

PART B: AMENDMENTS TO THE STANDARD AND PARTICULAR SPECIFICATIONS

INTRODUCTION

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

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

PSA GENERAL

PSA-3 MATERIALS

PSA-3.1 Quality

Where there is a standardization mark programme for any material, all such material supplied shall bear the official standardization mark.

Alternative materials or equipment proposed by the Contractor shall be tested. The test, as well as the materials or equipment, shall be approved by the Engineer prior to any such materials or equipment being built into the works and all costs involved in testing shall be deemed to be included in the rates tendered.

PSA-4. PLANT

PSA-4.2 Contractor's Office, Stores and Services

It is not a requirement of this contract that the Contractor provide an approved field laboratory on site, although he may elect to do so. If no laboratory is provided, the Contractor shall nevertheless arrange to have the required quality control tests (e.g. densities and pressure testing of pipelines) performed by an approved commercial laboratory, and his tendered rate shall include full compensation for such tests.

The Contractor's camp shall be kept neat and clean at all times and all surplus or rejected material shall be removed from the site.

PSA-5 CONSTRUCTION

PSA-5.1 Survey

PSA-5.1.1 Setting out of the Works

For any new work the Contractor shall establish his own reference lines from which the work can be set out. Such reference lines shall be checked and approved by the Engineer before commencement of construction.

PSA-5.5 Dealing with water on works

- **Add the following:**

The Contractor shall take the necessary steps as described in clause 5.5 to protect the works. The Contractor will be held responsible for damage caused by storm water and groundwater during construction and he shall ensure that the situation is monitored during weekends and holidays.

PSA-5.6 Pollution

- **Add the following to this sub clause :**

"The Contractor shall maintain all access roads and the area where the offices, stores and workshops are situated to the satisfaction of the Engineer. It shall be kept damp to limit dust and inconvenience or disturbance to the residents in the neighbourhood of the works to a minimum."

PSA-5.8 Ground and access to works

- **Add the following:**

On completion of operations the Contractor shall restore the ground surface, wherever it may have been disturbed, to its original condition by filling in all ruts with material similar to the material within the rut and leveling the ground and, where necessary, planting grass and shrubs as may be required. Any boundary fences which have been removed or damaged by his operations and activities shall be repaired and/or reinstated at the Contractor's expense

PSA-8. MEASUREMENT AND PAYMENT

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

PSA-8.3.2 Establishment of Facilities on the Site

PSA-8.3.2.2 Facilities for Contractor

For this contract the sub-items of clause 8.3.2.2 are consolidated into one item and the facilities for the Contractor will not be measured and paid for separately as itemized in sub clause 8.3.2.2. Payment under item PSA-8.3.2.2 shall therefore be deemed to cover sub-items (a) to (j).

PSA-8.4 Scheduled time-related items

PSA-8.4.2.....Operation and maintenance of Facilities on Site

PSA-8.4.2.2 Facilities for Contractor

Consolidate sub-items (a) to (j) of Clause 8.4.2.2 into one item as in PSA-8.3.2.2.

Payment under PSA-8.4.2.2 shall be deemed to cover sub-items (a) to (j).

PSA-8.5 Sums stated provisionally by Engineer

- **Add the following sub-items:**

“(c) Additional tests

(1) Additional tests ordered by Engineer..... Unit: Provisional Sum

(2) Handling cost and charges on (c)(1)..... Unit: Percentage

The stated provisional sum is provided for additional tests ordered by the Engineer. The

provisional sum shall cover the cost of tests specifically ordered by the Engineer to his discretion and executed by an approved commercial laboratory.”

PSA-8.8 Temporary works

PSA-8.8.2 Dealing with traffic

- **Add the following to the payment paragraph:**

"The tendered sum for item 8.8.2 shall include the safeguarding of all excavations by means of suitable barricades approved by the Engineer as well as covering up of excavations while awaiting installation of valves and meters. The tendered sum will be paid to the Contractor on a monthly basis and payment will be withheld permanently for any month during which the excavations have not been safeguarded to the satisfaction of the Engineer."

PSA-8.8.4 Existing services

- **Change the unit of measurement of subitems (a) and (b) from "Day or Sum" to "Provisional Sum."**

The stated provisional sum shall be employed to cover the cost for the supply and use of the electronic equipment as instructed by the Engineer to determine the position of services.

- **Add the following additional sub item:**

"(e) Reinstatement of damaged services and deviation of existing services Unit: Provisional Sum

The stated provisional sum shall cover the cost of reinstatement of services damaged as result of circumstances beyond the control of the Contractor, or the deviation of existing services as ordered by the Engineer. Damage to known services will be the responsibility of the Contractor."

PSA-8.8.6 Special water control in terms of the project specificationUnit: Sum

- **Add the following to the payment paragraph:**

"The tendered sum shall, in addition to the requirements of Clause 5.5, also cover the cost of standby dewatering pumps to keep excavations dry, as well as equipment such as a lighting plant, generators, spares and tools necessary to cope with emergency situations during shut-downs."

PSA-8.8.7 Supply and install electrical connection for pumps and backup powerUnit: Sum

The stated provisional sum is provided for the supply of electrical power connection and installation to the new water pump station and for backup power connection to IDC 1 and IDC 2.

The stated provisional sum shall cover the cost of all electrical materials necessary and installation and associated works to render power supply and backup power to the new water pump stations for IDC 1 and IDC 2 as ordered by the engineer. The exact position, route and quantity will be determined on site with the electrician and engineer.

PSAB ENGINEER'S OFFICE

PSAB-3 MATERIALS

PSAB-3.1 Name boards

The layout of the required name boards shall be provided to the contractor once appointed.

PSAB-3.2 Office Buildings

For this project, offices for the Engineer shall be provided as described in the Bill of Quantities.

Furnishing of the office buildings shall include an air-conditioning unit approved by the Engineer as part of each office. The unit shall be a compressor type with closed circuit and not an evaporation type. The capacity of the unit shall be at least 3 kW. The Contractor shall provide the necessary power for operating the unit.

The offices must also be equipped with a drawing rack of sturdy wood, to house at least 50 A1 drawings on six notches.

PSD EARTHWORKS

PSD-1 SCOPE

- **Add the following:**

“All excavations on this contract must be done by hand (labor intensive methods).”

PSD-3 MATERIALS

PSD-3.1 Classification for Excavation Purposes

PSD-3.1.2 Classes of excavation

For the purpose of this contract the materials to be excavated will be classified as soft excavation and hard excavation only.

(a) Soft excavation

- **Add the following sentence:**

“Soft excavation shall be material excavation as defined in subclause 3.1.2(b).”

(b) Hard excavation

- **Replace subclauses 3.1.2(c), (d) and (e) with the following:**

“Hard excavation shall be excavation other than material classified as soft excavation.”

PSD-5 CONSTRUCTION

PSD-5.1 Precautions

PSD-5.1.1 Safety

PSD-5.1.1.2 Safeguarding of excavations

- **Insert the following after paragraph (b)(2), before paragraph (c):**

“The Contractor or his agent or his representative shall **not** require or allow any person to work under unsupported overhanging material or in an excavation which is more than 1,5 m deep, and any excavation which has not been adequately supported or braced if there is a danger of the overhanging material or the sides of the excavation collapsing. The support, shoring or bracing to be designed and constructed by the Contractor, shall be strong and sturdy enough to support the sides of the excavation in question.”

PSD-5.1.1.3 Explosives

- **Add the following**

“The use of explosives in the proximity of services is subject to the approval and conditions stipulated by the service authority.

When blasting is permitted, only light charges shall be used. The Contractor shall in all cases be entirely responsible for any damage caused by blasting operations, and shall settle all claims resulting at his own expense.

The Contractor shall also note the following:

- (a) Inter-shot delay between rows shall be a minimum of 25 milliseconds.
- (b) Charge per delay shall be in accordance with AECI specifications for blasting adjacent to private property.
- (c) All underground services shall be treated as structures.

(d) PPV shall not exceed 12 mm/s at a frequency of not less than 10 Hz.

(e) Preference shall be given to the "Handidets" system.

The Contractor shall conform to all statutory and other regulations regarding blasting and the handling of explosives. All blasting shall be done under the control of persons holding valid blasting certificates for blasting in streets.

The Contractor shall make his own arrangements for the supply, transport and storage of all explosives and detonators in accordance with the requirements of the Chief Inspector of Explosives and the South African Police Services.

Explosives and detonators may be kept on the site outside normal working hours only if proper magazines are installed and maintained in accordance with all requirements of the above mentioned authorities.

No separate or additional payment will be made for blasting. The Contractor shall allow for all blasting costs in his prices for the relevant items of earthworks, excavations, demolitions etc.

The Contractor shall sign a Blasting Indemnity on award of the contract".

PSD-5.1.2 Existing services

- **Add the following additional sub clauses:**

"PSD-5.1.2.5 Movement of existing services

Except where otherwise indicated, the Contractor shall not alter, or in any way interfere with, existing works or services. Where such works are required to be moved on account of unsuitable levels or situation, adequate notice shall be given to the Engineer, who will arrange with the department or authority concerned for the work to be carried out.

Where the Engineer requires the Contractor to move existing works or services, or to execute work in connection therewith, the cost of such work will be paid for in accordance with the items provided in the Bill of Quantities, or as otherwise provided for in the contract.

The Contractor will not be entitled to any additional payment as a result of delays occasioned by the alteration of existing works or services and the tendered rates must include suitable allowance for the possible occurrence of such delays.

The Contractor must allow for the protection of existing services, buildings and structures in the tendered rates as there will be no separate payment for the protection thereof."

PSD-5.2 Methods and procedures

PSD-5.2.2 Excavation

- **Add the following additional subparagraph:**

"(f) Unsuitable and surplus excavated material shall be disposed of on sites selected by the Contractor and approved by the Engineer.

The Contractor shall, unless otherwise indicated, be entirely responsible for deciding whether or not any material, excavated or other, is surplus to that required for the full construction and reinstatement of the works, for the loading, transporting away, and unloading and spreading of such material at the approved or designated location. Excavated material shall be deemed to include loose surface boulders and rocks.

The tendered rates for the various items in the Bill of Quantities shall include loading, all transport costs, unloading and spreading/tipping charges etc.

Should it be necessary to reclaim or replace material previously disposed of in order to complete the works, all costs involved in recovering such material shall be borne by the Contractor.

The Contractor will be responsible for the settlement of all claims arising from any act or omission of his workmen in disposing of surplus material.”

PSD-5.2.3 Placing and compaction

PSD-5.2.3.2 Backfilling of trenches and backfilling or filling against structures

(a) General

Unless otherwise authorized by the Engineer, no backfilling or filling against structures shall commence until the concrete has been in place for at least 14 days.

The material to be compacted against structures shall be compacted in layers of 150 mm thick at OMC to at least 93 % of modified AASHTO density.

PSD-5.2.4 Finishing

PSD-5.2.4.2 Top soiling

- **Add the following:**

"Topsoil shall be obtained from material previously stockpiled on site or from sources found by the Contractor if adequate material is not available on site".

PSD-5.2.4.6 Final finishing and clearing up *(New sub clause)*

After completion of construction, including kerbing, storm water structures and bituminous surfacing, the site shall be cleaned of all loose stones, waste material, rubble and debris resulting from the operations of the Contractor.

The Contractor shall take care not to damage existing works during finishing and clearing up operations. Any damage to roads, kerbing and channeling, drains, cut and fill slopes and services caused by Contractor's final finishing and clearing up operations shall be repaired by the Contractor at his own cost to the satisfaction of the Engineer.

PSD-5.2.5 Transport for earthworks

PSD-5.2.5.1 Freehaul

For this contract all haul will be regarded as free haul and the cost of transportation of all materials will be deemed to be included in the rates and prices tendered in the Bill of Quantities.

PSD-5.2.5.2 Overhaul

The freehaul distance for this contract is unlimited and no payment will be made for overhaul.

PSD-5.2.6 Trenches in road reserves and paved areas *(additional sub clause)*

Before proceeding with any excavation work within road reserves the Contractor shall obtain the permission of the University of Johannesburg, and comply with their requirements.

Should it be found during the course of excavation that the bearing strength of the material at the indicated founding depth is insufficient; the excavation shall be extended at the discretion of the Engineer until satisfactory founding material is encountered. The difference in levels between the extended excavation and the indicated bedding or founding level shall be made up with suitable foundation fill.

Foundation fill, consisting of granular material, shall be constructed in layers not exceeding 150 mm in thickness after compaction. Each layer shall be moistened or dried to the optimum moisture content for the material and compacted to a density of not less than 95% of modified AASHTO density.

Mass concrete fill to be used shall be Class 15 MPa/19 mm or as may be prescribed by the Engineer.

After construction of valves, meters, strainer chambers and pipe work etc., the excavations surrounding the chambers and pipe trenches shall be backfilled in layers not exceeding 100 mm in depth and each layer shall be compacted to a density not less than the density of the surrounding ground or the density of the paving layers where excavations were made in existing road pavements.

Any subsidence of reinstated areas shall be made good by the Contractor at his expense during the period of maintenance.

The Contractor shall be responsible for procuring approved imported material which complies with the requirements of the relevant specifications.

PSD-7

TESTING

PSD-7.2

Taking and Testing of samples

- ***Add the following:***

"All test results and the positions where samples were taken by the Contractor for his own quality control, must be submitted to the Engineer. The number and positions of tests shall be adequate to prove to the Engineer that the works as a whole comply with the requirements. (Refer PS-6 of Part A of the Project Specification). The minimum frequency of testing shall be one test per 20 m² compacted per layer material.

The Engineer will audit the Contractor's test results and he may, for acceptance control, have additional tests carried out by an independent commercial laboratory at the Employer's cost and he will make the results available to the Contractor (acceptance control). However, payment for such additional testing ordered by the Engineer will be made under PSA-8.5. Should these test results show that the work or the material does not comply with the specifications the Contractor will be responsible for the cost of such testing and he shall do the necessary remedial work."

PSDB **EARTHWORKS (PIPE TRENCHES)**

PSDB-3 **MATERIALS**

PSDB-3.1 **Classes of excavation**

• ***Replace the entire subclause with:***

“The excavation of material will be for the purposes of measurement and payment classified as specified in clause PSD-3.1.2.”

PSDB-3.7 **Selection**

The Contractor shall use selective methods of excavating for the purpose of providing suitable bedding materials for the pipelines from the excavated material.

PSDB-5 **CONSTRUCTION**

PSDB-5.1 **Precautions**

PSDB-5.1.4 Existing services that intersect or adjoin trenches

The Contractor shall make himself acquainted with the position of all existing services before any excavation or other work likely to affect the existing services is commenced. A separate scheduled item makes provision for the location of existing services using special electronic equipment and exploration digging. All services detected shall be marked up on the drawings and shall be deemed to be “known services”. The Contractor shall complete the investigation well in advance of the start of the construction of that section and must submit a report to the Engineer in good time.

The use of mechanical equipment for excavation in the vicinity of the existing services will not be permitted, nor will the use of explosives be allowed beneath and/or within 5,0 m of these services. Written permission to use explosives must be obtained from the Engineer.

The rates for excavation shall allow for excavation to the required depth and in all classes of material encountered.

Any damage shall be reported to the Engineer and the owner, without delay. Depending on the nature of the service damaged, the Engineer will rule whether the Contractor shall make good the damage or whether the owner of the service will be called upon to make the repairs on behalf of the Contractor. In any event the cost of the repairs to known services shall be to the Contractor's account.

PSDB-5.1.5 Safety and trench excavations *(additional sub clause)*

The Contractor shall take all the steps necessary to ensure that no person is required or allowed to work in a trench or any other unsupported overhanging excavation which is more than 1,5 m deep, or any excavation that has not been adequately supported, shored or braced if there is any danger whatsoever of the sides of the excavation collapsing. The support, shoring or bracing to be designed and constructed by the Contractor shall be strong and sturdy enough to support the sides of the excavation in question.

The Contractor shall provide all open and close timbering, strutting and shoring required for the safety of the excavations and any structures adjacent to the works and he shall be solely and entirely responsible for ensuring that these measures are sufficient for the purpose. Without in any way affecting or diminishing the Contractor's responsibility the Engineer shall have the right to instruct the Contractor to provide additional or improved timbering, shoring or strutting where he considers this necessary, and the Contractor shall have no claim for additional payment on this account.

Unless explicitly stated, no separate or additional payment will be made for timbering and shoring and allowance must be made for this work in the tendered rates for the relevant items in the Bill of Quantities.

PSDB-5.1.6 Trenches within roadways *(additional sub clause)*

When trenches fall within surfaced roadways the asphalt or bitumen surface of the trench edge shall be cut neatly with a rotary saw prior to mechanical excavation. The blacktop surfacing of the existing carriageway shall then be ripped up, removed and disposed of as

surplus material. Excavation of the base and sub base layers below the blacktop surfacing will be considered as normal excavation in soft material and shall be paid for as such.

PSDB-5.3 Site Clearance

- **Add the following to the sub clause:**

“The Contractor will be allowed to clear and grub a strip 2,5 m wide along the centre-line of the trench. No vegetation outside this strip may be damaged without the written approval of the Engineer.

All trees with a girth of 250 mm or more or a height of 2,5 m within this strip, shall be protected and may only be cut or removed after a written order by the Engineer.

The cutting of asphalt road pavements and removal of asphalt will also be measured under site clearance.”

PSDB-5.4 Excavation

- **Extend the sub clause to include the following:**

“The Contractor shall plan his operations in such a manner that the length of trench excavation remaining open shall be restricted to the absolute minimum. No excavations for pipes may be commenced until the pipes to be installed are on site, and the excavations shall be backfilled within seven days after the pipes have been installed.

Trenches and excavations may not be left open over weekends or holidays.

Unless otherwise permitted by the Engineer in writing the total length of open trench shall not exceed 100 m. Regardless of any approval or permission granted by the Engineer, the Contractor shall comply with any restrictions on length of trench contained in his insurance policy. All manholes, catch pits, kerb inlets, etc. shall be completed and backfilled at the same time as the installation of the prefabricated pipes. Excavations shall be opened and backfilled as rapidly as possible to ensure that trench lengths are kept to a practical minimum.

No water shall be allowed to accumulate in any portion of the excavations. The excavations shall be protected against any water entering them whether by seepage, leaking services, rain, storm, flood or any other means. Any water found in excavations shall immediately be removed by pumping or bailing.

It is the Contractor's responsibility to keep all excavations free of water and the Contractor must supply all pumps etc that may be necessary for the clearing out of water. Water must be cleared in such a way that it cannot seep or flow back into the excavations.

The Contractor shall make allowance for this work in the tendered rates for the relevant items in the Bill of Quantities.”

PSDB-5.5 Trench bottom

- **Extend the sub clause to include the following:**

“(a) On completion of excavation, before the bottom is trimmed or bedding is placed, the bottom of the trench in suitable material shall be so compacted that the density of the upper 100 mm thick layer of material is 90% of modified AASHTO density.

(b) Should the nature of the material be such that the specified density cannot be achieved, the bottom of the trench shall be over-excavated, the bottom of over-excavation compacted, and the excavated material replaced and compacted. The depths of over-excavation, which shall be agreed with the Engineer, shall be such that the specified density is attained at the bottom of the trench.”

PSDB-5.6 **Backfilling**

PSDB-5.6.1 General

Notwithstanding the requirements of sub clauses 5.6.1 and 5.6.6 of SANS 1200 DB, no pipe joint or fitting shall be covered by either the blanket or the backfill prior to the successful completion of the visual inspection and the pressure testing of the relevant section of the pipeline.

- PSDB-5.6.2 Material for backfilling
- Hard rock material excavated from the trenches shall not be incorporated in the backfill above the bedding.
- PSDB-5.6.3 Disposal of soft excavation material
- Unsuitable or surplus material shall be disposed of at a legal spoil site found by the Contractor and approved by the Engineer.
- PSDB-5.6.8 Transport for earthworks for trenches
- The free haul distance for this contract is unlimited and no payment will be made for overhaul.
- PSDB-5.7 Compaction**
- PSDB-5.7.2 Areas subject to traffic loads
- Add the following:***
- "Pipes laid below structures or buildings shall be sleeved or encased in concrete as shown on the drawings.
- Trenches in trafficked roadways shall be backfilled level with adjacent surfaces immediately after completion of pipe laying and successful testing. Should pipe-laying not be completed before work is due to cease for the day, the Engineer will be entitled to instruct the Contractor to temporarily backfill the trench and re-excavate it the following day in order to complete pipe laying. The cost of the above activity shall be included in the Contractor's rates for excavation.
- Buttresses left in soft ground to support the sides of trenches or headings for access to properties shall be broken down during backfilling and compaction.
- Simultaneously with the backfilling of a branch pipeline trench, backfilled material in the main pipeline trench shall be stepped or raked back and compacted in layers not exceeding 0,30 m compacted thickness."
- PSDB-5.8 Construction in headings**
- ***Add the following:***
- "Generally in soft material the buttresses and portions of ground left for the purpose of supporting the sides of the trenches or headings providing access to private properties, shall be broken down as the backfilling and compaction proceeds."
- PSDB-5.9 Reinstatement of services**
- PSDB-5.9.2 Private property and commonage
- Restoration of servitudes, parks, roadways and sidewalks, etc, shall be with the same type of surfacing and to at least the same standard and condition that existed before excavation took place.
- Grass sods shall be neatly cut from grassed areas to be excavated and shall be preserved and kept damp until they can be replaced during reinstatement. All other materials which can be preserved for use in reinstatement shall be carefully preserved and stored for such use.
- Should the Contractor fail to reinstate the surface of any trench within fourteen days of the pipeline concerned having been approved, the Engineer may, at his discretion, arrange for such reinstatement to be carried out by some other agency and the cost of this work shall be deducted from monies due to the Contractor. The Contractor will not be relieved of any responsibility for defects or claims arising from the condition of any trench reinstated by an outside agency on the instructions of the Engineer.
- No separate or additional payment will be made for costs in respect of the reinstatement of excavated or disturbed earth or other natural surfaces and the Contractor shall make

suitable allowance for this work on his tendered rates for excavation. Reinstatement of grassed, paved and other improved surfaces, fences, walls etc., and the replacement of shrubs and trees will be separately measured and paid for, provided that, in the opinion of the Engineer, such reinstatement was not necessitated by any negligence on the part of the Contractor.

PSDB-5.9.5 Bitumen roads: Surfacing

All precast concrete kerbing, paving slabs, road paving and foundations disturbed by the works shall be carefully removed and set aside for subsequent re-use and placed where directed.

PSDB-5.9.6 Maintenance of reinstated surfaces

In the event of a serious subsidence or failure taking place during the course of the work or during the maintenance period, the Contractor shall immediately take all necessary steps to make the subsidence safe and repair the damage. The Employer reserves the right, however, in cases of emergency to take all necessary measures, including lighting or barricading, refilling, reinstatement and repairing, and to charge the cost thereof to the Contractor if the subsidence or failure is a result of the Contractor's non-compliance with the Specifications. Such action by the Employer shall not relieve the Contractor of his liability to meet all claims arising out of the occurrence of subsidence.

The Contractor will in such cases be charged with the actual total cost of any reinstatement resulting from a subsidence which necessitates removal of surfacing material, importation of additional fill materials, compaction and reinstating of the surface.

PSDB-7 **TESTING**

PSDB-7.1 All test results and the positions where samples were taken by the Contractor must be submitted to the Engineer. The number and positions of tests shall be adequate to cover all parts of the work as necessary.

The following are the minimum frequencies for the process control tests to be executed by the Contractor:

- (a) Pipe bedding: one density test on each 50 m of pipe trench.
- (b) Normal trench backfilling: one density test on every second layer for every 50 m of pipe trench.
- (c) Backfilling in areas subject to vehicle loads: one test on each layer of 150 mm at each road crossing.

The positions of these minimum numbers of density tests shall be determined randomly and shall be clearly documented with the results. The results of the tests shall be submitted to the Engineer and shall prove to the Engineer that the work as a whole was done satisfactorily.

The Engineer may order additional tests, over and above the minimum tests. Payment for these tests will be made under Item PSA-8.5 if the tests indicate that the density is as specified. If any tests show non-compliance with the specification then the cost of such tests shall be for the account of the Contractor.

PSDB-8 **MEASUREMENT AND PAYMENT**

PSDB-8.1 **Basic Principles**

- ***Add the following to the sub clause:***

"The tendered rates for excavation shall (except where specifically measured separately) include timbering and shoring, trimming, selecting and transporting backfill material from any source, backfilling, compacting to 90% of modified AASHTO density and testing, removing surplus and spoil material, reinstatement of natural surfaces and all incidental work necessary".

PSDB-8.3 **Scheduled items**

PSDB-8.3.1 Site clearance and removal of topsoil

• **Add the following sub item:**

“(d) Removal of Brick paving in roadway and sidewalks.....Unit : m²

The tendered rate for item (d) shall include the cost for removal of the brick paving, stockpile for reuse later in the contract.

PSDB-8.3.2 Excavation

• **Revise the description of sub item (a) as follows:**

(a) Hand excavate in all materials, for trenches, backfill, compact and dispose of surplus materialUnit: m³

Only lengths that have been completed and backfilled will be measured for payment. Payment will be made in two installments, 80% at completion of the excavation and backfilling and the final 20% after final approval which will take account of surface finishing, disposal of all unused material and acceptance of all test results including welding tests and hydraulic testing of the pipe as specified.

The rates tendered for excavation shall include backfilling at any point or points as the Engineer may direct and the disposal of surplus and unsuitable material at a site found by the Contractor. The rates shall also include the cost of selective excavation as specified in PSDB-3.7 in the foregoing.

PSDB-8.3.3 Excavation ancillaries

PSDB-8.3.3.4 Overhaul

Overhaul will not be applicable to this contract.

PSDB-8.3.6 Finishing

• **Add the following additional sub items:**

“PSDB-8.3.6.2 Reinstate surfaces other than road surfaces

(a) Instant lawn on sidewalks (*state type of grass*). unit: m²

(b) Segmented paving on sidewalks and roadways using:

(1) Recovered paving blocks. unit: m²

(2) New paving blocks (*to match existing paving*)..... unit : m²

The tendered rate for sub item (a) shall cover the cost of reinstatement of the surface with grass or grass sods previously stockpiled as specified in PSDB-5.9.2.

The tendered rate for sub item (b) shall cover the cost of reinstating block-paved areas using paving blocks removed for excavations, or new, matching paving blocks to replace broken paving blocks or for new paving.

PSGA CONCRETE (Small works)

PSGA-3 MATERIAL

PSGA-3.2 Cement

The cement used in the works shall comply with SANS 50197-1 for common cements. The following types of cement are suitable for use on this project:

CEM I 32,5

CEM II/A-S 32,5

CEM II/B-V 32,5

PSGA-3.2.2 Storage of cement

Consignments of cement shall be stored in such a way that they are used in the same sequence as they are delivered on the site. Any cement that shows any degree of hydration and setting or which has been stored on the site for a period exceeding twelve weeks from the date of despatch by the manufacturer shall be removed from the site of the works and replaced at the Contractor's own expense.

PSGA-4 PLANT

PSGA-4.4 Formwork

PSGA-4.4.2 Finish

All off-shutter concrete shall be smooth. All surfaces not shuttered shall be wood-floated.

PSGA-4.4.3 Ties

Formwork ties in water-retaining structures shall be of the 12 mm Extended Coil Tie with Water-Bar type by Form-scaff. No ferrules or ferrule pipes may be used in structural elements of water-retaining structures. The Contractor shall allow in his rates for the specified formwork ties and ensure that his formwork is compatible with these ties.

After removal of plastic spacing cones of the extended coil ties from concrete, the openings in the concrete shall be roughened with a mechanical wire brush. Thereafter the openings shall be painted with cement mortar and filled with a non-shrink grout such as "Standard Bedding Grout" by Samson or a similar approved non-toxic product compatible with the chemicals used in the water. The grout filling shall be applied in such a way as to protect the ties against corrosion.

PSGA-5 CONSTRUCTION

PSGA-5.1 Reinforcement

PSGA-5.1.2 Bending

No flame cutting of bars will be permitted except with the written approval of the Engineer. Hot-bending of bars will not be permitted. Bars already bent may not be straightened and re-used.

PSGA-5.1.2 Fixing

Welding of steel reinforcement will not be allowed.

PSGA-5.1.3 Cover

The minimum concrete cover to reinforcement shall be 40 mm.

PSGA-5.2 Formwork

PSG-5.2.1 Classification of finishes

- **Add the following additional sub clauses:**

“(c) Special off-shutter finish

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

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

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

(d) Top of floors and roof slabs

The top of the floors and roof slabs shall have a wood-floated finish.

(e) Visible corners

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

PSGA-5.4 **Concrete**

PSGA-5.4.1 Quality

PSGA-5.4.1.2 Consistency

The slump for all concrete shall be between 50 mm and 75 mm.

PSGA-5.4.1.5 Strength Concrete

The classes of concrete to be used are specified in the Bill of Quantities.

The Contractor shall design trial mixes for each strength specified in accordance with SANS 10100-2, 1980, Appendix B. The target strength of the trial mix shall be determined using K equal to 1,7 and a standard deviation 5 MPa for a "good" degree of site control. The average 28 day cube strength of the trial mix shall be equal to or exceed the target strength with no test cube strength below the specified design strength. The Contractor shall submit the trial mixes and the 7 and 28 day test results to the Engineer for approval. No concreting may proceed until the trial mixes have been approved.

PSGA-5.4.1.6 Ready-mixed Concrete

Ready-mixed concrete will be allowed on the site, provided that it complies with the requirements of this specification. The prior approval of the Engineer is however required, as well as test results of the concrete used.

- **Add the following additional sub clause:**

“PSGA-5.4.1.7 Durability

The maximum water: cement ratio shall be 0,5.

PSGA-5.4.3 Mixing

- **Replace sub clause (e) with the following:**

"(e) Concrete shall be placed within thirty minutes after the start of mixing".

PSGA-5.4.6 Compaction

PSGA-5.4.6.3 Only mechanical vibrators shall be used for the compaction of the concrete. Any other method of compaction may only be used with the written approval of the Engineer.

PSGA-6 TOLERANCES

PSGA-6.1 **Basis of measurement**

PSGA-6.1.1 General

All concrete, excluding blinding and mass concrete, shall comply with the specified tolerances, except where a different tolerance is shown on the drawings, in which case the specification on the drawing shall prevail.

PSGA-6.4 **Permissible deviations**

Degree of Accuracy II is required.

PSGA-7 TESTS

PSGA-7.1 **Facilities and Frequency of Sampling**

PSGA-7.1.1 Facilities

- **Add the following:**

"For his own quality control the Contractor shall be fully responsible for sampling and testing the concrete at the frequency specified".

PSGA-7.1.2 Frequency of Sampling

- **Add the following:**

"One set of samples shall be taken from each day's casting and from at least every 20 m³ of concrete of each grade placed. More frequent slump tests shall be taken should the consistency of the concrete be seen to vary".

PSGA-8 MEASUREMENT AND PAYMENT

PSGA-8.2 Scheduled Items

PSGA-8.9 Supply and Install Galvanized Steel Support Structure for Sectional Steel Tank complete as detailed on the drawings.Unit: No

The tendered rates shall include all costs necessary for the supply and installation of the Galvanized Steel Support Structure, complete as detailed and specified on the drawings.

PSGA-8.10 Horizontal core drilling 100mm through existing 230mm brick wall......Unit: No

The tendered rates shall cover all the costs required to core drill through the existing brick wall.

PSL **MEDIUM PRESSURE PIPELINES**

PSL-3 **MATERIALS**

PSL-3.1 **General**

Unless otherwise specified, pipes with a diameter of 50 mm OD or larger shall be High impact uPVC Class 16 pipes shoulder ended to suit the standard Victaulic type coupling or similar approved. Fittings and specials are normally Class 16. If required because of problems to maintain minimum cover (extensive rock excavation, narrow section, crossing of sewers or other reasons), uPVC pipes can be encased in concrete where ordered by the Engineer.

PSL-3.8 **Jointing materials**

PSL-3.8.4 Loose flanges

Bolts and nuts shall comply with the relevant requirements of SANS 1700-5-8 and 1700-5-9. Flanges shall be drilled to SANS 1123 or BS 4504, Table 16.

PSL-3.9 **Corrosion protection**

PSL-3.9.5 Joints, bolts, nuts and washers

After satisfactory testing of pipelines all flanged and welded joints, slip-on and shoulder-end type couplings (including bolts, etc) shall be thoroughly cleaned and given two coats of approved bituminous paint on all exposed surfaces.

PSL-3.9.6 Corrosive soil

Where indicated on the relevant drawings pipes, flanged and welded joints, and slip-on type couplings shall have a protective tape wrapping applied in addition to any other protective coating specified. In addition and where so ordered by the Engineer, the pipelines shall likewise have a protective wrapping applied.

The tape shall be applied with a 50 % overlap and in the case of the joints the wrapping shall extend for at least 100 mm on either side of the joint.

The tape shall consist of a petrolatum impregnated tape (Denso tape), shall have a nylon, fibreglass or similar material web, and shall be at least 1,0 mm thick with a minimum tensile strength of 4,4 kg/cm width, and shall be suitable for both machine and hand application. In addition the tape shall be chemically resistant to all common acids and alkali's normally encountered and in particular those prevailing on the site.

PSL-3.10 **Valves**

Valves shall comply with the requirements of the relevant SANS specifications as well as Particular Specification PLK: VALVES.

PSL-3.11 **Manholes and surface boxes**

PSL-3.11.1 Bricks

Notwithstanding the requirements of Sub clause 3.11.1 of SABS 1200L, 230 mm wide hollow concrete blocks with minimum compressive strength 3,5 MPa and filled with Grade 15 MPa mass concrete, will be accepted for valve chamber walls.

PSL-5 **CONSTRUCTION**

PSL-5.1 **Laying**

PSL-5.1.1 General

Where necessary to avoid conflict with sewer manholes, storm water drains or other obstacles, the pipeline may have to be realigned locally as directed by the Engineer.

PSL-5.1.3 Keeping Pipelines Clean

The interior surface of all pipes, specials, valves and fittings shall at all times be kept free

from dust, silt, foreign matter, and access by rodents, animals and birds shall be prevented. Pipes and specials shall not be used as shelter by staff or for the storage of garments, tools, materials, food containers or similar goods. Particular care shall be exercised at all times to prevent faecal contamination of pipe interiors by staff, casual visitors or passers-by.

Metal night-caps approved by the Engineer shall be used to close off the ends of each laid section of pipeline when work is stopped at the end of the day or for longer periods and shall be left on the ends of sections of completed pipe work until such sections are tied-in with the remainder of the completed pipeline.

Notwithstanding the use of night-caps the Contractor shall at his own expense make good all damage to pipe linings and fittings caused by the ingress of dirty water, silt, sand, debris, vermin, insects and other foreign matter. The Contractor shall at his own expense and to the satisfaction of the Engineer clean the interior of the pipeline of such contaminants, failing which the Engineer may order the Contractor to remove the pipes from the trench and replace them with clean pipes at his own cost.

PSL-5.1.4 Depths and cover

- **Add the following sub clause:**

The minimum cover over pipes shall be 800 mm.

PSL-5.1.5 Locating of existing pipes (Additional clause)

The Engineer will indicate the approximate positions of existing pipes on site where new pipelines are to be joined with existing pipelines, or where new pipelines may cross existing pipelines or services. At the indicated positions a trench shall be excavated to locate the existing pipe or service. Payment for locating existing pipes and services will be made under Section 1200 A clause PSDA-8.8.4(c).

After the pipeline has been exposed it will be regarded as a known service.

PSL-5.1.6 Connections to existing pipes (Additional clause)

Before pipe fittings and accessories for connecting with existing pipelines are ordered, the precise dimensions of the existing pipe shall be determined on site. The method of cutting into the existing pipe, the special pipe fittings to be used as well as the dimensions of the pipe fittings shall be determined in consultation with the Engineer.

Where supply pipelines are involved, a suitable date for the connection at each existing pipe must be arranged beforehand with the Engineer and the University of Johannesburg. In order to accommodate the consumers, it may be necessary that connections are made during the night, over weekend or even on Sundays. The Contractor must ensure that all material and accessories are available when starting with such operation in order to complete the work within the shortest possible time.

The date and time for all arranged disruptions of water supply and the duration of the disruptions must be confirmed beforehand with the University of Johannesburg. All consumers who may be affected by such interruption of the water supply must be informed by means of notices or handbills.

PSL-5.5 Anchor / Thrust Blocks and pedestals

Thrust blocks are to be constructed in Class 20 MPa/19 mm mass concrete as shown on drawings.

PSL-5.6 Valve and Hydrant Chambers

PSL-5.6.2 Construction of chambers

Valve and hydrant chambers shall be constructed as detailed on the drawings.

PSL-5.8 Brickwork in Chambers and Manholes

Construction shall be as detailed on the drawings.

PSL-5.11 Connection to existing mains (additional clause)

Connections to existing mains shall be made as detailed on the drawings.

PSL-7 TESTING

PSL-7.3 Standard hydraulic pipe test

PSL-7.3.1 Test pressure and time of test

The maximum working pressure shall be 16 bar and the test pressure for field testing shall be 1,5 times this value.

PSL-7.3.4 General (Additional clause)

All completed pipelines shall be satisfactorily tested hydrostatically and no payment in respect of pipe laying or the supply of pipes and fittings on any section of pipeline shall be made until such tests have been completed.

Hydrostatic tests shall be carried out on approved suitably sized completed sections of the works as pipe laying proceeds.

The Contractor shall be responsible to arrange all aspects of the hydrostatic testing and for the supply of all equipment, material, water for testing and labour required.

The mains shall be carefully and slowly charged with potable water, so that all air is expelled and shall then be allowed to stand full for at least 48 hours before pressure testing is commenced.

Joints shall, except where otherwise approved, be exposed during testing. Except where unavoidable, testing shall not be carried out against closed valves and blank flanges, and other means of blanking off of sections under test shall be provided. Care shall be taken to strut and support the mains wherever necessary during testing such as at ends of pipelines, at bends, etc.

The pressure shall be applied by a manually operated force pump or by a power driven pump which shall not be left unattended during testing. The Contractor shall ensure that pressure gauges are accurately calibrated before testing commences and precautions shall be taken to ensure that the quantity of make-up water pumped into the pipelines during testing is measured.

The test pressure applied to the section of mains being tested shall be such that the pressure in any pipe, fitting or valve in the section does not exceed its specified pressure rating.

The test pressure shall be maintained by the pump for at least one hour and during the period the quantity of make-up water required to maintain the test pressure in the mains shall be measured and all joints shall be carefully inspected for signs of leakage.

The hydrostatic test shall be regarded as satisfactory if the amount of make-up water required during the last hour of the testing period does not exceed 0,005 litres per millimetre of diameter per kilometre of length of the pipelines making up the section for every 30 m head of water, and if no visible leaks were observed at joints, fittings, valves, etc. If any hydrostatic test result is unsatisfactory in any regard, the Contractor shall carry out all necessary remedial measures to approval and the test shall be repeated, all at his expenses.

Water used for hydrostatic testing shall be disposed of in an approved manner without causing damage, nuisance or injury.

The Contractor shall allow for the cost of all labour, equipment, water for testing and material for hydrostatic testing in his tendered rates for supply and laying of pipes and fittings and no separate payment will be made in respect of hydrostatic testing.

PSL-8 MEASUREMENT AND PAYMENT

PSL-8.2 Scheduled items

PSL-8.2.3 Extra-over 8.2.1 for the supplying, fixing, and bedding of valves

- **Add the following:**

Refer to Particular Specification PLK for valve specifications.

PSL-8.2.4 No additional payment will be made for cutting and jointing of any pipes.

PSL-8.2.15 Special wrapping in corrosive soil

- **Change the unit of measurement "m" to "No".**

For this contract special wrapping will be required only for steel flanges, pipe fittings, couplings, etc as described in PSL-3.9.6. The unit of measurement shall therefore be the number of fittings or flanges etc wrapped as described.

PSL-8.2.16 Connection into and tie in with live water main (describe) (additional clause) Unit: No

Connection to the existing water mains shall be as detailed on drawing. The tendered sum for each connection shall include the cost to tie into the existing main including the cost of all additional excavations required to provide working space over and above the necessary trench excavation and excavations previously done for locating existing pipelines, labour, equipment, tools, fittings, pipes, cutting of pipes, specials, removal of end caps/loose flanges, anchor blocks and supervision necessary to complete the connection.

PSL-8.2.17 Elevated Steel Water Tank 4.88 m x 3.66 m x 4.88 m high (4 panels x 3 panels x 4 panels high) (additional clause)..... Unit : No

The tender rate shall cover the cost for the installation of a galvanized bolted sectional steel water tank on the steel support structure (measured elsewhere), complete inclusive of 2 inlet pipes, 1 Vortex outlet, 1x outlet, 1 overflow, 1 scour pipe, 1 x cat ladder with protected cage and lockable access gate, 1 x float level indicators, 1 x raised manhole and 1 vent.

PSL-8.2.18 Water Transfer Pump Set (additional clause)

Complete installation for the works as a whole to be done by a specialist selected sub-contractor.

- (i) Grundfos CR 15-5 booster pump system.....Unit: PC Sum
- (ii) Take delivery of aforesaid booster pump transfer set..... Unit: No
- (iii) Affix aforesaid booster Pump set.....Unit: No
- (iv) Test and commission the a forgoing booster pump set.....Unit: No

The tendered rates shall include all costs necessary for taking delivery and the installation of the transfer pump set complete as indicted under the items provided including testing and commissioning of the pump set.

PSL-8.2.19 Supply and Install Canopy 2.0 m wide x 2.5 m Long over pump set complete as detailed on typical drawing (additional clause).....Unit : No

The tendered rates shall include all costs necessary for the supply and installation of the canopy, complete as specified on the drawings.

PSL-8.2.20 Elevated Steel Water Tank 2.44 m x 1.22 m x 2.44 m high (2 panels x 1 panels x 2 panels high) (additional clause)..... Unit : No

The tender rate shall cover the cost for the installation of a galvanized bolted sectional steel water tank on the steel support structure (measured elsewhere), complete inclusive of 2 inlet pipes, 1 Vortex outlet, 1x outlet, 1 overflow, 1 scour pipe, 1 x cat ladder with protected cage and lockable access gate, 1 x float level indicators, 1 x raised manhole and 1 vent.

PSL-8.2.21 Water Transfer Pump Set (additional clause)

Complete installation for the works as a whole to be done by a specialist selected sub-contractor.

- (j) Grundfos CR 5-10 booster pump system.....Unit: PC Sum
- (ii) Take delivery of aforesaid booster pump transfer set..... Unit: No
- (iii) Affix aforesaid booster Pump set.....Unit: No
- (iv) Test and commission the a forgoing booster pump set.....Unit: No

The tendered rates shall include all costs necessary for taking delivery and the installation of the transfer pump set complete as indicted under the items provided including testing and commissioning of the pump set.

PSLB BEDDING (PIPES)

PSLB-3 MATERIALS

PSLB-3.3 Bedding

All buried pipes shall be bedded on Class B bedding unless otherwise ordered by the Engineer or specified in the Bill of quantities.

PSLB-3.4 Selection

Suitable selected bedding material is expected to be generally available from trench excavations along the pipe routes.

PSLB-5 CONSTRUCTION

PSLB-5.1 General

PSLB 5.1.1 Trench

PSLB-5.1.1.2 Bottom

Where unsuitable material is encountered in the bottom of a trench, the material shall be excavated an additional 150 mm, or to the depth as directed by the Engineer, and removed as described in clauses 5.5 and 8.3.2(c) of SANS 1200 DB. The excavated material shall then be replaced with suitable selected material excavated elsewhere on the site, and trimmed and compacted to the satisfaction of the Engineer.

PSLB-6 TOLERANCES

PSLB-6.1 Moisture content and density

Degree II accuracy shall be applicable.

PSLB-8 MEASUREMENT AND PAYMENT

PSLB-8.1 Principles

PSLB-8.1.3 Volume of Bedding Materials

- **Add the following:**

"The volume of bedding material shall exclude the volume taken up by the pipe".

PSLB-8.2 Scheduled Items

PSLB-8.2.5 Overhaul of material for bedding cradle and selected fill blanket

For this contract freehaul is not limited and no payment will be made for overhaul.

PART 3: PARTICULAR SPECIFICATIONS

In addition to the Standardized and Project Specifications the following Particular Specifications shall apply to this contract and are bound in hereafter.

PLK: VALVES

PCD: PALLISADE FENCING (STEEL)

PARTICULAR SPECIFICATION PLK: VALVES

CONTENTS

PLK-1	GENERAL
PLK-2	BUTTERFLY VALVES
PLK-3	GATE VALVES
PLK-4	AUTOMATIC AIR RELIEF VALVES
PLK-5	SPINDLES AND CAPS
PLK-6	FIRE HYDRANTS
PLK-7	MANUAL OPERATING MECHANISMS
PLK-8	MEASUREMENT AND PAYMENT

PLK VALVES

PLK 1 GENERAL

Valves shall be chosen by suitability for purpose, shall be of well-proven concept and shall, where possible, be resilient seated for bubble-tight shut-off.

All valves shall be manually operated.

Valves located to facilitate the removal of magnetic flow meters shall be located no closer to the relevant flow meters than recommended by the flow meter manufactures.

Unless otherwise specified elsewhere, all valves shall be rated PN16. Flanged valves shall have PN16 flanges to BS 4504 or SANS 1123, Table 16. All standard valves shall be suitable for frequent operation and for infrequent operation after long periods in the open or closed condition.

Unless otherwise specified elsewhere, valve components shall be of materials not inferior in strength or resistance to corrosion to those listed below:

Bodies, bonnets, covers, cowls discs and hinges	Spheroidal graphite iron to BS2789 grade 500/7 or cast iron to BS1452 grade 220
Pistons, sleeves, liners, guides bushes, seats, seat rings, seal holders and stem nuts:	Bronze to BS1400 gunmetal to BS1400 grade LG2
Hinge pins:	Bronze to BS2874 grade PB102
Stems:	Stainless steel to BS970: Part 4, grade 431 S29

All cast iron parts shall be coated in accordance with BS4164

Hand wheels for valves shall be cast iron or aluminium and of a robust pattern with corrugated periphery. Arrows shall be provided on all hand wheels to indicate the direction of opening which shall be anticlockwise.

Valves shall be capable of being opened and closed manually by one person only when the specified maximum unbalanced pressure is applied to the valve in use. Under this condition the force required to open the valve from the closed position shall not exceed 125 N at each of two diametrically opposite points on the rim of the hand wheel or at each end of the Tee key (i.e. the 'combined push-pull' effort needed shall not exceed 250 N)

Working drawings and details of valves shall be submitted to the Employer's Representative for approval prior to procurement.

Each type of valve shall be obtained from a single approved manufacturer.

PLK 2 BUTTERFLY VALVES

Butterfly valves shall be double flanged short with resilient seats, all in accordance with BS5155 unless otherwise approved by the Employer's Representative.

Butterfly valves shall be lockable in either open or closed positions.

PLK-3 GATE VALVES

Gate valves 50 mm and larger shall be of the non-rising spindle type with inside screw, type Vosa or similar approved with socket end for UPVC or flanged as specified. Facilities shall be provided for repacking the gland whilst the valve is under pressure in the open or closed position.

Each valve shall be suitable for flow in either direction and shall be works-tested in accordance with the requirements of BS5150 and BS5163, open-ended in each direction.

Gate valves 40 mm and smaller shall be cast brass to SANS 776 type Cobra or similar

approved.

PLK 4 AUTOMATIC AIR RELIEF VALVES

Automatic air relief valves shall be designated to meet the following conditions:

- (a) Discharge air during charging of the pipeline;
- (b) Admit air during emptying of the pipeline;
- (c) Discharge air accumulated at local peaks along the pipeline under normal operating conditions.

Conditions (a) and (b) shall be met by the employment of a large orifice capable of handling large volumes of air at a high flow rate and condition (c) by a small orifice capable of discharging small quantities of air as they accumulate.

Valves with air intake or exhaust facilities shall have approved screening arrangements to prevent the ingress of foreign matter.

Types of air valves:

Double air valves

These shall combine both large and small orifices within one valve. The large orifice shall be sealed by a float and the valve body shall be designed to avoid premature closing of the valve by the discharging air. The small orifice shall be sealed by a float at all pressures above atmospheric except when air accumulates in the valve body.

Single air valves

These include a small or large orifice only, operating in a manner identical to the orifice in a double acting valve.

Large orifice air valves, including those incorporated in double air valves, shall be constructed so that the airflow actively holds the valve open during the discharge of air at all flows up to and including sonic velocities.

Small orifice air valves, including those incorporated in double air valves, shall be constructed so that the airflow actively holds the valve open during the discharge of air at all flows up to and including sonic velocities.

Small orifice air valves, including those incorporated in double air valves, shall be capable of opening and discharging up to not less than 0,5 m³/min of free air when the pressure in the pipeline is at the maximum working pressure.

Air valves for use with sewage and effluent shall be of a type incorporating a separate operating float in a large-volume float chamber and does not come into contact with the orifice (s) or the parts sealing them.

Air valve shall be drip-tight at all pressures from 200 kPa to the test pressure specified for the pipeline. The mechanical strength of the valve shall be such that it can withstand the test pressure specified for the pipeline (or 1,5 times the maximum working pressure, if higher) without suffering permanent deformation of any part of the valve.

Body ends shall be flanged with raised faces and drilled to SANS 1123, Table 16, for the nominal pressure specified or indicated on the Drawings.

As minimum the materials for the valves shall be as follows:

Body cover and cowl	Cast iron
Small orifice	Small orifice ball
Large orifice	Large orifice ball

Each valve shall be provided with its own isolating gate valve.

Air valves on treated water systems shall be installed on riser pipes if necessary, such that

they are above any possible flooding level so that there can be no ingress of external water under internal vacuum conditions.

PLK-5 SPINDLES AND CAPS

Operating and extension spindles for valves operated by Tee key shall be capped.

Extension spindles shall be circular in section. For valves installed in chambers, extension spindles shall be provided with split bearings rigidly held on brackets spaced no more than 1500 mm apart. For buried valves the spindle shall be supported inside a protecting tube held on a purpose-made support fixed to the top of the valve and provided with a spindle guide. Bearings and spindles shall be suitably protected against corrosion. Extension spindle couplings shall be provided with split pins to prevent pullout.

PLK-6 FIRE HYDRANTS

Fire hydrants shall be as detailed on the drawings.

PLK-7 MANUAL OPERATING MECHANISMS

Manual closing of valves shall be by the clockwise rotation of a Tee key or hand wheel.

Tee-key operated valves shall be provided with detachable cast iron spindle caps to take the key. One key shall be supplied for every five valves installed, with a minimum requirement of two keys in any one size.

Hand wheels shall be shaped to give a safe grip without sharp projections, clearly marked with the direction of closing which shall be in the clockwise direction.

Gearboxes shall be totally enclosed oil bath lubricated. Thrust bearings shall be provided in such a way that the gear case may be opened for inspection or be dismantled without releasing the stem thrust or taking the valve or penstock out of service. Oil and grease lubricated gearing, bearings and glands shall be protected against the ingress of dust and moisture.

Operating mechanism shall be of the weatherproof type and those parts subject to submergence shall have a degree of protection IP68 to BS5490 at a depth of submergence of 5 m. Where practicable, operating mechanisms shall be fitted with mechanical position indicators clearly visible from the operating position.

PLK-8 MEASUREMENT AND PAYMENT

Valves to be provided and installed will be measured under the relevant payment items of Section 1200 L.