supplier's directions and with mesh spacing not exceeding 100mm in both the vertical and horizontal directions. Chevron tape shall be interwoven in a zig zag pattern from the top to the bottom of the fence thereby clearly marking off the working area.

Gates shall be provided by the Contractor at all points as required for construction access purposes. The Contractor shall be held responsible for the control of access at these gates as well as to the worksite during removal and re-erection of fencing. No other opening in the fence shall be permitted and the Contractor shall be responsible for monitoring the fencing daily and repairing any such opening within the same day that it is detected. Notices in three official languages (English, Sesotho, and Afrikaans) shall be attached to the fence where appropriate to indicate that the site is for personnel employed on the Contract only and that unauthorised entry is forbidden.

PSC 5.6 and 8.2.10 Conservation of Topsoil

Add to the Sub-Clause:

All topsoil shall be conserved for later use by stockpiling clear of the working area.

PSC 5.8 Demolition of Structures

Add the following new Sub-Clauses:

PSC 5.8.1 Removal and Re-Erection of Structures

Where the Contractor is directed to dismantle structures to facilitate construction and thereafter to re-erect the same structures, the structures shall be erected at the same locations, or such other locations as may be required by the owner within the same property, using the same or similar materials as those set aside when removing the structure. The acceptance of the work by the Employers Representative and certification for payment shall be subject to the Contractor submitting to the Employers Representative documentary evidence of the owner's satisfaction with the re-erected structure the over-riding consideration being that it shall be in a condition no worse than that pertaining prior to its removal.

The tendered rates shall include for the provision of a detailed photographic and written record of the structures before dismantling commences and following re-erection.

PSC 5.8.2 Demolition of Building Structures

Where the Contractor is directed to demolish structures, the Contractor shall provide a Method Statement for the approval of the Employers Representative. Entering upon the premises for the purpose of the demolition shall not commence before the Contractor has received a release form, duly authorised by representatives of the Employer and the Employers Representative, in which any special conditions applicable to the demolition are documented.

PSC 8 MEASUREMENT AND PAYMENT

PSC 8.2 Scheduled Items

PSC 8.2.12 Temporary Fencing Closures (New Sub-Clause)

Separate payment will be made for dealing with fences in the manner specified in PSC 5.3.2 above including re-instatement as scheduled.

PSC 8.2.13 Removal and Re-Erection of Structures (New Sub-Clause)

Separate payment will be made for removing and re-erecting structures in the manner specified in PSC 5.8.1 above as scheduled and including for the costs of photographic and written records.

PSC 8.2.14 Demarcation Fencing (New Sub-Clause)

Payment will be made per linear metre of temporary fencing installed in the manner specified in PSC 5.3.3 above, and the rate shall include for maintaining such fencing in good condition, including daily surveillance and repair, throughout the duration of construction and removal on completion of the works.

PSD: EARTHWORKS (Applicable to SABS 1200 D - 1988)

PSD 3 MATERIALS

PSD 3.1.2 Classes of excavation

Notwithstanding the provisions of Sub-Clause 3.1.2, the materials excavated, other than hard rock, will not be classified for the purposes of measurement and payment. The unit rate for excavation shall cover the cost of excavation in all materials with the only extra-over items payable being those for excavation in hard rock.

PSD 4 PLANT

PSD 4.5 Restriction on use of Plant

Add new Sub-Clause:

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

Add new Sub-Clause:

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 Employers Representative by the Contractor at his own expense.

PSD 5 CONSTRUCTION

PSD 5.1.1.1 Barricading and Lighting (Refer SANS 1921-1 Clause 4.18.2 and 4.18.3)

Delete the Sub-Clause and substitute:

Without limiting any obligation which the Contractor may have in terms of any Act, Ordinance or other legislation, 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 Clause 13 of the General Safety Regulations of the Occupational Health and Safety Act, 1993 (as amended) and that watchmen are employed to ensure that barricades, barriers and lights are effective at all times.

Trench excavations shall be protected by means of at least two horizontal doubles sided ‘red/white; chevron tapes approved by the Employers Representative. The tapes shall be

stretched tightly between supports along both sides and ends of the excavation at levels approximately 0.45m and 1.12 m above the ground. The supports shall consist of poles or iron standards securely planted in solid ground at not more than 10 m centres to enclose the spoil and the excavations.

Bridges for vehicles and/or pedestrians shall be provided along the route of the work as and where may be considered necessary by the Employers Representative. They shall consist of several suitably sized steel plates laid across open excavated trenches. They shall be protected on each side by a stout two rail timber safety barrier, at least 1m high, consisting of 150 x 75 mm timber verticals set firmly into the ground and, 75 mm x 50 mm rails securely fastened to them. At least 4 lamps or reflective markers shall be provided at each crossing.

Where construction is in, or across, public roads the barricades or barriers and temporary road signs that are erected shall comply with the requirement of the relevant authority. All such signs and positioning thereof shall comply with the requirements set out in Road Note 13 read in conjunction with the SA Road Traffic Signs Manual.

PSD 5.2.1.1 Clearing or clearing and stripping of site

Delete the last sentence and substitute:

"Material so removed shall be disposed of by the Contractor to the designated landfill identified by the Contractor and approved by the Employers Representative".

PSD 5.2.2.1 Excavation (Refer SANS 1921-1 Clause 4.10)

Add the following to sub-clause (d)

In order to minimize potential differential settlement of the shallow foundations for the proposed new works in relation to existing or new valve chambers or undermining of the existing structures, it may be necessary to carry out ground improvement.

Once excavation to the base of the existing structure has taken place, a Dynamic Cone Penetration Test (DCP) shall be carried out to a minimum depth of 1m to ascertain the necessity or otherwise to carry out the ground improvement. DCP results of ≥5 blows per 100 mm are deemed to indicate the presence of stiff clays.

Where stiff clays are encountered in the 1m zone below the existing structure, it is recommended that the clay is immediately blinded with a lean mix of concrete and construction proceed on the basis of a "raft" type foundation / base slab supporting the sidewalls of the new structure.

If the clays are soft or loose sand is encountered, vertical lightweight trench sheeting is to be vibrated or driven down as close as possible to the existing foundations for a distance of at least 1,0 to 1,2 m below founding level.

The base area shall then be over-excavated, both vertically and horizontally, and the material shall be replaced with well compacted granular material (G6 minimum). The surface shall be blinded with a lean concrete mix after removal of the trench sheeting, following which the base slab to support the sidewalls shall be cast.

Add the following to the Sub-Clause:

(f) Where outside shuttering is ordered by the Employers Representative, the excavations shall be carried out for an extra width of not more than 600 mm all around the structure, measured from the base of the face to be shuttered, to allow for the shuttering to be fixed, this extra excavation and refilling where necessary is to be measured and paid for under quantities allowed for this purpose in the Bills of Quantities. Outside shuttering shall be used for the construction of all major

structures unless ordered otherwise by the Employers Representative.

(g) Where permanent concrete is to be placed against an excavated face, the excavation shall be trimmed to ensure that there is no projection greater than 20 mm protruding into the excavation profile.

(h) The Contractor shall not spoil, waste or stockpile excavated material without approval.

PSD 5.2.3.1 Embankments

In the fourteenth line delete “600 mm” and substitute “300 mm”

In the seventeenth line delete “300 mm” and substitute “150 mm”

Delete the twentieth line and substitute the following:

Each layer shall be compacted to achieve 90% modified AASHTO density except where indicated otherwise on the Drawings

PSD 5.2.5 Transport of Earthworks

Delete the wording of Sub-Clause 5.2.5 and replace with the following:
All haul will be regarded as freehaul. No overhaul will be paid under this contract.

PSD 8 MEASUREMENT AND PAYMENT

PSD 8.1.3 Restricted excavation

The provision of working space (see Sub-Clause 8.3.5) will not be measured for payment. Notwithstanding the provisions of Sub-Clause 8.1.3, the Contractor shall make his own allowance for the excavation of any working space required for formwork or other purposes. The rates for restricted excavation shall also cover the costs of providing working space. All restricted excavation will be measured to the net dimensions of concrete floor slabs or other dimensions ordered by the Employers Representative.

PSDB: EARTHWORKS (PIPE TRENCHES)

PSDB5: CONSTRUCTION

PSDB5:1 PRECAUTION

PSDB5.1.1 General

ADD THE FOLLOWING TO THIS SUBCLAUSE 5.1.1:

"The Contractor shall programme his/her activity in such a way that long sections of trenches do not lie open for undue periods of time, as it poses a safety concern. And a security risk. The pipes shall be laid as soon as possible after excavation of the trenches and the trenches then backfilled. Under no circumstances will the trenches be left open for more than 1 week."

PSDB5.1.2 Stormwater, Seepage and Dewatering: Throughout the Works

ADD THE FOLLOWING TO THIS SUBCLAUSE 5.1.2:

"In addition to the Contractor's responsibilities for dealing with water, the Employers Representative may order the Contractor to place a crushed stone bedding layer (minimum thickness 150 mm) on the trench bottom. The Contractor will only be paid for providing and laying the stone bedding layer and filter fabric after receipt of a written order to do so from the Employers Representative."

PSDB 5.1.2.3 Sloping Ground

Delete the Sub-Clause and substitute:

The Contractor shall be responsible throughout the duration of the Contract, **inclusive of the Defects Liability Period**, for the provision of all soil erosion preventative measures necessary to protect the trenches, pipeline(s) and land utilised by the Contractor during the Contract from any adverse effects of soil erosion, settlement, scour, etc., resulting from the construction of the Works.

Cross embankments, generally extending across the full width of the working strip, consisting of low earth mounds shaped to rounded form and so oriented as to have a fall of 1% along their length, shall be constructed with compacted material having a minimum density of 90% modified AASHTO density and minimum dimensions and maximum spacings dependent on the slope of the ground along the length of the pipeline, as indicated in the following table:

Slope of Ground	Minimum Height	Minimum Base Width	Maximum Spacing
0% - 5%	No cross-embankments required		
5% - 10%	300 mm	1,2 m	40 m
10% - 15%	375 mm	1,5 m	30 m
Greater than 15%	450 mm	1,7 m	20 m

The height of the cross-embankments for a distance of 1 metre on either side of the trench centreline shall be raised 150 mm above the remainder of the cross-embankment to allow for settlement. In order to form a satisfactory drainage channel upstream of each cross-embankment (at a slope of 1%) the crown over the backfilled trench shall be removed for a distance of 0,5 m upstream of the cross-embankment.

Cross-embankments shall be constructed to the same minimum standards and dimensions indicated above wherever artificial slopes have been formed on the working strip or other areas used during construction and, with the approval of the Employers Representative, are permitted to be so left.

Payment will be made for the construction of cross-embankments in accordance with Sub-Clause 8.3.4(c), provided construction thereof has been either ordered or approved by the Employers Representative prior to the commencement of such construction.

PSDB 5.1.2.4 Cross-Walls in Trenches (New Sub-Clause)

In steeply sloping trenches (longitudinal slope > 15 %) and where otherwise ordered by the Employers Representative, the Contractor shall place sacks of earth as sack breakers or cross walls around and above the pipe up to ground level, prior to backfilling, as a soil erosion measure. Such sacks shall be filled with selected material free of stones in excess of 50 mm maximum dimension. One sack breaker shall consist of these sacks packed tightly against the trench bottom, pipe and actual trench sides, and against each other to form a solid cross wall at least 0,5 m thick from the bottom of the trench to the surface.

PSDB 5.2 Minimum Base Widths

Delete “Minimum and “Not less than “throughout this Sub-Clause and

Add to the Sub-Clause:

Trench sides shall be as near vertical as possible in order to minimise the quantity of backfill material required and to avoid possible difficulties where pipelines have to be installed parallel to existing services, fences, hedges, etc and to minimise the loading on the pipe.

The base width for trenches for cables, ducts and unbedded flexible continuous piping, of external diameter less than 125 mm laid at a depth not exceeding 1,5 m, shall be equal to the external diameter of the cable, duct or pipe, plus a side allowance of 200 mm on either side.

PSDB5.4 EXCAVATION

ADD THE FOLLOWING TO THIS SUBCLAUSE:

"Where the pipe trench crosses surfaced roads, the Contractor shall neatly cut two parallel grooves into and through the “black top” before excavating between the grooves.

The costs of this operation, where not scheduled separately, will be deemed to have been included in the general rates for excavation."

PSDB5.5 TRENCH BOTTOM

ADD THE FOLLOWING TO THIS SUBCLAUSE:

"Where the Contractor's method of working results in quagmire conditions in the trench bottom, the Contractor shall excavate and stabilise the trench at his/her cost.

If the trench crosses an area which is back filled with waste bricks, the Employers Representative may order the Contractor to place a geofabric on the bottom to ensure no loss of material into voids that may exist.

The Contractor will only be paid for providing and laying the geofabric after receipt of a written order to do so from the Employers Representative."

PSDB5.6.3 Disposal of Soft Excavation Material (Sub clause 5.6.3)

ADD THE FOLLOWING TO THIS SUBCLAUSE:

"All surplus and unsuitable material as described in DB 5.6.3 shall be disposed of within free haul distance as directed by the Employers Representative."

PSDB5.7 COMPACTION

PSDB5.7.2 Areas Subject to Traffic Loads (Sub clause 5.7.2)

ADD THE FOLLOWING TO THIS SUBCLAUSE:

"The provisions of sub clause 5.7.2 with regard to compaction of trenches shall be applicable to all trenches in road reserves. Sandy backfilling shall be provided and compacted to 98% Mod AASHTO maximum density."

PSDB8 MEASUREMENT AND PAYMENT

ADD THE FOLLOWING SUBCLAUSES:

PSDB8.1.5 Stone Bedding in Water-Logged Conditions (Subsoil Drainage)

Where the use of a layer of crushed stone in the trench bottom has been authorised by the Employers Representative, it will be measured by volume calculated according to length multiplied by the minimum base width and specified thickness. The layer of crush stone material of the grade and thickness shown on the drawing or as directed by the Employers Representative, shall be placed at the bottom of the trench and be lightly tempered and finished to the required gradient.

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.

Depth of trenches shall be measured from the roadbed level to the invert of the pipe irrespective of the actual depth excavation.

PSDB8.1.6 Geotextile or Synthetic-fibre filter fabric

Where shown on the drawing or directed by the Employers Representative, trenches of the subsoil drainage shall be lined with approved geotextile or synthetic-fibre filter fabric which

shall cover the bottom of the trench and shall extend upwards on both sides as specified on the drawing and shall be lapped both longitudinally and transversely by at least 300mm or as instructed by the manufactures. This shall be measured by area as:

width x net 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.

PSDB8.1.7 Manholes, Outlet Structure and Cleaning Eyes

Manholes, outlet structures and cleaning eye for subsoil drainage system shall be constructed in accordance with the details shown on the drawings or in position as instructed by the Employers Representative

PSDB8.1.8 Unsuitable Material

Unsuitable material for backfilling of trenches or roadworks shall be disposed of on site.

The rate tendered shall include for excavating, loading, haulage, tipping, compacting, trimming and finishing as instructed.

PSDB8.1.9 Bedding, Blanket and Backfill

The rate for placing and compacting bedding and blanket material shall be included in the items 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 then the Employers Representative will order the use of material from commercial sources.

PSDB8.1.10 Depth of Excavation

The depth of excavation in roadways is measured from the roadbed level and from natural ground level outside roadways where applicable.

PSDB8.3 SCHEDULED ITEMS

PSDB 8.3.4(c) Cross Embankments

Add new Sub-Clause:

Payment for cross embankments will be by volume of embankment constructed in accordance with the specification. .....Unit : m^3

PSDB 8.3.5 Existing Services that Intersect or Adjoin a Pipe Trench

Add to the end of the Sub-Clause:

(v) all work involved in locating the service by hand excavation

(vi) notifying and attending upon the owner of the service

(vii) supporting and protecting the service while the pipeline is installed, inspected, tested and backfilled.

ADD THE FOLLOWING NEW ITEMS:

"PSDB 8.3.8 Stone Bedding in Water-Logged Conditions (Subsoil Drainage)..... Unit: m^3

The tendered rate shall include full compensation for procuring, furnishing, and transporting approved crushed stone from commercial sources, including the costs of transporting the material to site, and placing of the layer of crush stone over at least the specified width and all related activities in order to produce a stable platform."

"PSDB 8.3.9 Geotextile or Synthetic-fibre filter fabric..... Unit: m^2

The tendered rate shall include full compensation for procuring, furnishing, assembling, placing and losses as a result of overlaps and over excavated trench widths."

"PSDB 8.3.10 Manholes, Outlet Structure and Cleaning Eyes

a) Outlet Structure..... Unit: No

The tendered rate shall full compensation for all excavation, backfilling, compacting to 90% Mod AASHTO density, keeping the excavation safe, dealing with any surface and subsurface water and constructing the concrete outlet structure complete as specified

PSG CONCRETE (STRUCTURAL) (SANS 1200 G)

PSG 2: INTERPRETATIONS

PSG 2.4.2 Strength concrete

Add the following to this Sub-clause:

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 Schedule of Quantities, all structural concrete shall be Grade 35 MPa/19 and shall at all times have crack sealing admixture in it.

PSG 3: MATERIALS

PSG 3.2 Cement

Add the following to this Sub-clause:

CEM1 42.5 as specified in SABS EN 197-1 common cements, a 75% CEM1 42.5 and 25% PFA blend or 50% slagment and 50% CEM1 shall be used as specified in the relevant sections of SANS 1491 and SANS EN 197-1. Any variations to these are subject to the Employers Representative's approval.

For non-structural concrete CEMI 32.5 is acceptable.

PSG 3.2.3 Storage

Add the following to this Sub-clause:

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 the contents of this clause 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 this Sub-clause:

The maximum aggregate size shall be 25 mm. Any aggregate may be used provided the free sodium alkali content in the concrete mix does not cause an alkali-aggregate reaction.

Coarse aggregate may be obtained from the nearest available commercial sources, and shall be subject to the Employers Representative's approval.

Fine aggregate may be obtained from local sources subject to testing of its suitability by an approved laboratory and approval by the Employers Representative.

Aggregates shall be tested periodically for reactivity, the costs of which shall be deemed included in the rate tendered for concrete. A design mix will have to be made and the results submitted to the Employers Representative for approval before construction begins.

Coarse and fine dolomitic aggregate may be used. When tested in accordance with the method specified in Appendix C of SANS 677, not more than 25% by mass of the dolomitic aggregate shall be insoluble in hydrochloric acid.

At least one month before commencement of concrete work the Contractor shall supply at his own representative samples to the Employers Representative 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 Contract the Employers Representative considers that there has been any deviation from the approved standard the Contractor shall submit further tested samples of material to the Employers Representative for approval.

Aggregates for grouting

Notwithstanding the requirements of Sub-clause 3.4.1, the grading of the fine aggregate (sand) and coarse aggregate (stone or pea gravel) to be used for grouting shall conform to the grading given in Tables 1 and 2 respectively, below.

TABLE 1 - SAND	
Test sieve nominal aperture size, mm	% Passing (by mass)
9,5	100
4,75	95 - 100
1,18	45 - 65

TABLE 2 - STONE OR PEA GRAVEL	
Test sieve nominal aperture size, mm	% Passing (by mass)
9,5	100
4,74	95 - 100
2,36	0 - 5

0,3 0,15	5 - 15 0 - 5		

Dolomitic Aggregate

Coarse and fine dolomitic aggregate may be used. When tested in accordance with the method specified in Appendix C of SANS 677, not more than 25% by mass of the dolomitic aggregate shall be insoluble in hydrochloric acid.

PSG 3.5 Admixtures

Add the following Sub-clause to clause 3.5:

PSG 3.5.3 Pulverized fly ash (PFA)

PSG 3.5.3.1 General

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

All concrete used shall consist of FA in the concrete unless otherwise shown on the drawings or ordered by the Employers Representative.

FA 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 FA concrete shall consist of a mixture of between 75% and 80% by mass of ordinary Portland cement and of between 25% and 20% by mass of FA.

Add the following Clauses:

PSG 3.9 Granolithic screed

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.

PSG 3.10 Bond breaker

The bond breaker between the top of the blinding layer or dry packed mortar screed and the underside of the floor slabs for civil structures 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^2 of net bitumen or a (minimum) 250 micrometre or 500 micrometre (as per the detail on the drawing) 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.

PSG 3.11 Materials for movement joints

PSG 3.11.1 General

The various jointing materials, the manufacturers of the materials and the methods of application shall be as approved by the Employers Representative. 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 3.11.2 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 in clause 6.1 of SANS 1200G. 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:

	PVC	**Rubber**
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 Employers Representative. 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 3.11.3 Fillers

Closed cell expanded polyethylene fillers shall comply with the following:

Property	**Unit**	**Value Test Method**
Density	kg/m³ 110	DIN 53420
Compression Stress at compression strains of 10% 25% 50%	 kPa 175 kPa 210 kPa 340	 DIN 53577 DIN 53577 DIN 53577

Property	Unit	Value Test Method
Compression set after 24 hours recovery	% 14	
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 approved epoxy glue.

PSG 3.11.4 Bond breakers, primers and sealants

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%.

PSG 3.12 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.

PSG 4: PLANT

PSG 4.3 Mixing plant

PSG 4.3.1 General Requirement for Mixing Plant

Add the following to this Sub-clause:

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 this Sub-clause:

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 4.5.3 Ties

Add the following to this Sub-clause:

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.

For Watertight concrete structures the shutters shall be fastened using an approved imbedded fastening system. Open ferrules will not be permitted.

Add the following Clause:

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 this Sub-clause:

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 Employers Representative, 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 adequately

cured as specified. 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 Employers Representative. 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 5.2 Formwork

PSG 5.2.1 Classification of finishes

Add the following to this Sub-clause:

Rough formwork Degree of Accuracy III may be used on the outside faces where the concrete is more than 500 mm below the final ground level.

Smooth formwork Degree of Accuracy II will be used elsewhere.

Where specified special finishes shall be to Degree of Accuracy I

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

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 this Sub-clause:

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 (Watertight)

PSG 5.5.1 Concrete (Quality)

Add the following to this clause:

35 MPa concrete with the minimum and maximum cement contents of 325 kg/m3 and 450 kg/m3 respectively shall be used. For concrete containing extenders the maximum cement content shall be 450 kg/m3. The water to cement ratio shall not exceed 0.50. All concrete mix designs shall be approved by the Employers Representative in advance.

The mix design and casting procedure shall be approved by the Employers Representative prior to casting.

All Water Retaining structures and all manholes shall be constructed using watertight concrete. The Contractor shall abide by all conditions set out in sub-clause 5.5.11 as amended of SABS 1200 G, and pay particular attention to this aspect of the works.

Cubes shall be taken on all pours in accordance with SABS 1200 G. Payment shall be included in the rate tendered for the supply of concrete. No payment shall be made for concrete pours on which no cube tests have been performed. A single cube test comprises the mean crushing strength of 3 cubes taken from the same batch of concrete and cubes must be taken at the frequency specified SANS 1200 G

The concrete shall be tested for water sorptivity, oxygen permeability, chloride conductivity, depth of cover and shrinkage; the details of the tests are given on the specification.

PSG 5.5.1.4 Chloride content

Add the following to this Sub-clause:

Efflorescence will not be acceptable on any exposed concrete surface

PSG 5.5.1.5 Durability

Add to this Sub-clause the following:

The water/cement ratio, as specified in Table 5, but shall not exceeding **0.5**.

PSG 5.5.1.6 Prescribed mix concrete

Add the following to this Sub-clause:

Notwithstanding the requirements of Sub-clause 5.5.1.6, samples of aggregates will not be made available by the Employers Representative. The Contractor shall supply aggregates from commercial sources located by him, complying with the requirements of Sub-clause 3.4.1, as amended, for the production of prescribed mix concrete.

"No-fines" concrete:

A nominal aggregate size of 19 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: sand 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.
Payment shall be per cubic metre of no-fines concrete placed. The rate shall include compaction and skimming to the approval of the Employers Representative.

PSG 5.5.1.7 Strength Concrete

Add the following to this Sub-clause:

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 and design mix to the Employers Representative for approval, 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, the Contractor shall 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.

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

Where blinding layers are specified, the concrete shall be grade 15 MPa/19 placed and finished off to the final level.

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

The workability of concrete shall be assessed by means of the slump test. The slump shall be between 75 ± 25mm.

Curing

Curing shall be done using a curing compound to the Employers Representative's approval and frequency or, in addition to water curing, well-secured plastic sheeting, shall be used. Water curing alone shall not be permitted. Where the Contractor fails to cure for a minimum of 7 days, no payment shall be made for the relevant pour of concrete.

PSG 5.5.2 Batching

Add the following to this Sub-clause:

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 the contents of this Sub-clause 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 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 Sub-clause 7.3.4, provided the cubes are stored and cured on site.

PSG 5.5.5 Placing

Add the following Sub-clause:

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 Employers Representative.

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 5.5.7 Construction joints

Add the following to these Sub-clauses:

PSG 5.5.7.1 General

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 Sub-clauses 5.5.7.3(a) to (d), shall be such as to remove all laitance or inert and strength-less 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 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 Sub-clause 5.5.7.3, as amended.

Unless construction joints between designated joints shown on the drawings are authorized by the Employers Representative 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)

Formed joints will be considered to be designated joints as defined in 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, General 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.

PSG 5.5.7.3 Non-designated joints

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 Sub-clauses:

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 Employers Representative. The "kicker" shall be cast as an integral part of the foundation, footing or floor.

PSG 5.5.7.5 Construction Joints In Circular Reservoirs

(a) Construction Joints In Walls Or Footings

Construction joints may only be placed where shown on the drawings or to the approval of the Employers Representative. Vertical joints in the walls of the reservoir are permitted only in the pre-stressed reservoir. These joints shall only be permitted radially on each side of stressing buttresses. No vertical joints shall be permitted in the reinforced concrete reservoir or circular sedimentation tank.

The entire contact surface along the joint in the concrete already cast shall be chipped or water jetted to expose the coarse aggregate to 5 mm beyond the surrounding matrix. Care shall be taken to ensure that the concrete structure is not damaged and that all loose material is removed. The surface must be thoroughly cleaned and wetted before casting against the joint.

All construction joints in the reservoir walls and footing shall be cast with water stops. Water stops shall be as per detail drawings. No construction joints will be permitted in the floor.

Payment shall be per linear meter. The rate shall include supply and casting in of the water stop as per detail drawings.

(b) Construction Joints In Roof Slabs

Construction joints in the roof slab are permitted. The position of these joints shall be approved by the Employers Representative.

These joints shall be cast against a vertical shutter leaving a 15 mm deep by 20 mm wide recess which is sealed with a one part poly-sulphide sealer on completion. The sealer used and method of application shall be to the Employers Representative's approval.

No water stops are required; however, the completed roof shall be tested for water tightness in accordance with Sub-clause PSG 7.2.5(b), as amended. No additional payment shall be made for these joints.

(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 200 bar water jet. All joints shall be butt jointed and patched over.

The waterproofing bandage shall comprise of two elements:

(i) A 2 mm thick Hypalon or Combiflex strip

(ii) (For Expansion joints) A 2 mm x 60 mm stainless steel strip with polythene backing bond breaker to the detail shown on the drawing.

The bandage shall be applied by coating the concrete and underside of the hyperlon bandage with an epoxy adhesive. The stainless steel strip is first positioned over the joint and the bandage with epoxy adhesive placed over the stainless steel strip. All trapped air shall be eliminated by hand rolling the bandage until the epoxy is fully cured.

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

PSG 5.5.7.6 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 Employers Representative 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 5.5.7.7 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 Employers Representative will impair the performance or appearance of the joint shall be made good by reconstructing the work as directed by the Employers Representative. 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 5.5.7.8 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 Employers Representative, to ensure that all flexible waterstops are in perfect contact with well compacted void-free concrete.

PSG 5.5.7.9 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 Employers Representative.

PSG 5.5.7.10 Application of joint seals

Rebates shall be cleaned as required by PSG 5.5.7.6 Application of primers and adhesives and shall be inspected and approved by the Employers Representative's Representative 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 5.5.8 Curing and protection

Add the following to this Sub-clause:

PSG 5.5.8.1 Horizontal surfaces

Surfaces of the concrete shall be treated with a curing compound complying with Sub-clause PSG 5.5.8.3 Post-Crystallization (Concentrate & Modified) slurry coat and curing.

PSG 5.5.8.2 Formed surfaces

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.

PSG 5.5.8.3 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.

Surfaces shall be smooth and uncovered from excess form oil, laitance and foreign matter. The concrete should be lightly water blasted to remove such material for surface preparation.

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/m² 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 5.5.8.4 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 Employers Representative, 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 Employers Representative 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 Employers Representative, is unsatisfactory. The curing compound used shall be to the approval of the Employers Representative. 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 Employers Representative 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 the contents of Sub-clause 5.5.9.2 with the following:

No placing of concrete shall take place if the ambient temperature exceeds 32°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 the contents of this Clause 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 Sub-clause PSG 5.10.1, as amended, Screeded finish 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 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 steel-trowelled under firm pressure to produce a dense, smooth, uniform surface free from trowel marks.

PSG 5.5.10.4 Granolithic screeds

PSG 5.5.10.4.1 General

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 Sub-clause 5.5.8(b), 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 5.5.10.4.2 Screed to floor (Where Specified)

Where screed is specified it shall be approximately 50 mm thickness is required to each floor.

The screed shall be formed from granolithic concrete as specified in Sub-clause PSG 5.5.10.4 Granolithic screed. The screed shall be applied after the mechanical equipment has been erected by the mechanical plant contractor and shall be laid in alternate concentric rings not greater than 2,00 m in width. A period of 24 hours shall elapse before the intervening rings are laid.

The Contractor shall supply and fit a plywood template to the clarifier mechanism to act as a guide in determining the finished screed level. He shall not use the template to physically form the screed surface nor shall he place an excessive load on the scraper mechanism.

The Contractor shall only operate the scraper mechanism in strict accordance with the instructions of the manufacturer and the Employers Representative, and he shall make good any damage resulting from the use of the machinery.

Granolithic concrete shall be placed in position for a distance of approximately 3,0 m in front of the template and consolidated and roughly trimmed to level. The surface of the screed shall then be trimmed off to the level of the template which shall be moved as required by hand operation of the mechanism.

The trimmed surface shall be steel float finished and the edges of the ring left in a rough vertical condition to provide a key for the adjoining ring.

The preparation of the base concrete shall be done in accordance with Sub-clause PSG 5.5.10.1, as amended, Screeded finish. Before placing granolithic concrete against an adjacent band of granolithic concrete 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.

Concrete to manholes shall be watertight concrete.

PSG 5.5.11 Watertight Concrete

Add the following to this Sub-clause:

The water-tightness of the reservoirs and sedimentations, all liquid retaining structures and concrete chambers shall be tested as indicated below:

On completion the structure 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 per m^2 of the surface in contact with water.

In the event of any leakage or dampness being evident at any stage of the filling or testing or in the event of the Employers Representative considering the final degree of water-

tightness to be unsatisfactory, the Contractor when ordered by the Employers Representative shall discontinue such filling or testing and shall, at his own expense, immediately take approved steps to rectify the leakage and to make the work thoroughly sound to the complete satisfaction of the Employers Representative. All such rectification work shall be continued assiduously until a satisfactory test is obtained, which shall prove to the Employers Representative that water-tightness has been obtained.

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

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

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

The cost of the above tests will be deemed to be included if the rates for the relative concrete to be provided by the contractor.

PSG 5.5.14 Defects

Add the following to this Sub-clause:

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

Add the following sub-clauses:

PSG 5.5.16 Casting pipes and specials in concrete

Where the pipe or special is supplied by others the Contractor may elect to 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 Employers Representative; 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 in Sub-clause 5.5.7.3, as amended.

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 5.5.17 Precast paving slabs

The area to be paved shall be compacted to a minimum of 93% Mod AASSHTO density (100% for sand), trimmed and then treated with an approved weed killer, 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 Employers Representative. 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 5.5.18 Items to be cast in or grouted into concrete

PSG 5.5.18.1 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 Employers Representative 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 5.5.18.2 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 Employers Representative.

Where anchor bolts are used which are installed into holes drilled into concrete or masonry these shall be of a type approved by the Employers Representative. 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 Anchor Size	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 5.5.18.3 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 Employers Representative.

All such fittings shall be manufactured from mPVC 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 5.5.18.3 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 Employers Representative in respect of:

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

PSG7 TESTS

PSG 7.1.2 Frequency of sampling

Add the following to this clause:

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.

Sampling of concrete of a particular grade shall be as specified in Sub-clause 7.1.2 with the following frequency of sampling referred to in Sub-clause 7.1.2.2 being amended to read as follows:

"A minimum of 4 samples per day of each grade of concrete placed or 6 samples for pours in excess of 10 m^3 shall be taken."

PSG 7.2 Testing

Add the following Sub-clauses:

PSG 7.2.5 Testing Watertight Concrete

The Clear/potable water retaining structures shall be disinfected before testing. Any re-testing that may be required shall be at the Contractor's expense.

The entire inside surface of the structure including columns and roof shall be thoroughly hosed down with water and brushed until properly cleaned off all dirt and other foreign matter.

The floor of the structure shall then be flooded to a depth of 300 mm with purified water, with calcium hypochlorite solution being added gradually to mix thoroughly as the water enters. The water shall be dosed with calcium hypochlorite at a rate of 150 grams per cubic meter of water entering the structure. The entire inside surface shall again be scrubbed using this water. The workers engaged in this operation shall wear clean rubber boots. On completion the water is to be run to waste once the free chlorine is reduced to an acceptable level, and the floor of the structure shall be swept clean.

The chlorinated water shall be stored until the free chlorine level has dropped to an acceptable level. Excess dirt swept from the floor into the sump may be discharged subject to written approval being obtained from the Local Authority.

Payment shall be a lump sum. The rate shall cover the costs of all materials and water used.

The structure shall be tested for water tightness in accordance with BS 8007 1987 Section 9.

(a) Testing of the Structure:

For testing the liquid retention, the structure shall be cleaned and initially filled to the normal maximum level with the water at a uniform rate of not greater than 2 m in 24 hours.

When first filled, the water level should be maintained by the addition of further water for a stabilising period while absorption and autogenous healing take place. After a stabilization period of 21 days, refill (top up) and record the water level at 24 hour intervals for a test period of 7 days. During this 7 day test period the total permissible drop in level, after allowing for evaporation and rainfall, should not exceed 10 mm.

Notwithstanding the satisfactory completion of the test, any evidence of seepage of the liquid to the outside faces of the liquid-retaining walls shall be assessed by the Employers Representative against the requirements of the specification. Any necessary remedial treatment of the concrete, cracks, or joints shall be carried out from the liquid face where practicable. If a lining is used for this purpose, it shall be sufficiently flexible and not be in any way detrimental to the water quality.

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

If required by the Employers Representative, 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 Employers Representative.

(b) Testing of the Roof of water retaining structures

The roof shall be tested on completion by using a hose or sprinkler system to obtain a sheet flow over the whole area of the roof for a period of not less than 6 hours.

The roof shall be considered satisfactory if no leaks or damp patches appear on the soffit.

PSG 7.2.6 Durability Testing:

Concrete shall comply with the durability parameters defined below:

a) Water Sorptivity:

Sorptivity is sensitive to surface effects and may be used to assess the effectiveness of initial curing.

b) Oxygen Permeability:

Permeability is sensitive to changes in the coarse pore fraction and is thus a means of assessing the degree of compaction of concrete. It may be used to quantify the microstructure of the concrete and is sensitive to macro-defects such as voids and cracks. Permeability shall be tested in a manner approved by the Employers Representative.

c) Chloride Conductivity:

Chloride conductivity provides a method of characterisation of concrete in the marine environment and may be used to assess the chloride resistance of concrete.

Unlike oxygen permeability and water sorptivity, chloride conductivity is not really a measure of construction quality, but it shall be used for materials selection and design of mixes in aggressive chloride conditions. It will therefore only be used as a check on mix designs during the initial stages of construction.

d) Concrete Cover:

Concrete cover is a dimensional indicator of cover concrete depth. Cover concrete is the outer concrete layer which protects the internal reinforcing steel, and its depth varies according to the requirements of the different environmental exposure classes.

Test for cover shall be conducted using an approved calibrated electromagnetic cover meter.

This test shall be conducted when instructed by the Employers Representative to confirm that the specified depth of concrete cover has been achieved. The cover meter tests shall cover at least 1 m^2 for every 10 m^2 exposed. The average cover of the 1 m^2 subjected to the test shall be used to determine the payment, unless the Contractor chooses to carry out additional tests as detailed under clause PSG 7.3.8. The cover meter must be calibrated for each project by drilling and measuring actual cover in at least 3 locations to validate the readings.

Minimum cover to reinforcing for the utility building and guard house shall be as indicated on the drawings.

e) General:

Durability predictions will be based on the following tests that shall be arranged by the contractor. The durability testing shall be carried out by a laboratory approved by the Employers Representative.

f) Shrinkage

The dry shrinkage tests shall be conducted in accordance with SABS 1085. The drying shrinkage shall not exceed 0.04%.

PSG 7.3 Acceptance Criteria for Strength Concrete

Add the following Sub-clauses:

PSG 7.3.6 Durability Index Tests

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 it actually used in the liquid retaining structure. 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 its intended use in the structure, after a period of 28 days curing. The following test panels shall be constructed and tested:

a) One test as part of trial mixes
b) One test for the first 50m^3 batch of concrete.
c) Thereafter 1 set for every discreet element namely floor slabs, sloped floor slabs, walls and columns (4 No. total) upon instruction by the Employers Representative.

Any additional durability tests will be paid for as extras. The durability tests are to be carried out by an accredited laboratory approved by the supplier in terms his Quality Management System. Each test as quantified in the Bill of Quantities shall include each of the following tests:

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

(E.g. One No. durability test includes permeability testing, water sorptivity testing and chloride conductivity testing).

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 Dia.) 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.

PSG 7.3.6.1 Durability Test Parameters

DURABILITY INDEX TEST	TARGET VALUE
Oxygen permeability index	≥ 10 (log scale)
Chloride conductivity index	≤ 0.6 m.sec/cm
Water Sorptivity	≤ 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 any of the target values as stated above, the results will be reviewed by the Employers Representative who will assess them in accordance with the required durability parameters. If these results are still not found to be satisfactory by the Employers Representative, the Contractor shall propose alternative methods to improve the durability of the mix and/or any items cast. 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 7.3.7 Criteria for the Compliance with the Requirements

No extra payment shall be made for cube strength testing. The cost of cube strength testing shall be included in the rates tendered for concrete.

Water used for testing shall be free of charge except for failed tests when water will be charged at standard municipal rates.

In the event that the actual achieved average cube strengths of an element are less than 85% of the target mean strength, the Employers Representative may instruct the taking of cores for additional strength testing. The cost of taking the cores and repairing the holes in the structures shall be for the Contractor's account.

The Employers Representative will conduct routine tests for the durability parameters on cores taken from the completed elements during the construction, the costs for which shall be to the Employer's account unless the parameters are not met.

The test results shall be accepted or rejected based on the criteria as set out in PSG 7.3.6.1 based on the following categories:

a) Full Acceptance:
Concrete shall be accepted unconditionally and full payment shall be made.

b) Conditional Acceptance:
Concrete may be accepted at the Employers Representative's discretion with a warning that construction methods be examined to improve the durability criteria. A reduced payment shall be applied to all the relevant pay items under SABS 1200 G for the non-conforming element or concrete pour. Alternatively, the Contractor may elect to carry out remedial work to improve the durability of the concrete to the criterion of "Full Acceptance" to the satisfaction of the Employers Representative, and receive full payment. All proposed remedial measures shall be subject to the approval of the Employers Representative. The cost of all such remedial work shall be for the Contractor's account.

c) Rejection:
The concrete shall be removed and replaced with fresh concrete at the expense of the Contractor, as directed by the Employers Representative.

Should the test result(s) indicate conditional acceptance or rejection of the item tested, the Contractor shall have the option of carrying out additional tests on that item, at his own expense, to confirm or disapprove the original test result(s). Not more than two such additional tests shall be carried out.

PSG 7.3.8 Procedure in the Event of Non-Compliance with the Requirements

Structural concrete elements or concrete pours shall be represented by test cubes and extracted cores, which shall be tested for strengths and the appropriate durability parameters.

If the durability parameters have been proved acceptable, the costs for such testing shall be borne by the Employer. However, where non-compliance to the specified parameters has been identified, the assessed element shall be rejected and at the Employers Representative's sole discretion any of the following measures may be considered at the Contractor's expense:

a) Coating with an approved product specifically designed to improve the non-conforming parameter depending on the severity of the test results.
b) Acceptance at reduced payment.
c) Demolition and rebuilding.

PSG 7.3.9 Tests Ordered By the Employers Representative

One concrete cube strength test shall comprise the results of tests carried out on three standard test cubes made from concrete sampled from one batch of concrete in accordance with these specifications.

Percentage payment for concrete cover shall be based on the average result of the total number of cover meter tests performed on a particular concrete element.

The overall percentage payment applied to a concrete member shall be based on the average of the percentage payments applicable to each durability parameter, together with the percentage payment based on the strength requirements described in the project specifications.

The reduced payments shall apply to the relevant payment items scheduled in the Schedule of Quantities.

PSG 7.3.11 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^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 Employers Representative.

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-clauses 7.2.1 to 7.2.3.

PSG 8 MEASUREMENT AND PAYMENT

PSG 8.1.1 Formwork

Add the following Sub-clause:

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 Sub-clause 8.2.5.

PSG 8.1.2 Reinforcement

Add the following to Sub-clauses 8.1.2.2 and 8.1.2.3:

Notwithstanding the method of measuring and paying for reinforcement specified in 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

Add the following to Sub-clauses 8.1.3.3:

The rates for concrete shall also cover:

a) the use of dolomitic aggregate where prescribed,
b) the cost of the preparation of design mixes by an approved laboratory and submission for approval by the Employers Representative,
c) screeded finish of unformed surface as specified in PSG 5.5.10.1, as amended, Screeded finish, and
d) inclusion of admixtures.

PSG 8.2 Scheduled Formwork Items

Add the following payment item to this clause:

PSG 8.2.7 Kickers .....Unit: m^2

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

PSG 8.2.8 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 8.2.9 Chamfers and fillets.....Unit: m^2

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 Sub clause 8.2.5.

PSG 8.4 Concrete

PSG 8.4.4 Unformed surface finishes .....Unit: m^2

Add the following to this Sub-clause:

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 this clause:

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 Sub-clause 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.

Add the following Sub-clause to this payment clause:

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 Sub-clause 5.5.7, as amended, and Sub-clause PSG 5.5.7.2, as amended, Formed joints (generally vertical or near vertical), and detailed on the drawings such as joint filler, dowel bars and tubes, bitumen coats, etc., but excluding waterstops or waterbars.

Waterstops and waterbars will be measured by length separately for each type.

PSG 8.7 Grouting .....Unit: m^2

Add the following to this payment clause:

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.

PSG 8.8 HD Bolts and miscellaneous Metal Work .....Unit: t

Add the following to this payment clause:

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 payment items:

PSG 8.9 Impervious membrane .....Unit: m^2

The impervious membrane will be measured by the surface area covered excluding laps and wastage. The rate shall cover the cost of the supply, laying, jointing of sheets as recommended by the supplier and final trimming of outer edges.

PSG 8.10 No-fines concrete .....Unit: m^2

No-fines concrete will be measured by area.

The rate shall cover the cost of supplying materials, constructing and placing in position the no-fines concrete, and shall include for the steel floated 20 mm mortar skim.

PSG 8.11 Items cast in concrete .....Unit: No.

Items cast in concrete will be measured by number separately for each type of item.

Notwithstanding 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 item will be measured and paid separately.

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 8.12 Granolithic screeds.....Unit: m^2

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 Employers Representative. 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 Sub-clause PSG 5.5.10.4, as amended, Granolithic screeds. The rate shall include the steel float finish.

PSG 8.13 Precast paving slabs.....Unit: m^2

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.

PSG 8.14 PFA concrete.....Unit: m^3

Measurement and payment for PFA concrete shall be as specified in Sub-clause 8.1.3 as amended.

The tendered rate shall cover all costs in connection with the supply, storage, handling on site and mixing in of PFA.

PSG 8.15 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 to carry out the tests, as specified in Sub-clause PSG 5.5.11, as amended, Watertightness test, to rectify faults and to achieve a test result to the satisfaction of the Employers Representative.

The sum shall include for all water required over and above that required for one filling of the water retaining structure based on the assumption that water will be available.

A provisional item is provided for an extra payment to the above to allow for the water not being available in time and the Contractor has to make his own other arrangements for providing water for testing. Such an arrangement shall only come into effect on the Employers Representative's instruction.

PSG 8.16 Slurry coat and curing .....Unit: m^2

Supply & apply waterproof treatment with proprietory chrystalline additive to all areas inside tank.

The rate shall cover for the supply and surface treatment of specified concrete surfaces according to Sub-clause PSG 5.5.8.3, as amended.

PSG 8.16 Miscellaneous Metalwork.....Unit: No.

Payment shall be by number. Separate items shall be scheduled for the following where required:

a) Manhole covers

The manhole cover in the reservoir roof shall be installed to the details shown on the drawings. The rate shall include supply, bitumen coating, installation and casting of the frame into the supporting concrete.

b) Reservoir ventilators

The reservoir ventilators in the reservoir roof shall be installed to the details shown on the drawings. The rate shall include fabrication, galvanising, shuttering, grouting and installation.

c) Step irons

Cast iron step irons shall be cast into the side of the reservoir wall, sump and manholes as detailed. The rate shall include for the supply and installation of the step irons.

PSG 8.17 Black Plastic Bond Breaker.....Unit: m^2

A 500 micron black plastic continuous layer is to be laid over the no-fines concrete under the reservoir floor. 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.

Payment shall be by the square meter laid. Care shall be taken not to rip or tear the sheeting. All repairs shall be at the Contractor's expense.

PSG 8.18 Teflon Sliding Bearings.....Unit: m

Neoprene (Kilcher or similarly approved) Teflon sliding bearings shall be placed on the top of the reservoir wall prior to casting the roof slab. A 3T50/50 bearing shall be used for the reinforced concrete reservoir, while a 3T50/100 bearing shall be used for the prestressed concrete reservoir. The top of the wall shall be cast to a smooth steel float finish.

Payment shall be per linear metre for the preparing and placing of the bearings. The rate shall include the supply, laying, jointing and masking of the bearings to the polystyrene strip.

PSG 8.19 Poly-urethane sealants.....Unit: m

A polyurethane sealant (UV-resistant) shall be used on the outside joint between the reservoir roof and walls to the details shown and shall be finished off neatly leaving a smooth regular finish.

Payment shall be per linear metre. The rate shall include the supply, preparation, sealing and finishing.

PSG 8.20 Commercial Laboratory.....Unit: Prov Sum

A Provisional Sum for the services of a commercial laboratory has been included in the Bill of Quantities for the Employers Representative's Acceptance Testing. The use of this laboratory is for additional testing required over and above the testing specified in SANS 1200 G and the variations to SANS 1200 G specified above. Testing shall only be paid on written instruction for additional testing from the Employers Representative.

The procedure for sampling and manufacturing, storing, curing and testing test cubes shall be in accordance with SABS 863.

PSL: MEDIUM-PRESSURE PIPELINES

PSL3 MATERIALS

PSL3.1 General (Sub clause 3.1)

ADD THE FOLLOWING TO THIS SUBCLAUSE:

Class 16 mPVC pipes with spigot and socket ends and bearing the SABS 966 mark shall be used as specified, unless otherwise shown in the schedule or in the project drawings.

PSL3.3 CI Pipes, Fittings and Specials (Sub clause 3.3)

ADD THE FOLLOWING TO THIS SUBCLAUSE:

Cast iron bends, tees fittings, etc. to SABS 546 are required for water mains.

All steel pipes and specials for reservoirs and sedimentation tanks, irrespective of diameter, shall be fabricated from plain ended pipes. The use of screwed flanges and fittings shall be limited and minimised, 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.

PSL3.8 Bolts and Nuts (Sub clause 3.8.3 and 3.8.4)

ADD THE FOLLOWING TO THIS SUBCLAUSE:

Bolts and nuts shall comply with SABS 135 and be hot dip galvanised.

PSL 3.9 CORROSION PROTECTION

PSL 3.9.2 Steel Pipes

PSL 3.9.2.1 Steel Pipes of Nominal Bore up to 150 mm

All steel pipe specials of nominal bore up to 150 mm shall be factory coated and lined with hot-fused Rilsan coating to a DFT of at least 350 microns generally in accordance with Subclause 3.9.2.2 and in accordance with the epoxy manufacturer's specifications for preparation of the receiving surface and application of the product.

PSL 3.9.2.2 Steel Pipes of Nominal Bore over 150mm

Unless otherwise scheduled, all mild steel specials up to DN500 in size shall be factory coated with a rigid polyutherane and lined with solvent free polyamine coating to a DFT of at least 1500 microns and 500 microns respectively in accordance with Subclause 3.9.2.2 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 larger than DN500 shall be factory coated and lined with a solvent-free two-pack glassflake surface-tolerant epoxy paint applied in two layers to a total DFT of at least 350 micrometres and lined with twin pack epoxy polyamide in accordance with Subclause 3.9.2.2 and in accordance with the epoxy manufacturer's specifications for preparation of the receiving surface and application of the product.

Unless otherwise specified, all steel pipes, fittings and specials with a cement mortar lining shall be in accordance with the requirements of the Australian Standard ASW 1281:2001 with thicknesses as stated in Clause 3.9.1 (and 3.9.2 for DN 250 pipes).

PSL 3.9.2.3 Preparation of Steel Surfaces for Repairs and/or Reinstatement of Internal Lining and/or External Coating (New Sub-Clause)

Add new Sub-Clause:

The following method is applicable for the preparation of all 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 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. 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. The finished grit blasted surface shall be 75 micron with an angular profile.

Transition areas from EPOXY internal lining to bare metal which have been grit blasted, shall be smooth without rough edges or flaking appearances.

All grit blasting within the pipeline 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.

The Contractor shall provide the Employers Representative with a method statement for approval for each type/location of grit blasting before work commences.

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.

PSL 3.9.2.4 Holiday Testing – Epoxy Linings and Coatings (New Sub-Clause)

Add new Sub-Clause:

All Holiday Testing of epoxy linings and coatings shall be carried out with an instrument approved by the Employers Representative. 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 Employers Representative for approval. Method statements for the process of holiday testing shall be submitted to the Employers Representative 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 Employers Representative.

PSL 3.9.3.2 Preparation Mixing and Application of Epoxy Compounds (New Sub-Clause)

Add new Sub-Clause:

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 pipeline. This specification refers to “two-part epoxy” as an epoxy repair kit which consists

of a base and an activator approved by the Employers Representative and could be products similar to “Denso ST100”, "Sigma SF 523”, “Nordbak”, etc.

For the repair of cement mortar linings, “Epidermix 338” or similar approved will be required.

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 affected in order to deliver a serviceable and acceptable pipe line. (This excludes such repairs as instructed by the Employers Representative because of manufacturing defects, if any).

Two-part epoxy may only be applied on steel surfaces prepared as specified in PSL 3.9.3.1.

PSL 3.9.3.3 Making Good of Cement Mortar Lining at Welded Joints (New Sub-Clause)

Add new Sub-clause:

When straight steel pipes are cut, the cement mortar lining is to be cut back between 50 mm and 75 mm from the cut end of the pipe and “chamfered” by approximately 15 degrees to provide a positive dove-tail joint for the epoxy mortar repair plug after butt welding.

The surfaces are to be prepared as specified in PSL3.9.3.1.

A 50 mm wide by 20 mm thick band of “Epidermix 338” or similar approved epoxy, shall be applied internally on the uncoated steel adjacent to the cement mortar lining. For pipes that are too small for internal access for hand repairs, the plain end of the adjoining pipe shall be pushed into the bellmouth (or into the external sleeve when there is no bellmouth) in such a way that the epoxy band is compressed and makes contact with the transverse face of the cement mortar lining of both pipes. The excess material that is squeezed into the bore of the pipes is to be removed by drawing a suitable plug that is 5 mm smaller than the bore of the cement mortar lining across the joint. The plug that is used shall be such as to render an even and smooth finish to the epoxy at the joint. The timing of when the plug is pulled through is critical and shall be carefully controlled.

For pipes large enough for safe internal access, the cement-mortar lining shall be made-good with the same materials, but by hand.

PSL 3.9.3.4 Repair and Making Good of Solvent Free Epoxy Linings (New Sub-Clause)

Add new Sub-clause:

Pipes with linings damaged prior to acceptance by the Contractor shall be marked and recorded by both the Contractor and the Employers Representative’s Representative 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.

PSL 3.9.3.5 External Corrosion Protection of Factory Welded Joints and Coating Repairs (New Sub-Clause)

Add new Sub-clause:

All ~~*DN 600*~~ 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 Employers Representative, they may be used. Irrespective of which products are approved by the Employers Representative 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 Employers Representative. 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 3.9.3.6 External Corrosion Protection of Shop-Fabricated Pipe Bends and Fittings (New Sub-Clause)

Add new Sub-Clause:

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 3.9.3.5 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 (refer PSL3.9.3.8) 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.

PSL 3.9.3.7 External Corrosion Protection of Site-Fabricated Pipe Bends and Fittings (New Sub-Clause)

Add new Sub-Clause:

The coating repairs/make good shall be carried out in accordance with PSL 3.9.3.5.

PSL 3.9.3.8 Corrosion Protection of Buried Flanges and Flexible Adaptor/Anchoring Joints (New Sub-Clause)

Add new Sub-clause:

All buried 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 Employers Representative).

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 3.9.3.9 Coating of Permanently Exposed Pipes/Fittings (New Sub-Clause)

Add new Sub-Clause:

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 m² 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 m² per litre.

ADD THE FOLLOWING TO THIS SUBCLAUSE:

Saddles, cast iron specials and flanged joints together with their bolts, shall be protected by means of either an approved protective paste, then wrapped with three layers of an approved impregnated tape, or other means of inhibiting corrosion approved by the Employers Representative. The protection shall also be applied to the bolts and flanges used by the manufacturer in the construction of valves and hydrants.

PSL3.10 Valves (Sub clause 3.10)

REPLACE THIS SUBCLAUSE WITH THE FOLLOWING:

(a) Gate Valves

Valves shall be of the Wedge Gate Valve type (PN 25) bearing the SABS mark of approval, with socket couplings, counter clockwise closing, non-rising spindle with cap top complying with SABS 664, drop tight when tested in accordance with the requirements or BS 5163, supplied with all materials necessary for complete installation and protected against corrosion.

In addition, the Contractor shall ensure that the differential pressure across valve gates does not exceed the manufacturer's stated maximum working pressure.

Flanges if specified shall be drilled to SABS 1123 Table 2500/3.

(b) Hydrants (Sub clause 3.10)

Hydrants shall be nominal 90 mm inlet cast iron, anti-clockwise closing with cap top, rising spindle and fitted with London round thread outlet in gun metal, with cast iron cap and safety chain. All fire hydrant to be above ground pillar types with bayonet coupling or similar compatible with the local authority fire brigade equipment.

The use of the flash fire fitting hydrant (marked with a triangular FFF logo) shall not be allowed.

PSL3.11 Surface Boxes (Sub clause 3.11.6)

ADD THE FOLLOWING TO THIS SUBCLAUSE:

CI surface boxes for valve chambers shall comply with the requirements of SABS 558 and shall be painted yellow with approved oil based paint.

No separate payment will be made for the marking or painting of cast iron surfaced boxes. The position of the valves must also be marked on the side slope of the kerb with a 150 mm wide blue paint strip.

PSL5 CONSTRUCTION

PSL5.1 Depths and Cover (Sub clause 5.1.4)

REPLACE THIS SUBCLAUSE WITH THE FOLLOWING:

Water mains shall be laid so that the cover to the top of the pipe barrel from finished surface level is generally, but not less than 1 000 mm and not greater than 1 200 mm.

Where the minimum clearance between pipe crossings would be less than specified, the water main shall be laid beneath the service crossed at an invert level which allows for the

clear space as specified. (Subject to the approval of the Employers Representative.) The water main shall be laid horizontally at this level for a distance of at least 1,0 m on either side of the centreline of the service crossed and then revert to the specified cover. If the Employers Representative rules that passing under the crossing service in this manner is unsuitable, a galvanised steel offset special shall be used to offset the water main.

No decrease in cover or clear space between the pipe barrels as specified will be permitted unless otherwise instructed by the Employers Representative in writing.

PSL7 TESTING

PSL7.3 Standard Hydraulic Pipe Test (Sub clause 7.3)

PSL7.3.1 Test Pressure and Time of Test (Sub clause 7.3.1)

ADD THE FOLLOWING SUBCLAUSE:

Pipes shall not be tested against isolating valves. Special blank flanges or end caps, fully anchored, shall be provided for testing.

REPLACE SUBCLAUSE 7.3.1.2 WITH THE FOLLOWING:

The test pressure for field testing shall be 1.25 times the rated maximum working pressure of the pipe.

ADD THE FOLLOWING SUBCLAUSE:

PSL7.5 CONNECTION TO EXISTING MAINS

The direct connections to the municipal mains will be done by the relevant local authority. The Contractor shall co-ordinate the connection with the local authority.

PSL8 MEASUREMENT AND PAYMENT

PSL8.2 SCHEDULED ITEMS

PSL 8.2.15 Special Wrapping in Corrosive Soil

DELETE THE SUB-CLAUSE AND SUBSTITUTE THE FOLLOWING:

The costs of making good the internal linings and external coatings on all butt welded and fillet welded joints on the pipeline are to be included in the tendered rates.

External corrosion protection to flanges, adaptor joints, valves…….. ..... Unit : No

Separate items will be scheduled for each item by pipe nominal diameter.

In the case of valves, the rate shall include for protection of the whole of the valve body, all flanges integral to the valve, the connecting flanges to the valve (i.e. including the two flanges of the pipework connected to either side of the valve) and the packing of mastic (without tape or sheathing) over the gland adjusting bolts and nuts.

"PSL 8.2.16 Cut Pipes (New Sub-Clause)

Extra over for forming scarf joint……..... …….Unit : No

Add new item:

Extra over for forming mitre cut joint……..... Unit : No

Add new item:

Extra over for cutting pipe as closure……..... Unit : No

The rates shall cover the cost of the cutting of the pipes and forming the joint and welding and making good of the internal lining and external coating, testing, and forming joint holes in trench in all materials to facilitate in-situ welding."

.

"PSL 8.2.17 Cutting into and Connecting to Existing Pipeline (New Sub-Clause)

"Cutting into and connecting to existing pipeline ..... Unit : Sum

The rate for cutting into and connecting to existing pipelines shall cover the cost of exposing the existing pipeline, making arrangements with the Employer's staff to temporarily shut off the existing pipeline whilst effecting the connection, cleaning and preparing the pipe for cutting, cutting, dealing with all water (including that from possible leaking valves), preparing the pipe ends for jointing, welding / jointing and connecting the new pipework, making good internal linings and external coatings, re-commissioning the pipeline, and including all temporary supports, bedding and backfilling."

"PSL 8.2.18 Standpipes complete (New Sub-Clause)

(a) Give description and reference drawing ..... Unit : Number

The tendered rate shall include full compensation for all excavations for the pipe, for the drain, if required; the base of the concrete pedestal (for the tap); the supply and installation of all pipework and fittings including a 1,2 m long section of the supply pipe measured from the rising pipe; the supply and installation of the taps; backfilling the drain with stone, and the trench with approved backfill material; all formwork and concrete, and; all equipment, labour and diverse material required to complete the standpipe as shown on the Drawings."

"PSL 8.2.19 Marker Blocks (New Sub-Clause)

(a) Give description and reference drawing ..... Unit : Number

The tendered rate shall include full compensation for all excavation and backfill, labour, equipment and materials to manufacture and install the blocks as shown on the Drawings."

"PSL 8.2.20 Connection to existing infrastructure (New Sub-Clause)

(a) Give description and reference drawing ..... Unit : Number

The tendered rate shall include full compensation for the cost of excavation, breaking into, and connection to the existing outfall sewer, removal of surplus material, all labour and equipment necessary to make the connection and all liaison with the local authorities. Contractor to determine the invert level of the outfall sewer pipe before commencing with construction."

PSLB: BEDDING (PIPES)

PSL3 MATERIALS

PSLB3.1 SELECTED GRANULAR MATERIAL (SUBCLAUSE 3.1)

ADD THE FOLLOWING SUBCLAUSE:

Sandy slightly plastic or non-plastic material from trench excavations shall generally be used for bedding purposes and shall not include particles greater than 19 mm diameter.

PSLB3.3 BEDDING (SUBCLAUSE 3.3)

ADD THE FOLLOWING SUBCLAUSE:

All pipes are to be considered as rigid and Class D bedding shall be applicable throughout unless instructed by the Employers Representative that Class C or stone bedding described in Section PSDB be used.

PSLD: SEWERS

PSLD3 MATERIALS

PSLD3.1 PIPES, FITTINGS, AND PIPE JOINTS

ADD THE FOLLOWING TO THIS SUBCLAUSE:

"Sewer pipes and specials shall be heavy duty uPVC Class 34 heavy-duty drainpipes with socketed joints all in accordance with SABS 791. Flexible connections shall be used at manholes as per SABS 1200 Drawing LD-2."

PSLD3.5 MANHOLES, CHAMBERS, Etc.

PSLD3.5.3 Prefabricated Manholes

ADD THE FOLLOWING TO THIS SUBCLAUSE:

Precast concrete manholes shall be acceptable provided that dolomitic aggregate be used and joints between rings be watertight. Brick manholes may be constructed for depths up to 2.0 m and shall be plastered internally with a steel-trowelled finish. Only Engineering grade NFX burnt clay bricks shall be used. Sulphate resisting cement shall be used for all mortar and concrete work.

The maximum chimney length for manholes shall be 600 mm. The minimum chamber depth shall be 1.0 m.

PSLD3.5.7 Step Irons

REPLACE THE FIRST PART OF SUBCLAUSE WITH THE FOLLOWING:

Step irons shall be manufactured from a polypropylene copolymer.

PSLD7.2 TESTING

PSLD7.2 Tests and Acceptance/Rejection Criteria

ADD THE FOLLOWING TO THIS SUBCLAUSE:

All acceptance tests shall be carried out in the presence of the Employers Representative in accordance with the air test.

PSLD8 MEASUREMENT AND PAYMENT

PSLD8.2 SCHEDULED ITEMS

PSLD8.2.3 Manholes

Depth of manholes, located within the internal road reserve shall be defined as the distance from roadbed level to the lowest invert level of the manhole. The manholes that are located on the outside of the internal road reserve, such as the external outfall sewer, are measured from the top of the cover to the invert level of the manhole. In the latter case the top of the sewer manhole cover must be raised 150 mm above natural ground level.

PSLD8.2.11 Connection to Existing Sewers

The sewer line will connect to the existing council manhole as indicated on the drawings. The rate for this item will include for extra excavation, backfilling, breaking into the manhole or pipeline dealing with the existing flow, connecting and modifying the benching in manholes, ensuring no foreign matter enters the existing sewer and making good.