



**WATER AND SANITATION DEPARTMENT**

**ANNEXURE B:**

**MATERIAL STANDARDS**

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### NOMENCLATURE

ASTM	American Society for Testing and Materials
CoE	City of Ekurhuleni
FC	Fibre Cement
FCV	Flow control valve
GRP	Glass Reinforced Plastic
HDPE	High Density Polyethylene
JASWIC	The Joint Acceptance Scheme for Water Services Installation Components
mPVC	Modified polyvinyl chloride
NRV	Non Return Valve
PE	Polyethylene
PRV	Pressure Reducing Valve
PVC	Polyvinyl chloride
PVC-O	Orientated polyvinyl chloride
RC	Reinforced Concrete
RSV	Resilient seal valve
SABS	South African Bureau of Standards
SANS	South African National Standards

## MATERIAL STANDARDS

### 1. WATER SERVICES

#### 1.1. Pipelines

##### 1.1.1. General requirements

Only material approved by CoE's Water & Sanitation Department may be used as a minimum requirement, pipes and fittings may only be used if:

- The pipe or fitting bears the standardisation mark of the SABS / SANS in respect of the relevant South African National Standards specification as issued by the SABS, and
- The pipe or fitting is included in the JASWIC list of accepted water and sanitation installations.

##### 1.1.2. Steel pipes and fittings

###### 1.1.2.1. *General*

Mild steel pipes shall only be considered where uPVC, mPVC, PVC-O or HDPE pipes are not available for the specific pipe diameter and pressure class.

All mild steel pipes shall be spirally welded and butt welded – longitudinal welded pipes shall not be considered in these circumstances.

For the design of pipe fittings and specials, care must be taken to allow adequate spacing for bolts, flange adaptors, anchor blocks, etc.

###### 1.1.2.2. *Standards*

All mild steel pipes and fittings/specials shall be designed, manufactured, tested and inspected in accordance with the latest issue of the following standard specifications:

###### Pipes

- SANS 719: Steel Grades A, B and C
- SANS 1431: Steel Grades 300 WA and 350 WA
- API 5L: Steel Grades X42, X46, X52, X56 and X60
- EN 10025-2: Steel Grade S355JR + AR (where specified for specials)
  
- Steel pipes of between 500 and 800 mm OD must be Electric Resistance Welded (ERW) steel pipes manufactured to SANS 1431 Gr 300W with a minimum wall thickness of 6.0 mm.
- Steel pipes from 800 mm OD and above must be Spirally Welded (SAW) steel pipes manufactured to API 5L X42 with a wall thickness of 8 mm.

###### Specials /fittings

- 150mm Ø and smaller to be manufactured with pipe conforming to SANS 62 (heavy duty) or ASTM Schedule 40 (seamless pipes) to suit specified pressures;
- Larger than 150mm Ø shall be manufactured from pipes complying with the specification above.

### 1.1.2.3. *Corrosion protection*

All mild steel pipes and fittings shall be externally coated and internally lined, a two component cross linked epoxy that complies with the requirements of SABS 1217. The Target Thickness of lining must be (minimum 500 µm and maximum thickness 800 µm). Maximum dry film thickness per coat of 125 µm to 250 µm must be achieved. The pipe material must be prepared as required in the epoxy manufacturer's specifications.

Further to the above-mentioned requirements, the epoxy coating/lining must be mechanically protected by suitable tape wrapping.

The pipe manufacturer must submit to the Engineer the steel maker's certificate covering all steel used. These certificates shall indicate the process of manufacture, the chemical analysis and the physical properties of the steel except that, at the option of the pipe manufacturer, the physical properties of the steel may be determined from specimens taken from finished pipe. The pipe manufacturer must also provide X-rays and welding approval certificates for all circumferential welds, including welding for flanges.

All mild steel lining and coating protection systems shall be approved by the Divisional Head: Project Division.

Data sheets of the proposed corrosion protection systems must be attached to the Design Development Report.

For guidelines on the corrosion protection of steel pipes and fittings, refer to CoE's Water Services Cathodic Protection Manual.

### 1.1.3. Flexible couplings

Flexible couplings shall be manufactured from hot rolled asymmetric steel T sections with a profiled rolled steel sleeve and accommodated with an EPDM gasket. All bolts shall be of D cup head low carbon steel. All flexible couplings shall be fusion bonded powder coated.

### 1.1.4. Flanges

All flanges shall be manufactured from mild steel in accordance with SANS Table 1123 and finished to an acceptable machined finish.

### 1.1.5. Bolts and nuts for flanges / couplings

All bolts and nuts shall be SANS 1700 Gr 8.8 mild steel or hot dipped galvanised to SANS 763.

### 1.1.6. Fittings / specials for PVC pipes

Where available, fittings/specials for PVC pipes shall be PVC, cast iron or ductile iron with spigot and socket rubber ring joints. All fittings/specials shall comply with the relevant requirements of SABS 966 or EN 12842. All cast iron or ductile iron fittings shall be fusion bonded thermoplastic coated internally and externally, to a minimum thickness of 400 µm.

All compression fittings shall be JASWIC approved. – 'Plasson' or similar approved by Division Head: Operations Division.

### 1.1.7. Valves

#### 1.1.7.1. *Isolating valves*

All valves shall be anticlockwise, **LEFT HAND** closing. All sizes are nominal (DN) with a minimum working pressure rating of 16 bar (PN) which are suitable for dealing with a maximum working pressure of 1 600 kPa. Where higher working

pressures are experienced, depending on circumstances, Class 25 or Class 40 valves shall be used. Valves shall be able to open and close under an unbalanced pressure equal to the specified maximum working pressure.

#### Resilient Seal Valves

All gate valves shall be the RSV type (AVK, or similar approved by the Divisional Head: Water and Sanitation Department – Project Division), PN 16 minimum pressure, to SABS 664, cap top, non-rising spindle and anti-clockwise closing.

The body and bonnet shall be internally and externally epoxy-coated.

The valve shall carry a 10-year replacement warranty under normal operating conditions. All valves shall conform to the dimensional and performance specification of the latest SANS 664 Standard and shall carry the JASWIC approval.

Hydraulic test certificates for all valves shall be submitted. These tests shall be carried out at the following pressure ratings:

- Body tests: 1.5 x nominal pressure rating
- Seat tests: 1.1 x nominal pressure rating

Scour installations shall include RSV type valves.

#### Ball valves / ball-o-stop

Only ball valves (Cobra, or similar approved by the Divisional Head: Water and Sanitation Department – Project Division) shall be used on erf connections / communication lead pipes.

- The body of the ball valves shall be of a one-piece construction
- Ball valves shall be of DZR alloy composition
- Ball valves shall be PN 12.5 rated (minimum ) and of nominal size
- Ball valve components shall conform to Table 1 of SABS 1056 Part III

#### Butterfly valves

Butterfly valves (Salvalve, Bermad, Gunric Ainsworth or similar approved by the Divisional Head: Water and Sanitation Department – Project Division) will only be considered in cases where the pipe diameter is greater than 300 mm, with prior approval from CoE.

Butterfly valves shall be of the gearbox-operated system, flanged and drilled to SABS 1123.

Butterfly valves shall be of the worm gear operated system. The valve body shall be cast from SG 42 iron with integral shaft hubs and an operator mounting flange in stainless steel. The valve disc offset shall be of a single eccentric type with a highly efficient hydrofoil profile to maximise the open flow area and cast from the same material as the body. The valve seal shall be precision injection moulded from Nitrile rubber and fitted within the body perimeter. Valve bearings shall be of the low friction PTFE type where no lubrication will be needed. Manual gear operators shall be of quadrant worm reducers, keyed to the valve shaft and fitted with hand wheel or cap top positioning bolts for disc adjustment. Valves may be painted with a primer coat and a final enamel, but preferably fusion bond powder coated.

#### *1.1.7.2. Pressure and Flow Control Valves*

All PRV's and FCV's (Cla-Val, Bermad or similar approved by CoE's Divisional Head: Water and Sanitation Department – Project Division) shall be properly designed and installed and housed in a reinforced concrete chamber.

The typical reduction ratio of PRV's is  $\pm 1:3$ . Systems that operates at higher pressures may require the PRV installations to be designed in a series configuration.

For ease of maintenance and repair, the use of smaller diameter PRV's is preferred. However, should 500 mm diameter PRV's be required, suitable lifting equipment must be provided.

FCV shall be shall be hydraulically operated globe valves. The inner valve assembly shall be top and bottom guided by means of bearing bushings. The inner valve assembly shall be the only moving part and shall be securely mounted on an AISI 316 Stainless Steel stem. Lower grades of Stainless Steel shall not be acceptable. The Stainless Steel stem shall be provided with wrench flats for ease of assembly and maintenance. Wrench flats will be fully accessible when inner valve is assembled.

All pressure containing components shall be constructed of ASTM A536-65 / 45 / 12 ductile iron. Valves shall be provided with smooth frictionless motion and maximum low flow stability with actuation being achieved by the use of Rolling Diaphragm technology.

Valves shall have a protective fusion bonded epoxy coating internally and externally to a minimum of 250 microns. The protective fusion bonded epoxy coating shall conform to the ANSI / AWWA C116 / A21.16 (current version) specification. No machining of any external parts after final coating will be acceptable to ensure a continuous coating surface throughout the entire valve.

The valve cover shall have a separate stem cap giving access to the stem for alignment check, spring installation and ease of assembly. Valve bonnets shall be accurately located to bodies utilizing locating pins. Locating pins shall eliminate corrosion resulting from the use of uncoated ductile iron to ductile iron surfaces. Valves with lipped spigot covers shall not be acceptable due to risk of rust and difficulty in assembly.

Valves shall have the AISI 316 Stainless Steel seat and shall incorporate a two-piece seat and bottom guide design. The valves shall form a drip-tight seal between the stationary stainless steel seat ring and the resilient disc, which has a rectangular cross-section and is retained by clamping on three and one half sides. The resilient disc shall be constructed of EPDM for normal service conditions.

All external fasteners shall be AISI 18-8 Stainless Steel with AISI 18-8 Stainless Steel washers. Mild steel studs or bolts will not be acceptable.

All repairs and maintenance shall be possible without removing the valve from the line. To facilitate easy removal and replacement of the inner valve assembly and to reduce unnecessary wear on the guide, the stem shall be vertical when the valve is mounted in a horizontal line.

Each valve shall be air tested prior to shipment. The standard test shall include leakage test, seat leakage test, and stroke test. The valves shall be covered by a minimum three years (3) warranty against defects in materials and workmanship. The stainless steel seat shall be covered by a lifetime replacement warranty.

The auxiliary control system shall be fitted with a large filter assembly, to prevent fouling of the control system. This filter shall be fitted with a transparent drain cap, which allows maintenance personnel to inspect the strainer, without the need to shut of the system, or remove the strainer from service. The main valve body shall be fitted with a visual position indicator, to offer the maintenance personnel visual indication of the valve position, as well as opening and closing speed controls.

The strainer shall have an integral blowdown valve and discharge tube for facilitate the ease of maintenance.

#### 1.1.7.3. *Air Valves*

All air valves shall be Vent-O-Mat type or similar approved by the Divisional Head: Water and Sanitation Department – Project Division.

#### 1.1.7.4. *Non-return / reflux / check valves*

NRV's / reflux valves / check valves may be swing check type with a PN 16 minimum pressure rating. The valves shall be suitable for either horizontal or vertical mounting with the angle of the door ensuring that closure starts at the point where forward flow declines.

The disk and hinge shall be fixed in the valve bonnet for easy access and maintenance. The body configuration shall be such that friction losses are minimized. The disc shall be fully encapsulated with rubber to prevent corrosion and ensures a drop tight shut-off, while the seat shall be hydraulically pressed into the body. The valve hinge shall be designed to adjust itself accurately to the plane of the seating under load.

Arm-weight type NRV's can also be considered if approved by the Divisional Head: Water and Sanitation Department – Project Division.

#### 1.1.8. Flow / water meters

All 300 mm diameter and above flow meters are to be electromagnetic flow meters and shall be Class 16, to be supplied, delivered, installed and commissioned.

The flow meter shall be of the electromagnetic type, utilising pulsed DC excitation and shall be microprocessor based. It must be capable of measuring flow rate and flow total in both directions, with two independent totalisers to give flow for network management purposes. There shall be separate isolated analogue (4 to 20 mA) and pulse outputs (volts free) for forward and reverse flow. These outputs shall be fully user configurable.

The accuracy shall be better than 0,15% of the reading or +/- 1 mm/s whichever is the greater, in both forward and reverse directions. The working flow range shall be 10 mm/s to 15 m/s (i.e. 1500:1).

The repeatability shall be 0,05% of the reading or better. This performance is required for water management and / or billing purposes.

The meter shall offer lifetime stable zero so that routine zeroing is not required. The meter shall automatically indicate zero flow under empty pipe sensor conditions.

The meter performance shall have been verified on a test facility that is internationally acceptable (such as NAMAS, NIST, or equivalent), such that fully traceability is assured. Laboratory traceability packs shall be available on request. It shall be possible to verify the calibration of the complete flow system (sensor and transmitter) in-situ, without removal of, or access to the sensor. A calibration certificate shall be provided.

Condition monitoring of the sensor, transmitter and interconnection cable shall be available to provide verification of long-term satisfaction field system operation. This shall be traceable and shall conform to ISO 9000 series quality standards. The meter shall be designed and manufactured under the ISO 9000 series quality standards. The meter shall have lay lengths to current ISO standards for magnetic meters to facilitate interchangeableness of products.

The wetted materials shall be compatible with, and suitable for, the appropriate application. An internationally recognized body such as WRC, AWWA, or equal shall certify the liner. Acceptable electrodes are stainless steel, Hastelloy C, Tantalum,

or Titanium. The power supply shall be 85 - 265 v AC, 40 - 400 Hz for mains powered devices, or 24 v for DC powered devices without the need for link setting or voltage selection to allow for dips and surges without disruption. The impedance shall be 10 to the power 15 ohms or greater so that electrode fouling does not affect signal integrity. The meter shall be furnished with built-in grounding electrodes of the same material as the sense electrodes. The flow sensor shall be rated IP68, and be suitable for indefinite submergence to a depth of 10 m.

Multiple diagnostic and self-monitoring functions such as empty pipe detection, low/high flow, reverse flow, flow over-range, etc. shall be standard features. Integral and dual output alarms shall be provided. Serial communication shall be provided as standard. It shall be possible to pre-commission the system using a configurator and verify all display and outputs. Dual or triple line alphanumeric backlit display shall indicate user defined flow rate and flow total units and all menu selection shall be possible from outside the electronic housing. Data shall be stored in non-volatile memory with a retention capacity of 10 years. The meter software shall incorporate dual password features, to prevent inadvertent or fraudulent program or unit changes.

The electronic housing may be integral or remote and may be safety certified to FM, CENELEC, CSA.SAA, or Gost standards for international usage without the need for air purging. It shall be NEMA 4X/IP65 or better with separate electronics and termination areas for enhanced protection. The system shall conform to EMC Directive 89/336/eec to 10 v/m, for electromagnetic radiation susceptibility standards. The tube must be lined with an approved potable water liner - neoprene or hard rubber, which will stand up to the duty and conditions specified. Vacuum conditions must be considered. All end connections shall be flanged, drilled to SABS 1123, Table 1 000 / 3 or table 1600 / 3 as specified. A set of earth rings and copper connecting wire must be supplied with each primary head. Electrical protection must be class IP68. The signal converter must be of the compact type. It must be possible to use a signal converter with any other primary head of the same make, with reasonable accuracy.

#### 1.1.9. Valve markers

A concrete / impregnated polymer (plastic) valve marker shall be placed within 500mm from the closest erf boundary.

- Powder blue impregnated valve markers with blue caps with a "V" moulded into the marker shall be positioned opposite normal isolating valves.
- Powder blue impregnated valve markers with red caps with a "ZV" moulded into the marker shall be positioned opposite zone isolating valves.

All existing valves, where applicable shall be paint marked with a 'V' / 'ZV' template in the relevant colour of the type of valve on the kerbstone closest to the valve.

In the case of new developments the 'V' and/or 'ZV' shall be moulded/formed in the relevant kerbstone and paint marked accordingly.

#### 1.1.10. Valve boxes / chambers

##### 1.1.10.1. *Valve boxes*

Valve boxes in sidewalks shall be constructed of 750 mm diameter precast concrete rings with concrete cover slab with a cast in frame for a polymer resin cover. The cover shall be positioned above the valve spindle according to the standard drawing.

The placement of valves in roadways should be avoided at all times. Should it be required 160 / 200 mm diameter pipe sleeve valve box with 300 mm x 300 mm polymer resin cover as shown on the standard drawing must be used.

The configuration of typical reticulation valve boxes shall be as follows:

- The valve shaft, 150 mm Ø uPVC pipe (minimum, depending on the depth of the valve), installed on top of the valve body.
- The valve box, installed on top of the valve shaft to protrude 50 mm (maximum) above ground level.
- The valve box must be supported by four engineering bricks or any other acceptable means of support, approved by the Engineer.
- 3% soilcrete backfilling in order to prevent movement/subsidence. Valve boxes shall be supplied complete, assembled and tested. All valve boxes and lids shall be manufactured in accordance with SABS 558. Valve boxes and lids shall be of ultraviolet proof, polypropylene thermoplastic material.

Valve boxes and lids shall be able to withstand temperatures ranging from -30°C to +80°C and shall not deform within these limits. Built-in stainless steel cable shall secure all lids.

Valve box lid will have the following colours:

- All isolating valves boxes shall be blue pigment impregnated
- All zone isolating valves boxes shall be red pigment impregnated
- All fire hydrant boxes shall be yellow pigment impregnated
- All erf connection valve boxes for greater than 80 mm connections shall be white pigment impregnated

#### 1.1.10.2. Valve chambers

All chambers shall be purposely designed to suite the specific valve installation with regards to size and type. Chambers shall be constructed from reinforced concrete, in accordance with the relevant SANS Specifications pertaining to water retaining structures and sealed to prevent stormwater ingress.

## 1.2. Water reticulation

### 1.2.1. Networks and piping

***The maximum operating pressure in networks shall be at least 900 kPa. Test pressures shall be in accordance with the relevant SANS 1200 requirements or higher, if so prescribed by the manufacturer. No FC or GRP pipes will be allowed as water reticulation pipes.***

For water pressure pipes, use of uPVC, mPVC, PVC-O or HDPE pipes (DPI, Sekunjalo, Marley, Sizabantu or similar approved by the Divisional Head: Water and Sanitation Department – Project Division shall be made up to the maximum diameter and pressure available, with a minimum pressure class of 12 bar.

At road crossings, water pressure pipes shall be uPVC, mPVC, PVC-O or HDPE, with a minimum pressure class of 12 bar (solid wall), underneath the road surface and including 1 000 mm both sides of the road surface.

Steel pipes will only be considered if relevant uPVC, mPVC, PVC-O or HDPE sizes or pressure ratings are not available on the market. Use of steel pipes is subject to the approval of the Divisional Head: Water and Sanitation Department – Project Division and shall comply with CoE's Water Services Cathodic Protection Manual.

The minimum nominal diameter for reticulation pipes shall be 110 mm. Special consent from the Divisional Head: Water and Sanitation – Projects and Operations Divisions must be obtained for the use of smaller pipes.

### 1.2.2. Fire hydrants

All fire hydrants shall be of the **ABOVE-GROUND** type. For business, commercial and industrial areas, the industrial, high efficiency type with two outlets (1 x 100 mm and 1 x 65 mm) shall be provided. For residential areas, the tamperproof type shall be provided.

All underground fittings shall be flanged, in accordance with the SANS 1123, and corrosion protected in accordance with CoE's Water Services Cathodic Protection Manual.

The composition of the standpipe shall be as follows:

- a) Cast Iron 80 mm NB flanged fire hydrant tee.
- b) 80 mm NB flanged left hand closing isolating valve on water mains larger than 200 mm in diameter.
- c) 80 mm NB flanged mild steel pipe with weld-on 90° bend.
- d) 80 mm NB mild steel pipe, threaded on top end to accommodate the fire hydrant head, increase to 100 mm for double headed outlet or larger.
- e) In order to protect the thread, the steel pipe will be white fusion bond powder coated after welding with socket

Hydrants shall be installed 450mm from erf boundaries and spaced in accordance with fire flow requirements.

A blue reflectors / "cat's eye" with a blue backing shall be fixed to the kerb, in line with the hydrant.

In the case of residential type fire hydrants, the standpipe shall be painted with yellow fusion bonded powder coat paint (applied in one direction only) and the head of the hydrant shall be painted signal red (ex factory).

All residential type hydrants shall conform to the following requirements:

- Required flow rates of the specific area
- Tamperproof
- Cast in one cast iron body (not brass)
- Inlet seals to eliminate nuts and washers
- Right angle pattern
- Globe valve design
- Non-rising stainless steel Woodlands Square spindle
- Clockwise closing direction
- Inlet 80 mm BSP (150=R7=B.S.P.)
- 65 mm female instantaneous outlet with cover sleeve and single lug pressure release action
- Minimum working pressure of 16 bar
- A screw-in socket to fit thread
- Removable, changeable propylene crack washer

In the case of business, commercial and industrial type hydrants, the hydrant shall be painted signal red (ex-factory).

All business, industrial and commercial type hydrants shall conform to the following requirements:

- Required flow rates of the specific area
- Dimensions: 300 mm x 550 mm x 720 mm (L x B x H).
- Cast in one iron signal red powder coated body with steel outlet caps
- Full bore opening
- Non rising spindle, left hand closing direction
- Flanged to SANS 1123, 100mm BSP inlet.

- 100 mm threaded large outlet
- 65 mm London Round thread small outlet
- Minimum working pressure of 16 bar

Adapters shall be manufactured of brass or stainless steel and not aluminium.

No individual / separate fire fighting connection(s) will be permitted to a property. Appropriate and adequately sized combination meter(s) shall also be installed.

### **1.3. Water pipes in areas underlain by dolomite**

The minimum pressure rating or ring stiffness of the pipe to be used shall depend on the dolomite land designation, i.e. D1, D2, D3 or D4.

High density polyethylene (HDPE) pipes and manholes are preferred in dolomite areas.

#### **1.3.1. Pipes and fittings**

Polyethylene type PE100, PN16, SDR 11 (or higher pressure class if required) as per ISO 4427, Parts 1, 2, 3 and 5

#### **1.3.2. Supply lengths**

12 m minimum

#### **1.3.3. Joints**

Butt-welded to SANS 10268 - Part 1 or approved bar coded electro-fusion welding as per SANS 10268 - Part 2 where butt-welding is impossible. The latter must be applied to the manufacturer's specification

## WATER APPENDICES

**APPENDIX B1:** List of Approved Valve Suppliers

**APPENDIX: B1**

**LIST OF APPROVED VALVE SUPPLIERS**

## PROVISIONAL LIST

All valves must be flanged Valves and shall be one of the following or similar approved:

- **Resilient Seal Valves (RSV's)**
  - AVK
  - VAG
  
- **Butterfly Valves**
  - Salvalve,
  - Bermad
  - Gunric
  - Ainsworth
  - AVM
  - VAG
  - Ozkan (East Rand Valves)
  
- **Air Valves**
  - VAG
  - Vent-o-Mat
  - Ari
  
- **Control Valves**
  - Clayton
  - Cla-Val
  - Bermad

## 2. SANITATION SERVICES

### 2.1. Sewer reticulation pipes

All pipes and fittings will bear the standardization mark of the SABS / SANS in respect of the relevant South African National Standards specification issued by the SANS, as a minimum requirement.

All sewer reticulation pipes shall be class 34 solid wall or 400 kPa uPVC (Maincore, Mainlite or similar approved by Divisional Head: Water and Sanitation Department – Project, Planning and Operations Divisions) with slip couplings (Lyng joints) according to SABS 1601, heavy duty structured wall 400 kPa pipe stiffness.

In general, the use of uPVC sewer pipes is preferred for reticulation systems up to 400 mm in diameter. For larger diameter sewer lines (i.e. above 400 mm diameter), either structured wall HDPE pipes or reinforced concrete pipes (RC) with sacrificial lining can be considered. However, approval must be obtained from the CoE Divisional Head: Water and Sanitation Department –Planning Division.

**Table 1:** Acceptable sewer pipe material

MATERIAL	DIAMETER	RELEVANT STANDARDS
Class 34 solid wall uPVC or 400kPa uPVC with slip on couplings	Up to 400 mm	SANS 791:2010 (SABS, 2010f), SANS 1601:2010 (SABS, 2010g), SANS 21138-1:2008 (SABS, 2008b), SANS 21138-2:2008 (SABS, 2008c) and SANS 21138-3:2008 (SABS, 2008d).
Heavy duty structured wall pipe 400kPa pipe stiffness		
Structured Wall HDPE Pipe	Over 400 mm	SANS 674:2010, (SABS, 2010d), SANS 10112:2003 (SABS, 2003b), SANS 21138-1:2008 (SABS, 2008b), SANS 21138-2:2008 (SABS, 2008c) and SANS 21138-3:2008 (SABS, 2008d)
Reinforced concrete (RC) with sacrificial lining	Over 400 mm	SANS 677:2010 (SABS, 2010a)

Only HDPE pipes shall be used in areas underlain by dolomite.

The minimum nominal diameter for reticulation pipes shall be 160 mm. Special consent from the Divisional Head: Water and Sanitation – Projects and Operations Divisions must be obtained for the use of smaller pipes.

### 2.2. Manholes details

The following details are applicable:

- For manhole depths up to 3 m, 1000 mm diameter concrete rings with a wall thickness not less than 65 mm, shall be used.
- For manhole depths deeper than 3 m, 1 500 mm diameter concrete rings with a wall thickness of not less than 85 mm, shall be used. These manholes will include a 750 mm diameter reducing shaft with a minimum thickness of 55 mm.
- Manholes to be installed on proper foundations of at least 150 mm thick and with a diameter of at least 500 mm greater than the manhole diameter.
- Starter rings for all manholes shall be founded on 20 MPa concrete mixture on compacted soil strata.
- Inlet and outlet pipes shall make provision for flexible joints close to the chamber to accommodate differential movement of manholes.

- All manholes shall be provided with benching and shall be constructed from dolomitic origin aggregate at a max slope of 1:3 and minimum of 1:4. Channelling inside manholes shall be vitrified clay embedded in the foundation concrete. PVC piping shall not be considered as benching/channelling in sewer manholes. Precast channelling will be allowed.
- Joints between the manhole rings shall be sealed with a bitumen sealant and wrapped with a fabric backed bitumen tape to the approval of the CoE.
- All manhole concrete rings shall be supplied with step irons, staggered in the chamber.
- All manhole cover slabs shall have 560 mm diameter holes with a recess to accommodate the access covers. Round spacers may be used with 560 mm diameter holes for slabs.
- The following circular concrete access covers of 560 mm diameter, with acceptable lifting mechanisms and 750 mm diameter frame constructed of dolomitic origin aggregate shall be used:
  - a) Heavy duty in road reserves with a breaking strength of not less than 135 kN
  - b) Medium duty elsewhere with a breaking strength of not less than 45 kN
- All manholes shall stand extend not less than 150 mm above finished ground level.
- All manholes installed next to a river or stream or in the open veld must be installed with its manhole cover 1000 mm above the surrounding ground level.
- Manholes located within flood plains must be raised to a level above the 1: 50 year flood level to prevent ingress of water.
- All manholes must be adequately sealed to prevent ingress of stormwater and groundwater.
- The quality of raw sewage must be obtained during the detail design stage to select suitable material for constructing outfall sewer manholes. This will assist with the prevention of carbonation of concrete manholes and sewers.
- Where Structured Wall HDPE pipes are used for sewers, HDPE manholes shall be used. Concrete manholes shall not be permitted on HDPE sewer lines.

### 2.3. **Sewers in areas underlain by dolomite**

The minimum pressure rating or ring stiffness of the pipe to be used shall depend on the dolomite land designation, i.e. D1, D2, D3 or D4. High density polyethylene (HDPE) pipes and manholes are preferred in dolomite areas.

The minimum pressure rating or ring stiffness of the pipe to be used shall depend on the dolomite land designation, i.e. D1, D2, D3 or D4.

High density polyethylene (HDPE) pipes and manholes are preferred in dolomite areas.

#### 2.3.1. Pipes and fittings

Polyethylene type PE100, PN16, SDR 11 (or higher pressure class if required) as per ISO 4427, Parts 1, 2, 3 and 5

#### 2.3.2. Supply lengths

12 m minimum

#### 2.3.3. Joints

Butt-welded to SANS 10268 - Part 1 or approved bar coded electro-fusion welding as per SANS 10268 - Part 2 where butt-welding is impossible. The latter must be applied to the manufacturer's specification.