LEPELLE NORTHERN WATER

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TENDER NO: LNW 13/21/22

PROJECT NAME: PROCUREMENT AND SUPPLY OF CONSTUCTION MATERIALS

BOOK 2 of 3: THE TENDER, CONTRACT DATA AND PRICING DATA

CLOSING DATE: 26 JANUARY 2022 @ 11H00

ISSUED BY:

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NAME OF TENDERER: _____

TOTAL AMOUNT: _____**(incl. VAT)**

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1. PART C3
SCOPE OF WORK

C3.1 DESCRIPTION OF WORKS

The Babanana Pipeline project-RS 135 comprises of the Nkambako WTW, Musiphana Pipeline, Babanana Pipeline and Xihoko distribution system, which is the bulk regional water distribution system downstream of the 5000 kl Serolorolo command reservoir including bulk distribution pipelines, command reservoir and village reservoirs and pump stations where required. These construction activities include the supply of materials such as steel pipes specials, fittings, uPVC pipes, precast chambers, telemetry and bedding and backfill materials. The main contractor, the department of Water and Sanitation-Construction North (DWS-CN) requested that Lepelle assist with the procurement of these material. The appointed contractor DWS-CN is currently implementing construction activities but requires specific construction materials services to complete some of the tasks at hand.

In this specific work package, the following deliverables is to be implemented:

a. Supply and delivery of all steel pipes specials and fittings to DWS-CN;
b. Supply and delivery of uPVC and oPVC pipes and fittings to DWS-CN;
c. Supply and delivery of precast chambers to DWS-CN;
d. Supply and delivery of bedding and backfill materials to DWS-CN;
e. Supply of telemetry equipment.

C3.1.1 SCOPE

Under this Contract LNW 13/21/22, Lepelle Northern Water is inviting tenders for the:

a) Supply and delivery of PVC pipes and Special Fittings;

b) Supply and delivery of Steel Pipes Special Fittings;

c) Supply and Delivery of Pre-Cast Manholes;

d) Supply and delivery of bedding and backfill materials to DWS-CN;

e) Supply of telemetry equipment.

The project entails the following: procurement, supply and delivery of pipes, fittings, precast chambers, bedding and backfill materials that are SANS approved. The construction materials shall be delivered to DWS-CN Camp Sites which are located in Nkambako WTW and Xihoko villages;

Note: It remains the contractor's responsibility to ensure that the correct uPVC pipes, fittings, steel pipes specials and valves specifications as indicated in the specification and Bill of Quantities is provided. All the procured materials shall be verified and approved by the Engineer and Client prior to supply and delivery to site. The supplier shall consent to provide a 5-year warranty against manufacturing and material defects on all procured and supplied materials. The scope includes but is not limited to the supply of the following items:

NKAMBAKO WTW

2a) Single pressure and flow loggers

ID	Item	**Specification**
1	Battery	Qlog IP68 Extended Battery Powered Logger
2	Service Pack	Sim and Hosting Data Service Pac
3	Pigtail	GSM pigtail to SMA bulkhead F con 200mm
4	Antenna	Low profile antenna
5	Transmitter	Gems pressure transmitter 0-16 bar
6	Press Fittings	Pressure fittings complete for logging
7	Quantities	10 (one)

2b) Dual pressure and flow loggers

ID	Item	**Specification**
1	Battery	Qlog IP68 Extended Battery Powered Logger
2	Service Pack	Sim and Hosting Data Service Pac
3	Pigtail	GSM pigtail to SMA bulkhead F con 200mm
4	Antenna	Low profile antenna
5	Transmitter	Gems pressure transmitter 0-16 bar
6	Press Fittings	Pressure fittings complete for logging

ID	Item	**Specification**
7	Quantities	10 (one)

2c) SCADA SOFTWARE REQUIREMENTS

General

(a) The Supervisory Control and Data Acquisition software package (SCADA) chosen for thisapplication shall be a standard package and shall have a wide and well-established user base in the South African telemetry environment. Custom written software will not be considered for this project. The package shall be able to scan up to a required number of scan points initially and shall be scalable and upgradeable to expand the data base to any size to include additional scan points by merely upgrading the license agreement. The number of scan points required is indicated in the Project Detail Specification.

(b) The software shall be a native 32-bit application and must run on the Windows NT or Windows XP operating system or an operating system of similar capability. Preference will be given to systems build on Distributed Internet Application Architecture standard (DNA).

(c) A software support service with optional updates shall be available. The location and level of software support available shall be indicated. Preference shall be given to a locally supported SCADA package.

(d) The SCADA software shall be supplied as a complete package and shall include an integrated development package. No additional software should be required to configure or run all the features of the SCADA system. Systems comprising a collection of software from various manufacturers (other than the computer operating system, the network operating software and the reporting package) will not be considered.

Standard Software Requirements

The SCADA software shall serve as Human Machine Interface (HMI), collect data from various field devices, perform process control and monitoring, alarm handling/monitoring, historical data logging, historical and real time trending and report generation. The software shall enable the running of all these tasks simultaneously and one task shall not inhibit another (e.g. printing of reports shall not inhibit the telemetry task or require it to go off-line). The same applies to the editing of mimic displays and database tag configuration, which shall be possible concurrently with the main scanning task running.

2d) NETWORKING CAPABILITY

The package shall be capable of transparently supporting distributed multi-client, multi-server configurations. In this configuration, the database shall be distributed

among the server stations with each one scanning its front-end device(s) and updating its own database.

The SCADA system must allow client stations (i.e. supervisory stations) to connect to server stations (nodes) via a remote link. The system shall provide the capability of supporting Local Area Network (LAN - Ethernet) and Wide Area Network (WAN - radio, telephone modem).

2e) DATA LOGGING

All logged data shall be stored in Microsoft's SQL Server standard compatible format. Database with proprietary formats will not be acceptable for this project. The system shall implement the data-logging scheme to permit configuration without users being required to write SQL-type commands.

The system shall support data collected from field devices by polling and exception reporting.

2f) DATABASE CONNECTIVITY

All database items shall be transparently available on all operator stations (nodes) via adedicated network. This includes mimic displays, trending, reporting and alarms. There shall be no appreciable degradation in response time between subscriptions to local database items, and subscriptions to database items in another server station (node)

The system architecture shall support native database interfaces to popular relational database management systems such as Oracle, Sybase, dBase IV with connectivity to ODBC-compliant systems as well. It is the intent to provide an open system based upon the ANSI SQL standard. Enterprise connectivity through the native database interfaces as listed above shall be supported.

2g) CONFIGURATION

(a) On-line monitoring, control, configuration and engineering functions must be provided on all client and server stations (nodes) on the SCADA network. Built in tools must exist to do bulk configuration of the database. SCADA packages that require off-line compilation of configuration changes will not be considered.

(b) The system must provide the ability to add tags on the fly from within the graphics editor, trend viewer, or anywhere in the system that calls for a tag.

(c) The software shall provide the user with the ability to monitor, fault find and configure a server from a remote LAN or WAN based workstation.

(d) It must be possible to configure the server software application to execute as a Windows NT Service, allowing the configuration of a robust control system.

(e) It shall be possible to configure a node as View Only or Full Control.

2h) FRONT-END DEVICES

The SCADA package offered should be able to interface to a vendor's Front-End Processor (FEP) via a serial communications port.

The SCADA package shall come complete with a comprehensive library of drivers for all standard industrial applications, including the drivers required to provide the communications mechanism between the SCADA and the telemetry Central Interface Unit equipment. One critical feature that the driver shall support is the time-and-date stamping of data as detailed below. It will be preferred to use OPC (Object Linking and Embedding for Process Control) drivers to interface telemetry, PLC's and other intelligent devices (OPS servers) to the SCADA system (OPC client).

2i) OPEN INTERFACES

The system shall support the current industry standards for open system interfaces: OLE, DDE, CSV etc.

The software shall easily and seamlessly connect up to other third-party applications such as Excel, Lotus, Microsoft Office, SQL Server, Oracle, Delphi, Power Builder, Visual Basic etc. SCADA systems that 'lock' the user into one programming language / environment will not be considered for this project.

2j) OBJECT ORIENTED GRAPHICS

(a) Mimic screens shall be graphically based on dynamic and static objects. The system shallsupport true vector-based graphics and allow unlimited panning and zooming without any degradation in mimic resolution and sharpness. There shall be no limitation to the screen resolution and / or number of colours supported.

(b) A comprehensive standard graphics symbol library must be provided and must allow modification and / or adding of custom symbols to the library easily without purchasing additional software. All library symbols must support unlimited panning, zooming and sizing.

(c) It shall be possible to dynamically move, size and rotate all graphic objects, linked to changes of state in the on-line database.

(d) The package shall have conventional CAD type editing facilities to ensure that the mimicsare easy to build and modify.

(e) It shall be possible to launch third party applications from within a graphic page, by operator action or on process event, as well as configure user-specified, process triggered, hypertext help pages for display.

(f) The SCADA system must allow mimics to be 'replayed' from historically logged data as well as live real-time data.

2k) MIMIC SCREENS

Information about the system status shall be gradually graphically displayed on the variousscreens (starting with major components and then going to ever more detail sub components).

The following graphic animated pictures shall be available to the operator at the master station:

(a) A system diagram showing all major water system components with their statuses (e.g. Raw Water Pump Station, Water Treatment Works, High Lift Pump Station and all reservoirs and radio communication status and wired networks).

(b) The Water Treatment Works showing all major components (chemical dosing system, filters, electrical panels, motorised valves, pumps, and communication statuses).

(c) Pump Stations diagrams (raw and high lift) showing all major components (pumps,motorised valves, pump consoles, electrical panel and communication statuses).

(d) Chemical dosing plant diagram (with all its components and parameters)

(e) Filter plant diagram (with all its components and parameters). Filter back wash processesshall be continuously monitored and displayed and the cause of a back wash sequence failure shall be indicated.

(f) Pump diagrams showing all pump parameters (for each pump). A pop-up window with remote control (SCADA control functions) shall be provided that will allow remote starting and stopping of a pump set.

(g) Electrical diagrams showing all electrical parameters (for each sub system and general)

(h) Telemetry diagrams showing all outstation telemetry parameters.

(i) Graphs showing water level, flow and total flow trends (30 days, 7 days, 24 hours)

(j) Graphs showing Motor electrical parameters (30 days, 7 days, 24 hours)

(k) Graphs showing general electrical power quality parameters (30 days, 7 days, 24 hours)

(l) Graphs showing battery voltage for each station (30 days, 7 days, 24 hours)

(m) List of all station inputs, outputs and software delivered alarms with their status and measured values - for each station

(n) Alarm log

(o) Event log

It shall be possible to group up to six analog values on one graph and to zoom on the graph by entering starting - ending day / time and minimum / maximum value to be displayed.

To ensure fast trend window performance trend sample times must be matched with data log sample (dead band) times so that trends are forced to use matching data log sets that log to theproprietary logging files instead of the SQL tables.

The system shall be capable of handling a minimum of 200 graphic pictures.

2l) TIME AND DATE STAMPED PROTOCOL SUPPORT

The system offered shall be able to handle time and date stamped digital events and analog values IN THE INTRINSIC DESIGN OF THE PACKAGE, and not by writing special code, scripts or other instructions. This feature shall NOT be achieved via a custom add-on. The time and date stamping shall occur at the source of the data (reflecting time-of-occurrence, NOT time-of-arrival at the master station) and these records shall be correctly incorporated in the historical data files of the computer and automatically form part of the trends and reports. This shall occur correctly even if the records do not arrive in chronological order. It shall occur automatically without any special operator intervention.

The events shall be stored in chronological order into the alarm and event files for accurate viewing and report generation. The Tenderer shall clearly describe how this requirement shallbe met.

2m) SECURITY

(a) The software shall provide a comprehensive security system. The security system must integrate smoothly with the operating system's security system. It must be possible to completely disable all Windows controls like Title Bar, Sizing Border, Menu, Status Bar etc., and thereby create a totally tamper-proof operator interface.

(b) Operator access to software facilities shall be via keyboard / mouse and shall be password protected. At least five levels shall be required. It shall be possible

to assign a minimum of five different passwords to the same level (to accommodate different operators).

(c) The following five levels haves been identified and shall serve as a guideline:

Level 1: Basic functions - selecting graphic pictures and graphs, acknowledging alarms,requesting printouts of graphs, alarm, event and maintenance logs.

Level 2: Control functions (remote starting and stopping)

Level 3: Software control function (auto, remote control function)

Level 4: Software facilities - generation of mimics, selection of report types andfrequency of printing.

Level 5: Software changes (system level).

(d) The level of password to be assigned to various operator functions shall be discussedand finalised with the successful Tenderer.

(e) All attempts made by an operator to access a password-protected level shall be loggedon the printer and in the historical file.

2n) REPORT GENERATION

(a) It should be possible for an operator to select the automatic printing (to disc and / or printer) of the daily / weekly / monthly reports required.

(b) The operator (who would have attended the SCADA software training sessions provided for in this specification) shall be able to create his own report forms. Building a report shall be menu-driven. Each menu shall allow the operator to specify what informationshall be printed and where it shall be placed on the page. Basic mathematical functions and graphs shall be supported. A report scheduler shall enable the operator to specify when the report should be printed based on the time of day, day of the week, month or event. The data for the report shall come from either the current database or from historical trending files.

(c) The contractor shall set up a number of standard reports (at least three) that can be used on this system during the training sessions. These shall be specified before the advent of such a training course and shall, amongst others, include the generation of a summary sheet of the total volumes of water that has past specific points (where flow meters have been installed) in the water supply network, for billing purposes.

(d) It shall be possible for the operator to request the printing of graphic pictures, historical and real time trends.

(e) To aid the generation of professional reports, a package such as Microsoft Office (MS Access, Excel) or an equivalent shall be included in the master station software to be supplied.

(f) If report generating software is specified then report information must be drawn directly from the SCADA data logs and not through the SQL server.

2o) DATA STORAGE AND RETRIEVAL

The master station hard disk shall be of sufficient capacity to accommodate a record of at least 365 preceding days of all the analogue and digital values obtained from the various outstations.

History files shall be automatically backed-up to a compact disk (DVD) upon software-specified day of the month or as the hard disk approaches 2/3 filled. An appropriate message shall alarm the operator that such action is about to take place and shall prompt the operator to load a DVD into the disk drive, before commencing with the procedure of saving the data to the disk. The whole process shall otherwise be software-driven. The software shall determine the date of the last data downloaded onto the disk (from the time/date stamp) and shall only download that portion of data not yet saved to disk. No data already saved to disk shall be destroyed in the process.

2p) POWER FAILURE

In case of power failure (battery low signal from UPS) the SCADA application and operating system shall shut down gracefully (all programs and files closed, memory flushed, buffers written to disk). On power restoration system shall restart automatically.

2q) SCADA HARDWARE REQUIREMENTS

<u>Operator Station</u>

(a) Latest Industrial PC Intel Pentium (at least 3.2GHz) with dual core processor orequivalent complete with Cache memory: (level 2)

(b) RAM:2 GIG 667MHz DDRAM, expandable

(c) Hard drive: IDE / EIDE 500GIG

(d) DVD multi-layer, R/W, internal, IDE / EIDE with software

(e) RS232 card with four ports (telemetry FEP, modem, UPS, spare) and external lightning and surge protection units.

(f) Graphic card: 64 Bit hardware – accelerated 3D graphics.

(g) Modem: 56K external V.90, voice, fax, data modem

(h) Mouse: Internet Scroll Mouse (optical) and mouse pad

(i) Industrial keyboard 104, windows keys

(j) LCD Colour display monitor with at least 21" screen

(k) Printer: Colour Ink Jet

(l) Network card.

(m) Printer port

Uninterruptible Power Supply (UPS) Operator Station

ON-LINE transformer based (isolation transformer shall form part of UPS system and shall minimum be rated 3kVA) UPS system shall provide power to all SCADA equipment (PC, Telemetry FEP, radio, printer, VDU and modem) with standby capacity of at least 2 hours.

Bypass switch shall be provided to enable operating of SCADA station in case of UPS failure.Adequate lightning and surge protection units (on Mains side) shall be installed.

2r) CONFIGURATION OF SCADA SOFTWARE

Tenderers shall make sufficient provision in their Tenders for the following:

(a) To create mimic screens for all plant processes under this contract.

(b) To provide trend screens for all flow meters, levels and pumps under this contract.

(c) At least the following dynamic trend screens shall be provided for:

- On and off cycle of pumps
- Flow indications
- Level indications

(d) Pump speed indications

(e) Alarm reports

(f) At least the following alarm reports shall be required:

- Motor trip
- High levels
- Outstation failure
- Power failures and low battery power

(g) The following standard control features shall be offered:

- Plant animated mimics, graphic display of mimics and plant status with simultaneousselectable displays of different plant sections on the monitor.
- Security levels of access to control functions shall be allowed for. Tenderers shallsubmit full details of security access to control functions.
- On the initiation of the system the mother station with its peripherals shall scan the plant and determine the number of points it monitors. It shall then create relevant datatables from the above.
- The monitoring system shall scan the plant continually and compare the information received with that in data tables and any changes shall be stored.

(h) Reporting

- The software shall be so assembled to allow for the transfer of data into spreadsheetto allow reporting and analysis of results.
- The ability to change windows and constraints on-line; and changing time scaling on- line.

(i) Alarms

- The system shall accept alarm signals in abnormal conditions and attract the operator’s attention with an audible alarm and visible change on the VDU.
- Until acknowledgement of alarms which require operator's action the alarm shallcontinue to signal.
- Alarms shall be divided into categories viz:
  - Urgent
  - Caution
  - Attention and Event

(j) General

- The outstations shall be interrogated sequentially by the mother station.
- On initiation the outstation shall scan the plant and determine the number of points it controls and monitors. It shall then create relevant data tables from this;
- The outstation shall scan the plant continually and compare the information received with that in the data tables and any change shall be stored;
- When the outstation is interrogated by the master station the stored information shallbe sent from the mother station where it shall be read into a parallel buffer; and

- On initialization, the master station shall obtain from the outstation all the informationin their data tables and set up its own data tables.

(k) To execute a control:

- An outstation shall be selected;
- The plant shall be selected;
- The desired command shall be fed in; and
- The command is then sent to the outstation which selects the plant and sends as a check the re-compiled word back. When this is received at the master station the "execute command" is given which operates the plant at the outstation.
- If the command is not executed, an error message shall be sent by the outstation indicating whether:
  - The plant failed to operate
  - It was not possible to select the plant
  - The control signals shall feature, in addition, interlocks that will prevent plantequipment operating if it can cause a dangerous condition

(l) Front-end Processor

The front-end processor shall scan all outstations to collect data for processing. The front-end processor shall generate the following scan routines which are:

- Alarm, status scan;
- Analog, pulses scan;
- Controls;
- Communications fail scan;
- Suppressed scan; and
- Data correlation;

2s) REPORTING SOFTWARE

Web-based reporting and analytical software shall be compatible with the SCADA software. Thereporting software shall be capable of creating meaningful and relevant reports from multiple data sources including the SCADA system database, OPC, Industrial Historians and spreadsheets.

The software shall be so assembled to allow for the transfer of data into spreadsheet to allow reporting and analysis of results.

The software shall have the ability to change windows and constraints on line; and changing time scaling on line.

This specification includes the supply, development, delivery, handling, protection, storage, installation, successful commissioning and upholding during the Defects Liability Period. The SCADA System and peripheral equipment will be installed inside a control room at Nkambako WTP Site.

XIHOKO PIPPELINE 2

3a) Precast Rectangular Portal Culvert 1500x1200 Box culvert 100S

ID	Item	**Specification**
1	Type	Crown unit
2	Classes	100S
3	Culvert Standard	SANS 986
4	Quantities	10

3b) Precast portal culvert concrete base slab

ID	Item	**Specification**
1	Type	RP Culvert base
2	length	1800
3	width	1220
4	thickness	165mm
5	Quantities	10

3c) 160NB PN20, Unplasticised Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	20
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	160mm
7	Quantities	600m

3d) 160NB PN16, Unplasticised Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.

2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	160mm
7	Quantities	2400m

3e) 110 NB PN20, Unplasticised Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	20
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	110mm
7	Quantities	680m

3f) 110NB PN16, Unplasticised Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Quantities	1871m

3g) 90NB PN16, Unplasticised Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16

3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Quantities	960m

3h) 90NB PN12, Unplasticised Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	12
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Quantities	2826m

3i) 90NB PN16, Unplasticised Poly Vinyl Chloride (uPVC) 0-45° pressure bends

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	12
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Quantities	39

3j) 110NB PN20, Unplasticised Poly Vinyl Chloride (uPVC) 0-45° pressure bends

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	20
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Quantities	31

3k) 160NB PN20, Unplasticised Poly Vinyl Chloride (uPVC) 0-90° pressure bends

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	20
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Quantities	34

3l) 160mm x 160mm NB, PN20, SG iron Equal Tees

ID	Item	**Specification**
1	Class	SG iron grade 42
2	Corrosion protection	Bitumen dipped or fusion bonded
3	Pressure rating	PN20
4	Factory standard	ISO 9001
5	Quantities	2

3m)160mm x 10mm NB, Reducer spigot and socket

ID	Item	**Specification**
1	Class	SG iron grade 42
2	Corrosion protection	Bitumen dipped or fusion bonded
3	Pressure rating	PN20
4	Factory standard	ISO 9001
5	Quantities	1

3n) 1000mm X 250mm Deep precast manholes

ID	Item	**Specification**
1	Type	Circular
2	Pipe strength	15KN/m
3	Proof load	15KN/m
4	Chamber Diameter	1000mm
5	Pipe Standard	SANS 1294

6	Quantities	25

3o) 1000mm X 500mm Deep precast manholes

ID	Item	**Specification**
1	Type	Circular
2	Pipe strength	15KN/m
3	Proof load	15KN/m
4	Chamber Diameter	1000mm
5	Pipe Standard	SANS 1294
6	Quantities	80

3p) 110mm Standard SG iron hydrant tee

ID	Item	**Specification**
1	Type	SG Iron Hydrant Tees
2	Pressure rating	PN 25
3	Number of holes	8
4	Hole diameter	18mm
5	Branch diameter	80mm
6	PCD	160mm
7	Quantities	2

3q) 160mm Standard SG iron hydrant tee, Air valve tee PN25

ID	Item	**Specification**
1	Type	SG Iron Hydrant Tees
2	Pressure rating	PN 25
3	Number of holes	8
4	Hole diameter	18mm
5	Branch diameter	80mm
6	PCD	160mm
7	Quantities	5

3r) 90mm Standard SG iron hydrant tee, Air valve tee PN16

ID	Item	**Specification**
1	Type	SG Iron Hydrant Tees

2	Pressure rating	PN 25
3	Number of holes	8
4	Hole diameter	18mm
5	Branch diameter	80mm
6	PCD	160mm
7	Quantities	6

3s) 110mm: 80mm NB Blank flange with 25mm NB stub 125mm long

ID	Item	**Specification**
1	Type	Special reducer
2	Pressure rating	PN 25
3	Reduced Diameters	80mm NB with 25mm NB stub
4	Valve Connection	Thread end
5	Stub	Stub with 3 x 5mm M.S gusset plates fitted
6	Material	Mild steel
7	Quantities	2

3t) 160mm: 80mm NB Blank flange with 25mm NB stub 125mm long

ID	Item	**Specification**
1	Type	Special reducer
2	Pressure rating	PN 25
3	Reduced Diameters	80mm NB with 25mm NB stub
4	Valve Connection	Thread end
5	Stub	Stub with 3 x 5mm M.S gusset plates fitted
6	Material	Mild steel
7	Quantities	5

3u) 90mm: 80mm NB Blank flange with 25mm NB stub 125mm long

ID	Item	**Specification**
1	Type	Special reducer
2	Pressure rating	PN 25
3	Reduced Diameters	80mm NB with 25mm NB stub
4	Valve Connection	Thread end

5	Stub	Stub with 3 x 5mm M.S gusset plates fitted
6	Material	Mild steel
7	Quantities	6

3v) 25 NB BALL VALVE– SCREWED

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	screwed
3	Body	Stainless Steel
4	Pressure rating	PN16
5	Nominal Size	25 NB
6	Quantities	6

3w) 25 NB BALL VALVE– SCREWED

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	screwed
3	Body	Stainless Steel
4	Pressure rating	PN25
5	Nominal Size	25 NB
6	Quantities	7

3x) 25mm NB AIR RELEASE AND VACUUM BRAKE VALVE– SCREWED

ID	Item	**Specification**
1	Type	Double Orifice with Anti-Shock Orifice Mechanism Flanged
2	End connection	Screwed
3	Pressure rating	PN 16
4	End connection	Screwed Studs
5	Nominal size	DN 25
6	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
7	Quantities	6

3y) 25mm NB AIR RELEASE AND VACUUM BRAKE VALVE– SCREWED

ID	Item	**Specification**
1	Type	Double Orifice with Anti-Shock Orifice Mechanism Flanged
2	End connection	Screwed
3	Pressure rating	PN 25
4	End connection	Screwed Studs
5	Nominal size	DN 25
6	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
7	Quantities	7

3z) 110mm uPVC Straight pipe, 1 000mm long PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	110mm
7	Quantities	2

3aa) 160mm uPVC Straight pipe, 1 000mm long PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	160mm
7	Quantities	5

3bb) 90mm uPVC Straight pipe, 1 000mm long PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	90mm
7	Quantities	4

3cc) 90mm uPVC Straight pipe, 1 000mm long PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	90mm
7	Quantities	4

3dd) 90mm uPVC Straight pipe, 1 000mm long PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	90mm
7	Quantities	2

3ee) 110mm uPVC Double socket PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	110mm
7	Quantities	2

3ff) 160mm uPVC Double socket PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	160mm
7	Quantities	5

3gg) 90mm uPVC Double socket PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	160mm
7	Quantities	4

3hh) 90mm uPVC Double socket PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket

2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	90mm
7	Quantities	2

3ii) 100NB to 25 NB Unequal Tee, Class Heavy

ID	Item	**Specification**
1	Norminal Diameter	100mm.
2	Branch Diameter	25mm
3	Pipe Standard	SABS 62
4	Pressure Class	25
5	Quantities	2

3jj) 110NB SG Iron Flange adaptor

ID	Item	**Specification**
1	Nominal Diameter	110mm.
2	Material	ductile iron
3	Pressure rating	PN 25
4	Quantities	4

3kk) 100NB Straight pipe both ends flanged, anchor flange

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	4

3ll) 100NB Straight pipe one end flanged, other plain for cutting PN25

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Flange Standard	SABS 1123:2500/3

3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	2

3mm) 90NB SG Iron Flange adaptor

ID	Item	**Specification**
1	Nominal Diameter	90mm.
2	Material	ductile iron
3	Pressure rating	PN 16
4	Quantities	4

3nn) 90mm straight pipe both end flanged, anchor flange as indicated PN16

ID	Item	**Specification**
1	Nominal Diameter	90mm.
2	Flange Standard	SABS 1123:1600/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	4

3oo) 90mm Straight pipe one end flanged, other plain for cutting PN16

ID	Item	**Specification**
1	Nominal Diameter	90mm.
2	Flange Standard	SABS 1123:1600/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	2

3pp) 80NB SG Flange adaptor

ID	Item	**Specification**
1	Nominal Diameter	80mm.
2	Material	ductile iron
3	Pressure rating	PN 16
4	Quantities	2

3qq) 90NB to 25 NB Unequal Tee, Class Heavy

ID	Item	**Specification**
1	Norminal Diameter	90mm.
2	Branch Diameter	25mm
3	Pipe Standard	SABS 62
4	Pressure Class	16
5	Quantities	2

3rr) 25 NB BALL VALVE– FLANGED

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	Flanged
3	Body	Stainless Steel
4	Pressure rating	PN16
5	Nominal Size	25 NB
6	Quantities	4

3ss) 25 NB BALL VALVE– FLANGED

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	Flanged
3	Body	Stainless Steel
4	Pressure rating	PN25
5	Nominal Size	25 NB
6	Quantities	4

3tt) 25mm NB flanged double orifice air valve PN16

ID	Item	**Specification**
1	Type	Double Orifice with Anti-Shock Orifice Mechanism Flanged
2	End connection	Flanged
3	Pressure rating	PN 16
4	End connection	Flanged with Screwed Studs
5	Nominal size	DN 25
6	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns

7	Quantities	4

3uu) 25mm NB flanged double orifice air valve PN25

ID	Item	**Specification**
1	Type	Double Orifice with Anti-Shock Orifice Mechanism Flanged
2	End connection	Flanged
3	Pressure rating	PN 25
4	End connection	Flanged with Screwed Studs
5	Nominal size	DN 25
6	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
7	Quantities	4

3vv) 100NB SG Flange adaptor

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Material	ductile iron
3	Pressure rating	PN 25
4	Quantities	2

3ww) 1000mm Precast reinforced concrete cover slab

ID	Item	**Specification**
1	Type	circular concrete cover sla
2	Lid type	heavy duty steel banded concrete lid
3	Manhole access	locking device
4	lifting holes	3
7	Quantities	24

3xx) 160mm x 50mm Cast iron SG Reducing tee PN25

ID	Item	**Specification**
1	Type	SG Reducing tee
2	Pressure rating	PN 25
3	Reduced Diameters	160mm NB with 50mm NB branch
4	Material	Ductile Iron

5	Quantities	2

3yy) 90mm x 50mm Cast iron SG Reducing tee PN16

ID	Item	**Specification**
1	Type	SG Reducing tee
2	Pressure rating	PN 16
3	Reduced Diameters	90mm NB with 50mm NB branch
4	Material	Ductile Iron
5	Quantities	2

3zz) 50mm uPVC Straight pipe PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	50mm
7	Quantities	2

3aaa) 50mm uPVC Straight pipe PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	50mm
7	Quantities	4

3bbb) 50mm SG Standard SG iron flange adaptor PN25

ID	Item	**Specification**

1	Nominal Diameter	50mm.
2	Material	ductile iron
3	Pressure rating	PN 25
4	Quantities	6

3ccc) 50mm NB stainless steel flanged ends ball valve PN25

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	Flanged
3	Body	Stainless Steel
4	Pressure rating	PN25
5	Nominal Size	50NB
6	Quantities	3

3ddd) 50mm uPVC Double socket PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	50mm
7	Quantities	6

3eee) 100mm Steel Straight pipe one end plain, puddle flange PN25

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	1

3fff) 100mm Steel Scour tee flanged PN25

ID	Item	**Specification**

1	Nominal Diameter	100mm.
2	Scour pipe size	80mm.
3	Flange Standard	SABS 1123:2500/3
4	Pipe Standard	SABS 62
5	Pipe Class	Heavy
6	Quantities	1

3ggg) 90mm Steel Scour tee flanged PN25

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Scour pipe size	80mm.
3	Flange Standard	SABS 1123:2500/3
4	Pipe Standard	SABS 62
5	Pipe Class	Heavy
6	Quantities	1

3hhh) 100mm Steel Straight pipe both flanged, puddle flange PN25

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	1

3iii) 90mm Steel Straight pipe both flanged, puddle flange PN25

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	1

3jjj) 80mm NB Steel Wedge gate valve PN25

ID	Item	**Specification**
1	Type	Non rising spindle
2	End Connection	Flanged
3	Body	SG Iron Grd 420/12
4	Pressure rating	PN25
5	Nominal Size	80 NB
6	Flanges	To SANS 1123
7	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
8	Quantities	2

3kkk) 80mm NB Steel Flange adaptor PN25

ID	Item	**Specification**
1	Nominal Diameter	80mm.
2	Material	steel
3	Pressure rating	PN 25
4	Quantities	2

3lll) 80mm NB Steel Sleeve valve with hydraulic actuator PN25

ID	Item	**Specification**
1	Nominal Diameter	80mm.
2	Body	Steel ASTM A516 Grade 70 or Stainless Steel A240
3	Seals	EPDM and Stainless Steel
4	Thrust Nut	Bronze
5	Fasteners	Stainless Steel
6	Features	hydraulic actuation
7	Quantities	2

3mmm) 110NB SG Iron Flange adaptor

ID	Item	**Specification**
1	Nominal Diameter	110mm.
2	Material	ductile iron
3	Pressure rating	PN 25

4	Quantities	2

3nnn) 90mm SG flange adaptor PN25

ID	Item	**Specification**
1	Nominal Diameter	90mm.
2	Material	ductile iron
3	Pressure rating	PN 25
4	Quantities	2

3ooo) 90mm uPVC Double socket PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	90mm
7	Quantities	2

3ppp) 110mm uPVC double socket PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	110mm
7	Quantities	2

3qqq) 90mm uPVC straight pipe 500mm long PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16

3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Quantities	2

3rrr) 110mm uPVC straight pipe 500mm long PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Quantities	2

3sss) 100mm standard SG iron flange adaptor PN16

ID	Item	**Specification**
1	Nominal Diameter	110mm.
2	Material	ductile iron
3	Pressure rating	PN 16
4	Quantities	2

3ttt) 90mm standard SG iron flange adaptor PN16

ID	Item	**Specification**
1	Nominal Diameter	110mm.
2	Material	ductile iron
3	Pressure rating	PN 16
4	Quantities	2

3uuu) 90mm NB flanged ends ball valve PN16

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	Flanged
3	Body	Stainless Steel
4	Pressure rating	PN16

5	Nominal Size	90 NB
6	Quantities	1

3vvv) 100mm NB flanged ends ball valve PN25

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	Flanged
3	Body	Stainless Steel
4	Pressure rating	PN25
5	Nominal Size	110 NB
6	Quantities	1

3www) 90mm uPVC double socket PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	90mm
7	Quantities	2

3xxx) 110mm uPVC double socket PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	110mm
7	Quantities	2

3yyy) 90mm uPVC straight pipe 400mm long PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Quantities	2

3zzz) 110mm uPVC straight pipe 400mm long PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Quantities	2

3aaaa) 90mm standard SG iron flange adaptor PN16

ID	Item	**Specification**
1	Nominal Diameter	90mm.
2	Material	ductile iron
3	Pressure rating	PN 16
4	Quantities	2

3bbbb) 110mm standard SG iron flange adaptor PN25

ID	Item	**Specification**
1	Nominal Diameter	110mm.
2	Material	ductile iron
3	Pressure rating	PN 25
4	Quantities	2

3cccc) 90mm Mechanical turbine flow meter PN16

ID	Item	**Specification**
1	Type	Dry dial, Magnetic drive sensitive action
2	End connection	Flanged
3	Body	SS316
4	Flanges	Stainless Steel AISI 316
5	Pulse position	100/1000L/Pulse
5	Material	Cast iron, Ductile iron
6	Pressure rating	PN16
7	Nominal Size	90 NB
8	Quantities	2

3dddd) 110mm Mechanical turbine flow meter PN25

ID	Item	**Specification**
1	Type	Dry dial, Magnetic drive sensitive action
2	End connection	Flanged
3	Body	SS316
4	Flanges	Stainless Steel AISI 316
5	Pulse position	100/1000L/Pulse
5	Material	Cast iron, Ductile iron
6	Pressure rating	PN25
7	Nominal Size	110 NB
8	Quantities	2

3eeee) 90NB Flange adaptor

ID	Item	**Specification**
1	Nominal Diameter	90mm.
2	Material	ductile iron
3	Pressure rating	PN 16
4	Quantities	1

3ffff) 110mm flange adaptor PN25

ID	Item	**Specification**

1	Nominal Diameter	110mm.
2	Material	ductile iron
3	Pressure rating	PN 25
4	Quantities	1

3gggg) 90mm straight pipe one end flanged other plain for cutting on site to suit PN16

ID	Item	**Specification**
1	Nominal Diameter	90mm.
2	Flange Standard	SABS 1123:1600/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	1

3hhhh) 110mm straight pipe one end flanged other plain for cutting on site to suit PN25

ID	Item	**Specification**
1	Nominal Diameter	110mm.
2	Flange Standard	SABS 1123:1600/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	1

3iiii) 1000mm Precast reinforced concrete cover slab

ID	Item	**Specification**
1	Type	circular concrete cover sla
2	Lid type	heavy duty steel banded concrete lid
3	Manhole access	locking device
4	lifting holes	3
7	Quantities	12

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4a) Precast Rectangular Portal Culvert 1500x1200 Box culvert 100S

ID	Item	**Specification**
1	Type	Crown unit
2	Classes	100S

3	Culvert Standard	SANS 986
4	Quantities	22

4b) Precast portal culvert concrete base slab

ID	Item	**Specification**
1	Type	RP Culvert base
2	length	1800
3	width	1220
4	thickness	165mm
5	Quantities	22

4c) 200NB PN20, Unplasticized Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	20
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	200mm
7	Quantities	3101

4d) 200NB PN16, Unplasticized Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	200mm
7	Quantities	964

4e) 200 NB PN12, Unplasticized Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	12
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	200mm
7	Quantities	3481

4f) 160NB PN12, Unplasticized Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	12
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	160mm
7	Quantities	2601

4g) 140NB PN12, Unplasticized Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	12
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	140mm
7	Quantities	568

4h) 140NB PN12, Unplasticized Poly Vinyl Chloride (uPVC) 0-90° pressure bends

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	12
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Quantities	94

4i) 160mm x 160mm NB, PN12, SG iron Equal Tees

ID	Item	**Specification**
1	Class	SG iron grade 42
2	Corrosion protection	Bitumen dipped or fusion bonded
3	Pressure rating	PN12
5	Factory standard	ISO 9001
6	Quantities	11

4j) 160mm x 10mm NB, Reducer spigot and socket

ID	Item	**Specification**
1	Class	SG iron grade 42
2	Corrosion protection	Bitumen dipped or fusion bonded
3	Pressure rating	PN12
5	Factory standard	ISO 9001
6	Quantities	0

4k) 200NB PN20, Unplasticized Poly Vinyl Chloride (uPVC) 0-90° pressure bends

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	20
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001

6	Quantities	89

4l) 200mm x 200mm NB, PN20, SG iron Equal Tees

ID	Item	**Specification**
1	Class	SG iron grade 42
2	Corrosion protection	Bitumen dipped or fusion bonded
3	Pressure rating	PN20
5	Factory standard	ISO 9001
6	Quantities	10

4m)1000mm X 250mm Deep precast manholes

ID	Item	**Specification**
1	Type	Circular
2	Pipe strength	15KN/m
3	Proof load	15KN/m
4	Chamber Diameter	1000mm
5	Pipe Standard	SANS 1294
6	Quantities	64

4n) 1000mm X 500mm Deep precast manholes

ID	Item	**Specification**
1	Type	Circular
2	Pipe strength	15KN/m
3	Proof load	15KN/m
4	Chamber Diameter	1000mm
5	Pipe Standard	SANS 1294
6	Quantities	231

4o) 160mm Standard SG iron hydrant tee

ID	Item	**Specification**
1	Type	SG Iron Hydrant Tees
2	Pressure rating	PN 25
3	Number of holes	8

4	Hole diameter	18mm
5	Branch diameter	80mm
6	PCD	160mm
7	Quantities	13

4p) 200mm Standard SG iron hydrant tee

ID	Item	**Specification**
1	Type	SG Iron Hydrant Tees
2	Pressure rating	PN 25
3	Number of holes	8
4	Hole diameter	18mm
5	Branch diameter	80mm
6	PCD	160mm
7	Quantities	8

4q) 200mm Standard SG iron hydrant tee

ID	Item	**Specification**
1	Type	SG Iron Hydrant Tees
2	Pressure rating	PN 25
3	Number of holes	8
4	Hole diameter	18mm
5	Branch diameter	80mm
6	PCD	160mm
7	Quantities	10

4r) 140mm Standard SG iron hydrant tee

ID	Item	**Specification**
1	Type	SG Iron Hydrant Tees
2	Pressure rating	PN 25
3	Number of holes	8
4	Hole diameter	18mm
5	Branch diameter	80mm
6	Quantities	5

4s) 160mm : 80mm NB Blank flange with 25mm NB stub 125mm long

ID	Item	**Specification**
1	Type	Special reducer
2	Pressure rating	PN 16
3	Reduced Diameters	80mm NB with 25mm NB stub
4	Valve Connection	Thread end
5	Stub	Stub with 3 x 5mm M.S gusset plates fitted
6	Material	Mild steel
7	Quantities	13

4t) 200mm : 80mm NB Blank flange with 25mm NB stub 125mm long

ID	Item	**Specification**
1	Type	Special reducer
2	Pressure rating	PN 25
3	Reduced Diameters	80mm NB with 25mm NB stub
4	Valve Connection	Thread end
5	Stub	Stub with 3 x 5mm M.S gusset plates fitted
6	Material	Mild steel
7	Quantities	18

4u) 140mm : 80mm NB Blank flange with 25mm NB stub 125mm long

ID	Item	**Specification**
1	Type	Special reducer
2	Pressure rating	PN 16
3	Reduced Diameters	80mm NB with 25mm NB stub
4	Valve Connection	Thread end
5	Stub	Stub with 3 x 5mm M.S gusset plates fitted
6	Material	Mild steel
7	Quantities	2

4v) 25 NB BALL VALVE– SCREWED

ID	Item	**Specification**

1	Type	Ball valve
2	End connection	screwed
3	Body	Stainless Steel
4	Pressure rating	PN16
5	Nominal Size	25 NB
6	Quantities	24

4w) 25 NB BALL VALVE– SCREWED

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	screwed
3	Body	Stainless Steel
4	Pressure rating	PN25
5	Nominal Size	25 NB
6	Quantities	8

4x) 25mm NB AIR RELEASE AND VACUUM BRAKE VALVE– SCREWED

ID	Item	**Specification**
1	Type	Double Orifice with Anti-Shock Orifice Mechanism Flanged
2	End connection	Screwed
3	Pressure rating	PN 16
4	End connection	Screwed Studs
5	Nominal size	DN 25
6	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
7	Quantities	24

4y) 25mm NB AIR RELEASE AND VACUUM BRAKE VALVE– SCREWED

ID	Item	**Specification**

1	Type	Double Orifice with Anti-Shock Orifice Mechanism Flanged
2	End connection	Screwed
3	Pressure rating	PN 25
4	End connection	Screwed Studs
5	Nominal size	DN 25
6	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
7	Quantities	8

4z) 160mm uPVC Straight pipe, 1 000mm long PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	160mm
7	Quantities	26

4aa) 200mm uPVC Straight pipe, 1 000mm long PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	200mm
7	Quantities	16

4bb) 200mm uPVC Straight pipe, 1 000mm long PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	200mm
7	Quantities	20

4cc) 140mm uPVC Straight pipe, 1 000mm long PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	140mm
7	Quantities	2

4dd) 160mm uPVC Double socket PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	160mm
7	Quantities	26

4ee) 200mm uPVC Double socket PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	200mm
7	Quantities	36

4ff) 140mm uPVC Double socket PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	140mm
7	Quantities	2

4gg) 1000mm NB Precast reinforced concrete cover slab

ID	Item	**Specification**
1	lid	steel banded concrete
2	Classes	heavy duty
3	Standard	SANS 1294
5	Security device	Locking device
6	Lifting holes	3
7	Quantities	64

4hh) 160mm x 50mm NB, PN16, cast iron Reducing Tees

ID	Item	**Specification**
1	Class	SG iron grade 42
2	Corrosion protection	Bitumen dipped or fusion bonded

3	Pressure rating	PN16
5	Factory standard	ISO 9001
6	Quantities	11

4ii) 200mm x 50mm NB, PN16, cast iron Reducing Tees

ID	Item	**Specification**
1	Class	SG iron grade 42
2	Corrosion protection	Bitumen dipped or fusion bonded
3	Pressure rating	PN16
5	Factory standard	ISO 9001
6	Quantities	10

4jj) 200mm x 50mm NB, PN25, cast iron Reducing Tees

ID	Item	**Specification**
1	Class	SG iron grade 42
2	Corrosion protection	Bitumen dipped or fusion bonded
3	Pressure rating	PN25
5	Factory standard	ISO 9001
6	Quantities	3

4kk) 50mm uPVC Straight pipe, 500mm long PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	90mm
7	Quantities	42

4ll) 50mm uPVC Straight pipe, 500mm long PN25

ID	Item	**Specification**

1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	90mm
7	Quantities	6

4mm) 50mm SG iron flange adaptor PN16

ID	Item	**Specification**
1	Type	SG Iron flange adaptor
2	Pressure rating	PN 16
3	Number of holes	4
4	Hole diameter	18mm
5	Flange diameter	150mm
6	PCD	125mm
7	Quantities	42

4nn) 50mm SG iron flange adaptor PN25

ID	Item	**Specification**
1	Type	SG Iron flange adaptor
2	Pressure rating	PN 25
3	Number of holes	4
4	Hole diameter	18mm
5	Flange diameter	150mm
6	PCD	125mm
7	Quantities	6

4oo) 50 NB BALL VALVE– FLANGED

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	Flanged

3	Body	Stainless Steel
4	Pressure rating	PN16
5	Nominal Size	50 NB
6	Quantities	21

4pp) 50 NB BALL VALVE– FLANGED

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	Flanged
3	Body	Stainless Steel
4	Pressure rating	PN25
5	Nominal Size	50 NB
6	Quantities	3

4qq) 50mm uPVC Double socket PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	200mm
7	Quantities	42

4rr) 50mm uPVC Double socket PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Classes	25
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	200mm

7	Quantities	6

4ss) 150mm Steel Straight pipe one end flanged with a puddle flange, 640mm long PN16

ID	Item	**Specification**
1	Pipe Ends / Joints	Flanged
2	Pressure Classes	16
3	Pipe Standard	SANS 62
4	Outside Diameter	160mm
5	Quantities	1

4tt) 200mm Steel Straight pipe one end flanged with a puddle flange, 640mm long PN25

ID	Item	**Specification**
1	Pipe Ends / Joints	Flanged
2	Pressure Classes	25
3	Pipe Standard	SANS 719
4	Outside Diameter	160mm
5	Quantities	2

4uu) 150mm Steel Scour tee flanged PN16

ID	Item	**Specification**
1	Nominal Diameter	150mm.
2	Scour pipe size	100mm.
3	Flange Standard	SABS 1123:2500/3
4	Pipe Standard	SABS 62
5	Pipe Class	Heavy
6	Quantities	1

4vv) 200mm Steel Scour tee flanged PN25

ID	Item	**Specification**
1	Nominal Diameter	200mm.
2	Scour pipe size	100mm.
3	Flange Standard	SABS 1123:2500/3
4	Pipe Standard	SABS 719

5	Pipe Class	Heavy
6	Quantities	2

4ww) 160mm NB Steel Flange adaptor PN16

ID	Item	**Specification**
1	Nominal Diameter	160mm.
2	Material	steel
3	Pressure rating	PN 16
4	Quantities	1

4xx) 200mm NB Steel Flange adaptor PN25

ID	Item	**Specification**
1	Nominal Diameter	200mm.
2	Material	steel
3	Pressure rating	PN 25
4	Quantities	2

4yy) 160mm Steel Straight pipe both flanged, puddle flange PN16

ID	Item	**Specification**
1	Nominal Diameter	160mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	1

4zz) 200mm Steel Straight pipe both flanged, puddle flange PN25

ID	Item	**Specification**
1	Nominal Diameter	200mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 719
4	Pipe Class	Heavy
5	Quantities	2

4aaa) 100 NB WEDGE GATE VALVE – FLANGED

ID	Item	**Specification**
1	Type	Wedge Gate Valve
2	End connection	Flanged
3	Body	Stainless Steel
4	Valve Flange Table	2500/3
5	Flanges	To SANS 1123
6	Pressure rating	PN16
7	Nominal Size	100 NB
8	Quantities	1

4bbb) 100 NB WEDGE GATE VALVE – FLANGED

ID	Item	**Specification**
1	Type	Wedge Gate Valve
2	End connection	Flanged
3	Body	Stainless Steel
4	Valve Flange Table	2500/3
5	Flanges	To SANS 1123
6	Pressure rating	PN25
7	Nominal Size	100 NB
8	Quantities	2

4ccc) 100mm NB Steel Flange adaptor PN16

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Material	steel
3	Pressure rating	PN 16
4	Quantities	1

4ddd) 100mm NB Steel Flange adaptor PN25

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Material	steel
3	Pressure rating	PN 25
4	Quantities	2

4eee) 100mm Steel Straight pipe one end plain, puddle flange PN16

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	1

4fff) 100mm Steel Straight pipe one end plain, puddle flange PN25

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	2

4ggg) 100mm NB Steel Sleeve valve with hydraulic actuator PN16

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Body	Steel ASTM A516 Grade 70 or Stainless Steel A240
3	Seals	EPDM and Stainless Steel
4	Thrust Nut	Bronze
5	Fasteners	Stainless Steel
6	Features	hydraulic actuation
7	Quantities	1

4hhh) 100mm NB Steel Sleeve valve with hydraulic actuator PN25

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Body	Steel ASTM A516 Grade 70 or Stainless Steel A240
3	Seals	EPDM and Stainless Steel
4	Thrust Nut	Bronze

5	Fasteners	Stainless Steel
6	Features	hydraulic actuation
7	Quantities	2

4iii) 160NB SG Flange adaptor

ID	Item	**Specification**
1	Nominal Diameter	160mm.
2	Material	ductile iron
3	Pressure rating	PN 16
4	Quantities	2

4jjj) 200NB SG Flange adaptor

ID	Item	**Specification**
1	Nominal Diameter	200mm.
2	Material	ductile iron
3	Pressure rating	PN 25
4	Quantities	4

4kkk) 200NB SG Flange adaptor

ID	Item	**Specification**
1	Nominal Diameter	200mm.
2	Material	ductile iron
3	Pressure rating	PN 16
4	Quantities	1

4lll) 200NB Straight pipe both ends flanged, anchor flange

ID	Item	**Specification**
1	Nominal Diameter	200mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 719
4	Pipe Class	Heavy
5	Quantities	1

4mmm) 200NB Straight pipe one end flanged other plain for cutting to suit on site, 80NB flanged vertical stub, welded to the 200NB pipe PN 16

ID	Item	**Specification**
1	Nominal Diameter	200mm.
2	Stub Diameter	80mm
3	Stub Length	400mm
4	Flange Standard	SABS 1123:2500/3
5	Pipe Standard	SABS 719
6	Stub Standards	SABS 62
7	Pipe Class	Heavy
8	Quantities	1

4nnn) 200mm NB Steel Flange adaptor PN16

ID	Item	**Specification**
1	Nominal Diameter	200mm.
2	Material	Steel
3	Pressure rating	PN 16
4	Quantities	1

4ooo) 200 NB RESILIENT SEAL GATE VALVE

ID	Item	**Specification**
1	Type	Non rising spindle
2	End Connection	Flanged
3	Cap Top	SG Iron Grd 420/12
4	Bonnet	SG Iron Grd 420/12
5	Cap Screws	HT Steel Grd 8.8 / Stainless Steel AISI 304
6	Bonnet Gasket	O Ring type – protects bolts against corrosion
8	Spindle	Stainless Steel AISI 304
9	Gate Nut	Brass
10	Gate	SG Iron EPDM
11	Body	SG Iron Grd 420/12
12	Circlip	Stainless Steel AISI 410
13	O-Ring	Nitrile Rubber

ID	Item	**Specification**
14	Seal	Nylon
15	Bolt	Stainless steel AISI 304
16	Dust Wiper Seal	Nitrile Rubber
17	Gland Housing	Brass
18	Washer	Brass
19	Pressure rating	PN16
20	Nominal Size	200 NB
21	Face to Face distance	317 mm
22	Flanges	To SANS 1123
23	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
24	Quantities	1

4ppp) 200mm NB Cross

ID	Item	**Specification**
1	Class	Heavy
2	Pressure rating	PN16
3	Norminall diameter	200mmm
4	Corrosion protection	Bitumen dipped or fusion bonded
5	Standard	SABS 719
6	Quantities	1

4qqq) 200mm x 150mm NB, Concentric Reducer

ID	Item	**Specification**
1	Class	Steel X42
2	Pressure rating	PN16
3	Bigger diameter	200mmm
4	Smaller Diameter	160mm
5	Corrosion protection	Bitumen dipped or fusion bonded
6	Quantities	2

4rrr) 150 NB RESILIENT SEAL GATE VALVE

ID	Item	**Specification**
1	Type	Non rising spindle
2	End Connection	Flanged
3	Cap Top	SG Iron Grd 420/12
4	Bonnet	SG Iron Grd 420/12
5	Cap Screws	HT Steel Grd 8.8 / Stainless Steel AISI 304
6	Bonnet Gasket	O Ring type – protects bolts against corrosion
8	Spindle	Stainless Steel AISI 304
9	Gate Nut	Brass
10	Gate	SG Iron EPDM
11	Body	SG Iron Grd 420/12
12	Circlip	Stainless Steel AISI 410
13	O-Ring	Nitrile Rubber
14	Seal	Nylon
15	Bolt	Stainless steel AISI 304
16	Dust Wiper Seal	Nitrile Rubber
17	Gland Housing	Brass
18	Washer	Brass
19	Pressure rating	PN16
20	Nominal Size	150 NB
21	Face to Face distance	280 mm
22	Flanges	To SANS 1123
23	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
24	Quantities	2

4sss) 150 NB RESILIENT SEAL GATE VALVE

ID	Item	**Specification**
1	Type	Non rising spindle
2	End Connection	Flanged
3	Cap Top	SG Iron Grd 420/12
4	Bonnet	SG Iron Grd 420/12
5	Cap Screws	HT Steel Grd 8.8 / Stainless Steel AISI 304

ID	Item	**Specification**
6	Bonnet Gasket	O Ring type – protects bolts against corrosion
8	Spindle	Stainless Steel AISI 304
9	Gate Nut	Brass
10	Gate	SG Iron EPDM
11	Body	SG Iron Grd 420/12
12	Circlip	Stainless Steel AISI 410
13	O-Ring	Nitrile Rubber
14	Seal	Nylon
15	Bolt	Stainless steel AISI 304
16	Dust Wiper Seal	Nitrile Rubber
17	Gland Housing	Brass
18	Washer	Brass
19	Pressure rating	PN16
20	Nominal Size	150 NB
21	Face to Face distance	280 mm
22	Flanges	To SANS 1123
23	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
24	Quantities	2

4ttt) 150mm NB Steel Flange adaptor PN16

ID	Item	**Specification**
1	Nominal Diameter	150mm.
2	Material	Steel
3	Pressure rating	PN 16
4	Quantities	1

4uuu) 150mm Steel Straight pipe one end flanged other plain for cutting to suit on site PN16

ID	Item	**Specification**
1	Nominal Diameter	150mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 62

4	Pipe Class	Heavy
5	Quantities	1

4vvv) 150NB Straight pipe both ends flanged, puddle flange PN16

ID	Item	**Specification**
1	Nominal Diameter	150mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	1

4www) 160NB SG Flange adaptor

ID	Item	**Specification**
1	Nominal Diameter	160mm.
2	Material	ductile iron
3	Pressure rating	PN 16
4	Quantities	1

4xxx) 150mm NB Steel Flange adaptor PN16

ID	Item	**Specification**
1	Nominal Diameter	150mm.
2	Material	Steel
3	Pressure rating	PN 16
4	Quantities	1

4yyy) 150NB Straight pipe both ends flanged, puddle flange PN16

ID	Item	**Specification**
1	Nominal Diameter	150mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	1

4zzz) 140NB SG Flange adaptor

ID	Item	**Specification**

1	Nominal Diameter	140mm.
2	Material	ductile iron
3	Pressure rating	PN 16
4	Quantities	1

4aaaa) 200mm x 100mm NB, Concentric Reducer

ID	Item	**Specification**
1	Class	Steel X42
2	Pressure rating	PN16
3	Bigger diameter	200mmm
4	Smaller Diameter	100mm
5	Corrosion protection	Bitumen dipped or fusion bonded
6	Quantities	1

4bbbb) 100 NB RESILIENT SEAL GATE VALVE

ID	Item	**Specification**
1	Type	Non rising spindle
2	End Connection	Flanged
3	Cap Top	SG Iron Grd 420/12
4	Bonnet	SG Iron Grd 420/12
5	Cap Screws	HT Steel Grd 8.8 / Stainless Steel AISI 304
6	Bonnet Gasket	O Ring type – protects bolts against corrosion
8	Spindle	Stainless Steel AISI 304
9	Gate Nut	Brass
10	Gate	SG Iron EPDM
11	Body	SG Iron Grd 420/12
12	Circlip	Stainless Steel AISI 410
13	O-Ring	Nitrile Rubber
14	Seal	Nylon
15	Bolt	Stainless steel AISI 304
16	Dust Wiper Seal	Nitrile Rubber
17	Gland Housing	Brass
18	Washer	Brass

ID	Item	**Specification**
19	Pressure rating	PN16
20	Nominal Size	100 NB
21	Face to Face distance	254 mm
22	Flanges	To SANS 1123
23	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
24	Quantities	1

4cccc) 100mm NB Steel Flange adaptor PN16

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Material	Steel
3	Pressure rating	PN 16
4	Quantities	1

4dddd) 100NB Straight pipe one end flanged, anchor flange PN16

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	1

4eeee) 100mm NB Steel Sleeve valve with hydraulic actuator PN16

ID	Item	**Specification**
1	Nominal Diameter	100mm.
2	Body	Steel ASTM A516 Grade 70 or Stainless Steel A240
3	Seals	EPDM and Stainless Steel
4	Thrust Nut	Bronze
5	Fasteners	Stainless Steel
6	Features	hydraulic actuation
7	Quantities	1

4ffff) 80NB PN16, steel 90° bends

ID	Item	**Specification**
1	Class	SG iron grade 42
2	Corrosion protection	Bitumen dipped or fusion bonded
3	Pressure rating	PN16
5	Factory standard	ISO 9001
6	Quantities	2

4gggg) 80NB Straight pipe one end flanged other plain for cutting to suit on site PN16

ID	Item	**Specification**
1	Nominal Diameter	80mm.
2	Flange Standard	SABS 1123:2500/3
3	Pipe Standard	SABS 62
4	Pipe Class	Heavy
5	Quantities	1

4hhhh) 80mm NB Steel Flange adaptor PN16

ID	Item	**Specification**
1	Nominal Diameter	80mm.
2	Material	Steel
3	Pressure rating	PN 16
4	Quantities	1

4iiii) 80 NB RESILIENT SEAL GATE VALVE

ID	Item	**Specification**
1	Type	Non rising spindle
2	End Connection	Flanged
3	Cap Top	SG Iron Grd 420/12
4	Bonnet	SG Iron Grd 420/12
5	Cap Screws	HT Steel Grd 8.8 / Stainless Steel AISI 304
6	Bonnet Gasket	O Ring type – protects bolts against corrosion
8	Spindle	Stainless Steel AISI 304
9	Gate Nut	Brass

ID	Item	**Specification**
10	Gate	SG Iron EPDM
11	Body	SG Iron Grd 420/12
12	Circlip	Stainless Steel AISI 410
13	O-Ring	Nitrile Rubber
14	Seal	Nylon
15	Bolt	Stainless steel AISI 304
16	Dust Wiper Seal	Nitrile Rubber
17	Gland Housing	Brass
18	Washer	Brass
19	Pressure rating	PN16
20	Nominal Size	80 NB
21	Face to Face distance	229 mm
22	Flanges	To SANS 1123
23	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
24	Quantities	1

4jjjj) 1000mm NB Precast reinforced concrete cover slab

ID	Item	**Specification**
1	lid	steel banded concrete
2	Classes	heavy duty
3	Standard	SANS 1294
5	Security device	Locking device
6	Lifting holes	3
7	Quantities	39

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5a) Precast Rectangular Portal Culvert 1500 x 1200 culvert 100S

ID	Item	**Specification**
1	Type	Crown unit
2	Classes	100S
3	Culvert Standard	SANS 986

4	Quantities	10

5b) Precast Portal Culvert concrete base slab

ID	Item	**Specification**
1	Type	RP Culvert base
2	Length	1800
3	Width	1220
4	Thickness	165 mm
5	Quantities	10

5c) 125mm NB PN9, Unplasticized Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Class	9
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	125mm
7	Quantities	1214

5d) 125mm NB PN6, Unplasticized Poly Vinyl Chloride (uPVC) pipes

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	6
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	125mm
7	Quantities	920

5e) 125mm NB PN9, Unplasticized Poly Vinyl Chloride (uPVC) 0-90° pressure bends

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Class	9
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Quantities	16

5f) 125mm x 125mm NB, PN9, SG Iron Equal Tees

ID	Item	**Specification**
1	Class	SG iron grade 42
2	Corrosion protection	Bitumen dipped or fusion bonded
3	Pressure rating	PN9
4	Factory standard	ISO 9001
5	Quantities	1

5g) 1000mm X 250mm Deep Precast Manholes

ID	Item	**Specification**
1	Type	Circular
2	Pipe strength	15KN/m
3	Proof load	15KN/m
4	Chamber Diameter	1000mm
5	Pipe Standard	SANS 1294
6	Quantities	9

5h) 1000mm X 500mm Deep Precast Manholes

ID	Item	**Specification**
1	Type	Circular
2	Pipe strength	15KN/m
3	Proof load	15KN/m
4	Chamber Diameter	1000mm
5	Pipe Standard	SANS 1294

6	Quantities	3

5i) 125 mm Standard SG Iron Hydrant Tee, Air Valve Tee PN 16

ID	Item	**Specification**
1	Type	SG Iron Hydrant Tees
2	Pressure rating	PN 16
3	Number of holes	4
4	Hole diameter	18mm
5	Branch diameter	80mm
6	PCD	160mm
7	Quantities	2

5j) 125 mm Standard SG Iron Hydrant Tee, Air Valve Tee PN 10

ID	Item	**Specification**
1	Type	SG Iron Hydrant Tees
2	Pressure rating	PN 10
3	Number of holes	8
4	Hole diameter	18mm
5	Branch diameter	80mm
6	PCD	160mm
7	Quantities	4

5k) 125 mm: 80 mm NB Blank Flange with 25 mm NB stub 125 mm long

ID	Item	**Specification**
1	Type	Special reducer
2	Pressure rating	PN 16
3	Reduced Diameters	80mm NB with 25mm NB stub
4	Valve Connection	Thread end
5	Stub	Stub with 3 x 5mm M.S gusset plates fitted
6	Material	Mild steel
7	Quantities	2

5l) 125 mm: 80 mm NB Blank Flange with 25 mm NB stub 125 mm long

ID	Item	**Specification**

1	Type	Special reducer
2	Pressure rating	PN 10
3	Reduced Diameters	80mm NB with 25mm NB stub
4	Valve Connection	Thread end
5	Stub	Stub with 3 x 5mm M.S gusset plates fitted
6	Material	Mild steel
7	Quantities	4

5m)25 mm NB Ball Valve PN16 – Screwed

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	Screwed
3	Body	Stainless Steel
4	Pressure rating	PN16
5	Nominal Size	25 NB
6	Quantities	2

5n) 25 mm NB Ball Valve PN10 – Screwed

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	Screwed
3	Body	Stainless Steel
4	Pressure rating	PN 10
5	Nominal Size	25 NB
6	Quantities	4

5o) 25 mm NB AIR RELEASE AND VACUUM BRAKE VALVE– SCREWED

ID	Item	**Specification**
1	Type	Double Orifice with Anti-Shock Orifice Mechanism Flanged
2	End connection	Screwed
3	Pressure rating	PN 16
4	End connection	Screwed Studs
5	Nominal size	DN 25
6	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
7	Quantities	2

5p) 25mm NB AIR RELEASE AND VACUUM BRAKE VALVE– SCREWED

ID	Item	**Specification**
1	Type	Double Orifice with Anti-Shock Orifice Mechanism Flanged
2	End connection	Screwed
3	Pressure rating	PN 10
4	End connection	Screwed Studs
5	Nominal size	DN 25
6	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
7	Quantities	4

5q) 125 mm uPVC Straight pipe, 1 000mm long PN 16

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Class	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	125 mm
7	Quantities	4

5r) 125 mm uPVC Straight pipe, 1 000mm long PN 10

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Classes	10
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	125 mm
7	Quantities	8

5s) 125 mm uPVC Double socket PN 16

ID	Item	**Specification**
1	Pipe Ends / Joints	Double socket
2	Pressure Class	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	125 mm
7	Quantities	4

5t) 125 mm uPVC Double socket PN 10

ID	Item	**Specification**
1	Pipe Ends / Joints	Double socket
2	Pressure Class	10
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	160mm
7	Quantities	8

5u) 1000 mm Precast Reinforced Concrete Cover Slab

ID	Item	**Specification**
1	Type	Circular concrete cover slab
2	Lid type	Heavy duty steel banded concrete lid
3	Manhole access	Locking device
4	Lifting holes	3
7	Quantities	9

5v) 125 mm x 50 mm Cast Iron SG Reducing Tee PN 16

ID	Item	**Specification**
1	Type	SG Reducing tee
2	Pressure rating	PN 16
3	Reduced Diameters	250 mm NB with 50mm NB branch
4	Material	Ductile Iron

5	Quantities	1

5w) 125 mm x 50 mm Cast Iron SG Reducing Tee PN 10

ID	Item	**Specification**
1	Type	SG Reducing tee
2	Pressure rating	PN 10
3	Reduced Diameters	125 mm NB with 50mm NB branch
4	Material	Ductile Iron
5	Quantities	2

5x) 50 mm uPVC Straight pipe 500 mm long PN 16

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Class	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	50 mm
7	Quantities	2

5y) 50 mm uPVC Straight pipe 500 mm long PN 10

ID	Item	**Specification**
1	Pipe Ends / Joints	Spigot and socket pipe with integral socket and locked-in rubber ring seal.
2	Pressure Class	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	50 mm
7	Quantities	3

5z) 50 mm SG Standard SG iron flange adaptor PN 16

ID	Item	**Specification**

1	Nominal Diameter	50 mm
2	Material	Ductile iron
3	Pressure rating	PN 16
4	Quantities	2

5aa) 50 mm SG Standard SG Iron Flange Adaptor PN 10

ID	Item	**Specification**
1	Nominal Diameter	50 mm
2	Material	Ductile iron
3	Pressure rating	PN 16
4	Quantities	3

5bb) 50 mm NB Stainless Steel Flanged Ends Ball Valve PN 16

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	Flanged
3	Body	Stainless Steel
4	Pressure rating	PN 16
5	Nominal Size	50NB
6	Quantities	1

5cc) 50 mm NB Stainless Steel Flanged Ends Ball Valve PN 10

ID	Item	**Specification**
1	Type	Ball valve
2	End connection	Flanged
3	Body	Stainless Steel
4	Pressure rating	PN 10
5	Nominal Size	50NB
6	Quantities	2

5dd) 50 mm uPVC Double socket PN 16

ID	Item	**Specification**
1	Pipe Ends / Joints	double socket
2	Pressure Class	16
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1

5	Factory standard	ISO 9001
6	Outside Diameter	50 mm
7	Quantities	2

5ee) 50 mm uPVC Double socket PN 10

ID	Item	**Specification**
1	Pipe Ends / Joints	Double socket
2	Pressure Class	10
3	Pipe Standard	SANS 966 Part 1
4	Bends Standard	SANS 966 Part 1
5	Factory standard	ISO 9001
6	Outside Diameter	50 mm
7	Quantities	3

5ff) 1000 mm Precast Reinforced Concrete Cover Slab

ID	Item	**Specification**
1	Type	Circular concrete cover slab
2	Lid type	Heavy duty steel banded concrete lid
3	Manhole access	Locking device
4	Lifting holes	3
7	Quantities	2

Hlohlokwe Reservoir

6a) Precast Cover slabs of Various Sizes

ID	**Item**	**Specification**
1.	Material	Precast Concrete
2.	Shape	Rectangular units
3.	Overall cover slab area	$40m^2$
4.	Quantity	3

6b) 400mm NB PN16 SG Flange Adaptor

ID	**Item**	**Specification**
1.	Material	Carbon Steel/Ductile Iron
2.	Pressure Rating	PN16

ID	Item	Specification
3.	Factory standard	ISO 9001
4.	Nominal Diameter	400mm
5.	Quantity	1

6c) 400mm NB PN16 Straight Pipe, One End Flanged, One End Bell Mouth

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	400 mm
7.	Wall Thickness	4.5 mm
8.	Bell Mouth Length	205 mm
9.	Straight Pipe Length	320 mm
10	End Connection	One end flanged, the other end with Bellmouth
11	Quantity	1

6d) 200mm NB PN16 Straight Pipe

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	200 mm
7.	Length	385 mm
8.	End Connection	One end flanged, the other end plain for cutting to suit
9.	Quantity	1

6e) 200mm NB PN16 Wedge Gate Valve

ID	Item	Specification
1.	Type	Non rising stem
2.	Material	Cast Iron
3.	Grade	Grade 250
4.	Pressure Rating	PN16
5.	Body, bonnet, stuffing box yoke, gland and Handwheel Standard	SABS 1034
6.	Seat and Gate Rings	Malleable Iron
7.	Stem	Mild Steel 970 Gr En 3 or Stainless-Steel BS 970: 304S 15
8.	Flanges	SANS 1123
9.	Factory standard	ISO 9001
10	Nominal Diameter	200 mm
11	End Connection	Flanged
12	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
13	Quantity	1

6f) 200mm NB PN16 Straight Pipe Both Ends Flanged, With Puddle Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	200 mm
8.	Wall Thickness	4.5 mm
9.	End Connection	Flanged
10	Length	961 mm
11	Puddle Flange Position	495 mm from edge

ID	Item	Specification
12	Quantity	1

6g) 200mm NB PN16 Flange Adaptor

ID	Item	Specification
1.	Material	Carbon Steel/Ductile Iron
2.	Pressure Rating	PN16
3.	Factory standard	ISO 9001
4.	Nominal Diameter	200mm
5.	Quantity	1

6h) 200mm NB PN16 Straight Pipe

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	200 mm
7.	Length	2215 mm
8.	End Connection	One end flanged, the other end plain for cutting to suit
9.	Quantity	1

6i) 200mm NB PN16 Elbow Flanged

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade A
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	200mm

ID	Item	Specification
7.	Wall Thickness	4.5 mm
8.	Quantity	1

6j) 200mm NB PN16 Straight Pipe, One End Flanged, One End Bell Mouth, with Puddle Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	200 mm
7.	Wall Thickness	4.5 mm
8.	Straight Pipe Length	815 mm
9.	Puddle Flange Position	518 mm
10	End Connection	One end flanged, the other end with Bellmouth
11	Quantity	1

6k) 350mm NB PN16 Straight Pipe Both Ends Plain, With Puddle Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	350 mm
8.	Wall Thickness	4.5 mm
9.	End Connection	Plain
10	Length	1425 mm

ID	Item	Specification
11	Puddle Flange Position	945 mm from one edge, 480 mm from the other
12	Quantity	1

6l) 350mm NB PN16 Flange Adaptor

ID	Item	Specification
1.	Material	Carbon Steel/Ductile Iron
2.	Pressure Rating	PN16
3.	Factory standard	ISO 9001
4.	Nominal Diameter	350mm
5.	Quantity	5

6m) 350mm NB PN16 Elbow Flanged

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	350mm
7.	Wall Thickness	4.5 mm
8.	Dimension A	355 mm
9.	Dimension B	253 mm
10	End Condition	Flanged
11	Quantity	1

6n) 350mm NB PN16 Straight Pipe Both Ends Flanged, With Puddle Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16

ID	Item	Specification
4.	Pipe & Fitting Standard	SABS 719
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	350 mm
8.	Wall Thickness	4.5 mm
9.	End Connection	Flanged
10	Length	961 mm
11	Puddle Flange Position	495 mm from edge
12	Quantity	1

6o) 350mm NB PN16 Equal Tee Flanged

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	350mm
7.	Wall Thickness	4.5 mm
8.	Branch Length	355 mm
9.	Tee Length	710 mm
10	End Condition	Flanged
11	Quantity	1

6p) 350mm NB PN16 Straight One End Flanged, One End Plain

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719

ID	Item	Specification
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	350 mm
8.	Wall Thickness	4.5 mm
9.	End Connection	One end plain, other end flanged
10	Length	600 mm
11	Quantity	1

6q) 350mm NB PN16 Wedge Gate Valve

ID	Item	Specification
1.	Type	Non rising stem
2.	Material	Cast Iron
3.	Grade	Grade 250
4.	Pressure Rating	PN16
5.	Body, bonnet, stuffing box yoke, gland and Handwheel Standard	SABS 1034
6.	Seat and Gate Rings	Malleable Iron
7.	Stem	Mild Steel 970 Gr En 3 or Stainless-Steel BS 970: 304S 15
8.	Flanges	SANS 1123
9.	Factory standard	ISO 9001
10	Nominal Diameter	350 mm
11	End Connection	Flanged
12	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
13	Quantity	2

6r) 350mm NB PN16 Straight Pipe Both Ends Plain, With Puddle Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16

ID	Item	Specification
4.	Pipe & Fitting Standard	SABS 719
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	350 mm
8.	Wall Thickness	4.5 mm
9.	End Connection	Plain
10	Length	880 mm
11	Puddle Flange Position	460 mm from one edge
12	Quantity	1

6s) 350/50mm NB PN16 Blank Flange with Steel Pipe Welded

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	350 mm
7.	Welded Pipe Diameter	50 mm
8.	Welded Pipe Length	150 mm
9.	Gusset Plate	4 x 6 mm Mild Steel
10	Quantity	1

6t) 50 NB BALL VALVE

ID	Item	Specification
1.	Type	Two-position handle
2.	End connection	Flanged
3.	Ball	Stainless Steel AISI 316
4.	Flanges	Stainless Steel AISI 316
5.	Gasket	EPDM according to FDA 177.2600
6.	Handle	Stainless Steel AISI 304

ID	Item	Specification
7.	Surface finish	Hygienic polish
8.	Pressure rating	PN16
9.	Nominal Size	50 NB
10	Quantity	1

6u) 50 NB DOUBLE ORIFICE AIR VALVE ANTI-SHOCK MECHANISM

ID	Item	Specification
1	Type	Double Orifice with Anti-Shock Orifice Mechanism
2	End Connection	Flanged ASME B16.5 Class 150
3	Top Flange	Fusion Bonded, Epoxy Powder Coated, Ductile Cast Iron, BS2789 Grade 420/12, Alternatively Mild Steel BS4360 Grade 43A
4	Top Cover	ABS Polylac PA737
5	Assembly Screws	Stainless Steel AISI 316
6	Nuts	Stainless Steel AISI 304
8	Washer	Stainless Steel AISI 304
9	Top Float	High Density Polyethylene
10	Nozzle	Stainless Steel AISI 316
11	Nozzle Seat	EPDM Rubber
12	Tie Rods	Stainless Steel AISI 304
13	Barrel	Stainless Steel AISI 316L
14	Barrel Seal	TEADIT NA 1002
15	Support Screw	Stainless Steel AISI 316
16	Baffle Plate Spacer	ABS Polylac PA 737
17	O-ring Seal	EPDM Rubber
18	Anti-Shock Orifice	High Density Polyethylene
19	Lower Float	High Density Polyethylene
20	Float Guide	Stainless Steel AISI 316
21	Baffle Plate	Stainless Steel AISI 316
22	Lower Flange	Fusion Bonded, Epoxy Powder Coated, Ductile Cast Iron, BS2789 Grade 420/12, Alternatively Mild Steel BS4360 Grade 43A
23	Pressure rating	PN16
24	Nominal Size	50 NB

ID	Item	Specification
27	Flanges	To SANS 1123
28	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
29	Quantities	3

6v) 80mm NB PN16 SG Flange Adaptor

ID	Item	Specification
1.	Material	Carbon Steel/Ductile Iron
2.	Pressure Rating	PN16
3.	Factory standard	ISO 9001
4.	Nominal Diameter	80mm
5.	Quantity	1

6w) 80mm NB PN16 Straight Pipe Both Ends Flanged, With Puddle Flange

ID	Item	Specification
1.	Material	Mild Steel
2.	Grade	Heavy
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 62
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	80 mm
8.	End Connection	Flanged
9.	Length	1130 mm
10	Puddle Flange Position	430 mm from one edge
11	Quantity	1

6x) 80mm NB PN16 Straight Pipe One End Flanged, other One Plain

ID	Item	Specification
1.	Material	Mild Steel
2.	Grade	Heavy
3.	Pressure Rating	PN16

ID	Item	Specification
4.	Pipe & Fitting Standard	SABS 62
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	80 mm
8.	End Connection	One End Flanged, Other End Plain
9.	Length	950 mm
10	Quantity	1

6y) 80mm NB PN16 Flange Adaptor

ID	Item	Specification
1.	Material	Carbon Steel/Ductile Iron
2.	Pressure Rating	PN16
3.	Factory standard	ISO 9001
4.	Nominal Diameter	80mm
5.	Quantity	1

6z) 80mm NB PN16 Wedge Gate Valve

ID	Item	Specification
1.	Type	Non rising stem
2.	Material	Cast Iron
3.	Grade	Grade 250
4.	Pressure Rating	PN16
5.	Body, bonnet, stuffing box yoke, gland and Handwheel Standard	SABS 1034
6.	Seat and Gate Rings	Malleable Iron
7.	Stem	Mild Steel 970 Gr En 3 or Stainless-Steel BS 970: 304S 15
8.	Flanges	SANS 1123
9.	Factory standard	ISO 9001
10	Nominal Diameter	80 mm
11	End Connection	Flanged

ID	Item	Specification
1.	Type	Non rising stem
12	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
13	Quantity	1

6aa) 350mm NB PN16 Straight Pipe Both Ends Flanged, With Puddle Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	350 mm
8.	Wall Thickness	4.5 mm
9.	End Connection	Flanged
10	Length	980 mm
11	Puddle Flange Position	560 mm from edge
12	Quantity	1

6bb) 350mm NB PN16 Unequal Tee Flanged

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Branch Material	Mild Steel
4.	Branch Grade	Heavy
5.	Pressure Rating	PN16
6.	Pipe & Fitting Standard	SABS 719
7.	Factory standard	ISO 9001
8.	Nominal Diameter	350 mm
9.	Branch Diameter	80 mm

ID	Item	Specification
10	Wall Thickness	4.5 mm
11	Branch Length	286 mm from centre line
12	Tee Length	710 mm
13	End Condition	Flanged
14	Quantity	1

6cc) 350mm NB PN16 Sweep Tee Flanged

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	350 mm
7.	Branch Diameter	350 mm
8.	Wall Thickness	4.5 mm
9.	Branch Length	1065 mm from centre line
10	Tee Length	1420 mm
11	End Condition	Flanged
12	Quantity	1

6dd) 350mm NB PN16 Straight One End Flanged, One End Plain, With Puddle Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	350 mm

ID	Item	Specification
8.	Wall Thickness	4.5 mm
9.	End Connection	One end plain, other end flanged
10	Length	1090 mm
11	Puddle Flange Position	450 mm from edge
12	Quantity	1

6ee) 350mm NB PN16 Blank Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	350mm
7.	Quantity	1

6ff) 350/150mm NB PN16 Reducer Flanged

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	350/150 mm
7.	Wall Thickness	3.9 mm
8.	Length	251 mm
9.	End Condition	Flanged
10	Quantity	1

6gg) 150mm NB PN16 Wedge Gate Valve

ID	Item	Specification
1.	Type	Non rising stem
2.	Material	Cast Iron
3.	Grade	Grade 250
4.	Pressure Rating	PN16
5.	Body, bonnet, stuffing box yoke, gland and Handwheel Standard	SABS 1034
6.	Seat and Gate Rings	Malleable Iron
7.	Stem	Mild Steel 970 Gr En 3 or Stainless-Steel BS 970: 304S 15
8.	Flanges	SANS 1123
9.	Factory standard	ISO 9001
10	Nominal Diameter	150 mm
11	End Connection	Flanged
12	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
13	Quantity	1

6hh) 150mm NB PN16 Flange Adaptor

ID	Item	Specification
1.	Material	Carbon Steel/Ductile Iron
2.	Pressure Rating	PN16
3.	Factory standard	ISO 9001
4.	Nominal Diameter	150mm
5.	Quantity	1

6ii) 150mm NB PN16 Straight One End Flanged, One End Plain, With Puddle Flange

ID	Item	Specification
1.	Material	Mild Steel
2.	Grade	Class Heavy
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 62

ID	Item	Specification
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	150 mm
8.	Wall Thickness	3.9 mm
9.	End Connection	One end plain, other end flanged
10	Length	1070 mm
11	Puddle Flange Position	430 mm from edge
12	Quantity	1

6jj) 150mm NB PN16 SG Flange Adaptor

ID	Item	Specification
1.	Material	Carbon Steel
2.	Grade	Grade A
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 62
5.	Factory standard	ISO 9001
6.	Nominal Diameter	150mm
7.	Wall Thickness	3.9 mm
8.	Quantity	1

6kk) 350mm NB PN16 Short Radius Bend Flanged, with Bellmouth

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	350mm
7.	Wall Thickness	4.5 mm
8.	Bell Mouth Diameter	535 mm

ID	Item	Specification
9.	Dimension	355 mm
10	Angle	90 degrees
11	End Connection	One end flanged, the other end with Bellmouth
12	Quantity	1

6ll) 350mm NB PN16 Straight Pipe Both Ends Flanged, With Puddle Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	350 mm
8.	Wall Thickness	4.5 mm
9.	End Connection	Flanged
10	Length	1351 mm
11	Puddle Flange Position	531 mm from edge
12	Quantity	1

6mm) 350mm NB PN16 Straight One End Flanged, One End Plain, With Loose Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001

ID	Item	Specification
7.	Nominal Diameter	350 mm
8.	Wall Thickness	4.5 mm
9.	End Connection	One end flanged, the other end plain, extra loose flange to be welded on site
10	Length	8000 mm
11	Quantity	1

6nn) 350mm NB PN16 Flow Control Valve

ID	Item	Specification
1.	Type	Float Control Valve
2.	Material	Cast Iron SABS Gr 250
3.	Lever	Mild Steel BS 970 Gr En3
4.	Stopper	Cast Iron SABS Gr. 250
5.	Hinge	Stainless Steel
6.	Pressure Rating	PN16
7.	Flanges	SANS 1123
8.	Factory standard	ISO 9001
9.	Nominal Diameter	350 mm
10	End Connection	Flanged
11	Corrosion Protection	Fusion Bonded Epoxy, to 250 microns
12	Quantity	1

6oo) 350mm NB PN16 Straight Pipe Both Ends Flanged, With Puddle Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001

ID	Item	Specification
7.	Nominal Diameter	350 mm
8.	Wall Thickness	4.5 mm
9.	End Connection	Flanged
10	Length	1442 mm
11	Puddle Flange Position	546 mm from one edge, 896 mm from the other
12	Quantity	1

6pp) 350mm NB PN16 Short Radius Bend Flanged

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	350mm
7.	Wall Thickness	4.5 mm
8.	Dimension A	355 mm
9.	Dimension B	355 mm
10	Angle	90 degrees
11	End Connection	Flanged
12	Quantity	4

6qq) 350mm NB PN16 Straight One End Flanged, One End Plain, With Loose Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Flanges	SANS 1123

ID	Item	Specification
6.	Factory standard	ISO 9001
7.	Nominal Diameter	350 mm
8.	Wall Thickness	4.5 mm
9.	End Connection	One end flanged, the other end plain, extra loose flange to be welded on site
10	Length	7041 mm
11	Quantity	1

6rr) 350mm NB PN16 Straight Pipe One End Flanged, other One Plain

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	350 mm
8.	End Connection	One End Flanged, Other End Plain
9.	Length	2605 mm
10	Quantity	1

6ss) 350mm NB PN16 Straight Pipe One End Flanged, other One Plain

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Flanges	SANS 1123
6.	Factory standard	ISO 9001
7.	Nominal Diameter	350 mm

ID	Item	Specification
8.	End Connection	One End Flanged, Other End Plain
9.	Length	2852 mm
10	Quantity	1

6tt) 350mm NB PN16 Straight Pipe, One End Flanged, One End Bell Mouth, With Puddle Flange

ID	Item	Specification
1.	Material	Steel
2.	Grade	Grade X42
3.	Pressure Rating	PN16
4.	Pipe & Fitting Standard	SABS 719
5.	Factory standard	ISO 9001
6.	Nominal Diameter	350 mm
7.	Wall Thickness	4.5 mm
8.	Bell Mouth Length	155 mm
9.	Straight Pipe Length	813 mm
10	Puddle Flange Position	470 mm from one edge flange
11	End Connection	One end flanged, the other end with Bellmouth
12	Quantity	1

BEDDING AND BACKFILL MATERIAL (To be locally subcontracted)

8a) Bedding and backfill material specifications

Table 3602/1	CRUSHED STONE BASE AND SUBBASE: MATERIAL REQUIREMENTS		
Material Characteristic	TYPE OF MATERIAL		
	G1	G2	G3
Parent Material	Sound rock from an approved quarry, or clean, sound mine rock from mine dumps, or clean sound boulders	Sound rock, boulders or coarse gravel	Sound rock, boulders or coarse gravel
ADDITIONAL FINES	Only fines crushed from the same sound parent rock may be added for grading correction provided that added fines shall have a LL. Not exceeding 25 and PI not exceeding 4	May contain UP to 10% by mass of approved natural fines not necessarily obtained from parent rock. Added fines fines shall have a LL. not exceeding 25 and PI not exceeding 6	May contain UP to 15% by mass of approved natural fines not obtained from parent rock. Added fines shall have a LL. not exceeding 25 and a PI not exceeding 6.
STRENGTH	10% Fines Aggregate Crushing Value (10% fact), determined in accordance with TMH1 method B2, shall be not less than the appropriate value in table 3602/2, column 3. The Aggregate crushed value(ACV), determined in accordance with TMH1 method B1, shall not exceed the appropriate value in the 3602/3.		
DURABILITY	The material shall comply with the requirements in columns 3,4 and 5 of table 3602/2.		
FLAKINESS INDEX	Flakiness Index, determined in accordance with TMH1 method B3, shall not exceed 35 on each of the -26,5 + 19mm fraction and the -19 + 13,2mm fraction.		
FRACTURED FACES	All faces shall be fractured faces	For crushed materials at least 50% by mass of the fractions retained on each standard sieve 4.75mm and larger shall have at least one fractured face	
Fraction (mm)	LL. Shall not exceed 25. PI shall not exceed 5 LS	LL.shall not exc.25 PI shall not exc.6 In	LL. Shall not exceed 25 PI shall not exceed 6 LS

Atterberg Limits	-0,425	shall not exceed 2% In addition the arithmetic mean of the PI's for a lot (min 6 tests) shall not exceed 4.	addition the arithmetic mean of the PI's for a lot (min6 tests) shall not exceed 4,5. LS shall not exc.3%.	shall not exceed 3% In the case of calcrete the PI shall not exceed 8 (% passing 0.425mm sieve) LS	
	-0,075	The PI shall not exceed 12. If the PI exceeds 12 the material shall be chemically modified. After chemical modification the PI of the minus 0.075mm fraction shall not exceed 8		If chemical modification is required, the PI of the -0,075mm fraction after modification shall not exceed 10.	
SOLUBLE SALTS		See additional requirements			
NOMINAL MAXIMUM SIZE		37,5mm	37,5mm	37,5mm	26,5mm
GRADING	Nominal apertu re size of sieve(mm)	Percentage passing sieve, by mass	Percentage passing sieve, by mass	Percentage passing sieve, by mass	
	37,5	100	100	100	
	26,5	84 -94	84 94	84 94	100
	19,0	71 - 84	71 - 84	71 - 84	85 - 95
	13,2	59 - 75	59 - 75	59 - 75	71 - 84
	4,75	36 - 53	36 - 53	36 - 53	42 - 60
	2,00	23 - 40	23 - 40	23 - 40	27 - 45
	0,425	11 - 24	11 - 24	11 - 24	13 - 27
	0,075	4 - 12	4 -12	4 -12	5 - 12
COARSE SAND RATIO (see definition in SUBSUBCLAUSE 3602(c)(i)(5))		Shall not be less than 35% and shall not exceed 50% in respect of the target grading	Shall not be less than 35% and shall not exceed 50% in respect of the target grading	Shall not be less than 35% and shall not exceed 50% in respect of the target grading.	
COMPACTION REQUIREMENTS		Minimum of 88% of apparent relative density.	Minimum of 85% of bulk relative density.	98% or 100% of modified AASHTO density (as specified)	

TABLE 3402/1	**REQUIREMENTS FOR TYPES G4 TO G6 MATERIALS**		
	TYPES OF MATERIAL		
PROPERTY	G4	G5	G6
	Natural gravel, or natural gravel	Natural gravel, or	Natural gravel, or natural gravel

DESCRIPTION OF MATERIAL		and boulders which may require crushing	natural gravel and boulders which may require crushing, or crushed rock	and boulders which may require crushing, or crushed rock.
ADDITIONAL FINES		May contain approved additional fines not obtained from parent rock. Added fines shall have a liquid limit (LL.) not exceeding 25 and a plasticity(PI) not	May contain approved natural fines not obtained from parent rock.	May contain approved natural fines not obtained from parent rock.
NOMINAL MAXIMUM SIZE		(i) Uncrushed material:53mm (ii) Crushed material:37,5mm or (unless otherwise specified in the project specifications)	(i) Uncrushed material: 63mm (ii) Crushed material: 53mm before compaction(unless otherwise specified in the project specifications)	(i) Uncrushed material: Two thirds of the compacted layer thickness(unless otherwise specified in the the project specifications) (ii) Crushed material: 63mm before compaction (unless otherwise specified in the project specifications)
FLAKINESS INDEX		Flakiness index, determined in accordance with the TMH1 method B3, shall not exceed 35 on each of the -26,5 + 19mm fraction and the -19 + 13,2mm fraction.		
FRACTURED FACES		Alluvial and colluvial gravels shall be crushed so that at least 50% by mass of the fractions retained on each standard sieve 4,75mm and any larger shall have at least one fractured face.	Alluvial and colluvial gravels shall be crushed so that at least 50% but. Mass of the fractions retained on each standard sieve 4,75m and any larger shall have at least one fractured face.	
GRADING	Nominal aperture	Percentage passing through sieve by mass Crushed material Nominal / Nominal / Uncrushed		

	size of sieve(mm)	maximum size 37,5mm	maximum size 26,5 mm	material	The percentage by mass passing the	
	53,0			100	2,00mm sieve shall	
	37,5	100		85-100	not be less than 20%	
	26,5	84-94	100	-	r môre than 70%.	
	19,0	71-84	85-95	60-90		
	13,2	59-75	71-84	-		
	4,75	36-53	42-60	30-65		
	2,00	23-40	27-45	20-50		
	0,425	11-24	13-27	10-30		
	0,075	4-12	5-12	5-15		
GRADING MODULE (GM)					2.5smaller & equal GM smaller &equal1.5	2.6 smaller & equal GM smaller & equal 1.2
ATTERBERG LIMITS FOR NATURAL MATERIAL (-0,425 FRACTION)		**(a) All materials except calcrete:** LL. Shall not exceed 25 PI shall not exceed 6 LS shall not exceed 3%. **(b) Calcrete:** LL. Greater than 25 PI greater than 8 (%) passing 0,425mm sieve LS greater than 170			**(a) All materials except calcrete:** LL. Shall not exceed 30, PI shall not not exceed 10. LS shall not exceed 5%. **(b) Calcrete:** LL. greater than 30 PI greater than 15 LS greater than 6 (% passing 0,425mm sieve) LS greater 320	PI shall not exceed 12 or a value equal to 2 times the GM plus 10, whichever is the higher value.LS shall not exceed 5%. In the case of calcrete the PI shall not exceed 15 provided the LS does not exceed 6% and (% passing 0,425mm sieve) LS greater than 320.
DURABILITY		The material shall comply with the requirements in table 3402/3			Mudrock shall have a wet 10% FACT value of not less than 90kN,and a wet/dry Venter test class of I or II	Mudrock shall have a wet 10% FACT value of not less than 80kN, and a wet/dry Venter test class of I or II.
SOLUBLE SALTS		The materials shall comply with the requirements of clause 3602.				
STRENGTH (CBR)		CBR at 98% of modified AASHTO density shall not be less than 80%			CBR AT 95% of modified AASHTO density shall not be less than 45%	CBR at 95% of modified AASHTO density shall not be less than 25%.
SWELL (Maximum)		Swell at 100% of modified			Swell at 100% of	Swell at 100% of modified

	AASHTO density shall not exceed 0,2% for all materials except calcrete for which the swell shall not exceed 0,5%.	modified AASHTO density shall not exceed 0,5%.	AASHTO density shall not exceed 1,0%.
COMPACTION REQUIREMENTS	98% or 100% (as specified) of modified AASHTO density for natural materials.	The density requirements of the layer in which the material is used, shall be applicable.(See subclause 3402(b).) In restricted areas the in situ dry density of gravel material shall comply with the requirements in the project specifications.	
REQUIREMENTS FOR TYPES G7 TO G9 MATERIALS			
	TYPE OF MATERIAL		
PROPERTY	G7	G8	G9
DESCRIPTION OF MATERIAL	Natural material (soil, sand or gravel)	Natural material (soil, sand or gravel)	Natural material (soil, sand or gravel)
ADDITIONAL FINES	Not applicable	Not applicable	Not applicable
NOMINAL MAXIMUM SIZE	(i) Uncrushed material: two thirds of the compacted layer thickness. (ii) Uncrushed material:75mm	Two thirds of the compacted layer thickness.	Two thirds of the compacted layer thickness.
GRADING MODULUS (GM)	2.7 smaller equal GM smaller equal 0.75		2.7 smaller equal GM smaller equal 0.75
ATTERBERG LIMITS FOR NATURAL MATERIAL(0,425mm FRACTION)	The PI shall not exceed 12 or a value equal to 3 times the GM plus 10, whichever is the higher value. In the case of the calcrete the PI shall not exceed 17 provided that the LS does not exceed 7% and (% passing0,425mm sieve) LS greater than 320.	The PI shall not exceed 12 or a value equal to 3 times the GM plus 10, which-ever is the higher value. In the case of calcrete the PI shall not exceed 17 provided that the LS does not exceed 7%	The PI shall not exceed 12 or a value equal to 3 times the GM plus 10, whichever is the higher value. In the case of the calcrete the PI shall not exceed 17 provided that the LS does not exceed 7%
DURABILITY	Mudrock shall have a wet 10% FACT value of not less than 60kN, and a wet.dry Venter test class of I, II or III.	Mudrock shall have a wet FACT value of not less than 60kN, and a wet/dry Venter test class of I, II or III.	Mudrock shall have a wet 10% FACT value of not less than 60kN, and a wet.dry Venter test class of I, II or III.
SOLUBLE SALTS	The materials shall comply with the requirements of clause 3602.		
STRENGTH (CBR)	CBR at 93% of modified AASHTO density shall be at	CBR at 93% of modified AASHTO	CBR at 93% of modified AASHTO density shall be at

	least 15%	density shall be at least 10%	least 7%
SWELL (MAXIMUM)	Swell at 100% of modified AASHTO density shall not exceed 1,5%	Swell of 100% of modified AASHTO density shall not exceed 1,5%	Swell at 100% of modified AASHTO density shall not exceed 1,5%
COMPACTION REQUIREMENTS	The density requirements of the layer in which the material is used, shall be applicable. (See subclause 3402(b).) In restricted areas the in situ dry density of gravel material shall comply with the requirements in the project specifications.		

Table 3402 / 3	**DURABILITY REQUIREMENTS FOR G4 MATERIAL**		
GROUP	MEMBERS OF THE GROUP	DURABILITY MILL INDEX (MAXIMUM)	%PASSING 0,425mm SIEVE AFTER THE DURABILITY MILL TEST (MAXIMUM)
Basic crystalline rock	Basalt Dolerite Gabbro	125	35
	Gneiss Granite	420	35
High silica rock	Chert Hornfels Quartzite	420 (clay mineral kaolin)	35
Sandstone	Arkose Conglomerate Sandstone Siltstone	125	35 (increase from original not môre than 15%)
Mudrock	Mudrock Phylite Shale etc.	125	35
Carbonater rock	Dolomite Limestone Marble	not applicable	not applicable
	Greywacke Tillite	125	35
Pedogenic material	Calcrete Ferricrete Silcrete	480	40

Table 3402/4	**REQUIREMENTS FOR GRAVEL WEARING COURSE**	
PARAMETER	LIMIT	
	TYPE 1	TYPE 2
Maximum size, mm	37,5	37,5
Oversize Index (Io) (maximum), %	Greater and equal to 5	0
Shrinkage product (Sp)	100-365 (maximum of 240 preferable)	100-240

Grading coefficient (Gc)	16-34	16-34
CBR at smaller & equal to 95% modified AASHTO Compaction(soaked value) (minimum), %	smaller and equal to 15	smaller and equal to 15
Io = Oversize Index (per cent retained on 37,5 mm sieve) Sp = Linear shrinkage x (per cent passing 0,425mm sieve) Gc = (Per cent passing 26,5mm - per cent passing 2,0mm) x per cent passing 4,75 mm /100		
Note: All the parameters in table 3402/4 are defined in TRH 20		

Table 3402/5 REQUIREMENTS FOR CHEMICALLY STABILIZED PAVEMENT LAYERS

CRITERIA	C1	C2	C3	C4
Material before treatment	At least G2 quality	At least G4 quality	At least G6 quality	
Atterberg limits after treatment	Slightly plastic	Slightly plastic	PI shall not exceed 6	
Design strength (Mpa) (Laboratory unconfined strength)				
(a) at 100% of modified AASHTO density	minimum : 6 maximum : 12	minimum : 3 maximum : 6	minimum:1,5 maximum:3	minimum: 0,75 maximum: 1,5
(b) at 97% of modified AASHTO density	minimum : 4 maximum : 6	minimum : 2 maximum : 4	minimum:1 maximum:2	minimum: 0,5 maximum: 1
Indirect tensile strength at 100% modified AASHTO density(kPa)			Minimum:250	Minimum :200
Durability: Fines lost Wet - dry Freeze - thaw	All characteristics, including amongst others the carbonated values with regard to durability, shall comply with the requirements in the project specifications.			
Quantities	27 800m^3			

C3.1.2 LOCATION OF WORKS

For details on the location of the Works refer to the locality map under Part C.4: Site Information. The main site camp is located at 23°44'58.46"S and 30°29'28.46"E.

C3.1.3 PROJECT MEETINGS

The contractor shall be required to attend meetings relating to the required construction materials and the scope of works.

C3.1.4 DRAWINGS

The reduced drawings contained in C4 that form part of the tender document shall be used for tender purposes only and for information only.

Drawings are not to be scaled. Only figured dimensions shall be used and drawings shall not be scaled unless so instructed by the employer. If a dimension is not shown, it will be the responsibility of the contractor to find the correct dimension from the employer's agent.

Certain dimensions are marked thus "*" and are to be confirmed on site by the contractor.

And again, the closing length is to be determined on site to fit.

The contractor shall submit workshop drawings before procurement of any materials on site and approval by the employer and employer's agent before commencement of works.

Drawings issued override the BoQ.

C3.1.5 AS BUILT DRAWINGS

Not applicable

C3.1.6 CUSTODY OF DRAWINGS AND SPECIFICATIONS

The Drawings and Specifications shall remain the sole property of the Employer and the Contractor shall be required to sign for receipt thereof. The copyright of all documents shall vest in the Employer and the Drawings and Specifications may not be reproduced, in part or in whole, without the written authority of the Engineer

C3.1.7 COPYRIGHT

The copyright in all documents, drawings and records related to the purpose and scope of the Works or related in any other manner to the Works, shall vest in the Employer and the Contractor shall not furnish any information in connection with the Works to anybody without the approval of the Employer.

C3.1.8 POWER, WATER SUPPLY AND OTHER SERVICES

Not Applicable.

C3.1.9 CONTRACTOR'S CAMP SITE AND SECURITY

The contractor shall make his own arrangements regarding the establishment of a camp site and housing for his construction personnel and all regulations stipulated by the local authority shall be adhered to.

It is anticipated that the contractor's choice of a camp site will be influenced by the availability of telephone and electrical connections as well as the supply of potable water. Provision is made in these specifications for the erection of a security fence around the site offices. The contractor shall be responsible for the security of his personnel and constructional plant on and around the site of the works and for the security of his camp, and the employer will consider no claims in this regard.

C3.1.10 ACCOMMODATION OF TRAFFIC

Not applicable.

C3.1.11 PROGRAMME REQUIREMENTS FOR CONSTRUCTION ACTIVITIES

The contractor shall programme his activities to be suitable in terms of his resources to complete the contract inside the stipulated time period.

C3.1.12 CONSTRUCTION IN CONFINED AREAS

Not applicable.

C3.1.13 BARRICADING OF EXCAVATIONS

Not applicable

C3.1.14 ENGINEERING

a) DESIGN

- The Employer's agent is responsible for the design of the permanent Works as reflected in these Contract Documents unless otherwise stated.
- The **Contractor** is responsible for the design of the temporary Works and their compatibility with the permanent Works.
- The **Contractor** shall supply all details necessary to assist the Employer's agent in the compilation of the as-built drawings.
- The **Contractor** is responsible for all drawings in the entire project.

b) CONTRACTOR'S DESIGN

Where contractor is to supply the design of designated parts of the permanent Works or temporary Works, he shall supply full working drawings supported by a professional engineer's design certificate.

c) DESIGN PROCEDURE

All designs and modifications thereto shall be communicated in writing and the contractor and engineer shall maintain master lists to record and track all transactions.

C3.1.15 EQUIVALENCY OF STANDARDS AND CODES

Wherever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise expressly stated in the Contract. Where such standards and codes are national, or relate to a country or region, other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be accepted subject to the Engineer's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 7 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the documents.

C3.1.16 TEMPORARY ACCOMMODATION

The contractor shall make his own arrangements for accommodation of his workmen and staff. He shall liaise with the relevant authorities and comply with any regulations required. No accommodation will be allowed inside the security area of the purification works.

The contractor's site camp and site accommodation of personnel will be subject to the requirements of the Construction Safety Act of 2003, the requirements of the Employment Act and the Environmental Impact Report.

C3.1.17 HEALTH AND SANITATION

Provide health and sanitation in accordance to the latest safety act regulations. In a similar manner change rooms, shower facilities, site personnel eating facilities with gender separation where required are to be supplied. The contractor shall be responsible for the safe and environmentally acceptable disposal of all rubbish and rubble from the site, accumulated during the construction period. All facilities must comply with the OHS act.

The hygiene measures with regards to the works durations as well the number of personnel to be deployed on site must be seen very seriously by the contractor. Chemical toilets will only be allowed on a temporary basis for use at the furthermost areas of the works, at the work face.

These shall be provided on the following basis:

One per 20 labourers of the Contractor's staff with separate facilities for male and female staff.

The Contractor shall make arrangements for the proper maintenance of these facilities.

Reference is made to the health and safety act and specific requirements for sanitation The Health and safety requirements are to be the prevailing standards requirements.

The main camp of the contractor will be expected to have container type ablution facilities with combined shower and hand wash facilities. Each chemical facility must be equipped with a hand cleaning facility with soap and paper towel dispenser. All effluent to be collected in containers for disposal of and evacuated timeously off site. Upon appointment and within two weeks a detailed plan must be put in place and submitted for the Engineer approval.

The contractor shall adhere to all covid regulations.

C3.1.18 NOTICE OF COVERING OF WORKS

Not applicable

C3.1.19 INSPECTION AND REJECTION OF FAULTY WORK

The Engineer or his representative (Resident Engineer) appointed by the Engineer shall have the full power to inspect the work during every stage of its construction, and for that purpose shall have free access to the works at all times. Should any work appear to the Engineer or his representative not be executed in accordance with the Specifications, the same may be immediately rejected, and the Contractor shall forthwith carry out the making good, breaking down and rebuilding where applicable of rejected work at his own expense.

The Engineer or his representative (Resident Engineer) appointed by the Engineer shall not be used as the CONTRACTORS SITE AGENT. The contractor is deemed to have carried out all PROCESS CONTROL before asking for the work to be inspected.

The inspection of all concrete work will be on all stages of the construction and no works will be released for the new stage unless is done so in writing by the Engineer the foundation level, the placing and fixing of steel and the final end product. Settings out and quality of shutters are the responsibility of the contractor and can only be accessed once the end product is built.

All inspection call outs (successful or not) will be recorded and must be reported at the site meetings. Both parties must agree all defect lists with a completion date entered into the list for each defect.

All site communications are to be confirmed in writing.

C3.1.20 SETTING OUT OF THE WORKS

Not applicable

C3.1.21 DISINFECTIONS OF THE WORKS

The Contractor shall be responsible for all disinfection of the structures and pipes they have worked on.

C3.1.22 FINISHING & TIDYING

Progressive and systematic finishing and tidying will form an essential part of this contract. Under no circumstances would spoil, rubble, materials, equipment or unfinished operations be allowed to accumulate unnecessarily. In the event of this occurring the Engineer will have the right to withhold payment for as long as necessary in respect of the relevant works in the area(s) concerned.

C3.1.23 CONTRACTOR'S CODE OF CONDUCT

Workmen Instant Dismissal

Workmen may be instantly dismissed for the following:
Theft.
Violence with co-workers or supervising staff
Committing a criminal offence and is sentenced to prison without the option of a fine.

Misconduct

Any employee who, within a period of 6 months, receives two written warnings and for the third time is guilty of misconduct as listed below may be dismissed without further notice.

- Insubordination and constant refusal to follow instructions
- Absenteeism for 3 or more days without a valid medical certificate
- Repeatedly coming to work late
- Disruptive behaviour conducive to delays in the work program
- Intimidation of other workers
- Dangerous behaviour
- Use of alcohol or drugs during working hours
- Non-performance
- Abuse or waste of company property
- Continuous absenteeism

C3.1.224 FEATURES REQUIRING SPECIAL ATTENTION

a) EXISTING SERVICES

The Contractor shall be deemed to have made allowance in his tender for the need to protect the existing services from damage and to hand over the completed works with the existing services intact and undamaged.

Notwithstanding the information given herein, the Contractor shall retain full responsibility for establishing the exact positions of the various existing services, which may not be shown on the construction drawings, in advance of the main construction work.

The use of specialised equipment for location of power cables and other services is allowed into the relevant Bill of quantities

All the works areas with known services are to be preceded with thorough investigation with hand excavations and exposure of the services.

b) SURVEY BEACONS

Not applicable

C3.1.25 DAMAGE TO SERVICES AND EXISTING WORKS

a) RESPONSIBILITY OF CONTRACTOR

The Contractor shall be responsible for any damage to existing services and existing works in the execution of this contract and shall reimburse the Owner concerned for any repairs required or compensation for damages awarded. The Contractor's attention is drawn to Clause 3.1.30 and SANS 1200 A, Clause 5.4.

b) NOTIFICATION

The Contractor will be responsible for immediately notifying the Authorities concerned the Employer and the Engineer regarding any damage caused to public services and existing works.

The Engineer's Representative must be notified without delay.

C3.1.26 WORK ON PUBLIC AND PRIVATE PROPERTY

The Contractor shall exercise the greatest care to avoid unnecessary damage to trees, gardens, fences, walls and structures on public and private property, and also strictly supervise the behaviour of his workmen.

On completion of the work over or in the vicinity of Local or Tribal Authority or private property, the Contractor shall ensure that anything that may have been disturbed or damaged has been compensated for or reinstated to a condition equal to that which it was before construction commenced and also to the satisfaction of the owner concerned. The materials resulting from any demolition of existing structures shall be the property of the owner.

C3.1.27 REGULATIONS

The Contractor shall in all respects conform to the requirements contained in regulations by higher authorities. Such regulations shall include *inter alia*:

1.) ***National Building Regulations. SABS 400**
2.) Code of Practice for the Wiring of Premises, SABS 0142-1981 as amended.
3.) The Mines and Works Regulations, Government Notice Number R1609 of 1962-09-28, as amended.
4.) ***The Occupational, Health and Safety Act 85/93, as amended**.
5.) The local Municipal Byelaws and Regulations as well as the regulations of the local Supply Authority.
6.) The local Fire Regulations.
7.) The regulations of Telkom.
8.) The regulations of the local Gas Board where applicable.
9.) The standard regulations of any Government Department or public service company where applicable.
10.) The Regulations of Lepelle Northern Water attached at volume no 1.
11.) The Regulations of Eskom
12.) ***The NHBRC National home builders: Home building manual part 1&2,& part 3 two volumes**
13.) ***SABS 1200 and the application SABS 0120**.

14.) The construction Regulations of the Construction Industry Development Board (CIDB)

The regulations marked "*" are to be kept on site.

The Contractor shall pay and indemnify the Employer against any fees or charges by law and shall keep the Employer and the Engineer indemnified against all penalties and liabilities of any kind for breach by the Contractor or any of the conditions due by law, except insofar as amended or specifically allowed by the Engineer.

C3.1.28 LABOUR BASED CONSTRUCTION

Not applicable

C3.1.29 ENVIRONMENT AND SAFETY

The Environmental Management Plan (EMP) for the site of the Works has been commissioned by the Client and will be issued to the Successful Contractor.

The Contractor shall comply with all the requirements laid down in the EMP. The Contractor shall take time to acquaint his employees with the provisions, regulations, duties, obligations and prohibitions, and shall accept sole liability for due compliance with the duties, obligations and prohibitions and absolve the Employer from being obliged to comply with the aforesaid duties, obligations and prohibitions.

In case of failure on the part of the Contractor to comply with the requirements of the EMP, the Employer shall be entitled to employ and pay other persons to carry out any remedial work to rectify any consequence resulting from the non-compliance by the Contactor and all cost consequent or incidental thereto shall be borne by the Contractor and shall be recoverable form him by the Employer. If it is not practical to rectify any consequence resulting from the non-compliance of the Contractor with the EMP the Employer will be entitled to impose a penalty on the Contractor which penalty shall be in relation to the expense which the Contractor would have incurred to comply.

The Contractor shall indemnify the Employer and the Engineer against responsibility for damage to the environment on the site of the Works.

C3.1.30 BLASTING INDEMNITY

Not applicable

C3.1.31 RECORDING OF WEATHER

Not applicable

C3.1.32 INCLEMENT WEATHER

Not applicable

C3.2 STANDARD SPECIFICATIONS

The following SANS specifications shall apply for the construction of the Works:

SANS 1200 GE	**:**	**Precast Concrete (Structural)**
SANS 1200 HA	**:**	**Structural Steelwork (Sundry items)**
SANS 1200 HC	**:**	**Corrosion Protection of Structural Steelwork**
SANS 1200 L	**:**	**Medium Pressure Pipelines**
SANS 1200 LB	**:**	**Bedding (Pipes)**

Wherever any reference is made to the South African Bureau of Standards (SABS) in either the Bill of Quantities or the document, this reference shall be deemed to read "SANS standard"

The following SANS specifications are also applicable to this contract:

SANS 1921 (2004):	Construction and Management Requirements for Works Contracts
Part 1:	General Engineering and Construction Works
Part 2:	Accommodation of Traffic on Public Roads Occupied by the Contractor
Part 3:	Structural Steelwork
Part 6:	HIV/AIDS Awareness
SANS 10396: 2003:	Preferential Construction Procurement Policies using Targeted Procurement Procedures
SANS 1914-1 to 6 (2002):	Targeted Construction Procurement
SANS 1921-1 (2004):	Construction and Management Requirements for Works Contracts
Part 1:	General Engineering and Construction Works and where accommodation of traffic is involved

The Tenderer is expected to be in possession of a copy of the Standard Specifications. The successful Tenderer will be required to provide a full set of the applicable standard specifications at the commencement of the Contract which is to be kept available on site at all times.

Copies of the "Standardised Specification for Civil Engineering Construction" SANS 1200 are available from the:

South African Bureau of Standards
Private Bag X191
Pretoria, 0001

C3.3 AMENDMENTS TO THE STANDARD SPECIFICATIONS

The following variations to standardized specifications and additional clauses are applicable to this Contract:

PSHA	**Structural steel (Sundry Items)**
PSL	**Medium Pressure Pipelines**
PSLB	**Bedding (Pipes)**

STATUS

Should any requirement of the project specification conflict with any requirements of the standardised specification listed, the requirements of the project specification shall prevail.

PSA **GENERAL**

PSA 1 **SCOPE**

REPLACE THE CONTENTS OF SUB-CLAUSE 1.1, INCLUDING THE NOTES, WITH THE FOLLOWING:

"1.1 This specification covers requirements, principles and responsibilities of a general nature which are generally applicable to civil engineering construction and building works contracts, as well as the requirements for the Contractor's establishment on the Site."

PSA 2 **INTERPRETATIONS**

PSA 2.3 **DEFINITIONS**

IN THE OPENING PHRASE BETWEEN THE WORDS "specification" *AND* "the following", *INSERT THE WORDS* "the definitions given in the Conditions of Contract and".

(a) General

ADD THE FOLLOWING DEFINITIONS:

" 'General Conditions' and 'Conditions of Contract': The General Conditions of Contract specified for use with this Contract, together with the Special Conditions of Contract as applicable.

'Specified': As specified in the Standardized Specifications, the Drawings or the Project Specifications. 'Specifications' shall have the corresponding meaning."

(b) Measurement and payment

REPLACE THE DEFINITIONS FOR "Fixed charge", "Time-related charge" *AND* "Value-related charge" *WITH THE FOLLOWING:*

" 'Fixed charge': A charge that is not subject to adjustment on account of variations in the value of the Contract Price or the time allowed in the Contract for the completion of the work.

'Time-related charge': A charge, the amount of which varies in accordance with the Time for Completion of the Works, adjusted in accordance with the provisions of the Contract.

'Value-related charge': A charge, the amount of which varies pro rata with the final value of the measured work executed and valued in accordance with the provisions of the Contract.' "

PSA 2.4 **ABBREVIATIONS**

(a) Abbreviations relating to standard documents

ADD THE FOLLOWING ABBREVIATION:

"CKS: SANS Co-ordinating Specification."

PSA 3 MATERIALS

PSA 3.1 QUALITY

ADD THE FOLLOWING AT THE END OF SUB-CLAUSE 3.1:

PSA 3.1 QUALITY

ADD TO THE FOLLOWING:

"No used or recycled material may be used in the Works unless expressly authorised by the Engineer.

All materials to be provided under this Contract shall bear the mark of the South African Bureau of Standards wherever such materials are the subject of an SABS standard.

Materials bearing the SABS or BS mark will not be subjected to tests to determine whether they comply with the relevant specifications. The Engineer may in his discretion require any material not bearing such mark to be tested in accordance with the relevant specifications; should he do so the Contractor shall arrange for such tests to be carried out at the Contractor's cost by the South African Bureau of Standards or other approved body. Should the tests prove that any material complies with the Specifications the Contractor will be reimbursed the value of the testing body's account for carrying out the tests required by the Engineer."

ADD THE FOLLOWING SUB-CLAUSES TO CLAUSE 3:

"PSA 3.3 ORDERING OF MATERIALS

The quantities set out in the schedule of quantities have been carefully determined from calculations based on data available at the time and should therefore be considered to be approximate quantities only. Before ordering materials of any kind the contractor shall check with the Engineer whether or not the scope of the work for which the materials are required is likely to change substantially. No liability or responsibility whatsoever shall be attached to the employer for materials ordered by the contractor except when ordered in accordance with written confirmation issued by the Engineer.

PSA 3.4 DELAY DUE TO SUPPLY OF MATERIALS

The Contractor shall ensure that the work is not delayed, due to the lack of materials on the site of the works, by placing orders with suppliers for the materials required under this contract timeously.

The Contractor shall, by producing copies of written orders or written enquiries for supplies, prove to the satisfaction of the Engineer that any delay occasioned by non-availability of materials has been caused by the inability of suppliers to supply and not by his own lack of timely ordering or lack of exhaustive enquiry for supplies, before any extensions of the contract time will be allowed due to such delays."

PSA 4 PLANT

PSA 4.1 SILENCING OF PLANT

REPLACE THE CONTENTS OF SUB-CLAUSE 4.1 WITH THE FOLLOWING:

"The Contractor's attention is drawn to the applicable regulations pertaining to noise and hearing conservation, framed under the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) as amended.

The Contractor shall at all times and at his own cost, be responsible for implementing all necessary steps to ensure full compliance with such regulations, including but not restricted to the provision and use of suitable and effective silencing devices for pneumatic tools and other plant which would otherwise cause a noise level in excess of that specified in the said regulations.

Where appropriate, the Contractor shall further, by means of temporary barriers, effectively isolate the source of such noise in order to comply with the said regulations."

PSA 4.2 CONTRACTOR'S OFFICES, STORES AND SERVICES

ADD THE FOLLOWING PARAGRAPH BEFORE THE EXISTING FIRST PARAGRAPH IN SUB-CLAUSE 4.2:

"Neither housing nor shelters are available for the Contractor's employees on site. The Contractor shall make his own arrangement to house his employees and transport them to the site.

The Contractor's buildings, sheds and other facilities erected or utilised on the Site for the purposes of the Contract shall be fenced off and shall contain all offices, stores, workshops, testing laboratories, toilet facilities, etc. as may be required by the Contractor. The facilities shall always be kept in a neat and orderly condition.

No personnel may reside on the Site. Only night-watchmen may be on the Site after hours."

DELETE "and first-aid services" *IN THE SECOND PARAGRAPH OF SUB-CLAUSE 4.2 AND ADD THE FOLLOWING:*

"The Contractor shall provide on the Site and in close proximity to the actual locations where the work is being executed, one toilet per 10 workmen, which toilets shall be effectively screened from public view and their use enforced. Such toilets shall be relocated from time to time as the location of the work being executed changes, so as to ensure that easy access to the toilets is maintained.

The Contractor shall, where applicable, make all necessary arrangements and pay for the removal of night soil."

ADD THE FOLLOWING NEW SUB-CLAUSE 4.3:

"PSA 4.3 SUITABILITY OF CONSTRUCTION PLANT

If the Engineer considers that any constructional plant in use is in any way inefficient or is inadequate in capacity to complete the Works properly or on time, he shall have the

right to call upon the Contractor to provide such additional plant or equipment as may be required to meet the needs of the Works."

PSA 5 CONSTRUCTION

PSA 5.1 SURVEY

PSA 5.1.2 Preservation and Replacement of Beacons and Pegs subject to the Land Survey Act

DELETE THE WORDS "in the vicinity of boundaries" *IN THE SECOND SENTENCE OF SUB-CLAUSE 5.1.2 AND REPLACE THE WORDS* "under the direction of" *IN THE SAME SENTENCE WITH* "in consultation and liaison with".

ADD THE FOLLOWING AFTER THE SECOND SENTENCE OF SUB-CLAUSE 5.1.2:

"The Contractor and the Engineer shall record on the said list, their concurrence or disagreement (as the case may be) regarding the completeness and accuracy of the details recorded therein."

REPLACE THE THIRD SENTENCE OF SUB-CLAUSE 5.1.2 WITH THE FOLLOWING:

"At the completion of the Contract, the Contractor shall expose all pegs that were listed at the commencement of the construction as being in order and the Contractor shall arrange with a registered Land Surveyor for the checking of the positions of all such pegs and the replacement of those that the Land Surveyor's check reveals have become disturbed or damaged. The Contractor shall, as a precedent to the issue of the Certificate of Completion, provide to the Engineer, a certificate from the registered land surveyor, certifying that all the pegs listed at the commencement of construction in accordance with the provisions of this clause, have been checked and that those found to have been disturbed, damaged or destroyed have been replaced in their correct positions, all in accordance with the provisions of the said Act.

The costs of all checking, replacement and certification as aforesaid shall be entirely for the Contractor's account. This, with the provision always that the Contractor shall not be held liable for the cost of replacement of pegs which:

(a) cannot reasonably be re-established in their original positions by reason of the finished dimensions of the permanent works, and

(b) the Contractor can prove beyond reasonable doubt to the satisfaction of the Engineer, were disturbed, damaged or destroyed by others beyond his control."

PSA 5.3 PROTECTION OF EXISTING STRUCTURES

REPLACE "Machinery and Occupational Safety Act, 1983 (Act No 6 of 1983)" *WITH* "Occupational Health and Safety Act, 1993 (Act No 85 of 1993), as amended," *AND INSERT THE FOLLOWING AFTER* "(Act No. 27 of 1956)": "as amended".

PSA 5.4 PROTECTION OF OVERHEAD AND UNDERGROUND SERVICES

REPLACE THE HEADING AND THE CONTENTS OF SUB-CLAUSE 5.4 WITH THE FOLLOWING:

"PSA 5.4 LOCATION AND PROTECTION OF EXISTING SERVICES

PSA 5.4.1 Location of existing services

Before commencing with any work in an area, the Contractor shall ascertain the presence and actual position of all services which can reasonably be expected by an experienced and competent contractor to be present on, under, over or within the Site.

Without in any way limiting his liability in terms of the Conditions of Contract in relation to damage to property and interference with services, the Contractor shall, in collaboration with the Engineer, obtain the most up-to-date plans as are available, showing the positions of services existing in the area where he intends to work. Neither the Employer nor the Engineer offers any warranty as to the accuracy or completeness of such plans and because services can often not be reliably located from plans, the Contractor shall ascertain the actual location of services depicted on such plans by means of careful inspection of the Site.

Thereafter, the Contractor shall, by the use of appropriate methodologies, carefully expose the services at such positions as are agreed to by the Engineer, for the purposes of verifying the exact location and position of the services. Where the exposure of existing services involves excavation to expose underground services, the further requirements of sub-clauses 4.4 and 5.1.2.2 of SANS 1200 D (as amended) shall apply.

The aforesaid procedure shall also be followed in respect of services not shown on the plans but which may reasonably be anticipated by an experienced Contractor to be present or potentially present on the site.

All services, the positions of which have been determined as aforesaid at the critical points, shall henceforth be designated as 'known services' and their positions shall be indicated by the Contractor on a separate set of drawings, a copy of which shall be furnished to the Engineer without delay.

As soon as any service which has not been identified and located as described above is encountered on, under, over or within the site, it shall henceforth be deemed to be a known service and the aforesaid provisions pertaining to locating, verifying and recording its position on the balance of the site shall apply. The Contractor shall notify the Engineer immediately when any such service is encountered or discovered on the Site.

Whilst he is in possession of the Site, the Contractor shall be liable for all loss of or damage as may occur to

(a) known services, anywhere along the entire lengths of their routes, as may reasonably be deduced from the actual locations at which their positions were verified as aforesaid, due cognizance being taken of such deviations in line and level which may reasonably be anticipated, and

(b) any other service which ought reasonably to have been a known service in accordance with the provisions of this clause,

The Contractor shall also be liable for consequential damage in regard to (a) and (b), whether caused directly by the Contractor's operations or by the lack of proper protection.

No separate payment will be made to the Contractor in respect of his costs of providing, holding available on the Site and utilising the said detecting and testing equipment, nor for

any costs incurred in preparing and submitting to the Engineer the Drawings as aforesaid. These costs shall be deemed included in the Contractor's other tendered rates and prices included in the Contract.

Payment to the Contractor in respect of exposing services at the positions agreed by the Engineer and as described above will be made under the payment items (if any) as may be provided for in the respective sections of the specifications pertaining to the type of work involved.

PSA 5.4.2 Protection during construction

The Contractor shall take all reasonable precautions and arrange its operations in such a manner as to prevent damage occurring to all known services during the period which the Contractor has occupation and/or possession of the Site.

Services left exposed shall be suitably protected from damage and in such a manner as will eliminate any danger arising therefrom to the public and/or workmen, all in accordance with the requirements of the prevailing legislation and related regulations.

Unless otherwise instructed by the Engineer, no services shall be left exposed after its exact position has been determined and all excavations carried out for the purpose of exposing underground services shall be promptly backfilled and compacted. In pipes, the requirements of sub-clause 4.1 of SANS 1200 DB should be observed.

PSA 5.4.3 Alterations and repairs to existing services

Unless the contrary is clearly specified in the Contract or ordered by the Engineer, the Contractor shall not carry out alterations to existing services. When any such alterations become necessary, the Contractor shall promptly inform the Engineer, who will either make arrangements for such work to be executed by the owner of the service or instruct the Contractor to make such arrangements himself.

Should damage occur to any existing services, the Contractor shall immediately inform the Engineer, or when this is not possible, the relevant authority, and obtain instructions as to who should carry out repairs. In urgent cases, the Contractor shall take appropriate steps to minimise damage to and interruption of the service. No repairs of telecommunication cables or electric power lines and cables shall be attempted by the Contractor.

PSA 5.7 SAFETY

REPLACE THE CONTENTS OF SUB-CLAUSE 5.7 WITH THE FOLLOWING:

"Pursuant to the provisions of the Conditions of Contract, and without in any way limiting the Contractor's obligations thereunder, the Contractor shall at his own expense (except only where specific provision (if any) is made in the Contract for the reimbursement to the Contractor in respect of particular items), provide the following:

(a) Provide to its Employees on the site of the works, all safety materials, clothing and equipment necessary to ensure full compliance with the provisions of the Occupational Health and Safety Act, 1993 (Act No 85 of 1993) as amended (hereinafter referred to as the Act) at all times, and shall institute appropriate and effective measures to ensure the proper usage of such safety materials, clothing and equipment at all times;

(b) Provide, install and maintain all barricades, safety signage and other measures to ensure the safety of workmen and all persons in, on and around the site, as well as the general public;

(c) Implement on the site of the works, such procedures and systems and keep all records as may be required to ensure compliance with the requirements of the Act at all times;

(d) Implement all necessary measures so as to ensure compliance with the Act by all subcontractors engaged by the Contractor and their employees engaged on the works.

(e) Full compliance with all other requirements pertaining to safety as may be specified in the Contract.

The Employer and the Engineer shall be entitled, although not obliged, to make such inspections on the site as they shall deem appropriate, for the purpose of verifying the Contractor's compliance with the requirements of the Act. For this purpose, the Contractor shall grant full access to the site of all parts of the site and shall co-operate fully in such inspections and shall make available for inspection all such documents and records as the Employer's and/or Engineer's representative may reasonably require.

Where any such investigations reveal, or where it comes to the Engineer's attention that the Contractor is in any way in breach of the requirements of the Act or is failing to comply with the provisions of this clause, the Engineer shall, in accordance with the provisions of Clause 39 of the Conditions of Contract, be entitled to suspend progress on the works or any part thereof until such time as the Contractor has demonstrated to the satisfaction of the Engineer, that such breach has been rectified.

The Contractor shall have no grounds for a claim against the Employer for extension of time and/or additional costs if the progress on the works or any part thereof is suspended by the Engineer in terms of this clause, and the Contractor shall remain fully liable in respect of the payment of penalties for late completion in accordance with the provisions of Clause 43(1) of the Conditions of Contract should the Contractor fail to complete the Works on or before the specified due completion date in consequence of the suspension.

Persistent and repeated breach by the Contractor of the requirements of the Act and/or this clause shall constitute grounds for the Engineer to act in terms of Clause 9 of the Conditions of Contract.

ADD THE FOLLOWING SUB-CLAUSES TO CLAUSE 5:

"PSA 5.9 <u>SITE MEETINGS</u>

The Contractor or his authorised agent will be required to attend regular site meetings, which shall normally be held once a month on dates and at times determined by the Engineer, but in any case, whenever reasonably required by the Engineer. Unless otherwise indicated in the Contract or instructed by the Engineer, such meetings shall be held at the Contractor's offices on the site. At such monthly meetings, matters such as general progress on the works, quality of work, problems, claims, payments, and safety shall be discussed, but not matters concerning the day-to-day running of the Contract.

The Contractor shall provide a suitable venue for holding these meetings. The venue shall be furnished with a conference table and chairs that can seat at least 12 people. The room shall be well ventilated and provided with adequate air conditioning. At least two 220 -240V power points shall be provided."

"PSA 5.10 TRAFFIC ACCOMMODATION

(a) Scope

It is a condition of this contract that traffic is accommodated taking into account the provisions of the latest edition of the South African Road Traffic Signs Manual (SARTSM). The latest version for use in the accommodation of traffic is volume 2, chapter 13 of the June 1999 edition. Copies of this publication are available from Government Printers – Arma Steyn – Tel: (012) 334 4500, e-mail: asteyn@print.pwv.gov.za.

(b) Safety

The Contractor shall be responsible for maintaining the existing road surface both within the works area and the advance warning and termination areas in a safe and trafficable condition for the duration of the contract.

The Contractor may not commence constructional activities before adequate provision has been made to accommodate traffic in accordance with the requirements of the drawings, specifications and the South African Road Traffic Signs Manual.

The Contractor shall supply, erect, operate and maintain all the road signs and other equipment shown on the drawings or in the specifications or as directed by the Engineer, necessary to safely carry out his traffic control responsibilities. He shall also carry out these responsibilities. He shall also carry out these responsibilities in consultation with the various Provincial Traffic Control Centres along the route and to the satisfaction of the Engineer.

(c) Use of the road by the public

The Contractor shall plan and conduct his activities so as to bring about the least possible disruption to the traffic on the roads on which he works. No detours for construction traffic and for the public are envisaged. Where there is no working space off the road, construction vehicles may be parked on the shoulder in which case flagmen and traffic cones shall be employed. All temporary lane closures and halting of traffic will require the prior approval of the Engineer and shall be pre-arranged with the appropriate traffic.

(d) Temporary traffic-control facilities

The Contractor shall provide, erect and maintain the necessary traffic-control devices, road signs, canalization devices, barricades, warning devices and road markings (hereinafter referred to as traffic-control devices) in accordance with these special provisions and as shown on the drawings and in the SARTSM and remove them when no longer required. It shall be incumbent upon the Contractor to see to it that the

abovementioned traffic-control devices are present where required at all times and are functioning properly.

"The type of construction, spacing and placing of traffic-control devices shall be in accordance with the SARTSM. The recommended arrangements of the traffic control devices illustrated and/or drawings issued by the Engineer shall not be departed from without prior approval of the Engineer. The arrangements expected to be most commonly used in the contract are given on the tender drawings.

The details shown for spacing and placement of traffic-control facilities may however, be revised at the discretion of the Engineer where deemed necessary to accommodate local site geometry and traffic conditions."

All traffic control facilities supply on the contract shall be new. Used traffic control facilities, bases, stands and poles which are in an "as new" conditions and approved by the Engineer may be used on site.

(e) Road signs and barricades

The Contractor shall be responsible for the protection and maintenance of all signs and shall at his own cost replace any that have been lost or stolen.

All temporary road signs required to remain in position for some time shall be pole mounted as shown on the drawings. All temporary road signs required to be moved more often shall be mounted on portable supports for the easy moving of signs to temporary positions. The only permitted method of ballasting the sign supports shall consist of durable sandbags filled with sand of adequate mass to prevent signs from being blown over by wind. The cost of the sandbags shall be included in the tendered rates for the various types of temporary road signs.

The covering of permanent road signs, if applicable, shall be by utilising a hessian bag that shall be pulled over the sign in the form of a hood and fastened to the signposts.

Plastic bags or other materials and fastened by means of adhesive tape shall not be permitted. The cost of covering of permanent road signs shall be included in the tendered rates of items PSA 8.3.19.06

The thickness and density of the hessian shall prevent the visibility of the road signs during day as well as nighttime."

(f) Canalization devices and barricades

The use of drums as canalization devices shall not be permitted. Drums may however be used to set up barriers.

Delineators shall comply with the requirements of SANS 1555;

(i) comply with the manufacturing and reflective requirements of the SARTSM for TW 401 and TW 402 signs and the blades shall be reversible with dimensions as indicated on the drawings.;

(ii) have smooth and round edges and be mounted on a post and base. All components shall be of durable plastic material;

(iii) have the lower edge of the reflective part of the delineator mounted not lower than 250mm above the road surface;

(iv) be capable of withstanding the movement of passing vehicles and gusting winds up to 60km/h in typical working conditions without falling over. To achieve this, the base shall be at least 0,18m^2 and ballasted by sandbags with sand;

(v) together with its mounting be designed such that it will collapse in a safe manner under traffic impact;

(vi) minimum size 1 000mm x 250mm.

Traffic cones manufactured in a fluorescent red-orange or red plastic material may be used only at short term lane deviations during daylight. Cones shall not be used on there own, but shall be interspersed with delineators at a ration not exceeding 3:1. Cones used on all deviations shall be 750mm high. Lane closures which continue into the night time shall be demarcated by delineators only.

(g) Warning devices

All construction vehicles and plant used on the works shall be equipped with rotating amber flashing lights and warning boards as specified. All vehicles and plant before being allowed onto the site shall obtain a clearance permit from the Engineer.

(h) Vehicle mounted flashing lights

Rotating lights shall have an amber lens of minimum height of 200mm and shall be mounted in such a way as to be highly visible from all directions. The lights on construction vehicles shall not be switched on while vehicles are being operated on unrestricted section of a public road, but shall be switched on while construction vehicles are operating within the accommodation of traffic area, as the vehicles decelerate to enter a construction area, and as the vehicles accelerate to the general continuously while the plant is working alongside sections of road open to public traffic.

All LDV's and cars operating on site shall also be equipped with rotating amber flashing lights which shall be placed so as to be highly visible and operated continuously while the vehicles are manoeuvring in or out of traffic or are travelling or parked alongside roads open to public traffic.

The Contractor shall mount and maintain lights together with temporary mounting brackets, to the approval of the Engineer. Vehicles and plant that do not comply with these requirements shall be removed from the site".

(h) Other traffic control measures ordered by the Engineer

The Engineer may instruct the Contractor to provide any other road sign, reflective tape, etc. Not measured in standard pay items. Such road signs shall conform to the requirements of the SARTSM, or specification provided by the Engineer. Similarly, in order to ensure that the travelling public is kept fully informed and warned on matters relating to the accommodation to traffic, construction sign posting and the effect of the construction on the free flow of traffic through the site, the Engineer may arrange for advertising in the press and/or for other forms of publicity."

PSA 6 TOLERANCES

ADD THE FOLLOWING SUB-CLAUSE TO CLAUSE 6:

"PSA 6.4 USE OF TOLERANCES

No guarantee is given that the full specified tolerances will be available independently of each other, and the Contractor is cautioned that the liberal or full use of any one or more of the tolerances may deprive him of the full or any use of tolerances relating to other aspects of the work.

Except where the contrary is specified, or when clearly not applicable, all quantities for measurement and payment shall be determined from the 'authorised' dimensions. These are specified dimensions or those shown on the Drawings or, if changed, as finally prescribed by the Engineer, without any allowance for the specified tolerances. Except if otherwise specified, all measurements for determining quantities for payment will be based on the 'authorised' dimensions.

If the work is constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, the calculation of quantities will be based on the 'authorised' dimensions, regardless of the actual dimensions to which the work has been constructed.

When the work is not constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, the Engineer may nevertheless, at his sole discretion, accept the work for payment. In such cases no payment shall be made for quantities of work or material in excess of those calculated for the 'authorised' dimensions, and where the actual dimensions are less than the 'authorised' dimensions minus the tolerance allowed, quantities for payment shall be calculated based on the actual dimensions as constructed."

PSA 7 TESTING

PSA 7.1 PRINCIPLES

PSA 7.1.1 Checking

REPLACE THE LAST SENTENCE WITH THE FOLLOWING:

"The Contractor shall obtain the services of an independent testing laboratory at his own expense (refer to Clause 8 in Portion 1 of the Project Specifications) to carry out the checks prescribed in the various standardized specifications."

PSA 7.1.2 Standard of finished work not to specification

REPLACE THE WORDS "Where the Engineer's checks reveal …" *WITH* "Where the checks by the approved laboratory reveal …"

PSA 7.2 APPROVED LABORATORIES

REPLACE THE CONTENTS OF SUB-CLAUSE 7.2 WITH THE FOLLOWING:

"Unless otherwise specified in the relevant specification or elsewhere in the Project Specification, the following shall be deemed to be approved laboratories in which design work, or testing required in terms of a specification for the purposes of acceptance by the Engineer of the quality of materials used and/or workmanship achieved, may be carried out:

(a) Any testing laboratory certified by the South African National Accreditation Systems (SANAS) in respect of the nature and type of testing to be undertaken for the purposes of the Contract;

(b) Any testing laboratory owned, managed or operated by the Employer or the Engineer;

(c) Any testing laboratory established and operated on the Site by or on behalf of the Employer or the Engineer.

(d) Any other laboratory that the Engineer approves in his absolute discretion.

PSA 8 **MEASUREMENT AND PAYMENT**

PSA 8.1 **MEASUREMENT**

PSA 8.1.1 **Method of measurement, all sections of the Schedule**

DELETE THE WORDS "and South West Africa".

PSA 8.1.2 **Preliminary and General item or section**

PSA 8.1.2.1 **Contents**

REPLACE THE LAST SENTENCE OF SUB-CLAUSE 8.1.2.1(b) WITH THE FOLLOWING:

"Separate items will be scheduled to cover the fixed, value-related and time-related components of the Contractor's preliminary and general costs."

PSA 8.1.2.2 **Tendered sums**

REPLACE THE CONTENTS OF THIS SUB-CLAUSE WITH THE FOLLOWING:

"Except only where specific provision is made in the Specifications and/or the Schedule of Quantities for separate compensation for any of these items, the Contractor's tendered sums under items PSA 8.3 and PSA 8.4 shall collectively cover all charges for:

- risks, costs and obligations in terms of the Conditions of Contract and of this standardized specification;
- head-office and site overheads and supervision;
- profit and financing costs;
- expenses of a general nature not specifically related to any item or items of the permanent or temporary work;
- providing such facilities on site as may be required by the Contractor for the proper performance of the Contract and for its personnel, including, but without limitation, providing offices, storage facilities, workshops, ablutions, services such as water, electricity, sewage and rubbish disposal, access roads and all other facilities required, as well as for the maintenance and removal on completion of the works of these facilities and cleaning-up of the site of the Contractor's establishment and reinstatement to not less than its original condition, and
- providing the facilities for the Engineer and his staff as specified in the Contract and their removal from the site on completion of the Contract."

PSA 8.2 PAYMENT

PSA 8.2.1 Fixed-charge and Value-related items

REPLACE THE CONTENTS OF SUB-CLAUSE 8.2.1 WITH THE FOLLOWING:

PSA 8.2.1.1 Fixed-charge items

"Payment of fixed charges in respect of Item 8.3.1 will be made as follows:

(a) NINETY PER CENT (90%) of the sum tendered will be paid when the contractual requirements (inclusive of cashflows, and schedule of quantities) have been provided and approved.

(b) The remaining TEN PER CENT (10%) will be paid when the Works have been completed, the facilities have been removed and the site of the Contractor's establishment has been cleared and cleaned to the satisfaction of the Engineer.

No adjustment will be made to the sum tendered in respect of item 8.3.1 should the value of the works finally executed or the time for completion vary in any way from that specified in the tender.

PSA 8.2.1.2 Value-related items

Payment for the sum tendered under item 8.3.2 will be made in three separate instalments as follows:

(a) The first instalment, which is 70% of the sum, will be paid when the Contractor has fulfilled all his obligations to date under this specification, the General Conditions of Contract and the Special Conditions of Contract,

(b) The second instalment, which is 30% of the sum will be made when the value of work certified for payment, excluding materials on site and payments for preliminary and general items, is equal to not less than 15% of the total value of the work listed in the Schedule of Quantities.

PSA 8.2.2 Time-related items

REPLACE THE CONTENTS OF SUB-CLAUSE 8.2.2 WITH THE FOLLOWING:

"Subject to the provisions of sub-clauses 8.2.3 and 8.2.4, payment under item 8.4.1 (time-related item) will be made monthly in equal amounts, calculated by dividing the sum tendered for the item by the tendered Contract period in months, provided always that the total of the monthly amounts so paid for the item is not out of proportion to the value of the progress of the Works as a whole."

PSA 8.5 SUMS STATED PROVISIONALLY BY THE ENGINEER

REPLACE THE CONTENTS OF SUB-CLAUSE 8.5 WITH THE FOLLOWING:

PSA 8.5.1 Works executed by the Contractor ..... Unit: Prov Sum

The Contractor will be reimbursed in accordance with the Provisional Sums (if any) allowed in the Schedule of Quantities, in the amounts determined in accordance with the provisions of Clause 6.6 of the General Conditions of Contract for Construction Works."

PSA 8.7 **DAYWORK**

REPLACE THE CONTENTS OF SUB-CLAUSE 8.7 WITH THE FOLLOWING:

"Measurement and payment shall be in accordance with the provisions of Sub-clause 6.5 of the Conditions of Contract for Construction Works.

PSA8.3.5 **Setting Out of the Works** Unit : Sum

The cost to the Contractor for the setting out of the Works and for the checking of the Surveyor's pegs and Benchmarks in terms of PSA5.1.1, shall be covered by the tendered sums for the fixed-charge and time-related items "Setting out of the Works" in the P & G of the Schedule of Quantities.

PSA8.9 **WORKMEN'S COMPENSATION ACT (APPLICATION)** Unit : Sum

The application of the Workmen's Compensation Act (PSA5.9) to all employees will be measured and paid as a sum. The tendered sum shall cover the cost of paying the necessary workmen's compensation levies, the cost of administration as well as any other incidentals necessary to implement the process in accordance with the requirements of the Workmen's Compensation Act.

PSA 8.10 **COMPLIANCE WITH OHS ACT AND REGULATIONS**

(INCLUDING THE CONSTRUCTION REGULATIONS 2003) Unit: sum

The tendered sum shall include full compensation to the Contractor for compliance with all the requirements of the OHS Act and Regulations (including the Construction Regulations 2003) at all times for the full duration of the Contract, as described in the project specifications and Employers' OHS policy. The successful tenderer shall provide the Engineer with a complete breakdown of this tendered sum.

This sum will be paid to the Contractor in equal monthly amounts subject to proper/substantial compliance.

PSA 8.10 **COMPLIANCE WITH ENVIRONMENTAL MANAGEMENT PLAN**……Unit: sum

The Tenderer shall carefully read the provisions of Clause C3.1.34 "Environment and Safety" and refer to Annexure 1 included at the end of the document for the applicable Environmental Management Plan (EMP) and shall make adequate allowance in the time-related rates for compliance to the said Specification during the period of construction of the Works. The successful tenderer shall provide the Engineer with a complete breakdown of this tendered sum.

This sum will be paid to the Contractor in equal monthly amounts subject to proper/substantial compliance.

PSA 8.11 ACCOMMODATION OF TRAFFIC

Accommodating traffic and re-use of temporary traffic control facilities …Unit: month

"The tendered rate shall include full compensation for accommodating traffic and maintaining temporary deviations, including roads used as temporary deviations during construction

The tendered rate shall also include full compensation for the re-use, moving, transporting and re-erection of temporary road signs, barricades, as well as the dismantling and storing irrespective of the number of times such traffic control facilities need to be moved during the construction period. The tendered rate shall include the temporary covering of road signs and shall include all labour cost including flagmen"

PSAB ENGINEER'S OFFICE

PSAB 3 MATERIALS

PSAB 3.1 NAMEBOARDS

REPLACE THE FIRST SENTENCE OF SUB-CLAUSE 3.1 WITH THE FOLLOWING:

"The Contractor shall supply and erect at locations approved by the Engineer, 1 name-board, which, unless otherwise specified in the Contract, shall comply with the recommendations for the standard board of the Consulting Engineers of South Africa (CESA), with regards to size, painting, decorating and detail, and the requirements described hereunder."

PSAB 3.2 OFFICE BUILDINGS

REPLACE THE FIRST SENTENCE OF SUB-CLAUSE 3.2 WITH THE FOLLOWING:

"The Contractor shall supply and furnish one air-conditioned temporary office (6 m x 3 m) for the sole use of the Employer's Agent and his/her staff, and one air-conditioned (9 m x 3.5 m) conference facility for conducting meetings".

Add to the Sub-Clause :

"In addition to the furnishings listed under subitems (a) to (j), the following shall be provided and properly maintained:

(k) electrical installation to include a light and two 15 A plug points plus an adequately sized air conditioning unit (for heating and cooling) for each room
(l) one refrigerator of at least 100 litre capacity
(m) one kettle of at least 2 litre capacity
(n) one tea set comprising six cups and saucers, six teaspoons, one teapot, one sugar bowl and one milk jug
(o) covered parking for one vehicle
(p) uncovered parking space for one vehicle
(q) two 'Barhold' or similar wall mounted racks each with 6 clamps suitable for hanging A0 sized drawings
(r) one large meeting table
(s) ten additional chairs."

PSAB 4 PLANT

PSAB 4.1 TELEPHONE

DELETE THE SUB-CLAUSE AND SUBSTITUTE THE FOLLOWING :

"The Contractor is required to provide a mobile telephone for use by the Engineer or his representative as per the schedule of quantities."

ADD THE FOLLOWING NEW SUB-CLAUSES TO CLAUSE 4:

PSAB 4.4 SURVEY EQUIPMENT

The Contractor shall provide on site and make available for the exclusive use of the Engineer and his staff, the survey equipment and labour listed below:

1. Automatic level (including staff and tripod stand)
2. 5m steel measuring tape
3. 30m plastic measuring tape
4. 2 survey assistants
5. 3 ranging rods
6. 4kg hammer

All survey equipment provided by the Contractor shall be in good condition, properly calibrated and fit for the purpose.

In addition to survey equipment provided by the Contractor for the exclusive use of the Engineer and his staff, the Contractor shall make available for use by the Engineer any further survey equipment when such is reasonably required by the Engineer and his staff for the purposes of the Contract.

PSAB 5.8 <u>SURVEY EQUIPMENT</u>

All survey equipment provided by the Contractor shall be kept fully serviceable at all times by the Contractor. The Contractor shall have any defective equipment repaired or replaced at its own cost within 12 hours after notification by the Engineer's staff.

Where required by the Engineer, the Contractor shall at its own cost, promptly arrange for the re-calibration of survey equipment provided.

PSC SITE CLEARANCE

PSC 3 MATERIALS

PSC 3.1 DISPOSAL OF MATERIAL

ADD THE FOLLOWING NEW PARAGRAPH AT THE END OF SUB-CLAUSE 3.1:

"The Contractor shall obtain his own dumping sites for the disposal of material and all transport costs shall be included in the rates tendered for site clearance."

PSC 5 CONSTRUCTION

PSC 5.1 AREAS TO BE CLEARED AND GRUBBED

ADD THE FOLLOWING TO SUB-CLAUSE 5.1 WHICH DEFINES THE EXACT AREAS TO BE CLEARED AND GRUBBED:

"The following areas are to be cleared and grubbed:

i) The Contractor's site.

ii) The fence perimeter to a distance of 1.5m on either side of the fence centre line. Care shall be taken not to damage any other existing services that may be on the route.

PSC 5.2 CUTTING OF TREES

PSC 5.2.3 Preservation of trees

PSC 5.2.3.2 Individual trees

REPLACE THE LAST SENTENCE OF SUB-CLAUSE 5.2.3.2 WITH THE FOLLOWING:

"An amount of not less than R500.00 (Five Hundred Rands) will be deducted from moneys due to the Contractor as a penalty for every tree that is damaged or removed unnecessarily, and as further guided by prevailing legislation."

PSC 5.3 CLEARING

ADD NEW SUB-CLAUSES

PSC 5.3.1 Restoration of Fences to Servitude Boundary

Where existing fencing is encroaching on the pipeline servitude, such fencing shall be removed prior to construction and re-erected to a condition no worse than that pertaining prior to the removal, on the formal cadastral boundary all as indicated on the respective land plans. For the period that the fence or wall is dismantled and not yet re-erected, the Contractor shall erect, at the end of each day's operations, a temporary fence to close the gap in the existing fence or wall and shall maintain adequate security to prevent use of the temporary fence as a point of access by unauthorised persons.

PSC 5.5 RECLEARING OF VEGETATION

ADD THE FOLLOWING NEW PARAGRAPH AT THE END OF SUB-CLAUSE 5.5:

"When areas have to be re-cleared on the written instructions of the Engineer, such re-clearing shall be carried out at the Contractor's own cost and the Contractor is therefore advised not to clear the areas too soon."

PSC 5.7 LANDSCAPE PRESERVATION AND CONSERVATION OF FLORA

ADD THE FOLLOWING NEW PARAGRAPH AT THE END OF SUB-CLAUSE 5.7:

*"*A penalty of R1000-00 (One Thousand Rands) per hectare of general habitat and flora damaged by the Contractor outside the designated areas shall be levied".

PSC 8 MEASUREMENT AND PAYMENT

PSC 8.2 PAYMENT

AMEND PAYMENT ITEMS 8.2.1 AND 8.2.4 AS FOLLOWS:

PSC 8.2.1 Clear and grub ……. Unit: m^2

REPLACE THE FIRST LINE IN SUB-CLAUSE 8.2.1 WITH THE FOLLOWING:

"The area designated by the Engineer to be cleared and grubbed will be measured in square metre to the nearest square metre or, "

PSC 8.2.4 Reclear surfaces (only on instructions from the Engineer) ..... Unit: m^2

REPLACE THE FIRST LINE WITH THE FOLLOWING:

"The area designated by the Engineer to be recleared will be measured in square metre to the nearest square metre or, "

PSC 8.2.11 Restoration of Fences to Servitude Boundary …….**Unit: m**

New Payment Item:

Separate payment will be made for dealing with fences in the manner specified in PSC 5.3.1 above as scheduled.

PSDA EARTHWORKS (SMALL WORKS)

PSDA 2 INTERPRETATION

PSDA 2.1 SUPPORTING SPECIFICATIONS

REPLACE SUB-CLAUSE 2.1 *WITH THE FOLLOWING:*

"Any of the other SANS 1200 specifications may form part of the Contract documents."

PSDA 3 MATERIALS

PSDA 3.1 CLASSIFICATION OF EXCAVATION PURPOSES

PSDA 3.1.1 Method of classifying

REPLACE THE CONTENTS OF SUB-CLAUSE 3.1.1, PARAGRAPH ONE WITH THE FOLLOWING:

"The contractor shall use local labourers to excavate soft material and any other method of excavation for harder material."

PSDA 5 CONSTRUCTION

PSDA 5.1 PRECAUTIONS

PSDA 5.1.1 Safety

PSDA 5.1.1.2 Safeguarding of excavations

AMEND SUB-CLAUSE 5.1.1.2 BY ADDING THE FOLLOWING:

"(g) Any cost the Contractor may undergo in ensuring the safety of excavations or any additional excavation and backfilling he may have to undertake due to the unstable sides of excavations and trenches shall be held to his account and the various rates for excavation and trenching included in the Schedule of Quantities shall include full compensation thereof."

PSDA 5.1.1.3 Explosives

REPLACE THE CONTENTS OF SUB-CLAUSE 5.1.1.3 WITH THE FOLLOWING:

"The Contractor will generally be permitted to use explosives for breaking up hard material during excavations, for demolishing existing structures, and for other purposes where explosives are normally required, subject to the following conditions:

(a) The Engineer may prohibit the use of explosives in cases where, in his opinion, the risk of injury to persons or damage to property or to adjoining structures is too high. Such action by the Engineer does not entitle the Contractor to additional payment for having

to resort to less economical methods of construction.

(b) The Engineer's prior written approval shall be obtained for each and every blasting operation. This approval may be withheld if the Contractor does not use explosives responsibly and carefully.

(c) The Contractor shall comply fully with the applicable legislation and regulations.

(d) Before blasting is undertaken, the Contractor shall satisfy the Engineer that he has established whether or not the insurers concerned require pre- and post-blasting inspections of buildings and structures within a certain radius of the proposed blasting.

Should such inspections be required, the Contractor shall, together with the Engineer and the insurer, examine and measure the buildings, houses or structures in the vicinity of the proposed blasting site and establish and record, together with the owner, lessee or occupier, the extent of any existing cracking or damage before blasting operations commence.

(e) When there is a possibility of damage to power and telephone lines or any other services or property, the Contractor shall adapt his method of blasting and the size of the charges and shall use adequate protective measures (eg cover-blasting) to reduce the risk of damage.

(f) All accidents, injury to persons and animals and damage to property shall be reported to the Engineer in detail and in writing as soon as is practical.

(g) The Engineer shall be given 24 hours' notice by the Contractor before each blasting operation is carried out.

(h) When blasting to specified profiles, the Contractor shall so arrange the holes and charges that the resulting exposed surfaces are as sound as the nature of the material permits. The Contractor shall make good, at his own expense, any additional excavation necessitated by the shattering of rock in excess of any over break allowances specified in the Project Specifications or given on any Drawing.

Notwithstanding the Contractor's compliance with the above provisions, the Contractor shall remain liable for any injury to persons and animals and loss of or damage to property occurring as a result of blasting operations."

PSDA 5.1.4 <u>Stormwater and Groundwater</u>

ADD THE FOLLOWING TO SUB-CLAUSE 5.1.3:

"The Contractor shall, where applicable and at the earliest practicable opportunity, install the permanent drainage specified or shown on the drawings and shall at his own cost provide the temporary drainage required to protect the works."

PSDA 5.2 <u>METHODS AND PROCEDURES</u>

PSDA 5.2.2 <u>Excavation</u>

ADD THE FOLLOWING TO PARAGRAPH b) OF SUB-CLAUSE 5.2.2:

"When the nature of the material precludes the above procedure, additional excavations shall be carried out to provide working space for the erection of formwork. The tendered rate for Item 8.3.5 will be deemed to include the cost of a working width of 600mm, but the Contractor may excavate a greater working width at no additional cost to the Employer."

REPLACE THE FIRST SENTENCE OF PARAGRAPH e) OF SUB-CLAUSE 5.2.2 WITH THE FOLLOWING:

"Where excavations have been carried out below the authorised levels, the Contractor shall backfill such excavations to the correct level with approved gravel compacted to 93% of modified AASHTO density or to the density of the surrounding material, whichever is the higher density.

Where excavations for structures have been carried out in hard material, the Engineer may direct that over-excavation be backfilled with weak concrete if there is a danger of settlement or differential settlement of the foundations.

Where the sides of excavations against which concrete is to be cast have been over-excavated or have collapsed partially, the Contractor shall re-trim the excavations if necessary and, unless other remedial measures are agreed to by the Engineer, shall cast the concrete for the structure, including the additional concrete that may be required as a result of the over-excavation or partial collapse. The cost of the additional concrete or remedial measures shall be for the Contractor's account."

PSDA 7 TESTING

PSDA 7.2 TAKING AND TESTING OF SAMPLES

REPLACE THE CONTENTS OF SUB-CALUSE 7.2 WITH THE FOLLOWING:

"The Contractor shall arrange with an approved independent laboratory engaged by the Contractor to carry out sufficient tests on a regular basis as agreed between him and the Engineer to determine whether the degree of compaction, and, where applicable, the quality of materials used, comply with the Specifications and shall submit the results of these tests to the Engineer in a form approved by him.

The compaction requirements for fills shall be deemed complied with when at least 75% of the dry-density tests on any lot show values equal to or above the specified density and when no single value is more than five (5) percentage points below the specified value."

PSGA CONCRETE (SMALL WORKS)

PSGA 1 SCOPE

This specification covers the requirements for plain concrete for footings and foundations.

PSGA 3.4 AGGREGATES

THE FOLLOWING ADD THE FOLLOWING TO SUB CLAUSE 3.4:

The use of 19mm granite is recommended. Any other aggregate to be subject to approval by the Engineer.

PSGA 5 CONSTRUCTION

PSGA 5.4 CONCRETE

PSGA 5.4.1 QUALITY

PSGA 5.5.1.7 Strength Concrete

It is a requirement that the Contractor employ the services of an approved specialist to recommend design mixes compatible with the Specification.

PSGA 6 TOLERANCES

PSGA 6.1 BASIS OF MEASUREMENT

PSGA 6.1.1 General

Unless otherwise stated on the Drawings, the degree of accuracy applicable to all concrete structures shall be Degree of Accuracy II (refer to table under clause 6.2.3).

PSGA 7 TESTS

PSGA 7.1 FACILITIES AND FREQUENCY OF TESTING

PSGA 7.1.1 Facilities

ADD THE FOLLOWING TO SUB-CLAUSE 7.1.1:

"The Contractor shall provide sufficient storage capacity for the concrete cubes and shall arrange to have them tested by an approved laboratory.

The cost of all testing, including the cost of sampling, storage and transport of samples shall be included in the rates tendered for concrete work."

PSGA 7.3 ACCEPTANCE CRITERIA FOR STRENGTH CONCRETE

ADD THE FOLLOWING TO SUB-CLAUSE 7.3:

"Test results obtained from the supplier of ready-mixed concrete will not be accepted for evaluation in terms of sub-clause 7.3, but samples for testing shall be taken of such concrete at the point of placing."

PSHA STRUCTURAL STEELWORK (SUNDRY ITEMS)

PSHA5 CONSTRUCTION

PSHA 5.1.2 Shop Details

REPLACE THE FIRST SENTENCE OF SUB-CLAUSE 5.1.2 WITH:

"The Engineer's drawings issued for construction purposes are preliminary with regards to structural steel items and the Contractor shall prepare shop drawings of all structural steel items for the Engineers approval."

ADD THE FOLLOWING SENTENCE TO THE END OF SUB-CLAUSE 5.1.2:

"No payment shall be considered for any structural steel item without shop details being provided and approved by the Engineer in writing."

PSHA 5.2 FABRICATION AND ASSEMBLY

PSHA 5.2.10 Protective Treatment

This clause shall be replaced with the requirements of Particular Specification PTV (Corrosion Protection).

PSL: MEDIUM-PRESSURE PIPELINES

PSL 2

INTERPRETATIONS

PSL 2.3 Definition

(a) The pipes to be supplied and laid under this Contract shall be defined as being flexible pipes for bedding purposes.

PSL 2.4

Abbreviations

O-PVC : Oriented poly vinyl chloride

PSL 3

MATERIALS

PSL 3.1

General

Add to the Sub-Clause:

The types of pipe materials called for under this Contract are:

- Steel Pipes
- Cast Iron (CI)
- O-PVC
- Appurtenant couplings, fittings, bends, valves and specials

PSL 3.4 Steel Pipes, Fittings and Specials

Delete the Sub-Clause and substitute:

PSLB: BEDDING (PIPES)

PSLB 2.3 DEFINITIONS

Main fill:

Delete "150 mm" in second line and substitute "300 mm".

PSLB 3 MATERIALS

PSLB 3.1 Selected Granular Material
In the second line delete "19 mm" and substitute "10 mm".

Add to the Sub-Clause :

The maximum compactibility factor shall be 0,4.

PSLB 3.2 Selected Fill Material
In the second line delete "30 mm" and substitute " 20 mm".

PSLB 3.3 Bedding

Add to the Sub-Clause :

All steel and PVC pipes and fittings laid under this Contract will be considered as being flexible pipes. Bedding (selected granular and selected fill material) for PVC pipes shall be fine sand or fine non- cohesive soil, carefully selected, with maximum particle size of 3 mm and which shall not cake nor form lumps when drying. It shall have a pH value of not less than 5,5 nor contain any acid forming or other material which can harm the protective coating or wrapping. Material complying with the above requirements will also be referred to in this Document as "padding". The bedding will be constructed to the dimensions shown on the drawings. Samples of bedding sand (padding) shall be submitted by the Contractor for approval by the Employer's Agent well in advance of construction. An item has been provided in the Bill of Quantities for the provision of approved bedding sand from approved Commercial or other approved off-site sources. No sharp-edged stones shall be allowed to come into contact with the pipes or fittings. Joint holes (pockets) shall be provided in the trench bottom and bedding, at each pipe joint to facilitate welding and tape wrapping, and no extra payment will be made for forming or filling joint holes (pockets).

All other pipes under this Contract will be considered as being rigid pipes and the bedding shall be of Class A, C (Drawing LB-1) or CE (concrete encased) as applicable and scheduled except that joint holes (pockets) shall be provided in the bedding, as per Drawing LB-2, at each pipe joint or coupling. No sharp-edged stones shall be allowed to come into contact with either the pipes or the couplings (joints). No extra payment will be made for forming joint holes (pockets).

PSLB 3.4 Selection

PSLB 3.4.1 Suitable Material available from Trench Excavation

Delete the Sub-Clause and substitute the following :

The excavation of a pipe trench shall comply with the requirements of Sub-Clause 5.4 of SABS 1200 DB and the provisions of Sub-Clause 3.7 of SABS 1200 DB (in terms of which, for the purposes of providing bedding materials, the Contractor is not required to use selective methods of excavating) shall apply. Nevertheless the Contractor shall take every reasonable precaution to avoid burying or contaminating material that is suitable and is required for bedding or covering the pipeline. If, in the opinion of the Employer's Agent, bedding material can be produced from the excavated material, the Contractor, if so ordered by the Employer's Agent, shall screen or otherwise treat (as Scheduled) the excavated material in order to produce material suitable for bedding (see also Sub-Clause 8.1.2).

PSLB 5

CONSTRUCTION

PSLB 5.1

General

Add to the Sub-Clause:

All the steel pipelines are to be bedded and protected in accordance with the details described in PSLB 3.3 except in certain sections where Class A bedding or stone bedding (as a drainage layer) or concrete encasing is to be provided as shown on the drawings or where ordered by the Employer's Agent.

PSLB 5.1.2 Details of Bedding

Add to the Sub-Clause:

The pipeline is to be laid on the class of bedding indicated in the Bill of Quantities and/or on the drawings.

PSLB 5.1.4 Compacting

Delete the second line and substitute:

top of the pipeline) shall be 95% of modified AASHTO density.

. Add to Sub-Clause 5.1.4:

Steps will have to be taken by the Contractor to ensure that flexible pipes do not deform excessively in cross-section during and after construction and backfilling operations. The maximum deflection which will be acceptable at any stage during or after construction is 2% of the pipe diameter horizontally or vertically. The Contractor will be required to provide the necessary apparatus and to monitor deflection during construction.

Pipe deformations will only be maintained within the specified tolerances by correct backfilling practice. No heavy compaction equipment will be permitted for compaction of any pipe bedding, only pneumatic or hand rammers being acceptable. To this end, and to achieve the 100% compaction specified it is recommended that bedding be brought up evenly on either side of the pipe. The use of complete saturation of the material as a method of achieving the specified compaction may, subject to the Employer's Agent's approval, be used. However, in this regard, contractors are advised that the presence of excessive quantities of water in the pipe trench could lead to flotation of the pipe.

Prior to the commencement of pipe laying the Contractor will be required to submit, to the Employer's Agent, for his approval, his proposed methods of placing, and compacting methods which he proposes to implement in order to ensure compliance with the specification.

PSLB 5.1.5 Testing (New Sub-Clause)

Flexible joints shall be left exposed with a minimum of 100 mm clearance around the bottom of the pipe during hydraulic pressure testing of the pipe.

PSLB 5.2 Placing and Compacting Rigid Pipes

PSLB 5.2.2 Class 'C' Bedding

Delete the third, fourth and portion of the fifth lines and substitute the following:

The pipes shall be bedded on a layer of compacted granular bedding material on which a 25 mm thick layer of uncompacted granular bedding material has been placed and spread. Loose granular bedding material lying next to the pipe shall be placed into the haunch area and compacted with suitable hand tools, and additional selected granular material shall be added and compacted in layers until levels for the bedding cradle as shown on Dwg LB - 1 (c) are reached. The remainder of the bedding i.e. the selected fill blanket, shall be placed in layers up the sides of the pipe, each layer being compacted until levels are reached as shown on Dwg LB-1 (c).

PSLB 5.2.5 Stone Bedding (New Sub-Clause)

In areas where waterlogged conditions exist or where ordered by the Employer's Agent, special drains consisting of a 150 mm thickness (See PSDB 5.5) of single sized stone with a geofabric filter surround (KAYTECH Bidim Grade A4 or similar approved) extending the full width of the trench shall be provided below the bedding to the pipes. The excavation for these drains will be measured in cubic metres at the contract rate applying to unsuitable excavation below the bottom of the trench. The stone filling will be paid for per cubic metre and the geofabric filter will be paid for per square metre. All measurements in this connection will be to a width equal to the base widths and depths ordered.

PSLB 5.3(b) Selected Fill Blanket

Delete "200 mm" from title.

PSLB 6 TOLERANCES

PSLB 6.1 Moisture Content and Density

Add to the Sub-Clause :

The permissible deviations applicable are to be those for Degree of Accuracy II class of work.

PSLB 8 MEASUREMENT AND

PAYMENT

PSLB 8.1.3 Volume of Bedding

Materials

Add to the Sub-Clause :

(c) The volume of bedding material shall be measured net i.e. the volume of the pipe is to be deducted.

PSLB 8.1.6 Freehaul

Delete the Sub-Clause and substitute the following :

All haul will be regarded as free haul. No overhaul will be paid for under this Contract.

PSLB 8.2.1 Provision of Bedding from Trench

Excavation Delete the Sub-Clause and substitute the

following : Without the need for screening :

(a) Selected granular material .....Unit :m^3
(b) Selected fill material .....Unit : m^3
(c) Padding sand to specified bedding dimensions .....Unit : m^3

The rates shall cover the cost of acquiring, from any point along the trench excavation as may be selected by the Employer's Agent, bedding that complies with the relevant requirements of the specification, of delivering it to points alongside the trench spaced to suit the Contractor's methods of working, of making good any backfill deficiency from points where backfill has been acquired, and of disposing of displaced material.

Including for screening:

(a) Selected granular material .....Unit : m^3 (b)
Selected fill material .....Unit : m^3 (c)
Padding sand to specified bedding dimensions .....Unit : m^3

The rates shall cover the cost of screening or otherwise treating excavated material, at any point along the trench excavation as may be selected by the Employer's Agent, in order to produce bedding that complies with the relevant specification, delivering it to points alongside the trench, spaced to suit the Contractor's methods of working, of making good any backfill deficiency there may be from points where screened backfill material has been acquired, and of disposing of displaced material.

NOTE: The rate for the supply and laying of pipelines covers the cost of handling the bedding material from alongside the trench, placing it under the pipeline, forming joint holes and completing the bedding around and over the pipeline.

PSLB 8.2.2 Provision of Bedding by Importation

(a) Selected granular material .....Unit : m^3
(b) Selected fill material .....Unit : m^3

The rates shall cover the cost of acquiring, loading, transporting, offloading, screening or otherwise treating material in order to produce bedding that complies with the relevant specification, delivering it to points alongside the trench spaced to suit the Contractor's methods of working and of disposing of displaced material.

PSLB 8.2.3 Concrete Bedding Cradle

Add the following paragraph to the Sub-Clause:

All concrete bedding to pipes will require formwork. The rate for concrete bedding shall include for the supply, installation and stripping of all formwork.

PSLB 8.2.4 Encasing of pipes in Concrete

Delete the fifth and sixth lines and substitute the following :

encasing the pipe in concrete 150 mm thick each side of the pipe and to 150 mm above the crown of the pipe including the cost of formwork, (if any), etc. and the cost of formwork to form stop ends on either side of collars, couplings, joints etc if instructed by the Employer's Agent.

The rate for concrete encasing shall include for the supply, installation and stripping of all formwork.

PSL 8.2.1 **Supply, Lay, and Bed Pipes Complete with Couplings** **Unit: m**

Only supply and deliver pipes. Remove "Lay, and bed pipes" and included delivering pipes to site.

PSL 8.2.2 **Supply, Lay, and Bed Pipes Complete with Couplings** **Unit: No**

Only supply and deliver pipe specials. Remove "Lay, and bed pipes" and included delivering pipe specials to site.

C3.4 PARTICULAR SPECIFICATIONS

PART C3.4: PARTICULAR SPECIFICATIONS

The following Particular Generic Specifications forming part of the Contract have been written to cover phases or items of work involving a specialist type of operations or material to be encountered on this Contract and that are not adequately covered by the SANS 1200 or general specifications.

C-PLI	Lining and Coating of Steel Pipes and Specials
M-PPP	Pressure Pipework
M-PSP	Steel Pipes
M-PVA	Valves
M-PWGRSV	Wedge Gate & Resilient Seal Valves

C3.4.1 PIPE WORK

All steel pipework shall be supplied, delivered, installed and commissioned as per the Standard Particular Specification, Design, Manufacture and Supply of Steel Pipes, Specials and Fittings and Lining and Coating of Steel Pipes and Specials. The following amendments and additional clauses will also apply:

C3.4.1.1 Pipe Work Cast into Water Retaining Structures

All pipe items which pass through water retaining walls and/or slabs must be cast into the wall at the time of casting the wall. The provision of box-outs will not be permitted. It is the Mechanical Contractor's responsibility to ensure that all pipes which will be cast into walls are available and positioned in the wall timeously.

C3.4.1.2 Pipe Linings and Coatings

Unless otherwise stated, all steel pipes are to receive "type C" coatings and linings (refer to note 9 on the pipe item schedules), which shall consist of an approved solvent free epoxy, (*Sigmaguard EHB*) or similar, applied strictly in accordance with the manufacturers specification to a minimum dry film thickness (DFT) of 250μm. All epoxy coatings are to be applied in accordance with SANS 1217:2001.

In order to minimise the risk of chipping the coating prior or during installation, all flanged pipes and valve must be fitted with plyboard or masonite blank flanges. Plain ends shall be protected with a rubber strip or other approved means. These protection devices must not be removed until the last possible moment during installation at which point the Engineer's Representative will inspect the pipe or valve lining for chipping.

C3.4.1.3 Testing of Pipe Linings and Coatings

All type "C" linings and coatings, refer to note #9 on pipe items schedules, are to be inspected at the factory for pinholes by an independent testing authority using a wet sponge pinhole detector with variable DC voltage and filtered with a sensitivity control. The wet sponge pinhole detector must be set to 90 volts at a calibration resistance of 10 MΩ. All pipes which are to be immersed in water must also be certified 100% pinhole free.

The thickness of all coatings must be tested at the factory by an independent testing authority in accordance with SANS 1200 HC, Clause 6.5. DFT readings must be taken at a rate of 1 reading per m2 of coated surface.

All test certificates must be fully documented and submitted to the Engineer before payment will be approved.

C3.4.1.4 Pipe Welding and Testing

All steel pipes are to be welded in accordance with API 1104. Class 40 pipework shall be manufactured to API 5L. All class 40 pipework welding, including Site welds, are to be 100% radio graphically tested by an independent SABS approved authority wile testing in accordance with SANS 1200 L for all other pipework swill suffice. All tests must be fully documented. Payment for the supply and delivery of pipework will not be approved until all test certificates have been received

C3.4.1.5 **Pipe Markings**

The pipe item number must be clearly stamped on the flange of each pipe and shall be clearly legible after the pipe is fully coated.

C3.4.1.6 **Bolts**

All bolts shall be of grade 4,6 mild steel, hot dipped galvanized to EN 10240 : 1997 and SANS ISO 1461 : 1999, except where periodically or permanently submersed in water in which case stainless steel bolts grade 316, are required. Stainless steel bolts are to be coated with Chesterton Nickel anti-size compound (or similar approved). All bolts shall be fitted with washers manufactured of the same material as the bolt.

C3.4.1.7 **Measurement and Payment**

The rates offered under the supply and delivery of pipework must include the cost of manufacture, delivery, coating, protection of the coating during storage and installation, marking, all welding and coating inspections and documentation.

Steel Pipe items and specials as instructed by Engineer ..... Unit: No

Measurement and payment will distinguish between supply/delivery and install/commissioning. The rate for supply and delivery shall include the design, manufacture and delivery of the pipe items and specials in accordance with specification in this document. The rate tendered for installation and commissioning must include all gaskets, bolts etc. to render a functional product according to specifications in this document.

C3.4.2 VALVES

C3.4.2.1 **General**

All valves must be provided with state of valve indicators.

Handwheels shall have the words ‘OPEN’ and ‘CLOSED’ cast into it together with arrows indicating the open and closed direction.

The valve class must be stamped clearly on each valve together with the item number as listed in the pipe item list.

Gears, where required, shall be machine cut and enclosed in an IP 65 rate enclosure.

Any valve with an extended spindle of longer than 1m must have two universal joints fitted in the spindle to cater for any misalignment.

All valves are to be coated and lined with Sigamaguard EHB applied strictly in accordance with the manufacturer’s specification to a minimum dry film thickness (DFT) of 250µm. All epoxy coatings are to be applied in accordance with SANS 1217:2001.

C3.4.2.2 **Knife Gate Valves**

Knife Gate Valves will be installed as isolation valves in sewage pumping station.

C3.4.2.3 **Non-return Valves**

All non-return or reflux valves shall be of the ball type.

C3.4.2.4 **Measurement and Payment**

Valves as instructed by Engineer..... Unit: No

Measurement and payment will distinguish between supply/delivery and install/commissioning. The rate for supply and delivery shall include the design, manufacture and delivery of the valves in accordance with specification in this document. The rate tendered for installation and commissioning must include all gaskets, bolts etc. to render a functional product according to specifications in this document.

C3.4.3 SUPPLY OF VALVES

C3.4.3.1 **Scope**

This specification covers the design, manufacture and supply of gate valves, butterfly valves, air valves, reflux valves and sleeve-type jet dispersion valves for use in pressure pipelines.

C3.4.3.2 **General Requirements**

C3.4.3.2.1 Design Pressure

Each valve is assigned a design pressure elsewhere in these documents and shall be tested in relation to these pressures as specified. The design pressure shall be hard stamped on the edge of a flange of each valve.

C3.4.3.2.2 Test Pressures

Valve bodies shall be subjected to closed-end tests at pressures of 1, 5 times the design pressure. Test pressures shall be maintained for not less than 5 minutes duration and valve bodies shall be watertight in all respects.

Complete valves shall be subjected to open-end tests at pressures of 1,5 times the design pressure for material strength and soundness. Drop tightness is not a requirement for this test.

Complete valves shall be subjected to open-end tests for drop tightness at pressures from zero (0) to 1, 0 times the design pressure. Valves shall be droplight over the complete range of pressures.

C3.4.3.2.3 Design Life

All valves and appurtenant fittings shall be designed for a useful life of 45 years under the operating conditions indicated elsewhere in the documents.

C3.4.3.2.4 Guarantee

All valves shall be guaranteed against faulty design, materials and workmanship for a period of 5 years from date of delivery. During this period the Contractor shall attend to and rectify at his own cost any defects which can be attributed to faulty design, materials and workmanship. Normal wear and tear shall be excluded. Welding on valve castings will not be allowed. Ultrasonic testing must be done on cast steel bodies.

C3.4.3.2.5 Flanges

Valves shall be flanged and drilled off-centre to B.S. 4504 or SANS 1123:2007, unless otherwise stated elsewhere. Flanges shall have flat joint faces machined in accordance with B.S. 4504 or SANS 1123:2007. All flange faces to have a gramophone finish.

Sufficient clearance shall be allowed between the body and the flange to enable flange bolts to be tightened. Tapped holes shall only be permissible where stiffening ribs interfere with bolting.

Should required flange size fall beyond the range of B.S. 4504 or SANS 1123:2007, mating dimensions shall be in accordance with ISO Standard 7005 with thicknesses adequate to withstand closed-end test pressures.

C3.4.3.2.6 Jointing Materials

Valves shall be supplied complete with bolts, nuts, washers and gaskets for joining up to adjacent mating flanges. Bolts shall be of sufficient length for at least 2 and maximum 4 screw threads to protrude outside nuts when assemblies are fully tightened. A washer shall be fitted under all bolt/screw heads and nuts. Only full-faced gaskets will be allowed.

C3.4.3.2.7 Contact between Dissimilar Metals

Suitable insulation materials shall be used on the contact faces between dissimilar metals of which the potential difference exceeds 0,3 volts.

C3.4.3.2.8 Painting of Valves

A pipe lining epoxy shall be used to coat all internal and external cast-iron, cast-steel and mild-steel components of valves in accordance with SANS 1217:2001 with the following provisions:

(a) Only non-metalic abrasives shall be used for surface preparation:

- It shall not be recycled after the first use.
- All blow/deep holes in cast iron surfaces shall be drilled out and filled with a solvent free epoxy filler before applying the epoxy coating(s).

(b) Minimum dry film thicknesses:

- Internal 300 micrometres.
- External 300 micrometres.
- Flange faces 125 micrometres.

(c) All internal surfaces shall be pinhole free.

C3.4.3.2.9 Valve Supports and Lifting

Gate valves, butterfly valves and reflux valves of 400 mm NB and larger shall have supporting feet cast integrally with the valve body. Each valve over 300 mm NB in size shall have two eye bolts of the requisite strength securely attached so that the valve can be lowered into its correct position for bolting to the mating flanges.

C3.4.3.2.10 Inspection

The inspection of valves shall be carried out by the Engineer or his representative in the manufacturer's works. The Supplier or Manufacturer shall give at least 2 weeks prior notification to the Engineer of the dates of inspection.

The Manufacturer or Supplier shall provide all labour, materials and facilities required for inspection free of charge.

The Engineer's inspection shall in no way relieve the Supplier or Manufacturer from any of his obligations to design, manufacture and supply valves of superior quality and workmanship in accordance with the specification.

C3.4.3.3 **Gate Valves**

C3.4.3.2.1 Type

Valves shall be double flanged, wedge gate or RSV, internal (non-rising) spindle types of which gates shall be completely clear of the waterway in the fully open position.

C3.4.3.2.2 Standards

SANS 664:1999 and SANS 191:2008 shall apply as and where applicable and where not in contradiction to this specification.

C3.4.3.2.3 Opening and Closing

Closure of valves shall be by clock wise rotation of spindles or handwheels.

All gate valves shall be capable of being opened or closed under an unbalanced pressure equal to design pressure.

The effort required on handwheels opening or close valves under these conditions shall not exceed 250 N in the case of valves up to 300 mm NB and shall not exceed 400 N in the case of larger valves.

C3.4.3.2.4 By-Passes

Where indicated in the documents, valves shall be fitted with by-passes and by-pass gate valves. By-passes shall be bolted on to the body of the main valve where possible and not to the adjoining pipework. By-pass gate valves shall conform to this specification. Pipework and fittings shall be hot dip galvanized after fabrication.

C3.4.3.2.5 Materials

Valve bodies and gates shall be of cast-iron or cast-steel. Cast-iron shall conform to SANS 936:1969 grade SG38/SG42 or SANS1034:1975 grade 300 minimum. Cast-steel shall conform to BS3100, BS1504-161 Gr 480 and SANS 1465-1:1988. Test specimens shall be submitted on request free of charge. No repair of cast components will be permitted, unless approved by the Engineer.

Spindles shall be of high strength stainless steel

Body and gate sealing rings shall be of stainless steel, bronze or zinc-free gunmetal, unless otherwise specified because of the nature of the water.

Gate position indicators, i.e. marking plates and needles shall be of cast aluminium or cast brass.

Channel guides and shoes shall be in bronze or zinc-free gunmetal or stainless steel as specified in the Schedule of Quantities.

C3.4.3.2.6 Construction

Body

The body shall be of rugged design with substantial ribs to minimize distortion under pressure where necessary.

Where gearing is provided, bodies shall be designed and manufactured to withstand any additional stresses with an ample margin of safety.

Gate

One face of the gate shall be marked, corresponding to a similar mark on the body, to ensure correct replacement after removal.

The gate shall operate satisfactorily under the conditions specified.

Sealing Faces

Body and gate seals shall be of design and construction such that would prevent seals becoming loose or water passing behind seals under all conditions of operation and test. This feature must be proved at tendering stage by suitable drawings and documentation.

The leading edges of sealing rings shall be slightly chamfered.

Channel Guides and Shoes

Channel guides with shoes shall be as deep and long as possible to support the gate during its travel.

Shoes shall be accurately fitted in the guides so as to ensure that sealing rings do not make contact before the gate is seated.

With the valve fully open at least half of the shoe shall be supported by the guides.

Spindles and Handwheels

The spindle thrust collar shall bear against a ball thrust bearing of approved design, details of which shall be furnished at tendering stage.

Provision shall be made for glands to be repackable under pressure without shutting off the water.

Unless otherwise specified all valves shall be fitted with caps complying with SANS 664:1999.

Position indicators

All valves of 300 mm NB and larger shall, except where otherwise specified elsewhere in the document, be fitted with mechanical indicators to show the position of the gate.

Marking plates shall be embossed to show clearly the fully open and closed positions and the 1/4, ½ and 3/4 intermediate open positions.

Indicators shall be of robust and rigid design and manufacture.

Gearing

Gears shall be robust and machine cut and mountings shall be of substantial design and manufacture.

All gears with ratios 1:3 and higher shall be provided with easily replaceable shear pins to prevent damage to the valves if excessive force is applied. A spare pin shall be attached to each valve.

All lubricating points shall be fitted with nipples for grease-gun lubrication.

C3.4.3.4 **Reflux Valves**

C3.4.3.2.1 Type

Valves shall be double flanged for horizontal installation in pipelines to minimize reflux action and to reduce water hammer in rising mains and shall be one of the following types as specified in the Schedule of Quantities.

(a) Single sloping swingdoor for sizes up to 400 mm N.B.

(b) Double sloping swingdoor for sizes larger than 400 mm N.B. up to 800 mm N.B.

(c) Multiple sloping swingdoors for sizes larger than 800 mm N.B.

(d) Tilting disc for all sizes up to 1 200 mm N.B. in rising mains where low hydraulic resistance is a requirement.

(e) Recoil type for sizes up to 600 mm N.B. in rising mains in situations where abnormally rapid reversal flow is likely to occur.

(f) A type consisting of a rubber annulus sealing on a perforated cone shall be acceptable in sizes up to 400 mm and to design pressures of 1 MPa in instances where clear water is to be conveyed. This type is however not covered by this specification.

C3.4.3.2.2 General Requirements

The valves shall have minimum hydraulic resistance, shall not be subject to gate or disc flutter and shall give rapid non-slam closure on reversal of flow. Preference shall be given to design which allows removal of doors or discs for inspection of doors or discs and seals without removal of the valve assembly from line. Valves shall be free from external moving parts.

C3.4.3.2.3 By-passes

Where indicated in the documents, valves shall be fitted with by-passes and by-pass gate valves. By-passes shall be bolted on to the body of the main valve where possible and not to the adjoining pipework. By-pass gate valves shall conform to this specification. Piping and fittings shall be hot dip galvanized after fabrication.

C3.4.3.2.4 Materials

(a) Valve bodies shall be of cast-iron or cast-steel. Cast iron shall conform to SANS 936:1969 grade SG38/SG42 or SABS grade 300 minimum. Cast-steel shall conform to BS 3100.

(b) Doors and discs shall be of zinc-free gunmetal or cast-steel to the above requirements.

(c) Test specimens shall be submitted on request, free of charge.

(d) Swing door or disc hinge spindles shall be of high strength stainless steel conforming to A.I.S.I. 431 or equivalent.

(e) Valve body seats and sealing faces on doors or discs shall be of stainless steel, zinc-free gunmetal or bronze or nickel.

C3.4.3.2.5 Construction

(a) Body

Bodies shall be of sound and robust design and shall be shaped to give the minimum change in waterway.

Designs of bodies and body seals shall be free from pockets to cause eddies or to accumulate debris. Special care shall be taken those foreign objects like bolts cannot lodge itself in pockets on the downstream side of body seats and thereby prevent doors from closing fully.

Access openings and covers shall be well designed and creation of stress raisers shall be prevented.

(b) Doors and Discs

Shall be cast as a unit with integral cast hinge lugs.

Doors and discs shall operate freely, but shall be restricted in its travel by the provision of substantial stops fitted with approved rubber facings to prevent wear due to metal contact. The rubber facings shall be vulcanized onto the metal and secured by corrosion resistant countersunk screws. Details shall be submitted with tenders.

The doors or discs shall have continuous hinge spindles which shall be supported at their ends in substantial bearings.

Each spindle is to be extended through a stuffing box on one side of the body only and a pointer is to be fitted to the extended spindle so that the open and closed positions of doors or discs are indicated on an embossed brass or cast-aluminium indicator plate.

(c) Sealing Faces

Sealing faces shall be securely fixed with corrosion resistant elements or shall be deposit welded with stainless steel.

Faces shall be accurately machined and finished to meet the requirements of Sub-clause 2.2.

(d) Bearings

Main bearings shall be external and accessible without emptying or removal from line of the valve body.

Bearings shall be of substantial design and shall be designed to take the unbalanced thrust on doors or discs in the open-ended test for material strength and soundness.

Bearings shall have a long life and retain a low coefficient of friction. Any possibility of bearings becoming tight during service or due to ageing shall be eliminated.

Where possible, bearings shall be water lubricated. Full particulars of type and construction of bearings shall be submitted at tendering stage.

C3.4.3.5 **Anti-shock Air Release and Vacuum Break Valves**

(a) Function

The required valves shall provide any of the functions, or combination of functions, described below and as specified in the schedule of quantities.

Pipeline Filling

Uninterrupted high volume air discharge through the large orifice.

Pipeline Draining or Column Separation

Uninterrupted high volume air intake through the large orifice.

Pipeline Full and Operating

Discharge of disentrained pressurised air through the small orifice.

Rapid Filling/Column Separation

The valve must incorporate an integral surge alleviation mechanism which will automatically dampen surge pressure due to rapid air discharge or the subsequent rejoining of separated water columns.

All valve functions shall be housed in a single valve chamber.

(b) Construction and Design

The air release and vacuum break valve shall be of compact single chamber design with solid cylindrical high density polyethylene control floats housed in a tubular stainless steel with fusion bonded epoxy powder coated mild steel ends secured by means of stainless steel tie rods.

Hollow spherical floats are not acceptable.

The valve shall have an integral surge alleviation mechanism which shall operate automatically to limit transient pressure rise of shock induced by closure due to high velocity air discharge or the subsequent rejoining of separated water columns. The limitation of pressure rise must be achieved by deceleration of approaching water prior to valve closure. Relief mechanisms that act subsequent to valve closure cannot react in the low millisecond time span required and are therefore unacceptable.

The performance of the integral surge alleviation mechanism must be substantiated by a reputable local third party test authority.

Large orifice sealing shall be affected by the flat face of the control float seating against a nitrile rubber “o” ring housed in a dovetail groove circumferentially surrounding the large orifice. The large orifice seal shall be of a dynamic type, adjusting automatically to the pressure exerted on it to reduce wear on the seal.

Discharge of pressurised air shall be controlled by the seating and unseating of a small orifice on an natural rubber seal affixed to the control float. Manufacturers offering any other small orifice arrangement shall substantiate the flow through the small orifice at pressures higher than 16 bar.

The intake/discharge orifice area shall be equal to the nominal size of the valve i.e., a 200mm (8”) valve shall have a 200mm (8”) intake/discharge orifice.

The valve construction shall be proportioned with regard to material strength characteristics, so that deformation, leaking or damage of any kind does not occur when it is tested to 1,5 times the designed working pressure.

The valve design shall incorporate an over pressure safety feature that will fail without an explosive effect, such as is normally the case when highly compressed air is released suddenly. This feature shall consist of easily replaceable components such as gaskets, seals or the like.

(c) Test Cock

Each air valve shall be manufactured with a ¼" BSP female test cock connection to enable pressure measurements on the pipeline. The connection shall be fitted with a parallel brass nipple and a full way ballcock RB, with plastic coated mild steel lever handle, with female ends.

C3.4.3.6 **Sleeve-type Jet dispersion Valves**

(a) Type

Valves shall be of the sliding sleeve, inverted cone, jet dispersing type with acceptable reduction drive and hand wheel operation.

(b) General Requirements

- Valves shall generally be required to control scour outlets of high-pressure pipelines.
- Installation shall either be horizontally or shall be inclined at an angle of 45 degrees.
- Valve operation shall be by a stainless-steel screwed spindle, operated by handwheel and a thrust head mounted on a trunnion for horizontal mounting or where so indicated, cast into a wall, and operating the sleeve lever linkage with a watertight gland.
- Where the gland is cast into the wall, the lever operating linkage shall be designed to accommodate movement restraints which might be due to casting in.
- Where so indicated elsewhere in the documents valve operation shall be by controls integral with the valve body.
- Valves and controls shall be exposed to the weather and sunlight and shall be non-operative for extended periods of time. Design shall allow for dependable operation under these conditions.
- Valves shall close by clock-wise rotation of handwheels. Handwheels shall have arrows cast on them to indicate closing and opening directions of rotation together with the words "TO OPEN" and "TO CLOSE".

(c) Materials and Construction

- The valve body shall be of cast-steel with a shrunk-on stainless steel sleeve on the portion of the body which does not contain the water ports and on which the sleeve slides. The water port web edges on which the sleeve slides should have machined weld-deposited stainless-steel faces to prevent moisture getting between the facing and the webs and causing corrosion.
- The sliding sleeve shall be of cast-steel with two (i.e. front and rear) renewable annular zinc-free bronze sliding surfaces and a stainless steel seal seating on to a renewable rubber ring. This end rubber sealing ring in the cone of the valve body must be out of the water-way and positively secured in position by stainless steel securing elements and the rubber seal must be readily replaceable on site.

- The back rubber water seal should also be replaceable on site and carried either in the sliding sleeve or in the case of seals relying on water pressure for watertightness, should be carried on the valve body.
- The valves shall be drop-tight when closed.
- Operating gear and linkage shall be of corrosion resistant materials.

All lubricating points shall be provided with nipples for grease gun lubrication.

PARTICULAR SPECIFICATION C-PLI: LINING AND COATING OFSTEEL PIPES AND SPECIALS

CONTENTS

C-PLI 1 SCOPE

This specification covers the internal lining of steel pipes and specials to be used for the conveyance of potable water at ambient temperatures and the external coating of steel pipes and specials which are to be buried in environments with highly variable corrosive tendencies.

C-PLI 2 INTERPRETATIONS

C-PLI 2.1 Supporting Specifications

Reference is made to the latest issues of the following Standard Specifications:

SANS ENV-197-1 Common cements

SANS ENC-413-1 Masonry cement

SANS 1024:2006 Welded steel fabric for concrete reinforcement

SANS 1090:2002 Sand for plaster and mortar

SANS 1083:2006 Aggregates from natural sources

SANS 1117:2007 Plastics wrappings for the protection of steel pipelines

SANS 1130:2006 Glass fibre reinforcing material for pipe wrapping

SABS 1136 Cold applied bitumen primer for steel pipeline protection (SABS - withdrawn)

SABS 1137 Hot applied bitumen for steel pipeline protection (SABS - withdrawn)

SANS 1178:2002 The production of lined and coated steel pipes using bitumen or coal tar namely

SANS 1217:2001 The production of painted and powder coated steel pipes

AWWA C602-83 Cement-mortar lining of water pipelines - 100 mm and larger - in place

AWWA C205-85 Cement-Mortar lining of water pipelines - 100mm and larger - shop applied

C-PLI 2.2 Application

This specification contains clauses that are generally applicable to the lining and coating of steel pipes and specials.

C-PLI 2.3 Definitions

For the purpose of this specification the definitions and abbreviations given in the applicable specifications listed in 2.1 and the following definitions shall apply:

Disbonded area An area of lining or coating that initially did adhere to the steel subtrate after application, but which subsequently became loose from the substrate as a result of mechanical, chemical or other action.

Unbonded area An area of lining or coating which at no stage adhered to the steel substrate.

Lining Refers to the internal coating of pipes and specials.

Coating Refers to the external coating of pipes and specials.

In certain instances a coating does imply a cover to the steel and can infer a lining or coating. This shall however be concluded from the specific use of the word in the sentence.

C-PLI 3 MATERIALS

C-PLI 3.1 General Requirements

Material used for lining shall be non-toxic and shall not impart any odour, taste, or colour to the water.

C-PLI 3.2 Bitumen Coatings

C-PLI 3.2.1 Hot Applied Bitumen and Primer

Shall conform to SANS 1178:2002. In all cases where bitumen or primer is to be stored in open tanks at elevated temperatures, or the storage temperature of the bitumen in enclosed tanks exceeds 180°C, the supplier shall be consulted and certificates obtained from him indicating recommended maximum temperatures and temperature/time relationships for storage. These certificates shall be made available to the Engineer or the Inspectorate on request.

C-PLI 3.3 Glass Fibre Tissue and Woven Wrap

Shall conform to SANS 1130:2006.

C-PLI 3.4 Plastic Tape Wrapping

Tapes shall conform to SANS 1117:2007, types A, B or C.

C-PLI 3.5 Cement Mortar (Concrete) Lining of Pipes and Specials

C-PLI 3.5.1 Cement

Cement shall be ordinary or rapid hardening Portland cement conforming to SANS ENV-197-1 and SANS ENC-413-1

The alkali content of Portland cement, when expressed as sodium oxide (Na2O) equivalent, shall not be greater than 0,6 % by mass of cement determined in accordance with SABS Method 551 or any other reduced value as determined by the Engineer, where:

% Na2O equivalent = % Na2O + (0,658 x % K2O)

Cement shall be from the same source and shall be fresh. Cement shall be used strictly in the order of delivery. All cement in storage for longer than eight weeks and all cement in unsealed pockets shall be removed from storage and discarded. Cement shall be stored in weather-proof bulk silos, or if in pockets, shall be stored in weather-proof sheds provided with damp proof floors at least 300 mm above ground level and covered with a waterproof membrane.

C-PLI 3.5.2 Aggregates

Both, the coarse aggregate (stone) and fine aggregate (sand) used in the manufacture of concrete or mortar shall conform to SANS 1083:2006.

The aggregates shall be evaluated for potential alkali reactivity using a method for testing developed by CSIR, i.e.

"An accelerated method for testing the potential alkali reactivity of siliceous aggregates" by R.E. Oberholster and G. Davis, published in "Cement and concrete research" Vol. 16, pp. 181-189, 1986.

The chloride content of the sand determined by SABS Method 830 shall not exceed 0,01 % per mass.

Coarse aggregate shall be suitable for concrete subject to surface abrasion, and of the largest possible size that would allow placement of concrete without difficulty.

Within 8 weeks of award of contract, the Contractor shall submit to the Engineer the results of tests carried out on aggregates from the Contractor's proposed source by an independent and competent body. The Engineer reserves the right to take further samples of aggregates at any time from the Contractor's source or from his stockpiles and have it tested for compliance with the specification.

C-PLI 3.5.3 Water

Water used for concrete, mortar or cement slurry shall be clean and free from injurious amounts of oil, acid, alkalis, vegetable and mineral matter.

The water shall generally conform to the recommendations in the appendix to BS 3148.

C-PLI 3.5.4 Concrete and Mortar

Concrete and mortar ingredients shall be batched by mass and shall be well mixed in mechanical mixers of good condition for a duration of not less than 2 minutes.

There shall be no re-tempering of the mix after discharge from the mixer. Only fresh concrete and mortar shall be used and all concrete, mortar or cement slurries in a mixed state for longer than 1 hour shall be discarded.

No additives shall be used, except where approved by the Engineer in writing.

The minimum cement per cubic meter of concrete shall be 400 kg.

Mortar shall be a mixture of 1 part cement to 2 parts fine aggregate, for linings of up to 15 mm thickness and 1 part cement to 3 parts fine aggregate for thicker linings. Mortar shall not be used for coatings.

Total water content shall be the minimum required to produce suitable consistency and shall not exceed 50 % by mass of cement content, allowance being made for the moisture content of aggregates.

150 mm cubes of concrete or mortar made and cured in accordance with SABS Method 863 shall have a minimum compressive strength of 30 MPa after 28 days.

C-PLI 3.5.5 Welded Steel Fabric

Welded steel fabric shall conform to SANS 1024:2006, except that wire diameter and mesh sizes shall conform to this Specification.

C-PLI 3.6 Epoxy Lining and Coating

Shall conform to SANS 1217:2001.

C-PLI 4 PLANT

The Contractor shall supply and maintain suitable tools, plant and equipment for the lining and coating of steel pipes and specials to the required standard.

C-PLI 5 CONSTRUCTION

C-PLI 5.1 Bitumen Coatings

C-PLI 5.1.1 Acceptability of Pipes

Shall conform to SANS 1178:2002 sub-clause 3.3.1.

C-PLI 5.1.2 Preparation of Surface

Shall conform to SANS 1178:2002 sub-clause 3.3.2, but with preparation grade Sa 2ø of SIS 05 59 00 and surface profile amplitude 75 micrometres.

C-PLI 5.1.3 Coating

(a) The coating procedure shall conform to SANS 1178:2002 sub-clauses 3.5.2, 3.7.2 and 3.7.3 and as specified here.

(b) The reinforcement wrapping shall be of glass fibre and shall have a 50 % overlap from one end of the pipe to the other. On completion of the first wrap a further coat of hot bitumen of temperature not exceeding 230°C shall be applied, whilst a second wrap shall be applied in the same manner as the first, but in the reverse direction. On no account shall the bitumen layer between two wraps be less than 1 mm thick.

(c) The minimum cover of bitumen over the second glass fibre tissue wrap shall not be less than 1 mm. The nominal thickness of the completed coating shall be 5,5 mm. The coating surface shall

be free of surface craters, crazing, laminations and pinholes and shall have an acceptable smooth surface.

(d) If specified in the Schedule of Quantities and/or elsewhere in these documents, the coated pipes shall be "armoured" against mechanical damage to the coating as follows.

Immediately after completion of the second glass fibre tissue (Type 1) wrap, a further coat of hot bitumen not exceeding 230°C shall be applied while bitumen impregnated woven glass fibre reinforcement, to SANS 1130:2006, Type 2 or Type 3 as applied in the above points (a) and (b), under tension with a minimum overlap of 35 mm is helically wound around the pipe as a single wrap from end to end. On no account shall the minimum thickness of the bitumen layer between the outer wrap and the second tissue wrap be less than 1,5 mm. The minimum cover of bitumen over the woven glass fibre outer wrap shall not be less then 1,0 mm. The nominal thickness of "armoured" coatings shall be 7 mm.

Armoured wrappings shall generally be applied at the following positions:

- all road crossings and through sleeves or culverts;
- all railway crossings;
- all river crossings.

(e) Treatment of pipe ends shall conform to SANS 1178:2002 sub-clause 3.7.11.

(f) Reflective finishes shall conform to SANS 1178:2002 sub-clause 3.7.10.

C-PLI 5.1.4 Bitumen Coating of Pipes with Linings other than Bitumen

Bitumen and glass fibre reinforcement shall comply with sub-clause 3.2.1. Cold applied bitumen primer shall conform to SANS 1136.

C-PLI 5.1.4.1 Application of Coating

(a) Within 12 hours of having been sand blasted, and provided the pipes and specials are kept dry and free of dust, cold applied bitumen primer shall be applied by brush, spray, roller or mechanical equipment while the pipe or special is supported on skids or in any other suitable manner to avoid damage to and contamination of the primed surface. Primer shall be applied in a uniform manner and at the coverage rate specified or recommended by the manufacturer, but at a rate of not less than 1,3 square meters of pipe surface per litre. Particular care is required to ensure complete penetration and coverage of welds and sharp edges. All defects in priming shall be immediately touched up by brush, care being taken to overlap the joint with the correctly primed area. Care shall be taken not to contaminate the inside of the pipe or special with the primer.

(b) All equipment used for priming shall be maintained in a clean condition. Primer shall be stored in sealed containers and before material is drawn from containers, the contents shall be agitated or stirred to ensure uniformity. After sufficient material for application is withdrawn, containers shall be sealed immediately to prevent contamination or loss of solvent. Material shall not be kept in open containers overnight, nor shall it be exposed to the sun. Primer which has become fouled with foreign substances shall be discarded. Primer shall be maintained at the correct consistency by mechanical agitation during application. Thinners may be used as recommended by the manufacturer, provided the thinners are uniformly mixed with the primer before use.

(c) As soon as the primer is dry to the touch, but not later than 3 days after application of the

primer and provided primed surfaces are kept clean, dry, free from dust and shaded from sunlight, the primed pipes shall be transferred to a lathe-like coating machine.

Coating shall further proceed strictly in accordance with sub-clause PLI 5.1.3 of this specification. Reflective finishes shall only be applied and the specified inspections and non-destructive tests shall only be carried out after the lining, if applicable, has been completed and fully cured.

C-PLI 5.1.5 Coating of Specials

In the case of specials where length and/or shape preclude the application of coating by the mechanical processes described for pipes, the coating shall be applied by hand or by any other suitable technique that will ensure the coating are not inferior to that applied to pipes by machine. The standards of pre-cleaning of specials and coatings applied to specials shall comply with all the requirements of this specification.

C-PLI 5.1.6 Reflective Finish

Bitumen coated pipes shall be given a temporary reflective finish of white wash, aluminium paint or Kraft paper (Type 1 of CKS 136), to minimize heat absorption in transit, and prior to laying and backfilling on site. Whenever bitumen coated spare pipes are to be placed in storage, bituminous based aluminium paint shall be used as reflective finish.

C-PLI 5.1.7 End Covers

After completion of coatings and subject to coatings having passed final inspections and tests, all ends including branch ends whether flanged or not, shall be sealed with plastic or other approved covers secured with flat steel binding strips to the pipe circumference. End covers shall be maintained in position under all conditions of transport, handling and storage.

C-PLI 5.1.8 Handling, Transport and Storage of Bitumen-coated Pipes

Bitumen coated pipes and specials shall be protected against damage at all stages from manufacture to delivery and laying. End covers shall be maintained until the pipe is welded or coupled during laying operations in the field. Pipes and specials shall only be lifted by means of broad band slings. Slings shall be at least 500 mm wide for pipes up to 500 mm NB and 1000 mm wide for larger pipes, or as approved by the Engineer. During transport by rail, road or other means pipes shall be supported at the ends on padded cradles or saw-dust filled bags of adequate strength. Under no circumstances shall coated pipes be allowed to rest directly on the ground or unpadded hard surfaces.

The Contractor shall be responsible for off-loading the pipes at the delivery site and for stacking to a height not exceeding two pipes high with pads between individual pipes or for stringing along the trench with pipes supported by cradles or saw-dust filled bags to prevent contact of the pipes or specials with the ground or other hard or sharp objects. The Engineer shall have the right to reject any material which is not delivered and off-loaded on site in the same conditions as it left the factory.

C-PLI 5.2 Plastic Tape Wrapping

C-PLI 5.2.1 General

Steel pipes, fittings and specials protected by means of pressure-sensitive polyethylene, and/or polyvinyl chloride tapes carrying elastomer based adhesives, and/or butyl rubber laminated tapes with laminates of polyvinyl chloride and butyl rubber, shall be wrapped in accordance with SANS 10129:2006 as amended and extended by this Specification. Tape wrapping shall only be carried out in an "over the trench" operation.

If in the opinion of the Engineer adverse weather conditions are such as to interfere with the successful application of an efficient corrosion protective wrapping, he shall order a stoppage of work, which risk the Contractor shall be regarded as having accepted and as having made provision for in his tender.

C-PLI 5.2.2 Cleaning of Surfaces

Shall conform to SANS 10129:2006 clause 3.2.

C-PLI 5.2.3 Priming

Immediately after cleaning and not later than 4 hours after cleaning provided the pipe surfaces are kept dry and free from dust, primer shall be applied according to SANS 10129:2006 sub-clause 4.2.1.

C-PLI 5.2.4 Wrapping

Tape wrapping of line pipe shall be applied immediately after priming, according to SANS 10129:2006 sub-clause 4.2.2, and shall ensure a smooth wrap free from wrinkles, blisters, frayed or torn edges, cracks or other defects. For normal wrap, tape shall be applied in 2 layers with a minimum overlap of 50 mm on both the inner and outer wraps.

Tape joints and repairs shall be done in accordance with SANS 10129:2006 sub-clause 4.2.3.

C-PLI 5.2.5 Armouring

Where required the wrapping shall be armoured by the application of a third layer of tape as follows : inner wrap shall overlap by half the tape width plus 25 mm and the outer wrap shall overlap by not less than 50 mm. Armoured wrappings shall generally be applied at the following positions:

(i) all road crossings and through sleeves or culverts;

(ii) all railway crossings;

(iii) all river crossings; and

(iv) wherever the Engineer may consider that special conditions warrant such measures.

C-PLI 5.2.6 Wrapping of Specials

In the case of specials or pipe lengths where length and/or shape preclude the application of a protective wrapping system by the mechanical means described for line pipes, cleaning, priming and wrapping shall be applied by hand or other suitable technique that will ensure a wrapping system not inferior to the mechanically applied product on line pipes.

C-PLI 5.2.7 Handling of Wrapped Pipes

Adequate provision shall be made for the protection of the wrapping from physical damage during the pipe handling and lowering into the trench. Wrapped pipes shall only be lifted by broad band slings. Wrapped pipes shall be protected from grit and other sharp objects while the pipe is in the trench prior to padding. Walking on wrapped pipes shall not be allowed. The Engineer may reject any length of wrapping on which physical damage by any cause whatsoever is visible.

C-PLI 5.3 Cement Mortar (Concrete) Lining

C-PLI 5.3.1 Lining

C-PLI 5.3.1.1 Thickness

The thickness of linings on pipes shall generally be as tabled below, except where specified to the contrary in the Schedule of Quantities or on the drawings.

Pipe OD in mm	Thickness of lining in mm		
	Nominal	Maximum	Minimum
273 to 609,6	10	13	8
above 609,6 to 1 016	14	16	12
above 1 016 to 1 220	16	20	14
above 1 220 to 1 620	20	24	16

The thickness of lining on specials shall generally comply with the above, provided the minimum cover of mortar over reinforcement mesh shall not be less than 10 mm.

C-PLI 5.3.1.2 Preparation of Surfaces

After bare pipes and specials have been tested and inspected for compliance with the applicable specification and after application of coating, if applicable, surface shall be prepared as follows:

(a) Welded spatter, loose rust and loose mill scale shall be removed by chipping and/or scraping.

(b) Gross deposits of grease, oil, bitumen or other contaminants shall be removed by scraping and wiping with rag soaked in white spirits or similar toxic free solvent.

(c) Other contaminants shall be removed by manual or mechanical cleaning. The standard of cleaning shall not be less than grade St 2 or grade Sa 1 of SIS 05 59 00, as appropriate.

(d) Residual dust and debris on the pipe surface shall be 0,2 % maximum when tested in accordance with SABS Method 769.

C-PLI 5.3.1.3 Shop Applied Linings - Centrifugal Spun

Within twenty four hours of having been sand blasted and provided the pipe surfaces are kept dry, free of dust, oil and other deleterious contaminants and provided ambient temperatures are above 20°C the pipe shall be transported to a suitable spinning machine. The coating, if applicable, shall be suitably protected against mechanical damage during the handling and spinning operation. Before being placed in the spinning machine, the pipe shall be suitably braced with external stiffening rings, which shall not be removed until the appropriate one of the following periods has elapsed from the time of placing of the lining:

(a) 72 hours when water curing is used; and

(b) 36 hours when steam curing is used.

End gauge rings shall be securely attached to the pipe ends to control the lining thickness, to act as stop end to prevent mortar leakage and to stiffen and hold the pipe ends round.

Each pipe shall be rotated in a spinning machine with its axis horizontal during and for a suitable period after the placing of the lining. The speed of rotation shall be such as to produce a uniform distribution of the cement mortar over the interior surfaces of the pipe. Sufficient mortar to line completely one pipe to the appropriate nominal thickness specified in sub-clause C-PLI 5.3.1.1 shall be mixed in one batch, and it shall be of such consistency as to minimize segregation during spinning. The mortar shall be placed in the pipe immediately after mixing and before initial set has taken place, and in a manner providing uniform longitudinal distribution of the batch from end to end of the pipe. As soon as the mortar lining has achieved a uniform thickness over the whole interior surface of the pipe, the speed of rotation shall be increased to a speed that will compact the mortar and is not less than 1

peripheral speed of 17 meters per second. The required speed shall be maintained for such a period as will give the maximum density of mortar and smoothness of surface, and sufficient bonding to permit removal of the pipe from the machine without injury to the lining.

The ends of the lining shall be finished uniform and square or slightly bevelled as required in Clause C-PLI 5.2.1.8. All water and laitance expelled during spinning shall be removed in such a manner that the surface of the lining is smooth, level and true. After the lapse of a suitable period after spinning (as determined by experiment), the spun lining shall be given a steel trowelled or smoothing bar finish. A second trowelling may be necessary to remove all laitance and produce a smooth and hard finished surface. The Colebrook-White (k) friction value shall be not more than 0,13 mm.

C-PLI 5.3.1.4 In-situ Applied Linings

(a) Standard

Shall be carried out generally in accordance with the provisions of the latest issue of AWWA C602 for "Cement-Mortar Lining of Water Pipeline - 4 in (100 mm) and larger - In Place", subject to the modifications, amendments and amplifications in this Specification.

(b) Length of uninterrupted lining

Tenderers shall state in tenders the maximum length of lining which they are prepared to undertake between any two consecutive points of access and under what circumstances they would require this length modified. This factor will be taken into account when assessing the comparative economic merits of tenders.

(c) Methods of lining

The lining by means of a suitable machine that travels through the pipe and distributes mortar by high velocity centrifugal spraying, followed by a trowelling device, shall be permissible for all pipe sizes.

Tenderers shall submit full details of the system to be employed with special reference to methods of pre-cleaning of surfaces and delivery of mortar to the spraying head.

C-PLI 5.3.1.5 Lining of Specials

Bends, tees and other specials that cannot be lined by machine shall be manually lined. In case where the nominal diameter exceeds 600 mm the lining shall be reinforced by steel mesh tack-welded to the inside of the pipe in such a way that it is not in contact with the pipe except where welded. The steel mesh shall be of 2,5 mm diameter steel wire at 100 mm by 50 mm, or equivalent spacing. The minimum cover over the mesh shall be 10 mm.

C-PLI 5.3.1.6 Finish

The lining shall be well finished with a smooth surface free from excessive laitance and surface irregularities. Projections exceeding a height of 1,5 mm shall be removed by trowelling before the concrete has set, or by grinding after the lining has cured.

The thickness of the laitance, if any, shall not exceed 10 % of the thickness of the lining, or 1,25 mm, whichever is less. The effective surface roughness of the lining when measured in terms of the Colebrook-White "K" friction coefficient for lining surface effective roughness shall be guaranteed by the suppliers and shall not be more than 0,13 mm when actually measured in the field after completion of the pipeline. No rougher surface will be acceptable.

The Hazen-Williams C factor is a generally accepted criteria for determining the acceptability of

surface finish of cement-mortar lining in pipelines. The Hazen-Williams C factor must have a value of 130 or higher for all cement-mortar linings, failing which the Contractor will be penalised by paying a penalty.

C-PLI 5.3.1.7 Curing

(a) Water curing

Immediately after the placing of the concrete, the pipe shall be so sealed as to prevent loss of contained water, and the concrete shall be kept continuously moist for a period of at least 7 days. During this period steps shall be taken, when necessary to prevent the temperature of the steel shell falling below 2°C.

(b) Steam curing

Pipes that have shop applied linings, and that have not been coated with bitumen may be steam cured. Immediately after application of the concrete lining, the ends of the pipe shall be completely sealed. After the lined pipe has been standing for not less than 2 hours, steam shall be injected into it so as to raise the temperature at a rate not exceeding 28°C per hour until the temperature of the lining is within the range 55-70°C. Steaming shall continue for a further 6 hours, the temperature of the lining being maintained within the range specified. Steaming shall be discontinued and the pipes shall remain sealed for a further 2 days from the time that the temperature of the pipe has fallen to ambient. During this period precautions shall be taken to prevent the temperature of the steel falling below 2°C. During the curing cycle, excluding the 2 day holding period, the temperature of at least one pipe out of that day's production, shall be recorded by a suitable automatic recording instrument. If the temperature record reveals that the requirements set out above have not been achieved, then the pipes shall be subjected to the full period of water curing as specified in Sub-clause 5.2.1.7(a).

(c) General

Concrete lined pipes shall not be moved or transported for a period of 21 days after the date of lining.

C-PLI 5.3.1.8 Pipe Ends

Where lining takes place before welding, i.e. not in-situ but on site or in the shop, the following shall apply:

(a) For flanged pipes and specials and pipes intended for jointing by couplings, including bell-ended pipes, the concrete lining shall be ended flush with pipe ends with a 6 mm bullnosing of edges by means of a nosing tool.

(b) For pipes to be butt welded, the lining shall terminate 100 mm from the internal end of each pipe and the end of the lining shall be bevelled to form an angle of approximately 85 degrees between the clear end of the pipe barrel and the lining end. The unlined surface of 100 mm wide from each end, may be protected by strips of pressure sensitive plastic tape, firmly pressed into the surface to exclude all air and moisture, and to give temporary protection between the works and butt welding on the site.

C-PLI 5.3.1.9 Repair of Defects

All defective concrete shall be removed and the surrounding area of concrete chipped back to a position where the concrete is firmly bonded to the steel. The edges of the firm surrounding concrete shall be bevelled to form an angle of 85 degrees with the portion of pipe barrel under repair. The pipe

surface shall be cleared from all signs of concrete and dust. The pipe surface and surrounding concrete shall then be given one coat of cement/water grout and the fresh mortar applied by hand while the grout coat is still wet. The mortar shall be of the same mix and consistency as the lining. The repair area shall be built up to the full thickness of the lining, care being taken to ensure complete filling of the bevelled edges with the mortar. The repaired areas shall be covered by damp hessian which shall be kept continuously wet for 7 days after completion of repair.

C-PLI 5.4 Epoxy Lining and Coating

C-PLI 5.4.1 Shop applied Epoxy Lining and Coating

C-PLI 5.4.1.1 General

The following details shall be submitted with tenders:

(a) Brand and type of epoxy and resin.

(b) Mixing and thinning instructions.

(c) Recommended type and quantity of solvent required for thinning during application.

(d) Pot life of mixed product.

(e) Maximum recommended dry film thickness per coat.

(f) Recommended time intervals between coats.

(g) Recommended minimum and maximum pipe surface temperatures during application.

(h) Time for complete drying and curing on steel surfaces.

(i) All relevant information the supplier wishes to submit on his product.

C-PLI 5.4.1.2 Acceptability of Pipes and Specials

Shall conform to SANS 1217:2001 sub-clause 4.1.1, with the proviso that pipes shall read pipes and specials.

C-PLI 5.4.1.3 Preparation of Surfaces of Pipes and Specials

NOTE: The contractor shall satisfy himself that the condition of each pipe/special is such that the pipe/special is fit for coating or lining, or both, as relevant. Immediately after surface preparation he shall examine each pipe/special, including the inside surface, where possible, for compliance with the relevant requirements of this sub-clause and he shall use SABS methods 767, 769 and 772 to check for cleanliness, freedom from dust and debris and the surface profile of the blast-cleaned surface. In the case of SABS Method 772, he shall take the mean of the readings from at least 10 test points per pipe.

The surface of the pipe/special to be lined or coated shall be treated as follows:

(a) Contaminants shall be removed by an appropriate method such as with an organic solvent emulsion cleaner or a suitable detergent.

(b) The surface shall be blast-cleaned with a suitable abrasive to achieve a preparation grade, determined in accordance with SABS Method 767, or not less than Sa 3 of SIS 05 59 00, and shall have an average surface profile, determined in accordance with SABS Method 772, of 50-75 micrometres.

(c) Should flanged pipes or specials and pipes or specials intended for joining with flexible couplings or for site welding by means of double sleeve weld-on couplings be epoxy lined, the sharp pipe edges shall be rounded off to a 3 mm radius and the prepared surfaces shall extend to the pipe and special ends and around the edges for a width of at least 150 mm on the outside of the pipe.

(d) For pipes and specials intended for butt welding the prepared surfaces shall extend to the pipe ends.

(e) The surface shall be blown clean with clean, dry, compressed air, dusted off with clean, dry brushes or vacuum-cleaned so as to give dust and debris, assessed in accordance with SABS method 769, not greater than 0,2 %.

(f) The clean pipe surfaces should be coated as soon as possible, but in any event before condensation, oxidation or contamination of the blast-cleaned surface can take place.

C-PLI 5.4.1.4 Epoxy Application Process

Except for repairs, epoxy shall be shop applied.

(a) Should immediate lining/coating not be possible, or should any atmospheric oxidation take place between the completion of blast cleaning and commencement of lining/coating, such oxidation shall be removed by open nozzle type localised blasting to restore the specified surface finish. Removal of dust debris shall be to the standard specified in sub-clause C-PLI 5.1.3(d).

(b) Component coatings and linings shall all be from the same manufacturer, and the manufacturer's instructions shall be closely followed.

(c) Epoxy resin shall then be applied by any appropriate method recommended by the manufacturer thereof, and approved by the purchaser.

(d) The epoxy resin shall be evenly applied to a minimum final film thickness of 300 micrometres over the whole surface to be coated/lined and there shall be no electrical insulation defects, excessive runs, sags, or other imperfections. Dry film thickness per layer shall be a minimum of 40 micrometres above the peaks of the blast profile as measured by an approved eddy current instrument. Successive coats, of either linings or coatings, shall be in distinctly different colours. The pipe shall be so supported during coating as to prevent damage to the wet coating material and until the coating material has hardened adequately, shall remain suitably supported during curing and storing and during handling.

(e) The first layer shall be allowed to dry for a minimum of 16 hours and a maximum of 48 hours or such other intervals as specified by the supplier of the epoxy resin in writing, during which time the first layer shall be protected against contamination by dust or foreign matter, and shall be kept dry and shaded from direct sunlight. Curing shall be as specified by the epoxy resin manufacturer in writing.

(f) The second layer shall then be applied and cured as the first layer was. This shall be followed by a third layer similarly applied and cured. Fourth or subsequent layers, if applicable, shall be applied, dried and cured as specified for the previous layers.

C-PLI 5.4.1.5 Pipe Ends

For flanged pipes or specials and pipes or specials intended for joining with flexible couplings or for site welding by means of double sleeve weld-on couplings, the lining shall extend to the ends of pipes and specials including edges and shall overlap by at least 150 mm on the outside of the pipe.

Coatings shall overlap epoxy surfaces on the outside by at least 25 mm. Sharp edges around pipe edges shall be rounded off to a 3 mm radius before application of epoxy. For pipes and specials intended for site butt welding, lining shall extend up to a distance of 100 mm from the pipe ends.

The unlined circumferential strip, 100 mm wide at pipe ends, shall be protected by a 120 mm wide strip of pressure sensitive plastic tape which shall be firmly pressed into the surface to exclude all air,

moisture and dust and to give temporary protection to the grit blasted surface between the works and the site.

All open ends of pipes and specials shall be covered and kept covered from final acceptance at the factory up to installation of the pipe or special in the pipeline in the field. End covers shall consist of plastic sheeting or lightweight "sterkolite" or equivalent approved material. The end cover material shall lap over the pipe or special ends and be adequately secured with flat steel binding strips. A single 150 mm slit shall be cut in the centre of each of the two end covers for each pipe or special. End covers over branch ends shall not be slit.

C-PLI 5.5 Marking of Pipes

Each pipe and special shall be legibly, indelibly and durably marked, in such a manner that the coating is not damaged, with the following information:

(a) Contract number

(b) Scheme name

(c) Serial number of the pipe or special

(d) Nominal diameter

(e) Grade and thickness of steel

(f) Hydrostatic test pressure

C-PLI 6 TOLERANCES

C-PLI 6.1 Bitumen Coatings

The nominal coating thickness shall be 5,5 mm with a tolerance of -0,5 mm and +5 mm. The nominal thickness of "armoured" coatings shall be 7,0 mm with a tolerance of -0,5 mm and +5,0 mm.

C-PLI 6.2 Plastic Tape Wrapping

C-PLI 6.2.1 Pressure Sensitive Tape Wrapping

The minimum thickness of the completed pressure sensitive tape wrapping shall be 750 micrometres applied in two layers; the inner low-density and the outer high-density, neither layer less than 375 micrometres film thickness.

C-PLI 6.3 Cement Mortar (Concrete) Lining

The thickness of linings shall be as given by sub-clause C-PLI 5.3.1.1 of this specification.

C-PLI 6.4 Epoxy Lining and Coating

The minimum dry film thickness of linings and coatings shall be 300 micrometres.

The minimum dry film thickness of flange face coatings shall be 125 micrometres.

C-PLI 7 TESTING

C-PLI 7.1 Bitumen Coating

C-PLI 7.1.1 Visual Inspection

Coatings shall be free of surface craters, crazing lamination, disbonding, unbonded areas, pinholes and shall have an acceptable smooth surface. No hollow sound shall be detected when the coating is tapped. The glass fibre reinforcement or the fibre pattern thereof shall not be discernible on the bitumen surface.

C-PLI 7.1.2 Non-destructive Tests

C-PLI 7.1.2.1 Holiday Testing

Shall conform to SANS 1178:2002 sub-clause 7.2.2.

C-PLI 7.1.2.2 Thickness testing

On each pipe in the sample taken in accordance with sub-clause C-PLI 7.1.4.2(b) the thickness of the coating shall be measured by means of a suitable magnetic or eddy current instrument designed for non-destructive measurement of the thickness of non-metallic films on a magnetic base and suitable for use on curved surfaces. Set zero and calibrate the instrument on steel similar to that used in the manufacture of the pipe, using a suitable shim of which the thickness is approximately equivalent to the thickness of the coating under test. Take readings as specified in SANS 1178:2002 sub-clause 7.2.1 (a) and (b).

C-PLI 7.1.3 Destructive Tests

C-PLI 7.1.3.1 Peel Test on Coating

Shall conform to SANS 1178:2002 sub-clause 7.3.2. Three tests shall be carried out, one of which shall be over the longitudinal or spiral weld seam, the test areas being approximately 120° apart. The coating shall not be accepted as having passed the test if the average of the three peel length readings is greater than 3 mm.

C-PLI 7.1.3.2 Condition of Bitumen

Shall conform to SANS 1178:2002 sub-clause 7.3.3(a) and (b), to the following standards:

(a) Frass breaking point : no failure to +10°C

(b) Softening point : 100 - 125°C

(c) Penetration : 1,0 - 2,2 mm

(d) Resistance to cracking : no cracking down to -10°C

In the event of the condition of bitumen test results not satisfying all these requirements, a series of other tests shall be carried out by the Contractor, and witnessed by the Inspectorate. The average of the 3 results for each test shall be determined. If the average does not comply with the requirements, then the day's production, from which coating samples were obtained, shall be rejected.

C-PLI 7.1.4 Test Samples

C-PLI 7.1.4.1 Visual

All pipes to be tested.

C-PLI 7.1.4.2 Non-destructive Testing

(a) Holiday testing

All pipes to be tested

(b) Thickness

On the first pipe and thereafter on at least 10 percent of the number of pipes and specials in each day's production.

C-PLI 7.1.4.3 Destructive Testing

Sufficient coating material shall be removed from the ends of at least one pipe selected at random from that day's production for the purpose of carrying out the tests, the peel test shall be carried out the next day on the same pipe.

C-PLI 7.1.5 Testing Facilities and Contractor's Inspection

The Contractor shall provide a fully equipped materials laboratory staffed with competent personnel

who shall carry out all tests specified herein together with any additional tests on the coating of pipes, fittings and specials considered necessary by the Contractor to ensure that all such materials comply with the specified requirements. The cost of providing the laboratory, test equipment, labour, consumables etc., together with the cost of carrying out such tests shall be included in the cost of coating the pipes, fittings and specials.

C-PLI 7.1.6 Engineer's Inspection

As soon as manufacture of the coating of pipes and specials in this Contract commences, the Engineer will appoint one or more Inspectors who may be permanently stationed at the factory. The Inspector(s) shall have free access to any part of the works which is involved in the execution of this Contract and may witness any or all tests carried out by the Contractor in compliance with the Contract.

The Inspector(s) shall have power in accordance with the relevant clause of the General Conditions of Contract and shall be subject to the limitations contained therein. The Inspector(s) shall be at liberty to reject at any stage of manufacture any material or workmanship which does not comply with the specification or subsequent modifications agreed upon between the Engineer and the Contractor.

The Contractor shall at his own expense furnish the Inspector(s) with reasonable office accommodation, facilities and space for inspection, testing and obtaining any information desired regarding the character of material used and the progress and condition of the work.

All work performed under this Specification shall be rigorously inspected, but this shall not relieve the Contractor of his responsibility for performing the work in accordance with the specification. The Engineer may at any time reject any work that does not comply with the requirements set forth in this Specification, whether the work has been previously passed by the Inspector or not.

C-PLI 7.2 Plastic Tape Wrapping

C-PLI 7.2.1 Visual Inspection

The wrapping shall have a smooth appearance, free from wrinkles, blisters, bridging across weld beads, frayed edges, cracks, disbonding and any signs of physical damage.

C-PLI 7.2.2 Non-destructive Testing

(a) Holiday testing

The entire wrapping of the pipeline shall be tested by the Contractor to the Engineer's satisfaction with an approved holiday detector equipped with a rolling ring detector around the pipe. The ring shall be in close contact with the wrapping surface along the pipe perimeter. The test shall be carried out immediately prior to lowering the pipe into the trench. The wrapping on specials or short pipe lengths shall be tested with an approved holiday detector fitted with a copper bristle brush detector of suitable form. The wrapping shall exhibit no holidays when tested with an effective voltage of 12 kV at a nominal pulse frequency of not less than 30 Hz.

The Engineer may instruct any length of pipe or any number of specials to be re-tested using a holiday detector with a copper bristle brush detector.

(b) Coating insulation test

With the pipeline wrapped and installed in the trench with padding and backfilling completed, the Engineer shall carry out a conductance test on the wrapping over any section of pipeline between valves, temporarily removed from the line, at the Contractor's expense, to ensure complete isolation of the pipeline section under test or between gaps left for tie-ins.

The length of the section of pipeline under test shall be carefully measured and the conductance over the section tested shall not exceed 180 micro-siemens per square meter of pipe surface under all conditions of test. If the results of the test for the section of pipeline tested are not satisfactory, two sections immediately adjacent to the testing section will be tested. If the results on one or both of these sections tested are not satisfactory, all sections of wrapped pipeline shall be tested.

The Contractor shall be required to locate areas of faulty protection on all sections on which unsatisfactory results are obtained and to affect the necessary repairs. The cost of this work and all additional materials provided or supplied, including the reinstatement of the trench and the retest shall be for the Contractor's account.

C-PLI 7.2.3 Destructive Testing

The Engineer may from time to time collect samples of 10 meters of each type of tape and one litre of primer for testing by any independent laboratory, appointed by the Engineer, for compliance with the specification. The supply of samples shall be for the Contractor's account. The Engineer reserves the right to reject the whole batch of materials from which unsatisfactory samples were obtained.

C-PLI 7.3 Cement Mortar (Concrete Lining)

C-PLI 7.3.1 Lining

C-PLI 7.3.1.1 Visual Inspection

(a) Shop applied lining

The cured lining in every pipe and special shall be inspected visually for defects before the pipe leaves the factory, but not sooner than 21 days after application of the lining. The lining shall have a smooth, steel floated appearance and shall have no projections exceeding a height of 1,5 mm above immediate lining surface. Slight surface crazing and hair cracks shall be permissible. All cracks into which a suitable metal depth gauge with a probe of 1,5 mm diameter can be inserted to a depth of half the minimum specified thickness of the lining shall be considered a defect and shall be repaired as described in sub-clause C-PLI 5.3.1.9 of this specification.

(b) In-situ lining

Visual inspection of the finished lining shall include the provision of a camera mounted on a suitable trolley which shall be so arranged as to make exposures at intervals of approximately 20 meters throughout the lined pipe. Accurate records including exposure serial numbers and the relative pipe chainages shall be kept by the Contractor. All records and exposures shall become the property of the Employer.

The Contractor shall supply all equipment, facilities and chemicals required for the processing of films. A full description of the equipment and method proposed shall be submitted with tenders. Exposures of any completed section of lining shall be processed and be made available immediately after. The Engineer may order repeat exposures at any point in the line due to the lack of good definition, lighting or focus, or because a defect in the lining is suspected. Repeat exposures shall be to the account of the Contractor. Repeat exposures to clarify suspected defects however, shall, if the suspected defects prove acceptable or non-existent, be to the account of the Employer.

C-PLI 7.3.1.2 Destructive Testing

(a) Thickness of lining and cover to reinforcement

On the first pipe lined and thereafter on one pipe selected at random out of every day's production and

after completion of curing, chisel down to bare steel base a representative section of area at least 250 square centimetres from the lining. The area shall contain the weld bead. Measure distance between steel base and surface of concrete, top of weld bead and surface, and reinforcement mesh to surface of concrete, with a suitable dial gauge or micrometer to an accuracy of 0,1 mm.

Take not less than 5 readings for each pipe and record all readings, the mean of readings, the maximum and the minimum readings. Repair lining as described in sub-clause C-PLI 5.3.1.9. Should thickness not fall within the specified ranges, a further two pipes out of the day's production shall be tested. If thickness of any of the two pipes or specials tested shall fail the requirements, the lining of all pipes and specials in that day's production may be rejected.

(b) Water absorption

On first pipe and thereafter on one pipe selected at random out of every day's production, chisel out approximately 200 cubic centimetres of cured lining in as large chunks as possible.

Dry sample in oven at 100°C to constant mass. Allow to cool to room temperature and determine dry mass to the nearest gram. Immerse sample in clean water for 24 hours. Withdraw sample, remove excess surface water and determine saturated mass to the nearest gram.

(c) Concrete strength

Prepare, cure and test in accordance with SABS method 863, three 150 mm cubes daily of mortar sampled out of a single batch of mortar selected at random from batches mixed for every day's production. Standard of acceptance shall be in accordance with clause 5.8 of SANS 0100, Part II.

C-PLI 7.3.1.3 Contractor's and Engineer's Inspections

Sub-clause C-PLI 7.1.5 and C-PLI 7.1.6 of this specification shall apply.

C-PLI 7.4 Epoxy Lining and Coating

C-PLI 7.4.1 Contractor's and Engineer's Inspection

Sub-clause C-PLI 7.1.5 and C-PLI 7.1.6 shall apply.

C-PLI 7.4.2 Visual Inspection

Every pipe shall be inspected visually and shall be free from tears, runs, visible pinholes, embedded dust and other deleterious blemishes.

C-PLI 7.4.3 Holiday Inspection

Every pipe shall be inspected by means of a suitable low voltage holiday instrument equipped with wet sponge electrode. There shall be no holidays on any area tested.

C-PLI 7.4.4 Thickness

(a) Shop applied lining and coating

The film thickness on the first pipe and thereafter on at least one pipe selected at random from every day's production, but not less than one pipe out of every ten pipes, shall be measured non-destructively by an approved eddy current instrument. At least four readings at equally spaced intervals around the circumference, approximately 300 mm from each end of the pipe, shall be taken. The first reading shall be over the weld bead. When practicable an additional four readings at equally spaced intervals around the circumference in the centre of the pipe shall be taken. The minimum thickness shall not be less than 300 micrometres over any area including weld beads. The Inspectorate may at their

discretion supplement the above test by checking wet film thickness on any or all pipes during application of the epoxy resin.

(b) In-situ applied lining

The lining thickness shall be tested by means of an approved eddy current or magnetic instrument. At least four readings shall be taken at equally spaced intervals around the pipe circumference at any test point. The first reading shall be over the weld bead. The minimum thickness over any area, including weld beads, shall not be less than 300 micrometres.

C-PLI 8 MEASUREMENTS AND PAYMENT

The lining and coating of straight pipes shall be measured per linear meter of pipe lined and coated.

The lining and coating of specials, whether lined by hand or otherwise, shall be measured per unit of complete specials, except where such specials are lined and coated in a single in-situ operation by mechanical means, when the lining and coating of same shall be included in measured per linear meter of complete pipeline lined or coated.

Payment for factory applied linings and coatings shall be included in the payment for pipes delivered to site.

Payment for in situ applied linings and coatings shall be for completed linings and coatings at the rates scheduled.

PARTICULAR SPECIFICATION M-PPP: PRESSURE PIPEWORK

CONTENTS

M-PPP 1 SCOPE

This specification covers the detailed design parameters, manufacture, supply, installation, test and commissioning of pipework, pipe items, protective coatings and describes methods for laying and jointing of pipes. The Particular Specification shall be read in conjunction with the Project Specification.

M-PPP 2 INTERPRETATIONS

M-PPP 2.1 Definitions

For the purposes of this Specification the following definitions shall apply:

(a) Cut Lengths

Where this term is used in the Specifications, on the Drawings or in the Schedule of Quantities it shall be taken to mean a pipe of differing length from the standard length for pipes as supplied by the manufacturer.

Cut lengths are required as closure pieces between standard pipe lengths, between the end of a pipe fitting or between pipe fittings.

(b) Plain End

This term refers to a pipe end that has been cut, machined or finished in a manner suitable for coupling to a pipe with a similar end as specified.

M-PPP 2.2 Abbreviations

For the purpose of this Specification the following abbreviation shall apply:

ASTM : American Society for Testing and Materials
API : American Petroleum Institute
BS : British Standard
SANS : South African National Standards
SIS : Swedish Institute of Standards
uPVC : Unplasticised Polyvinyl Chloride
ISO : International Standards Organsiation
DIN : Deutsches Institut für Normung
HDPE : High Density Polyethylene
MPVC : Modified Polyvinyl Chloride Pipes

M-PPP 2.3 Standards

All design standards for the pressure pipework shall be subject to the latest amendments and editions of the following standard specifications:

SANS 10400 : National Building Regulations
SANS 9096-1:1994 : Testing of welders, where applicable to the type of welding required
SANS 10064 : The preparation of steel surfaces for coating
SANS 10102-4 : Selection of pipes for buried pipelines Part 1: General Provisions
SANS 10111-2-1: Engineering Drawing Part 1: General principles Engineering Drawing Part 2: Geometric Tolerancing Section 1
SANS 1700-5-9 : Fasteners Part 5: General requirements & material properties Section 8: Corrosion resistant stainless steel fasteners-Bolts, Screws & Studs
SANS 1700-5-10: Fasteners Part 5: General requirements & material properties Section 8: Corrosion resistant stainless steel fasteners-Nuts

SANS 455 : Covered electrodes for the manual arc welding of carbon and carbon manganese steels

DWS 1110 : Construction of pipelines

M-PPP 2.4 General Requirements

This specification must be read in conjunction with the following specifications:

- Colour Codes
- Corrosion Protection

M-PPP 3 CLASS DESIGNATION

Pipe classes indicated on Drawings and in the Specification should have the following meaning:

Working Pressure (kPa)	Steel Pipes
300	
600	6
900	
1 000	10
1 200	
1 500	
1 600	16
1 800	
2 100	
2 400	
2 500	25

M-PPP 4 MATERIALS

The type, ability and condition of the equipment and material are subject to the Engineer's approval. Covered electrodes of mild steel or medium high tensile steel for hand welding must comply with SANS 455 and carry the SANS mark.

The Contractor must submit full particulars off all electrodes he intends using to the Engineer. All electrodes must be supplied by the Contractor and the consignment number submitted to the Engineer. Should a different consignment be used on the works, the Engineer may alter the welding procedure.

M-PPP 4.1 Standards

M-PPP 4.1.1 uPVC Pipes

Requirements:

SANS 966 : uPVC Type I Pressure Pipes and Fittings for Cold Water Services

SANS 967 : Unplasticized poly(vinyl chloride) (PVC-U) soil, waste and vent pipes and pipe fittings

ISO 4422 : Pipes and fittings made of unplasticized poly (vinyl chloride) (PVCU) for water supply – Specifications

SANS 1123 : Pipe flanges

SANS 791 : Unplasticized poly(vinyl chloride) (PVC-U) sewer and drain pipes and pipe fittings

SANS ISO 4427 : Components of Unplasticised Polyvinyl Chloride (uPVC) Pressure Pipe Systems for potable water

SABS 0112 : The installation of polyethylene and unplasticized polyvinyl chloride pipes

BS 3505 : Unplasticised polyvinyl chloride pressure pipes for cold potable water

DIN 8061: A1:1991 : Unplasticised polyvinyl chloride pipes: General quality requirements and testing

ISO 1167 : Plastic pipes for the transport of fluids: determination of the resistance to internal pressure.

ISO 1628 : Plastics determination of viscosity number and limiting viscosity number. Part 2: PVC resins.

ISO 4422 : Pipes and fittings made of unplasticised polyvinyl chloride for water supply specifications 125 & 140mm sizes are not recommended for uPVC pipes due to the lack of standard fitting.

M-PPP 4.1.2 HDPE

Requirements:

SANS ISO 4427 : Black polyethylene pipes for the conveyance of liquids

M-PPP 4.1.3 Mild Steel

Requirements:

SANS 719 grade B : Electric welded low carbon steel pipes for aqueous fluids (large bore) SANS 62 : Steel pipe and pipe fittings up to 150 mm nominal bore

M-PPP 4.1.4 Cast Iron

Requirements:

BS 2035 : Cast Iron flanged pipes and flanged fittings.

SANS 509 : Malleable cast iron pipe fittings.

SANS 664 : Cast Iron gate valves.

SANS 746 : Cast-iron pipes and pipe fittings for use above ground in drainage installations

M-PPP 4.1.5 Stainless Steel

Requirements:

SANS 1044-3 : Welding Part 3: The fusion of steel (including stainless steel): Tests for the approval of welding procedures

SANS 1044-4 : Welding Part 4: The fusion welding of steel (including austenitic stainless steel): Tests for the approval of welders working where weld procedure approval is not required.

SANS 10162-4 : Structural use of Steel Part 4: The design of cold-formed stainless steel structural

M-PPP 4.1.6 Ductile Iron

Requirements:

SANS 1835 : Ductile iron pipes, fittings, accessories and their joints, for use in high and low pressure systems for potable and foul water

SANS 50545 : Ductile iron pipes, fittings, accessories and their joints for water pipelines - Requirements and test methods

SANS 50598:1994 : Ductile iron pipes, fittings, accessories and their joints for sewerage application - Requirements and test methods

M-PPP 4.2 Steel (Other than Galvanised)

M-PPP 4.2.1 Manufacturing Specifications

SANS 62 : Steel pipe and pipe fittings up to 150 mm nominal bore

SANS 719 : Electric welded low carbon steel pipes for aqueous fluids

SANS 1123 : Standard Specification for steel pipe flanges

BS 4504 : Flanges and bolting for pipes, valves and fittings

M-PPP 4.2.2 Welding Specifications

BS 1965 : Butt-welding pipe fittings.

BS 2633 : Metal-arc welding of steel pipe lines and pipe assemblies for carrying fluids.

BS 4504 : Flanges and bolting for pipes, valves and fittings.

API 5L : Specification for line pipe.

API 5LS : Specification for spiral-weld line pipe.

API 1104 : Standard for welding pipe lines and related facilities.

M-PPP 4.2.3 Protective Coatings

SANS 763 : Hot-dipped (galvanised) zinc coatings.

SANS 0129 : Code of Practise for plastic tape wrapping of steel pipe lines.

SANS 1117 : Plastic wrapping for the protection of steel pipe lines.

SANS 1130 : Glass fibre reinforcing material for pipe wrapping.

SANS 1136 : Cold applied bitumen primer for steel pipe line protection.

SANS 1137 : Hot applied bitumen for steel pipe line protection.

SANS 1138 : Cold applied coal tar primer for steel pipe line protection.

SANS 1139 : Hot applied coal tar enamel for steel pipe line protection.

SANS 1178 : The production of lined and coated steel pipes using bitumen or coal tar enamel.

SIS 05 59 00 : Pictorial surface preparation standards for painting steel surfaces.

M-PPP 5 UPVC PIPES AND FITTINGS

All manufacturers of uPVC and MPVC pipes, fittings and couplings must be quality listed by the South African Bureau of Standards to comply with SABS ISO 9002.

All exposed uPVC piping shall be protected against ultra-violet degradation by the application of two coats of white PVA paint after degreasing.

Where flanged ends are required, the end of the pipe shall be prepared with a solvent welded stub adaptor to accommodate a galvanised steel backing flange.

All sludge and polyelectrolyte pipework shall be uPVC and rated 9 bar pressure and shall adequately supported to prevent sagging.

M-PPP 5.1 Handling

Care shall be taken when handling uPVC pipes to ensure that pipes are not dropped or mishandled.

Piping in transit shall be adequately secured using straps to prevent abrasion and surface damage. During transport, handling and storage, the Contractor shall ensure that the pipes lie on a smooth surface and are not in contact with sharp objects and are not subjected to point or linear loads.

Yield (MPa) at 28° C	**Tensile Modulus (GPa) 23°C**	**Max Temperature**	**Design Stress (MPa) at 20°C**	**Minimum Safety factor at 50 years**
55	2.7-3.0	60	10,000	2.1

M-PPP 6 HDPE PIPING

Flange couplings shall be kept to a minimum. Where the standard length of pipe is less than the required length, butt weld or flanged connections shall be used.

HDPE stub ends and loose flange connections may be butt welded and the bead formed inside the pipe shall be removed to avoid restrictions and product build-up. All flanges and bolts shall be galvanised.

Pipe work shall be adequately supported depending upon the size and class to prevent pipe sag. Where pipework is exposed directly to the environment, provision shall be made for suitable horizontal expansion joints.

M-PPP 6.1 Handling

Care shall be taken when handling HDPE pipes to ensure that pipes are not dropped or mishandled. Piping in transit shall be adequately secured using straps to prevent abrasion and surface damage. During transport, handling and storage, the Contractor shall ensure that the pipes lie on a smooth surface and are not in contact with sharp objects and are not subjected to point or linear loads.

The maximum stacking height for class 6-10 pipes shall not exceed 2m. All pipes exhibiting damage shall be rejected.

Yield (MPa) at 28° C	**Tensile Modulus (GPa) 23°C**	**Max Temperature**	**Design Stress (MPa) at 20°C**	**Minimum Safety factor at 50 years**
20	0.7-0.95	80	5,0	1.3

M-PPP 7 MILD STEEL

All mild steel pipework and fittings other than steam tubing and screwed and socketed pipe, larger than 150 mm diameter shall comply with the requirements of SABS 719 grade B and shall have a minimum wall thickness as follows:

Normal Bore mm	**Min Wall Thickness mm**
Less than 400 mm	4
400-500	5
600-700	6
750-900	8

950-1100	10
1100-1500	12
1600-1800	14

Pipework other than screwed and socketed of sizes up to and including 150 mm nominal bore, shall comply with the requirements of SABS 62. These pipes shall be heavy class with flanged joints and suitable for a minimum working pressure of 1.6 MPa.

All screwed and socketed pipes shall comply with the requirements of SABS 62 Medium class and shall be “hot dip” galvanised. Unless otherwise specified screwed and socketed pipes shall not be used for the conveyance of steam, gas and compressed air. Compressed air pipelines of diameter 25 mm or less may be screwed and socketed.

Plain ends of pipes and fittings shall be protected against damage while being transported from the factory to the site. Details of the proposed protection system shall be submitted by the Engineer for approval.

M-PPP 8 CAST IRON PIPES

All cast iron fittings shall be factory coated internally and externally with one coat bitumen paint to BS 3416 Type II leaving a dried film thickness of not less than 25 µm.

(a) All Exposed pipes and fittings except pipes installed in potable water retaining structures. Method of corrosion protection shall be specified in the project specification.

(b) After installation paint with one further coat as per factory coat.

M-PPP 9 STAINLESS STEEL PIPES

Stainless steel shall be ANSI Type 304L or 316L as stated in the detailed specification. Where no welding is required Type 304 or 316 may be used. Manufacturers test certificates shall be provided for each material and each stainless steel item supplied shall be clearly and permanently marked with the grade of stainless steel and cross referenced to the applicable test certificate.

Welding of stainless steel shall be carried out using welding electrodes most suitable for the material and its applications by reference to the manufacturers recommendations. Special precautions shall be taken to ensure that the strength and corrosion resistance of the material is not impaired by prolonged heating of the welds. All welds and adjacent areas shall be cleaned and pickled to remove the area of discolouration with a nitric and hydrofluoric acid formulation as recommended by the material suppliers.

After cleaning pickling all areas shall be thoroughly washed with clean water and re-passivated there after with a proprietary passivating solution of 10 per cent – 20 per cent nitric acid in aqueous solution recommended by the material suppliers.

M-PPP 10 3CR12 PIPES

Test certificates and marking shall be used for 3CR12 as per stainless steel.

All 3CR12 shall be supplied “passivated” and upon completion of fabrication welds and other areas where the passivating layer has been removed or damaged and are contamination with mild steel or discoloured shall be cleaned and pickled using nitric acid and hydrofluoric acid formulation as

recommended by the material suppliers. After cleaning/pickling all areas shall be thoroughly washed with a proprietary passivating solution of 10 per cent – 20 per cent nitric acid in aqueous solution recommended by the material suppliers.

Welding of 3CR12 steel shall be carried out under controlled conditions using stainless steel 309L welding rod or similar approved and recommended by the material suppliers. All welds shall be continuous and crevice free.

Where a fabricator has shops that deal with both carbon steel and stainless/ 3CR12 fabrications these shops are to be totally separated and no grinding wheels, etc., shall be interchanged between shops.

M-PPP 11 DUCTILE IRON PIPES

Ductile iron pipes and fittings shall comply with ISO 2531. The nominal diameters of ductile iron are 80 to 2000mm.

The pressure rating of ductile iron is K9 range, with the nominal pressure of 3200 kPa. A safety factor of 4 times the working pressure shall be used for ductile iron pipes.

An integral rubber ring socket and spigot is used for the jointing. Ductile iron pipes shall have a inner lining of alumina cement mortar.

M-PPP 12 STEEL PIPES, SPECIALS AND FITTINGS

M-PPP 12.1 General

Protective coatings shall be either "factory" implying coating prior to delivery from the factory to Site, or "Site" implying coating on the Site after the item has been installed.

Undercoats shall be coloured differently to ensure complete coverage with each coat.

External protections other than specified in this clause e.g. coal, tar, enamel and proprietary types of tape wrapping shall when called for in the Schedule of Quantities be carried out as specified.

M-PPP 12.2 Materials

Materials used for spun bitumen lining and bitumen fibre glass wrapping of pipes and the method to be followed shall comply with SANS 720.

Epoxy resin paint shall be approved by the Engineer and shall not break down chemically with time or affect the potability or cause discolouration of potable water in any way and the primer used with such paints shall be zinc rich epoxy type compatible with the paint. Bitumen based aluminium paint to be to SANS 802.

Undercoat for alkyd based enamel paint to be to SANS 681 Type II, and colour to match final decorative paint. Alkyd based enamel paint to be to SANS 630 Grade I.

Zinc chromate primer to be to SANS 679 Type I.

Bitumen paint to BS 3416 (Type II where specified).

M-PPP 12.3 Types of Protection

Pipe work and fittings will be protected in accordance with the Particular Specification: Corrosion Protection.

M-PPP 13 PIPE CONSTRUCTION

M-PPP 13.1 General

Pipes shall be tested hydraulically in accordance with SABS 719 and test certificates shall be submitted to the Engineer before the pipes leave the manufacturers workshops.

M-PPP 13.2 Marking of Pipes

The following markings shall be legibly and indelibly marked on each pipe and coupling:

(a) The name, trade name or registered trade mark of the manufacturer.

(b) The nominal internal diameter.

(c) The class of pipe and colour code (marked at each end).

(d) The wall thickness (for steel pipes).

(e) Length of pipe (if different from the standard length)

(f) Pipe items, specials and valves shall be legibly and indelibly marked with the item number corresponding to the item number given in the Item Lists on the Drawings, or where Item Lists are not provided, the item number in the Schedule of Quantities.

M-PPP 13.2.1 Information to be Supplied

The following information shall be made available to the Engineer prior to the award of the Contract:

(a) Make and types of pipe offered.

(b) The friction loss formula applicable to the types of pipe offered.

(c) Standard pipe length.

(d) Thickness of pipe wall.

(e) Type of coupling and degree of maximum safe deflection permissible with the coupling.

Where the Contract calls for the supply, delivery and laying of the piping, the unit rate tendered for straight pipes shall include for one complete coupling (i.e. including rubber rings, insertion, bolts, etc.) per pipe length and shall include for the protection of the coupling.

Where the Contract calls for the supply and delivery only of the piping, the unit rate tendered for straight pipes shall include for one complete coupling per pipe length together with sufficient material for protecting the coupling.

Where the Contract calls for taking delivery of and laying the piping the unit rate tendered for straight pipes shall include for the labour necessary for protecting the couplings.

M-PPP 14 WELDED STEEL PIPES

M-PPP 14.1 General

Welders must be successfully tested in accordance with SANS 044 Part V by a certificate institution defined by SANS 044 Part V. The Contractor is responsible for the competency certificates of the welders. The Contractor must issue each welder with such equipment so that a welder can identify his joints. A list of identification marks must be kept by the Contractor and made available to the Engineer. Should two joints of a particular welder not withstand the prescribed test, the welder may not undertake any more welds.

Pipes shall be manufactured by an approved welding process and shall not incorporate more than one longitudinal seam for pipes up to and including 1 000 mm diameter or two longitudinal seams for pipes bigger than 1 000 mm diameter.

Pipe specials shall be manufactured strictly as shown on the Drawings and described in the Documents. Plate thickness shall be such to ensure that the maximum stress shall not be higher than for an uncut pipe in the same pipeline.

The maximum angle between butt-ends of segments for gusseted bends shall be 22½□.

M-PPP 14.2 Pipe Ends

Pipe ends must be thoroughly cleaned of all rust, grease and protection which may affect the quality of the weld. For cut lengths the ends must be bevelled to 30□□with the end of the pipe and the roof surface prepared all at the Contractor's own cost. Should laminating, splitting of ends or any other defect occur during welding, the Contractor must cut the defective areas from the pipe.

M-PPP 14.3 Handling

Pipes shall be brought in position in such a manner that damage to the pipes is avoided.

Should the pipes have a longitudinal joint, the pipes must be placed so that this joint lies in the top third of the completed line. These longitudinal joints must be staggered at 20□□from each other.

M-PPP 14.4 Clamps

Internal clamps must be used to keep the pipes in position during the welding. The root opening must be between 1,5 and 3,0 mm and the pipes may not deviate more than 1,5 mm from the concentric.

Clamps may be removed only after 50 % of the root weld has been completed in equal sections around the perimeter of the pipes.

M-PPP 14.5 Welding

Root welding may at no place be thicker than two thirds of the pipe wall and must be without defects.

Welding must be thoroughly cleared of slag, scale and oxide before the next weld is applied.

Weld joints must consist of at least two welds to ensure the specified reinforcing.

Complete penetration must be ensured by letting the weld reinforcement protrude 1,5 mm on the inside of the pipe. No other protrusions will be allowed on the inside of the pipe.

Weld joints must be built up until the weld reinforcement protrudes between 0,8 mm to 1,6 mm above the pipe. The cover weld must be 3,2 mm wider than the original groove width.

In order to avoid cracks, the second or "warm" weld must be applied immediately after the root weld has been cleaned and prior to the cooling of the pipe at the joint.

The internal weld bead on welded seams shall protrude a maximum of 1,0 mm into the barrel of the pipe. For butt-welded pipelines the weld bead shall be ground flush with the pipe body at each pipe end.

The Contractor must submit with his tender a Qualification of Welding Procedures as set out in Section 2 of API Std 1104 including a procedure specification as set out in paragraphs 2.3a, d, e, f, g, h, I, j, k, l, m, n, p, q and r of above specification. The Contractor must demonstrate that this proposed procedure will produce an acceptable pipeline. Should tests reveal that an acceptable result cannot be obtained, the Contractor shall alter his procedure and qualification so that the desired result is obtained.

No welding may take place should inclement weather including rain, sand and wind result in bad joints. If practical, shelters may be erected. The Engineer's representative will decide if the weather is suitable for welding or not.

M-PPP 15 BONDING OF PIPELINE

It may be necessary as a result of tests to be carried out by the Employer, for the pipeline to be bonded across couplings for electrical continuity.

The bonds shall consist of lengths of 16 mm² PVC sheathed cable secured to the pipeline by thermal welding. Each and every flexible and flanged coupling will be bonded across except in the case of valve chambers where the bonding will take place in the form of a bypass around the outside of the

chamber. At flexible couplings two fastenings to the pipe (one on either side of the coupling) and one to the barrel of the coupling shall be made. The external protection of the pipe shall be made good by filling the space cleared of wrapping for the connection with bitumen as used for wrapping the pipe, such that the depth of bitumen thus applied is equal to the depth of the wrapping.

The bonding shall be carried out as soon as possible after installation of the piping and before joints are protected and backfilled. The cables shall be installed in accordance with the requirements of the supplier and to the satisfaction of the Engineer.

Bonding of pipes shall be measured per joint unit. This price shall include for supplying of materials, transporting on Site and installing bonds and making good of pipe wrapping all as described in this Clause.

M-PPP 16 BEDDING AND SUPPORTING OF PIPEWORK

In all cases buried pipes shall be laid on a 50 mm thick bedding layer, surrounded and covered to a height 150 mm above the pipe with selected fill material complying with the requirements of standardized specification unless otherwise indicated on the Drawings or ordered by the Engineer.

Bedding material shall be to the same Specification as selected fill.

Exposed pipework shall be adequately supported on concrete pads and fastened down with approved metal straps with rag-bolts cast into the concrete or with holderbats or as indicated on the Drawings or directed by the Engineer.

M-PPP 17 LAYING OF PIPES

Only qualified workmen shall be employed for the laying and jointing of pipes and proper tools shall be used for the execution of the works. Care shall be taken during construction that the ends of pipes are not hit against each other and pipe ends are damaged in this way.

Once a sufficient length of trench has been excavated and trimmed to the required levels and grades, the pipes shall be lifted and carefully lowered into the trench and placed on the prepared bedding layer (where gravel bedding layers are called for).

Immediately prior to laying the pipe or fitting, it shall be carefully examined both externally and internally for any damage or defect, and all foreign matter shall be removed from inside of the pipe.

Pipes shall be laid evenly on the prepared bedding layer that shall be free of hollows, bumps or other irregularities. Where any such irregularities occurring in this layer prevent the pipe barrel from bearing on the bedding layer for its full length between joint holes, the pipe shall be lifted out of the trench or moved to one side while the bedding layer is trimmed in the specified manner, and where such filling or trimming is necessary as a result of any fault or omission on the part of the Contractor responsible for excavating the trenches, the additional handling of the pipe and trimming shall be to his own cost.

A guideline shall be strung parallel to the centre-line of the pipe and at the height of the centreline of the pipe. Alternatively the Contractor may make use of a laser beam grade indicator.

All pipes and fittings shall be laid to the true lines and levels indicated on the drawings or as instructed by the Engineer. Pipes and fittings shall be positioned concentrically correct so as to obtain a thoroughly uniform joint. Where possible pipes shall be laid by commencing at the lower end of the grade and working uphill, and in the case of spigot and socket pipes, the socket end of the pipe shall face uphill.

In order to prevent foreign matter entering pipes already laid, a properly fitting wooden or other approved type plug or cap shall be used to cover the end of the last pipe laid whenever laying of pipes is interrupted.

Under no circumstances will the Contractor be permitted to use stones, corrugated iron or cement bags to cover the open end of closed pipes.

An approved pipe "cleaner" attached to a sturdy rope and left in the mouth of the pipe already laid and jointed, shall be pulled forward through the pipeline as each successive pipe is laid.

The scraper and ropes used must be of soft material, which will not damage the inner surface of the pipes.

M-PPP 18 DAMAGED PIPES

Damaged or defective pipes or fittings may not be used but shall be placed to one side for inspection by the Engineer who will determine and decide whether the damage is of such a nature that the pipe or fitting shall be rejected or whether it is so slight that it may be repaired on the Site. The decision of the Engineer with regard to the rejection of the damaged or defective pipes and fittings shall be final. Pipes and fittings shall be replaced or repairs undertaken by the Contractor at his own cost to the full satisfaction of the Engineer. In the case of pipes and fittings provided by the Employer, the responsibility of the Contractor for the repair and replacement of damaged pipes and fittings will commence once the Contractor has taken delivery of the material from the Employer. Before taking over any material from the Employer, he shall thoroughly inspect all material and immediately report any damage or defects therein to the Engineer.

The Engineer shall have the right to order the removal of any defective or damaged pipe or fitting that has not been repaired or approved as described above, from the pipe line, irrespective of whether such pipe or fitting has been laid and joined in the pipe line or not, and the Contractor must then undertake the removal and replacement of such pipe or fitting to the complete satisfaction of the Engineer, at his own cost.

M-PPP 19 SIGHT RAILS

In all cases pipes are to be laid to definite lines and levels and sight rails shall be erected after setting out, at changes in direction and grade and at intermediate positions such that the distance between sight rails does not exceed 50 m or as the Engineer may require.

Sight rails for bulk excavation of trenches may be temporary to suit the Contractor's requirements but for purpose of final trimming and pipe laying sight rails shall be of sturdy construction, firmly planted and have the cross-arm neatly and clearly painted black and white.

Boning rods shall be well constructed with the cross-arm painted red or other colour contrasting with the sight rail. Sight rails and boning rods shall be maintained in a clean and sound condition and shall be subject to the approval of the Engineer at all times.

M-PPP 20 STORAGE OF PIPES AND PREFABRICATED SECTIONS

Unless specifically stated to the contrary, the Contractor shall supply, deliver and install, as shown on the Drawings and in the Schedule of Quantities, all pipes, prefabricated sections and accessories required under each particular Section of the various Sections of the Contract.

Unless the pipes, prefabricated sections and accessories are off-loaded on the side of the excavated trench, the Contractor shall stack such pipes, prefabricated sections and accessories on an approved

site. The cost involved in the transport from such storage place to the section of the trench where the drain or pipe line has to be built, shall be included in the construction cost.

During transport, handling, stacking and placing, the prefabricated units shall be protected against damage.

The Engineer reserves the right to restrict the height to which pipes may be stacked. Pipes larger than 300 mm diameter may not be stacked at all.

M-PPP 21 JOINTING OF PIPES

Only suitably qualified workmen will be permitted to lay and join pipes and suitable equipment must be used for the execution of work.

Before they are joined together, the ends of pipes and all fittings and flanges shall be inspected and cleaned.

(a) Flanged Joints

Where flanged pipework, valves, etc, are to be connected, the insertion material shall be cut to the correct size and provided with bolt holes. The insertion material shall be positioned immediately prior to the two flanges being brought together and the whole joint must then be bolted together by tightening diametrically opposite bolts in sequence.

(b) Flexible Joints (Viking Johnson Type)

The flanges must be placed in position first, one over each end of the pipe, and the rubber rings must then be inserted by pulling them over the ends of the pipes or by using special pointed plugs, the point of which has been placed in the end of the pipe. Any twists in the rubber rings must be removed by rolling the rings along the outside of the pipe and they must then be brought into position so that the distance from the end of the pipe to the ring is equal to half the length of the detachable collar. The collar shall be placed over the end of one of the pipes and the two pipe ends shall be brought together in such a way that the collar is placed centrally over the joint. The bolts must then be placed through the flanges and carefully and evenly tightened to the required torque, thus ensuring a watertight joint.

(c) Flexible Joints (Loose Collar Type)

The pipe barrel shall be thoroughly cleaned over the area to be covered by the coupling.

The coupling shall be installed strictly in accordance with the manufacturer's instructions: a copy of which shall be kept by the Contractor on Site.

(d) Screwed Joints

Screw threads on pipes and in sockets shall conform to the relevant standards.

Threading on Site will be subject to the approval of the Engineer. PTFE tape only shall be used for thread sealing. Sockets shall not be over tightened and the pipes shall be screwed the same distance into the socket on either side.

(e) Spigot and Socket Joints

For spigot and socket joints the ring shall be placed around the spigot end of the pipe, perpendicular to the centre-line and as near as possible to the end. The ring shall be clean, dry and not twisted. The joint is made by pushing the pivot in the socket by means of a crowbar or block and tackle. If the pipe is inclined to creep out of the joint, it is a sign that the ring is not rolled on evenly and it must be redone.

(f) Open Joints

For open joints the pipes shall be laid close together and any gap larger than 3 mm on the inside as

well as outside shall be filled completely with 3:1 cement mortar and on the outside covered with one layer of jute material soaked in the same mortar. The jute material must overlap the joint by at least 75 mm on both sides.

M-PPP 22 COUPLING DIFFERENT TYPES OF PIPING

The following methods shall be used for connecting different types of pipe together:

Cast iron flange adaptors or steel flange and spigot pieces to suit the types of piping shall be coupled with a flexible coupling on one end and bolted to a flange on the other end which may, in the case of steel piping, be welded or screwed on.

Where a steel pipe is to be connected to an asbestos cement pipe with a larger outside diameter, without the use of a flange adaptor to the end of steel pipe shall be furnished with a steel ring welded on or, in the case of galvanised piping, a special galvanised steel socket shall be screwed on such that the outside diameters of the pipes match and the pipes may then be joined with a flexible coupling.

M-PPP 22.1 Making of Openings

Where drains have to be joined to existing structures or existing drains or newly constructed prefabricated box culverts in such a way that it was not possible for the Contractor to leave openings for the joining or building in of prefabricated units, such openings shall be made according to the instructions of the Engineer.

The Contractor shall supply the necessary equipment and labour to make the openings according to the dimensions and/or requirements directed by the Engineer without damaging the rest of the structure or drain. If the openings are made too large or the rest of the structures or drain is damaged in any way, the Contractor shall repair it at his own expense to the satisfaction of the Engineer.

Blasting to make openings will only be permitted in exceptional circumstances.

Where necessary, parts of the existing structure or drain shall be propped until the junction of the new drain is completed.

The prefabricated units must be built into the openings or the other drains joined thereto as directed by the Engineer and the joint shall be finished neatly so that a minimum of obstruction is caused to the flow of water. The Contractor must provide all material, tools and labour to make the new junction.

M-PPP 22.2 Positioning of Valves and Fittings

All valves and fittings shall be correctly positioned as indicated on the Drawings, and where necessary shall be supported by concrete pads. Spindle guides and anchors shall be fixed to the brickwork or concrete and carefully adjusted to ensure correct operation of the spindle.

M-PPP 22.3 Thrust Blocks

Unless otherwise ordered by the Engineer, concrete Class 25/19 MPa thrust blocks shall be cast as a support for bends, tees and caps and at valves. The size of the thrust will depend on the strength of the soil, the pipe diameter, the working pressure and the type of item to be supported.

All thrust blocks shall be cast against undisturbed soil and in such a manner as to leave all couplings accessible and such that the bearing area is in accordance with the table given below, which table is based on the assumption that the safe bearing capacity of the soil is at least 100 kN/m². The Engineer will determine in each case the safe bearing capacity for the soil, and the bearing area of the thrust block may then be interpolated from the table. The areas are given in square metres.

Thrust blocks and pipework supports inside buildings shall be constructed to the dimensions given on the Drawings or as directed by the Engineer after the piping and fittings are installed in position.

Note: Bearing area of thrust blocks for pipe diameters, working pressures and bends not stated in the table below, shall be interpolated from the values given.

Nominal Pipe Diameter (mm)	Working Pressure KPa	Bends				End Caps and T-pieces
		11.25º	22.50º	45.00º	90.00º	
100	300	0.010	0.020	0.035	0.065	0.045
	900	0.025	0.050	0.100	0.185	0.130
	1 500	0.045	0.085	0.165	0.305	0.215
	2 100	0.060	0.120	0.230	0.425	0.300
200	300	0.035	0.070	0.135	0.245	0.175
	900	0.107	0.200	0.395	0.725	0.515
	1 500	0.170	0.335	0.655	1.210	0.855
	2 100	0.235	0.470	0.915	1.695	1.195
300	300	0.080	0.150	0.295	0.545	0.385
	900	0.230	0.450	0.885	1.630	1.150
	1 500	0.380	0.750	1.475	2.720	1.920
	2 100	0.530	1.050	2.060	3.805	2.685
400	300	0.135	0.265	0.515	0.950	0.670
	900	0.395	0.785	1.540	2.845	2.005
	1 500	0.660	1.310	2.565	4.740	3.340
	2 100	0.920	1.895	3.590	6.635	4.675
500	300	0.210	0.420	0.820	1.510	1.065
	900	0.630	1.250	2.455	4.530	3.195
	1 500	1.050	2.085	4.085	7.550	5.325
	2 100	1.465	2.915	5.720	10.565	7.450
600	300	0.305	0.600	1.180	2.175	1.535
	900	0.905	1.800	3.530	6.521	4.600
	1 500	1.510	3.000	5.885	10.870	7.66
	2 100	2.110	4.200	8.235	15.215	10.730
800	300	0.540	1.070	2.095	3.865	2.725
	900	1.610	3.200	6.275	11.595	8.175
	1 500	2.680	5.335	10.460	19.320	13.625
	2 100	3.750	7.465	14.460	27.050	19.070
1 000	300	0.840	1.670	3.270	6.040	4.260
	900	2.510	5.000	9,805	18.110	12.770
	1 500	4.185	8.050	16.340	30.185	21.285
	2 100	5.855	11.660	22.875	42.260	29.795

M-PPP 23 CUT PIPES AND PREFABRICATED SECTIONS

Cut pipes may only be used with the Engineer's permission and the ends shall be cut square to the length of the pipe and finished smooth and evenly so that the cut ends is not inferior to that of an uncut pipe.

The Contractor shall measure the length required for a cut length, cut the pipe, prepare the end for the required coupling and install the cut length. The cutting and end-finishing operations shall be done with special tools available for the particular type of piping such that the cut end is not inferior to the factory made end. In the case of asbestos cement piping particularly, an end cutting machine as supplied by the pipe manufacturers only, shall be used for cutting and preparing the end.

In the case of steel pipes since the ends only are truly circular, it is necessary that cut lengths be factory made and prepared. The prices tendered for cut lengths for various types, classes and diameters of piping shall include for the cutting and end finishing operations but exclude the actual pipe length used as this will be measured and paid for under the item provided for supplying and/or laying of straight pipes. The price shall however, include for one coupling as required, and for any possible wastage.

In the case of sewer pipes, cut pipes may only be used at manholes and the cut end shall wherever possible be built into the manhole. Prefabricated units may only be trimmed or cut where they join structures or other drains.

Box culvert sections may only be trimmed or cut perpendicular to the direction of flow to obtain the correct length and units of the correct skew shall be obtained from the manufacturer where the box culvert drain joins at a skew and in such cases the second last unit shall be trimmed or cut to obtain the correct length.

The ends of pipes to be built in shall be trimmed or cut to the correct skew to be finished smoothly on the inside face of the wall into which it is built.

Units shall be cut in such a way that the edges are not shattered or cracks are not caused in the concrete where the structural strength of the unit causes it to break. When it is trimmed it shall be cut or sawn to obtain the correct length and skew end.

The necessary openings for junctions shall be left when structures or drains are constructed. If the Contractor neglects to leave such openings, he shall, at his own expense, make such openings afterwards or remove the building work and reconstruct it with openings, all according to the Engineer's directions.

Units must fit neatly into the openings provided for them and must be firmly concreted or built in without any obstruction to the flow of water.

M-PPP 23.1 Sterilizing of Pipelines

Pipelines that are to be used for potable water shall be sterilized over its complete length before it is taken into use.

The pipe shall be filled with potable water chlorinated to a concentration of 10 mg of chlorine per litre of water which shall remain with the inner surface of the pipe line for a period of not less than 24 hours. The pipeline is to be filled for sterilizing in such a manner that no shock is created or air trapped in the pipeline.

The Contractor shall at least 14 days prior to the commencement of sterilizing, submit full details of

the proposed method of sterilizing the pipe line to the Engineer for his approval.

The Contractor shall provide all necessary tools, equipment and labour necessary to sterilize the pipeline. After sterilizing the pipe line the Contractor shall, at no extra cost empty the pipe lines and dispose of the water in a manner approved by the Engineer.

The Contractor may use the following products as a source of chlorine:

(a) Chloride of Lime to SANS 295 yielding one third by weight free chlorine.

(b) Calcium Hyper Chloride to SANS 295 yielding 70% by weight free chlorine.

(c) Chlorine gas applied by chlorinator.

The unit rates tendered under the items in the Schedule of Quantities for sterilizing pipe lines shall include for all materials (including water) and labour necessary and shall also include for all arrangements the Contractor may have to make in order to obtain water and fill the pipe line.

M-PPP 23.2 Route Markers

In certain instances concrete pipe route markers may be required. Such markers shall be detailed fully in the Project Specification.

M-PPP 23.3 Protective Layers on Pipes and Fittings

Unless otherwise indicated on the Drawings or stated in the Schedule of Quantities, pipes, specials and fittings shall be protected as shown here-under. Note that preparation of metal surfaces shall be done as specified for steel and other metal work.

PVC, Polythene, galvanised and Chromed Piping

Pipes and fittings manufactured from the above materials shall receive no treatment except as follows:

(a) Exposed galvanised steel piping shall be thoroughly cleaned and coated with one layer of etching primer, one coat zinc chromate primer and finishing coats as for exposed steel piping when called for in the Schedule of Quantities.

(b) The exposed threads and where galvanising has been damaged shall be thoroughly cleaned and all traces of oil removed with an appropriate solvent. One coat of zinc chromate primer to SANS 679 Type 1 followed by one undercoat to SANS 681 Type II to a total dried film thickness of 50 µm shall be brush applied to all surfaces.

(c) Buried galvanised steel piping shall, when called for in the Schedule of Quantities, be protected by wrapping with pressure sensitive tape or butyl rubber laminated tape.

(d) Identification bands shall be painted on exposed PVC, Polythene and chromed piping in accordance with instructions of the Engineer.

M-PPP 23.4 Flexible and Flanged Couplings

The couplings shall first be cleaned by removing all loose scale, rust, extraneous matter such as mud, by means of wire brushing and removing possible excess water by wiping with a dry cloth.

After cleaning, the whole of the coupling shall be well primed with a paste of saturated petroleum hydrocarbons (petrolatum), insert fillers and passivating agents, leaving a thin film on flanges and sleeves and a liberal amount around the bolt heads, narrow cavities, etc. A mastic plats of petrolatum, insert fillers and mineral fibres shall then be applied to cover all the bolt heads on the outside of the flanges (also between flanges to give approximate 5 mm cover over the sleeve). The mastic shall then be moulded up to, but not to completely cover the bolts and flanges.

A glass fibre, felt coated tape saturated with petrolatum with insert siliceous fillers shall then be applied

circumferentially, starting and finishing on top of the coupling, care being taken to form the tape well into the angle between the flange and the pipe. Care shall be taken to smooth the tape down and ensure conformability to the underlying mastic. The tape should be "fed" onto the coupling and not stretched.

Two complete turns of 0,15 mm thick polyethylene sheeting shall be applied over the coupling.

The sheeting shall be wide enough to cover the entire coupling and overlap by 150 mm on top of the coupling. The sheeting shall be secured onto the pipe barrel each side of the coupling by means of self-adhesive tape overlapping 25 mm on the pipe barrel and 75 mm on itself.

The tendered unit rate for wrapped couplings shall include all materials, labour, transport, etc. to complete the protection of the coupling in any position along the pipeline.

M-PPP 24 COLOUR CODES

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification: Colour Coding.

M-PPP 25 TOLERANCES

Pipes shall be laid to the lines, grades and levels as specified on the Drawings.

(a) Vertical deviation from the straight line between two consecutive levels shall not be more than the value of "d" as calculated from the following formula:

d = 5 + L1/2 D1/2 S1/2

60

Where : d = tolerance in millimetre

L = length of pipe between control point in millimetre

D = nominal pipe diameter in millimetre

S = slope of pipe taken as the difference in level of control points in millimetre divided by L

(b) The horizontal deviation from the specified direction and line between two consecutive control points shall not be more than the maximum vertical deviation as calculated under (a) above.

Pipe items and specials shall be manufactured to the dimensions as specified in the pipe lists or shown on the Drawings.

Maximum allowable deviation from the specified dimensions shall be as follows:

(a) Straight pipes and tapers:

Length (mm)	Tolerance (face to face) (mm)
Up to 1 800	± 16
1 800 to 2 700	± 24
2 700 to 3 600	± 32
Longer than 3 600	± 40

(b) Bends and Tees:

Diameter (mm)	Tolerance (centre to face) (mm)
Up to 300	16
300 to 600	24
600 to 1 200	40

M-PPP 26 TESTING

M-PPP 26.1 Steel Pipes and Pipe Fittings

M-PPP 26.1.1 Testing and Inspection at Manufacturer's Works

Where factory inspection and supervision of tests are required by the Engineer, such tests and inspections shall be carried out at the manufacturer's works at the expense of the Contractor who shall provide free of charge all necessary testing facilities, labour, instruments, etc that may be required.

An independent inspector such as the SABS may be appointed to act on behalf of the Engineer.

Fees payable to such an inspector, however, will not be to the account of the Contractor.

M-PPP 26.2 Non-Destructive Tests

(a) Visual Inspection

All pipes and pipe specials shall be visually examined, shall be free of defects, such as cracks, laminations and arc burns and shall comply fully with the dimensions as specified.

A penetrant dye shall be used for the visual inspection of welding.

(b) Ultrasonic Inspection

All longitudinal or spiral welds on straight steel pipes shall be checked ultrasonically with approved equipment capable of continuous and uninterrupted inspection of weld seam - all in accordance with API 5L.

(c) Radiographic Inspection

As an alternative to (b) above, 20% of all longitudinal or spiral welds on straight pipe, and up to 100% of all buttwelds on straight pipes and up to 100% of all welds for pipe specials shall be checked radiographically in accordance with API 5L.

(d) Hydrostatic Testing

All pipes and pipe specials shall be subjected to hydrostatic testing at a test pressure determined from the following formula:

$$P = \frac{1\,500\,Yt}{D}$$

Where P = Hydrostatic test pressure in kPa

Y = Minimum Yield stress of material in Mpa

t = Nominal wall thickness in mm

D = Nominal outside diameter in mm

All leaks on sweating shall be considered as defects.

(e) Visual Inspection of Linings and Coatings

Linings shall have a smooth glossy finish, free from ripples, runs, pinholes, bubbles, laminations, disbanding, fraying or other blemishes.

Coatings shall be free of crazing, laminations, disbanding, pinholes, craters, bridging across and weld beads, or any sign of physical damage and shall have an acceptable smooth finish.

(f) Holiday Testing of Linings and Coatings

The entire lining and coating of each pipe shall be tested by the Contractor to the Engineer's satisfaction with an approved holiday detector fitted with the following heads:

(i) For epoxy linings and coatings - with a wet sponge detector head.

(ii) For bitumen or coal tar linings and coatings - with a copper bristle search head.

(iii) For wrapped coatings - with a rolling ring detector around the pipe.

(g) Thickness of Linings and Coatings

The thickness of linings and coatings shall be measured by means of a magnetic or eddy current instrument suitable for measuring non-metallic films on curved magnetic surfaces.

(h) Delamination Test and Disbonded Areas

Refer to SANS 1178 Clauses 7.2.3 and 7.2.4.

M-PPP 26.3 Destructive Tests

Destructive tests on steel pipes and specials shall be carried out in accordance with SANS 719 and SANS 1178.

M-PPP 26.4 Testing and Inspection on Site

M-PPP 26.4.1 Site Welding

The Contractor must appoint an inspector from a certified institution in accordance with SANS 044 Part V at his own cost. An incompetent inspector must be replaced by a competent person.

A copy of all inspection reports must be provided at no cost to the Engineer.

Inspection and test of welds must be carried out in accordance with API Std 1104 chapter 5 and the standard required must be according to chapter 6. All results must be tabulated.

Radiographical tests in accordance with chapter 8 of above specification must be carried out.

The number of welds of each welder that must be tested are: the first three joints, then every third joint to a total of 6 joints and then one out of every 10 joints. Should one joint fail the prescribed tests, the above procedure must be repeated starting from the before last joint.

The Contractor must keep a complete record of the position of every radiographical tested joint and provide a copy at no cost to the Engineer.

All joints, which fail the prescribed test of API Std 1104, must be repaired in accordance with chapter 7 of above specification.

M-PPP 26.4.2 Linings and Coatings

Linings and coatings shall be visually inspected on Site prior and after installation for any sign of physical damage.

All repairs to linings and coatings undertaken on Site shall be to the Engineer's approval who also reserves the right to order pipes and pipe specials to be returned to the factory for repairs to linings and coatings.

For bitumen linings and coatings the following procedure shall be followed:

Weld spatters must be removed and steel surfaces must be wire brushed to ST 3 of SIS 0559 and all dust must be removed. Damaged bitumen primers, bitumen and lime layers must be scraped and/or brushed until steel or good bitumen is reached to a point at least 100 mm from the point of repair.

Bitumen primer must be cold applied to steel and exposed bitumen surfaces and left to dry for at least 4 hours but not more than 4 days.

For the repair of linings bitumen applied hot in an acceptable manner shall be used.

One layer of warm bitumen to a thickness of 1.5 mm followed by two layers bitumen saturated glass fibre cloth applied by means of a warm iron to ensure complete affixion and bitumen saturation must be applied as wrapping. Above must be followed by one layer of 1 mm thick warm applied bitumen on one layer of white lime over the joint area. The thickness of the wrapping must be at least a thick as

the original and edges must fit to the original protection.

Bitumen must be heated in closed kettles to a maximum of 235□C. Local overheating must be prevented by stirring.

M-PPP 26.4.3 Hydrostatic Testing of Pipe Line

Pipe joints shall in general be left exposed until the pipeline has been successfully tested and passed by the Engineer. All open excavations at joints shall be adequately and safely protected. Should the Engineer order any joints to be backfilled prior to testing, the responsibility for re-exposing the joints for the purpose of repair of leaks after testing shall be entirely the Contractor's own and he shall not be entitled to extra payment for such work.

The Contractor shall provide and maintain in good condition the equipment necessary to carry out the test. Where temporary pumping equipment is used for testing, the equipment shall consist of a force pump with the suction end in a suitable container of water, and connected to the pipe line by means of high pressure hosing in good condition and/or piping and all the necessary flanges, connections, couplings, etc. and a pressure gauge suitably calibrated and in good condition. The equipment and method of assembly for testing shall be subject to the approval of the Engineer.

The entire pipe line or portion of the pipe line between closed valves and/or blank flanges mat be tested at any one time provided that no section of the pipe line is subject to a higher pressure than one and a half times the working pressure for the particular class of pipe and fitting.

Prior to commencing the test the Contractor may, if he so desires, keep the pipeline full of water for as long a period as he considers necessary. The Contractor shall, at least 14 days prior to the first test being carried out, submit full details of the procedure he intends to follow, to the Engineer for approval.

For the purpose of the test the pipeline shall be filled with water in such a manner that no shock is created or air trapped in the portion to be tested.

Once the pipe line is completely full of water, the pressure shall be brought up to one and a half times the maximum working pressure for all parts of the portion of pipe line under test as the water level in the container at the suction end of the pump noted. The initial application of the test pressure shall be done in the presence of the Engineer.

The pressure shall be maintained at the test level for 4 hours.

The quantity of water which has to be added to the container at the suction end of the pump during the 4 hours that the pipe line is under test in order to bring the water level back to the initial level at the start of the test, shall be carefully recorded. No water may be added to the container except in the presence of the Engineer.

Should the quantity of water thus added not exceed the following limit, the pipeline shall be deemed to be successfully tested.

Limit of leakage permitted over 4 hours:

(a) For pipeline with flexible joints

50 ml per 10 mm of pipe diameter per 1 000 m of pipe length per 10 m maximum test head for the portion of pipeline tested. All joints must be inspected while the test is in progress to ensure that there are no visible leaks.

(b) For pipeline with welded joints

10 ml per 10 mm pipe diameter per 1 000 m of pipe length per 10 m maximum test head for the portion of pipeline tested. Should the leakage be more than 3 l/km of pipe tested, the Contractor must prove that no single leak exceeds 0,2 l in 4 hours.

M-PPP 26.5 Other Pipe Materials

Visual inspections and hydrostatic tests shall be carried out on Site as described for steel pipes.

Factory inspections and tests shall be as specified in the relevant SANS Specification for the pipe material concerned.

M-PPP 27 MEASUREMENT AND PAYMENT

Payment under scheduled items shall be made per complete pipework system installation as specified. Measurement and payment will distinguish between supply / delivery and installation / commissioning of the equipment.

The tendered rates or sums shall cover the cost of drawings and instructions for anything not specifically mentioned but obviously required for the proper installation to enable the system as described to be installed and/or function safely and correctly as specified. No claims whatsoever for extras will be allowed on the grounds that a necessary piece of equipment or a part thereof is not specifically mentioned.

PARTICULAR SPECIFICATION M-PSP: STEEL PIPES

CONTENTS

M-PSP 1 SCOPE

This specification covers the design, manufacture and supply of bare, electric welded low carbon steel pipes, specials and other fittings for the conveyance of water at ambient temperatures and at medium pressures.

M-PSP 2 INTERPRETATIONS

M-PSP 2.1 Supporting Specifications

Reference is made to the latest issues of the following standards:

SANS 62-1:2003 Steel pipes and pipe fittings up to 150 mm nominal bore, suitable for screwing to SANS 1009-1:2005 / ISO 7-1:1994 AND SANS 1009-2:2005 / ISO 7-2:2000 pipe threads.

SANS 719:2008 Electric welded low carbon steel pipes for aqueous fluids (ordinary duties)

SANS 974 Rubber joint rings (non-cellular)

SANS 1123:2007 Steel Pipe Flanges

SANS 1431:2007 Weldable structural steels

SANS 10044-1&2:2004 Welding

BS534 Steel pipes and specials for water and sewage

BS2633 Class 1 arc welding of ferritic steel pipework for carrying fluids

BS2815 Compressed asbestos fiber jointing

BS4360 Weldable structural steels

BS4504 Flanges and bolting for pipes, valves and fittings. Metric series

SIS05 59 00 Pictorial surface preparation standards for painting steel surfaces (Swedish)

AP5L Line pipe

API1104 Standard for welding pipelines and related facilities

AWW June 1955 Design of wye branches for steel pipe

AWWM11 Steel pipes - a guide for design and installation. (Second edition)

ISO2084 Pipeline flanges for general use

BS6443 Penetrant flaw detection

M-PSP 2.2 Application

This specification contains clauses that are generally applicable to the design, manufacture and supply of steel pipes, specials and fittings for duties up to 4,6 MPa. Should no other specification for pipes of outside diameter larger than 2 220 mm be included in a contract, then the requirements of this specification shall apply.

M-PSP 2.3 Definitions

For the purposes of this specification the definitions and abbreviations given in the applicable specifications listed in 2.1 and the following definitions shall apply:

Skelp The jointing edges of steel coils used to manufacture spiral welded pipes.

H: The cross-sectional shape of a weld at skelp

Cut and shut bend See definition with sketches in BS 2633

M-PSP 3 MATERIALS

M-PSP 3.1 Pipes and Specials

Materials used for the manufacture of pipes and specials of nominal bore up to 150 mm shall conform to SANS 62-1:2003 and API 5L: steel grades up to X52, whilst that for pipes and specials of nominal

bore over 150 mm shall conform to SANS 1431:2007: steel grade 300W, as well as API 5L: steel grades X46, X52, X56 and X60. Flanges shall be manufactured from steel plates conforming to BS4360, or SANS 1431:2007 grade 300W. Specials and fittings shall be manufactured from materials conforming to SANS 62-1:2003 for nominal bores up to 150 mm and to BS 534 for nominal bores over 150 mm.

M-PSP 3.2 Rubber Joint Rings

Rubber rings shall comply with SANS 974 Class F.

M-PSP 3.3 Jointing Materials

Bolts, studs, nuts and washers for flanges shall be of materials conforming to the requirements of SANS 1123:2007 unless otherwise specified. Gaskets for flanged joints shall be of compressed asbestos fibre to BS 2815 grade A, and full faced with a minimum thickness of 3 mm.

M-PSP 4 PLANT

The Contractor shall supply and maintain suitable tools, plant and equipment to manufacture and supply steel pipes, specials and fittings to the required standard.

M-PSP 5 GENERAL

M-PSP 5.1 Design of Pipes

The design stress for pipes subjected to the specified design pressures shall be 60 % of the minimum yield stress of the steel. Unless otherwise specified in the Schedule of Quantities or on the drawings, the minimum pipe wall thickness to prevent buckling of straight piping due to internal sub-atmospheric pressures, shall not be less than the following:

Outside diameter (mm)	Minimum wall thickness (mm)
219,1 to 558,8	4
609,6 to 660,4	5
711,2 to 812,8	6
863,7 to 1092	8
1118 to 1245	10
1397 to 1620	12
708 to 1860	14
2020 to 2220	16

M-PSP 5.2 Dimensional Requirements

Unless otherwise specified in the Schedule of Quantities or on the drawings, all line pipes shall be of one fixed standard length between 9 meters and 12 meters. Standard pipes from which samples for destructive testing have been cut may be jointed together by butt welding to form single pipe lengths of the required standard length.

The tolerances on all other dimensions shall be in accordance with SANS 719:2008 clause 4.1, except that for pipe outside diameters bigger than 1250 mm it shall be ± 6 mm. The tolerances on the outside diameters of pipe ends and bodies shall be as specified for pipe diameters of 250 mm to 1 250 mm.

M-PSP 5.3 Fabrication

M-PSP 5.3.1 Welding

Welds shall comply with SANS 719:2008, SANS 10044-1&2:2004 and BS 2633 as modified below.

(a) Sections 1 and 2 of BS 2633 are excluded.

(b) Section 8 of BS 2633.

In addition to clause 8.1 the following shall also apply:

All butt-welds and branch fillet welds on specials shall where considered possible (refer clause 3.2.4.2, Section 3) have an internal weld. The weld bead of this internal weld shall not extend above the prolongation of the original inside surface of the pipe by more than 1,0 mm. Internal reinforcement in the form of backing rings at weld seams shall not be permitted.

(c) Section 10 of BS 2633.

Procedure qualification and qualifying tests shall be restricted to branch connections only.

The internal weld bead/upset metal and flash on the inner surface shall not exceed 1 mm. For pipes and specials to be jointed by butt welding, the internal weld bead shall not protrude more than 1 mm into the bore of the pipe or special. For electric resistance welded pipes, the height of upset metal and flash on the inner surface shall not exceed 1 mm. For pipes and specials to be jointed by butt welding, the internal weld bead shall be ground flush with the pipe body for a length of 200 mm from the ends to be jointed. For pipes and specials to be coupled by flexible couplings, external weld reinforcement or upset metal and flash shall be ground flush with the pipe body for a length of 200 mm from the end to be coupled.

Where automatic submerged arc welding is employed, at least one pass shall be made on the inside and at least one pass on the outside. This shall apply for double jointing of pipes in the factory as well. The number of longitudinal weld seams shall not exceed:

(i) 1 for pipes up to 1 000 mm nominal diameter;

(ii) 2 for pipes larger than 1 000 mm and up to 2 220 mm nominal diameter.

For pipes to be jointed by flexible couplings the pipe manufacturer is required to weld steel plates not less than 50 mm x 75 mm x 6 mm thick to each end of all pipes during the pipe manufacturing process, (i.e. before priming, lining and coating.)

All manual or semi-automatic welds and repair welds shall only be undertaken by welders qualified under the tests laid down in the Code of Practice for Welding SANS 10044-1&2:2004.

M-PSP 5.3.2 Pipes

Pipes shall be manufactured in conformity with SANS 719:2008 and as detailed under section M-PSP 8 of this specification.

M-PSP 5.3.3 Specials and Fittings

M-PSP 5.3.3.1 General

All specials and fittings shall be designed and manufactured by the Contractor in accordance with the general arrangement shown on the drawings and/or described in the Schedule of Quantities, in conformity with SANS 62-1:2003 or sections 3 and 4 of BS 534. In the latter case specials shall be manipulated or fabricated by welding from pipes which have been tested to SANS 719:2008 and as detailed under section 8 of this specification. Detailed drawings shall be approved by the Engineer. All material certificates of pipes used shall be made available to the Engineer.

M-PSP 5.3.3.2 Bends

Bends shall either be smooth formed or segmented. The maximum angle between oblique butt-ends of segments for gussetted bends shall not exceed 22½ degrees. Cut-and-shut bends shall not be permitted. Segmented bends shall be classified as short, medium and long with radii equal to one, two or three diameters respectively. All bends shall however be of a long radii type, unless otherwise specified in the Schedule of Quantities or on the drawings.

M-PSP 5.3.3.3 Branch Connections

Branch connections shall have barrel and branch plate thicknesses such that the maximum stress shall not be greater than that for an uncut pipe of the theoretically required minimum thickness. However, where it is more economical to provide external reinforcement in the form of saddle-type rings or triform shoes, these forms of reinforcement shall be used to achieve the same results. The attachment of reinforcement to the pipe branches shall be only by full penetration welding. Branch connections shall be as remote as possible from the seam weld on the barrel, and except where specifically indicated to the contrary on the drawings, the positioning and extent of external reinforcement is to be determined by the following methods:

(i) Saddle-type reinforcement: section 13.3 of AWWA Manual M11.

(ii) Triform-shoe reinforcement: in accordance with "Design of Wye Branches for Steel Pipe" by H.S.Swanson and co-authors, published in the Journal of the AWWA, June 1955.

Scour valve tees are to be at right angles to the barrel of the pipe, but tangential to the circumference at the invert of the pipe. The flanges are to be aligned to suit the gradient of the pipeline as indicated on the drawings.

Unless otherwise specified complete flanged air valve and access branches shall be supplied loose with the one end profiled and prepared for welding to the pipe or special. Branches are to be pre-aligned to suit the pipeline gradient as indicated on the drawings.

M-PSP 5.3.3.4 Reducers

Taper pieces shall not have more than two longitudinal weld seams.

M-PSP 5.3.3.5 Flexible Couplings

Flexible couplings shall be of the Viking Johnson type with centre register, except where specified to the contrary in the Schedule of Quantities or on the drawings. Flexible couplings shall be supplied complete with all necessary bolts, nuts and rubber jointing rings.

M-PSP 5.3.3.6 Insulated Joints

Insulated joints shall have their insulation material arranged as given in SANS 10121:1977, unless otherwise specified.

M-PSP 5.3.3.7 Flanges

Flanges shall be of the steel-plate for welding type and shall have flat joint faces, with dimensions and joint surfaces in accordance with SANS 1123:2007, BS 4504 or ISO 2084, unless otherwise specified in the Schedule of Quantities or on the drawings. Back surfaces may be left un-machined. All flanges shall be suitable for field welding to pipes and specials and shall conform to BS 2633, section 7, with preparation of plate flanges as shown in figure 41 ("slip-on") for pipes and specials up to 100 mm N.B. and figure 39 or 40 ("bore and fillet") for pipes and specials 125 mm N.B. and larger. Unless otherwise specified, jointing material i.e. bolts, nuts and washers, in conformity with SANS 1123:2007, BS 4504 or ISO 2084 shall be supplied by the Contractor. All flange faces to have a gramophone finish.

M-PSP 6 MARKING OF PIPES AND SPECIALS

All pipes and specials shall be clearly hard stamped alongside a longitudinal or spiral weld on one end of the pipe with the following:

(a) grade and thickness of steel;

(b) serial number of the pipe or special;

(c) nominal diameter;

(d) hydraulic test pressure.

The applicable drilling table shall be stamped on the periphery of all flanges. Bends shall have their centre plane marked with two small punch marks close to both ends to facilitate correct positioning in laying.

M-PSP 7 STORAGE, HANDLING AND TRANSPORT

Pipes and specials shall be protected against damage at all stages from manufacture to delivery. The ends of all pipes and specials shall be protected against denting. Pipes shall be transported and stacked in a manner such as to prevent deformation of the pipe body in excess of 2 percent of the diameter. Dents causing a protrusion in excess of 3 mm into the interior of the pipe shall be repaired by cutting out. The Contractor shall be responsible for dispatching and transporting of the pipes to site and off-loading. Suitable access along the pipeline route will be provided unless otherwise specified.

Access for delivery on site might be restricted by poor weather conditions and the Contractor shall make due allowance for such disruption. Unless otherwise specified the pipes shall be off-loaded adjacent to the laying position, and placed on sandbags or other approved protective supports.

As indicated on the drawings, the Contractor shall stack the pipes, specials and fittings at the top or bottom of very steep inclines from where the pipeline construction Contractor will transport them to their destination as required. He will furthermore provide in the rates for his delivery trucks to be hauled/towed up the steep inclines along the pipeline route where necessary.

M-PSP 8 INSPECTION AND METHODS OF TEST

M-PSP 8.1 General

Factory inspection, supervision of tests, and adjudication of test records shall be carried out by an independent Inspectorate appointed by the Employer to act on behalf of the Engineer. Tests and inspections shall be carried out at the manufacturer's works at his expense. He shall provide all necessary testing facilities, labour, instruments, equipment and samples that might be required, free of charge. The Inspectorate shall be afforded every facility during the course of manufacture and testing to enable the inspection to be carried out effectively. All test samples shall be selected by the appointed inspectors, and all instruments used for testing purposes shall be approved by the inspectors and if in their opinion any instrument should require calibration, such instruments shall be calibrated at the expense of the Manufacturer, by the SABS or other body as may be approved by the Inspectorate. No mechanical working or straining of pipes and specials shall be allowed after testing and inspection. All material certificates and test certificates shall be made available to the Engineer.

M-PSP 8.2 Non-destructive Inspection

M-PSP 8.2.1 Visual Inspection

All finished pipes and specials shall be visually examined and shall be free of injurious defects as

defined in API 5L section 10.7. In addition welds on specials shall be inspected by the application of a penetrant-dye on the inside of the welds. No trace of the dye should appear on the outside.

M-PSP 8.2.2 Ultrasonic Inspection to API 5L

Pipes shall be made by an approved welding process and 100 percent of all longitudinal or spiral welds on straight pipes shall be checked with an approved ultrasonic method capable of continuous and uninterrupted inspection of the weld seam in accordance with API 5L, section 9.14, 9.15, 9.16 and 9.17 except that the equipment shall be checked with an applicable reference standard at least twice every working turn.

M-PSP 8.2.3 Radiographic Inspection to API 1104

(a) Longitudinal welds: All electric fusion welded pipes shall be inspected by radiological methods for a distance of 200 mm from each pipe end.

(b) Spiral welds: All electric fusion welded pipes shall be inspected by radiological methods for a distance of 100 mm from each end of each length of pipe and of the complete "H" at all skelp and welds, including 150 mm of the spiral welds in both directions away from the intersection points of the skelp and welds.

(c) Circumferential butt welds and welds on specials: 100 percent of the weld length shall be examined. When

(d) Consistently acceptable results are obtained, the number of welds to be so tested may be reduced by mutual

(e) Agreement between the Engineer, Inspectorate and Contractor.

(f) Repairs

- Straight piping - 100 percent of the total length of all repairs shall be examined radiographically. Where repairs are made before ultrasonic inspection, and such repairs pass ultrasonic inspection, no further radiographic inspection is required.
- Specials - 100 percent of all repairs shall be examined radiographically.

(g) Pipes for rail, road and river crossings - 100 percent of the total length of all welds shall be examined radiographically.

M-PSP 8.2.4 Hydrostatic Testing

All pipes shall be hydrostatically tested to a pressure such as to produce a circumferential tensile stress in the steel not less than 90 percent of the minimum yield stress of the steel, or 9 MPa, whichever is the lesser. Each individual straight pipe shall be subjected to a hydrostatic test in accordance with the methods described in API 5L section 5. Leaks or sweats shall be considered injurious defects. Should it not be possible to hydrostatically test straight piping and/or specials, a liquid penetrant test shall be done on all welds over and above the non-destructive tests specified above. This will only be applicable with the prior written approval of the Engineer.

M-PSP 8.2.5 Liquid Penetrant Testing

Where requested by the Inspectorate, liquid penetrant testing shall be done in accordance with BS 6443.

M-PSP 8.3 Repair of Injurious Defects

Injurious defects found by non-destructive testing of welds, visual examination, hydrostatic testing or

determined by any other means to exceed the limitations in API 5L section 10.7 shall be repaired in accordance with API 5L sections 10.8 and 10.9 but subject always to the requirements of this specification.

M-PSP 8.4 Destructive Testing

M-PSP 8.4.1 Tests

Destructive tests shall be performed in accordance with SANS 719:2008 clause 7.2 on the first pipe and thereafter on one of every 500 subsequent pipes.

M-PSP 8.4.2 Sampling and Compliance with the Specification

This shall be performed in accordance with SANS 719:2008 clause 6.

M-PSP 9 MEASUREMENT AND PAYMENT

Measurement and payment shall be per linear meter of straight pipe fabricated, supplied and delivered to site. Measurement and payment of specials and fittings shall be per the number of each special and fitting fabricated, supplied and delivered to site. Where pipe linings and coatings are applied prior to delivery, the rates for pipes, specials and fittings shall include for all such linings and coatings, unless otherwise specified in the Schedule of Quantities.

PARTICULAR SPECIFICATION M-PVA: VALVES - MANUFACTURE AND SUPPLY

CONTENTS

M-PVA 1 SCOPE

This Specification covers the manufacture, testing and supply of sluice, butterfly, air, gate, reflux, diaphragm, flow limiter and pressure reducing valves for use in pressure pipelines for the conveyance of raw or potable water at ambient temperatures.

M-PVA 2 INTERPRETATIONS

M-PVA 2.1 Abbreviations

In this Specification the following abbreviations will apply:

ANSI : American National Standards Institute
ASTM : American Society for Testing and Materials
BS : British Standards Institution
SANS : South African National Standards
SIS : Swedish Institute of Standards
DIN : Deutsch Industry Normen
ISO : International Organisation for Standardization
ASME : American Society of Mechanical Engineers
SAECC : South African Electrolytic Corrosion Committee

M-PVA 2.2 Standards

For the purposes of this Specification the latest issues of the following standard specifications will apply:

SANS 1700 Fasteners
SANS 135 Isometric Bold Screws and Nuts (Lexagon & square/coarse thread free fit series)
SANS 136 Isometric Precision Hexagon Head Bolts and Screws and Hexagon Nuts (coarse thread medium fit series)
SANS 144 Cast Iron Single-door Reflux Valves
SANS 191 Cast Steel Gate Valves
SANS 192 Cast Steel Single-door Reflux Valves
SANS 664 Cast Iron Gate Valves for Waterworks and heavy Industrial Purposes
SANS 936 Cast Iron Spheroidal Graphite Iron Castings
SANS 1431 Steel
BS 3100 Cast Steel
BS 4504 Flange Drilling
BS 5155 Cast Iron and Carbon Steel Butterfly Valves
SIS 05 59 00 Pictorial Surface Preparation Standards for Painting Steel Surfaces
ISO 2441 Pipe Line Flanges for General use - Shapes and Dimensions of Pressure Tight Surfaces
SANS 1123 Steel Pipe Flanges

M-PVA 2.3 General Requirements

This specification must be read in conjunction with the following specifications:

- Colour Codes
- Corrosion Protection

M-PVA 3 GENERAL REQUIREMENTS

Satisfactory temporary end cover shall be provided to protect threads, flanges and prepared ends of valves from damage during transportation and handling on site.

Valves shall be so transported, stored and handled as to prevent damage. Valves damaged in any way shall be removed from the site.

The Contractor shall satisfy the Engineer as to the sufficiency of the place of manufacture regarding manufacturing, testing and inspection equipment to ensure that the production of valves is strictly in accordance with this Specification.

M-PVA 3.1 Pressure Rating

The design pressure for the valve is specified in the Tender Document either in/or the Project Specification, Drawings and Schedule of Quantities. The minimum pressure rating for valves shall be 10 Bar. Valves shall be capable of withstanding the applicable test pressure as specified in SABS 664. Test pressure shall be maintained for 5 minutes and the valve bodies shall be watertight in all aspects.

M-PVA 3.2 Wastewater Liquids and Chemicals

Various different chemicals are used to treat wastewater. These include:

- Ferric chloride
- Chlorine
- Polymer (Polyelectrolytes)
- Ammonium bromide

Valves used for the above mentioned chemicals shall be manufactured from highly non-reactive polymer such as Polyvinylidene Fluoride (PVDF) and PVC.

Valves which encounter raw wastewater, treated wastewater and sludge shall be manufactured from corrosive resistant material.

M-PVA 3.3 Guarantee

All valves shall be guaranteed against faulty design, materials and workmanship until the end of the maintenance period on the Main Contract. During this period the Contractor shall be required to attend to and rectify any defects, which occur due to faulty design, materials or workmanship at his own cost.

M-PVA 3.4 Operating and Maintenance Manuals

A copy of the Operating and Maintenance Manual for each valve type and different valve manufactures shall be bound in with the Operating and Maintenance Manual for the project.

The manual shall be A4 size and properly bound. Drawings larger than A3 size shall be contained in separate plastic pockets.

M-PVA 3.4.1 Contents

- A copy of the signed factory test certificate shall be bound in with the manual, while the original shall be handed to the Engineer.
- Operating instructions
- Maintenance instructions
- Lubrication instructions
- Spare parts list
- Drawings
- Brochures

M-PVA 3.5 Jointing Material

Jointing material shall comply with SANS 1700. Valves shall be supplied complete with bolts, nuts, washers (2 per bolt) and gaskets for joining up to adjacent mating flanges.

Bolts shall be of stainless steel in all open applications (e.g. in valve chambers, reservoirs, etc.) and galvanised when buried provided the flanges are protected with DENSO mastic and tape.

The bolt shall be long enough to allow at least two screw threads to protrude from the nut when the assembly is fully tightened. A washer must be provided both under the bolt head and the nut.

M-PVA 3.6 Contact between Dissimilar Metals

When flanges of dissimilar metals are bolted together, the internal epoxy coating shall cover the contact area of the flange without any break.

Suitable insulation material shall be used between the contact faces of dissimilar metals of which the potential difference exceeds 0,3 V. Where corrodible metal is welded to a corrosion resistant metal, the protection coating specified shall overlap onto the latter by at least 5 mm.

M-PVA 4 FABRICATION

M-PVA 4.1 General

(a) Marking of Valves

The design pressure in MPa shall be hard stamped on the edge of flanges to valves, to be visible from the top of valves.

(b) By-passes

Where indicated in the Project Specification or the Schedule of Quantities, valves shall be supplied with by-passes. Such by-passes shall be bolted on to the body of the valve and not to the adjoining pipework.

(c) Hand wheels and Direction of Closure

Where valves are required to be supplied with hand wheels, the rims of such hand wheels shall be machined to a smooth finish if specified. Arrows shall be cast on the hand wheels together with the wording "TO OPEN" or "TO CLOSE" - Closing being by the clockwise rotation of the spindle unless otherwise specified.

(d) For cap top valves an aluminium disc of at least 100 mm diameter with the same wording and arrows shall be slipped over the spindle and retained by the cap.

If specified in the Project Specification, valves shall be fitted with indicators representing the valve status, showing fully open, fully closed and intermediate positions. Such indicators shall be corrosive proof and of robust design.

(e) Flanges

Unless otherwise indicated flanges shall conform, in all respects, to the requirements of SANS 1123 appropriate for the class of valve specified.

Should required sizes fall beyond the range of SANS 1123, flange dimensions shall confirm to the requirements as specified.

The Contractor shall obtain written confirmation of required flange drilling from the Engineer prior to the commencement of manufacture.

Sufficient clearance shall be allowed between the body of the valve and the flange to enable proper tightening of bolts. Tapped holes shall only be allowed in exceptional cases and with the Engineer's

written consent.

(f) Information to be Supplied

Complete details of each valve offered must be provided at the time of tendering. This information will include at least the following:-

- Description
- Manufacturer's figure number
- Flange drilling
- Maximum working pressure (in kPa)
- Maximum unbalanced pressure (in kPa)
- Test pressure (in kPa)
- Material of components
- Gearing
- Accessories

M-PVA 5 BUTTERFLY VALVES

Butterfly Valves shall be of the full-bore type and NOT reduced bore type with flanged ends.

Valves larger than 200mm shall be fitted with gearboxes.

M-PVA 5.1 Opening and Closing

All valves shall be capable of being opened or closed by hand under an unbalanced pressure equal to the design pressure without any difficulty. The disc shall close with a positive action with no possibility of slamming shut during any stage of the closing operation and the valve shall be capable of operating at any opening without variation of disc position or flutter of the disc.

The direction of the spindle rotation for valve closing shall be clockwise.

M-PVA 5.2 Valve Body

Valve bodies shall be manufactured from cast iron or cast steel depending on test pressures and as specified.

The valve body shall have integral hubs for shaft bearing housings. Valves shall be provided with supporting feet and lifting rings where specified. A flow direction arrow shall either be cast into the body or shall be a brass plate screwed onto the body with brass screws.

M-PVA 5.3 Discs

Discs shall be manufactured from cast iron or cast steel depending on test pressures and as specified.

Discs shall be a single casting having a smooth streamlined design to minimize resistance to water flow.

The disc shall be off-set in the body to ensure simultaneous contact around its perimeter and shall have a positive non-slamming closing action.

M-PVA 5.4 Seats and Seals

The profiles of the seats shall be smooth and continuous and shall provide adequate “lead in” for the resilient seal during closure of the disc to prevent excessive seating torque requirements.

The seats shall be fixed to the valve body with stainless steel countersunk screws to facilitate replacement.

The seals shall be of the resilient type with non-weathering, non-sticking, long life properties.

Seals shall be replaceable and shall be secured to the edge of the disc by means of a retaining ring. Sealing rings and seal retaining rings shall be manufactured from stainless steel.

The design of the seat and seal shall allow replacement thereof without removing the valve from the line.

M-PVA 5.5 Shafts

Valve shafts shall be of high grade stainless steel. Valve shafts shall either be continuous through the disc or of a stub shaft design as described in the Project Specification and will be horizontal to the installed valve position. In the case of the sub-shaft type, each stub shaft shall extend into the disc hub for a distance of at least 1.5 times the shaft diameter.

All keys, dowel pins and taper pins used to attach the shaft to the disc shall be mechanically secured. The shaft shall be so sealed that the only two wetted parts shall be the disc and the seat.

M-PVA 5.6 Bearings

Class 16 (1600 kPa) valves or valves with diameters of 350 mm or bigger shall be fitted with two-way adjustable bearings in order to permit precise disc-to-seat positioning at all times.

Positive bearing retention shall also be provided so that the bearing will not shift under operating conditions. The valve shall be capable of being installed and operated in any position.

The bearings shall be self-lubricating, long lasting sleeve-type bearings shall be fitted in the hubs of the valve body and at least one set of thrust bearings shall be provided.

M-PVA 5.7 Gearboxes

Where it is necessary or where it is specified valves shall be operated via manually operated gearboxes.

Gearboxes shall be self-locking and capable of holding the disc in a fixed position for any extended period of time.

Gearboxes shall be geared to be operated against the maximum unbalanced pressure with an effort not exceeding 200 N with each hand on the rim of a standard hand wheel. (Total effort = 400 N).

Gearboxes shall also be fitted with mechanical stops to prevent excessive turning and shall be provided with replaceable shear pins. One spare shear pin shall be provided with each valve.

All gearboxes shall be equipped with position indicators, adjustable travel stops and indications of the “open” and “closed” positions.

The design of the gearbox shall readily allow for conversion to motorised drive at a later stage if required.

M-PVA 6 AIR RELEASE VALVES

M-PVA 6.1 Water Works Anti-shock and Air Release

Air valves shall be manufactured from cast iron or stainless steel depending on the test pressures and the project specification and of the single chamber design with cylindrical solid polymer control floats incorporating anti-shock design during high velocity air discharge.

The orifice plate, internals and body bolts shall be of stainless steel. All components of the valve shall be easily replaceable. All internals made of stainless steel that will be in contact with the fluid shall be lined or coated with a polyurethane paint to prevent cathodic action.

The design of the valve shall be such as to preclude the loss of water or the possibility of the float being blown shut by the passage of air when the accumulation of air in the pipeline is being released.

The valves shall be positive in the action to admit a free and full supply of air when the pipeline is being emptied or when the operating conditions demand.

Valves shall respond to the presence of accumulated air under normal working conditions by discharging it through a small orifice at any pressures within the specified design range.

Valves shall react immediately to pipeline drainage by full opening of the large orifice to allow unrestricted air intake. Valves shall not exhibit leaks or weeping past the large orifice seal at the maximum working pressure.

M-PVA 6.2 Air Valves (Sewage)

Where air valves are required on sewage or industrial effluent pumping mains, they shall be specifically designed for such usage. Ordinary waterworks pattern air valves will not be acceptable.

Air valves shall be installed with an isolating valve on the inlet.

Full details of the air valves offered shall be provided at the time of tendering.

M-PVA 6.3 Air Valves (Water Mains)

The following types of air valves as indicated on the Drawings and/or listed in the Schedule of Quantities are required.

- Type SO: Small orifice, single ball, lever type air valve which permits the escape of air from the pipe under working pressure.
- Type LO: Large orifice, single ball air valve which allow air to enter the pipe when the pipe is being emptied and permit air to escape from the pipe when it is being filled.
- Type DO: A combined small and large orifice air valve, the small orifice operating as the type SO and the large orifice as type LO above.

The size of the air valve shall be specified on the Drawings or in the Schedule of Quantities by the inlet diameter.

Air valves shall be suitable for the working pressure indicated on the Drawings or stated in the Schedule of Quantities.

All air valves shall be flanged and fitted with an isolating valve on the inlet pipe and a drain cock unless otherwise stated.

The air valves should be so designed that the balls are prevented from sticking.

Cover plates shall allow free discharge or intake of air, but shall prevent the ingress of foreign matter.

Valves shall be drop tight on shut-off and the design of the valve shall prevent balls from sticking.

When discharging large volumes of air at high rates the ball must not be caught up in the escaping air stream and close before all air has been released.

Tenderers shall submit full particulars of the air valves tendered on with the tender.

M-PVA 6.4 Special Valves

All valves other than sluice and air valves shall be classified as special valves. The general requirements, pressure ratings, protective layers, flanges, markings, tests, etc. as specified in this Section will be applicable to the special valves. The particular valve will be further specified in the Project Specification.

M-PVA 7 GATE VALVES

All gate valves shall comply with the requirements of SABS 664 and shall carry the SABS mark.

Gate valves shall completely clear the bore of the valve in the fully open position. The direction of closing shall be clearly marked on the bonnet of the valve. Vales shall be drip-tight from zero to maximum working pressure under test conditions.

M-PVA 7.1 Wedge Gate Valves

Valve seat and gate rings shall be manufactured from bronze to BS 1400 LG2.

Valves except flange faces shall be coated externally and internally with self-etching primer followed by one or more coats of fusion bonded epoxy material to give a total film thickness of at least 250 microns all applied in accordance with the manufacturer's specifications.

Valves where specified shall be supplied with fully enclosed, grease-packed, single-train spur gearboxes with a 3:1 or 4:1 ratio as specified.

Where required bronze gate guides and shoes shall be fitted as additional.

Integral mounted by-pass assemblies shall be fitted as additional where required.

M-PVA 7.1.1 Auxiliary Fittings

Wedge gate valves of 300 mm diameter and larger shall be fitted with the following auxiliary fittings:

- Drain Plugs

300 mm diameter valves and larger shall be supplied with gunmetal drain-plugs screwed into the lowest point of the valve and the valve body shall be suitably drilled and tapped to accept the drain-plug. The plug must be in position when the test pressure is applied.

- Ball Bearing thrust Collars

300 mm diameter valves and larger shall be fitted with ball-races on the top and bottom of the thrust collars. The ball-races shall be totally enclosed in a grease-packed cover, which shall be sealed to prevent the egress of grease. Provision must be made for lubricating the ball-races and the lubrication arrangement shall allow for re-greasing while the valve is under pressure.

M-PVA 7.2 Knife Gate Valves

The valve body shall be cast iron with soft rubber lining. Spindle and blade are to be manufactured from stainless steel. Valve seals are to be re-packable and reversible made from Nitrile rubber with PTFE scrapers, to withstand solid particles and grit associated with wastewater and sludge.

Hand wheels shall be rising spindle types. Knife gate valves shall be installed vertically at all times.

M-PVA 7.3 Resilient Seal Valves

Resilient Seal valves ensure tight compression sealing without wear and shall be used as isolating valves. Valve bodies shall have unobstructed, pocket-free, bores i.e. no seating protrusions or gate well, with inclined seats and gate guides to eliminate deposits in the valve body.

The spindle seal shall have at least two Nitrile Butadine rubber to DIN 3770 o-rings located in a corrosion-resistant housing and a wiper ring to prevent ingress of dirt. A back seal shall permit replacement of spindle seats under pressure, with the gate in the fully open position.

The cast iron gate shall be fully covered with a Nitrile Butadine rubber sheath fully bonded to the gate by vulcanising.

Valves shall be smooth bore and shall operate without the use of any wedging action, which may scuff or damage the rubberised gate.

Valves shall be coated with a fusion bonded epoxy coating of minimum thickness 200 microns.

M-PVA 8 NEEDLE VALVES

Type NLV1 needle valves of sizes 50 NB and under shall be used for flow control of dilution water. Needle valves shall be manufactured from stainless steel and shall adhere to ASTMA A 351.

The valve shall be hand operated and the ends of the body shall be screwed to BSP.

M-PVA 9 SPECIAL VALVES

All valves used for special operations and conditions shall be carefully selected.

Tenderers are required to submit full details of the valves offered and the final selection shall be subjected to the approval of the Engineer. The valves offered shall not be accepted as substitutes for the standard valves specified.

M-PVA 10 REFLUX/NON RETURN VALVES

Valves used for sewage effluent or sludge shall be self-cleansing at the base of the gate. The interior shall be smooth and free from any projections.

Valve bodies shall be of cast iron or cast steel depending on the test pressures and the project specification.

Valve doors shall be of cast steel or cast iron. Body rings, door rings and spindles shall be manufactured from stainless steel.

The following types of reflux valves as specified shall be supplied:

(a) Single sloping swing door for sizes up to 400 mm.

(b) Double sloping swing door for sizes larger than 400 mm and up to 800 mm.

(c) Multiple sloping swing doors for sizes larger than 800 mm.

Valve bodies and seals shall be free of pockets that will allow dirt accumulation.

Valve doors shall be designed to prevent fluttering and shall allow rapid but non-slamming closure on reversal of flow. The gate shall swing free in the body and in fully open position shall not obstruct the flow.

Valves shall seal effectively under all operating conditions and the design shall be such that the gate rests against the seat in the absence of flow or of differential pressure without the aid of springs or external counterweights.

Where specified in the Project Specification, valve doors shall be balanced by attaching counterweights and levers, or hydraulic dampers to the extended valve spindle.

Where valves are fitted to buried pipe lines, only hydraulic dampers shall be used.

M-PVA 11 DIAPHRAGM VALVES

The valve is to be able to handle sludge's, rags and grit as expected in waste treatment works.

The valve body must be designed to minimise turbulence and give 100% leak tight closure.

The valve must have a smooth bore and minimise wear from abrasion and allow for rodding when sludge's set in the pipeline.

The valve operating mechanism must be sealed from service and atmosphere.

The diaphragm must be manufactured from tough, resilient type natural rubber of sufficient grade to handle abrasives, acids and alkalis as expected in sewage works.

The valve body is to be cast iron with sufficient corrosion and erosion protection to last the useful life of the valve.

M-PVA 12 BALL VALVES

M-PVA 12.1 Type BLV1

This type is used for general purposes for sizes of 50 NB and under. The ball and stem shall be manufactured from 316 SS and the body shall be 304 SS.

The seat and the gland shall be PTFE material. The valve body shall be of the reduced bore type with ends screwed to BSP. The valve shall be lever operated.

M-PVA 12.2 Type BLV2

BLV2 type ball valves are used for sludge lines. The valve shall be short pattern reduced bore type, fully lined with a Polypropylene or fluorocarbon resin liner.

All interior surfaces including the ball, stem and collar shall be lined to ensure that there is no contact between the metallic components and the lined media. The liners shall be securely retained by means of dovetail grooves within the bore and shall extend over the flange faces.

M-PVA 12.3 Valve Body

The body of the valves shall be manufactured from ductile iron and all external bolts, nuts and gland followers shall be grade 316 material.

M-PVA 13 PRESSURE REDUCING VALVE ANGLE/GLOBE PATTERN TYPE

The pressure reducing valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure.

M-PVA 13.1 Main Valve

The valve shall be hydraulically operated, pilot-actuated, single or double chamber globe or angle patter. The valve shall consist of three major components: the body, with seat installed; the cover, with bearings installed; and the diaphragm assembly.

The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure form line pressure.

Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the main valve or pilot controls.

M-PVA 13.2 Main Valve Body

The valve body and cover shall be of cast material. Ductile iron is standard and other materials shall be available. No fabrication or welding shall be used in the manufacturing process.

The valve shall contain a resilient, synthetic rubber disc, with a rectangular cross-section contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat inset. No O-ring type discs shall be permitted as the seating surface. The disc guide shall be of the contoured type to permit smooth transition of flow and shall hold the disc firmly in place. The disc retainer shall be of a sturdy one-piece design capable of withstanding opening and closing shocks. It must have straight edges and a radius at the top edge to prevent excessive diaphragm wear as the diaphragm flexes across its surface.

M-PVA 13.2.1 Diaphragm

The diaphragm assembly containing a non-magnetic 304 stainless steel stem with sufficient diameter to withstand high hydraulic pressures shall be fully guided at both ends by a bearing in the valve cover an integral bearing in the valve seat. No centre guides shall be permitted. The stem shall be drilled and tapped in the cover and to receive and affix accessories as may be deemed necessary.

The diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve separating operating pressure from line pressure.

The diaphragm shall consist of nylon fabric bonded with synthetic rubber compatible with the operating fluid. The centre hole for the main valve stem must be sealed by the vulcanised process or a rubber grommet sealing the centre stem hole from the operating pressure.

The diaphragm must withstand a Mullins Burst Test of a minimum of 4000 kPa per layer of nylon fabric and shall be cycle tested 100 000 times to insure longevity. The diaphragm shall not be used as the seating surface. The diaphragm shall be fully supported in the valve body and cover by machined surfaces which support no less than one-half of the total surface area of the diaphragm in either the fully opened or fully closed position.

M-PVA 13.2.2 Valve Cover

The main valve seat and the stem bearing in the valve cover shall be removable. The cover bearing and seat in 15 mm and smaller size valves shall be threaded into the cover and body.

The valve seat in 200 mm and larger size valves shall be retained by flat head machine screws for ease of maintenance. The lower bearing of the valve stem shall be contained concentrically within the seat and shall be exposed to the flow on all sides to avoid deposits.

To insure proper alignment of the valve stem, the valve body and cover shall be machined with a locating lip. No pinned" covers to the valve body shall be permitted. Cover bearing, disc retainer, and seat shall be made of the same material. All necessary repairs and/or modifications other than the replacement of the main valve body shall be possible without removing the valve from the pipeline. Packing glands and/or stuffing boxes shall not be permitted.

M-PVA 13.2.3 Valve Manufacturer

The valve manufacturer shall warrant the valve to be free of defects in material and workmanship for a period of three year from date of shipment, provided the valve is installed and used in accordance with all applicable instructions. Electrical components shall have a one year warranty.

The valve manufacturer shall be able to supply a complete line of equipment from 32 mm through to 600 mm sizes and a complete selection of complementary equipment. The valve manufacturer shall also provide a cavitation chart which shall show flow rate, differential pressure, percentage of valve opening, Cv factor, system velocity and if there will be cavitation damage.

M-PVA 13.3 Material Specification

- Valve Size : 50-300 mm
- Main valve body and cover : Cast Iron
- Main valve trim : Stainless steel
- End detail : SABS 1123 table 1600/3 or 2500/3 as specified
- Pressure rating : 0-50°
- Coating : Fusion bonded epoxy

Desired options:

- X43 "y" strainer or equivalent on pilot piping
- Three ball valves on pilot piping, inlet, outlet and line to cover chamber
- 63 mm diameter pressure gauge, glycerine filled, fitted with 10 mm stainless steel ball valve on Tee-piece on inlet and outlet pilot piping.

M-PVA 13.4 Pilot Control System

The pressure reducing pilot control shall be direct-acting, adjustable, spring-loaded, normally open,

diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm, and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting.

The pilot control system shall include a fixed orifice. No variable orifices shall be permitted. The pilot system shall include opening speed control on all valves 100 mm and smaller.

Three-way pilot controls will not be acceptable if the connection of TECHNOLOG “Autowat” or “Ecowat” controllers is specified.

The pilot control shall have a second downstream sensing port which can be utilised to install a pressure gauge.

A full range of spring settings shall be available in the range of 0 to 3000 kPa.

A direct factory representative shall be made available for the start-up service, inspection and necessary adjustments.

M-PVA 13.5 Material Specification for Pilot Control

- Pressure rating : 1600 kPa or 2500 kPa as specified
- Trim : Stainless Steel
- Tubing and Fittings : Brass compression fittings with copper tubing
- Adjustment range : 200 to 2000 kPa or 100 to 500 kPa
- Operating fluids : Water

M-PVA 14 PRESSURE REDUCING VALVE (SINGLE DIAPHRAGM LINER-OPERATED TYPE)

M-PVA 14.1 Function

The pressure reducing valve shall maintain a constant downstream pressure regardless of changing flow rate and/or inlet pressure.

M-PVA 14.2 Main Valve

The valve shall be hydraulically operated, pilot activated automatic control valve for pressure reducing service. The valve shall consist of two parts: stainless steel body and an elastomeric liner. The valve shall be positioned in line and be controlled via an external pilot control valve.

M-PVA 14.3 Material Specification

Valve Size : 50-300mm

- Main valve Body : 316 Stainless steel, investment cast
- End Detail (50 to 100 mm) : Wafer pattern
- End Detail (150 to 300mm) : SABS 1123 Table 1600/3 or 2500/3 as specified
- Pressure rating : 1600 kPa or 2500 kPa as specified
- Temperature range : 0 to 70°
- Liner Material : Natural Rubber
- Liner retainer : 316 Stainless Steel
- Coating : Fusion bonded epoxy

Desired options:

- X43 “y” strainer or equivalent on pilot piping
- Three ball valves on pilot piping, inlet, outlet and line to cover chamber

- 63 mm diameter pressure gauge, glycerine filled, fitted with 10 mm stainless steel ball valve on Tee-piece on inlet and outlet pilot piping.

M-PVA 14.4 Pilot Control System

The pressure reducing pilot control shall be direct-acting, adjustable, spring-loaded, normally open, diaphragm valve designed to permit flow when controlled pressure is less than the spring setting. The pilot control is held open by the force of the compression on the spring above the diaphragm and it closes when the delivery pressure acting on the underside of the diaphragm exceeds the spring setting. The pilot control system shall include a fixed orifice. No variable orifices shall be permitted. The pilot system shall include opening speed control on all valves 100 mm and smaller.

Three-way pilot controls will not be acceptable if the connection of TECHNOLOG “Autowat” or “Ecowat” controllers is specified.

The pilot control shall have a second downstream sensing port which can be utilised to install a pressure gauge.

A full range of spring settings shall be available in the range of 0 to 3000 kPa.

A direct factory representative shall be made available for the start-up service, inspection and necessary adjustments.

M-PVA 14.5 Material Specification for Pilot Control

Pressure rating : 1600 kPa or 2500 kPa as specified

Trim : Stainless Steel

Tubing and Fittings : Brass compression fittings with copper tubing

Adjustment range : 200 to 2000 kPa or 100 to 500 kPa

Operating fluids : Water

Desired Options : -

M-PVA 15 FLOW LIMITER VALVES

M-PVA 15.1 Screwed type limiter valves

The limiter valve shall consist of a screwed fitting with a rubber control ring orifice insert, which affects a consistent flow control within ± 10 % of the rated flow for a differential pressure across the valves over a range extending from 100 kPa to 1100 kPa.

The body of the limiter valve shall be made of uPVC plastic and shall female screwed at both ends to B.S.P.

The control rings shall be made of flexible nitrile elastomer rubber and must be able to move on a tapered seat in the body as the flow increases and be replaceable. The valve must be complete with control rings for the specified initial flow, which may be replaced in the future (post-contract) for the final flow settings. The flow settings for the flow limiter valves are indicated in the Project Specification. The screwed type limiter valve must be stamped with the flow in litres per minute and with an arrow to indicate the direction of flow.

A flow test must be conducted at the suppliers factory or test facilities, on one sample each of 20 mm, 25 mm and 32 mm flow limiter valve as prepared for use in the contract, over the following differential pressures:

Differential Pressure (kPa) Tolerance limit on rated flow

50 ± 50%
100 ± 10%
150 ± 10%
200 ± 10%
300 ± 101%
1000 ± 10%

The measurement of flow rates must be to the satisfaction of the Engineer. If any one of the samples should fail to provide a flow rate within the tolerances specified, then all valves for installation on the contract must be tested for a selection of pressures on the contract must be tested for a selection of pressures up to the static pressures to be expected at installation sites, all to the satisfaction of the Engineer.

M-PVA 15.2 Wafer Type Limiter Valves

The limiter valves shall consist of a wafer pattern with a rubber control ring orifice insert, which effects a consistent flow control within ± 10% of the rated flow for a differential pressure across the valve over a range extending from the 100 kPa to 110 kPa.

The body of the limiter valve shall be made of uPVC plastic.

The control rings shall be made flexible nitrite elastomer rubber and shall be able to move on a tapered seat in body as the flow increases and be replaceable. The valve shall be complete with control rings for the specified initial flow, which may be replaced in the future (post-contract) for the final flow settings. The flow settings for the flow limiter valves are given in the Project Specification.

The limiter valve must be stamped with the flow in litres per minute and with an arrow to indicate the direction of flow.

A flow test must be conducted at the suppliers factory or test facilities, on one sample each of 50 mm and 80 mm flow limiter valve as prepared for use in the contract, over the following differential pressures:

Differential Pressure (kPa) Tolerance limit on rated flow
50 ± 50%
100 ± 10%
150 ± 10%
200 ± 10%
300 ± 101%
1000 ± 10%

The measurement of flow rates must be to the satisfaction of the Engineer. If any one of the samples should fail to provide a flow rate within the tolerances specified, then all valves for installation on the contract must be tested for a selection of pressures on the contract must be tested for a selection of pressures up to the static pressures to be expected at installation sites, all to the satisfaction of the Engineer.

M-PVA 16 VALVE GEARBOXES

Gearboxes shall not be an integral part of the main body but shall be separate unit mounted to the body for easy removal. All gears shall be machine cut and fully enclosed and the lubrication shall be of the permanent type.

Positive stops shall be provided to prevent over opening or over closing of the units and visual indication of the point of travel at all positions in the open/close cycle shall be provided.

Torque limiting devices shall be fitted to prevent damage to gears and casings due to over tightening.

Design of valves and gearboxes shall be such that leakage from the valve along the shaft cannot enter the gearbox.

M-PVA 17 PROTECTION OF VALVES

M-PVA 17.1 Internal Protection

Internal surfaces of valve bodies and discs shall be grit blasted to a Sa ½ of SIS 05 59 00 finish.

Successive coats of an approved non-toxic epoxy resin paint suitable for spray application (Copon EP2300 or similar) shall then be applied to give a final dry film thickness of 300 µm.

Drying times between successive layers will depend on environmental conditions and will be strictly in accordance with the requirements of the paint manufacturer.

As an alternative to the protection as specified above, the Contractor may be required to use either a solvent-less epoxy paint system or a fusion bonded epoxy powder coating. For fusionbonded epoxy, a final dry film thickness of 250 µm is required.

Details of the protection required shall be given in the Project Specification.

M-PVA 17.2 External Protection

External surfaces of valve bodies and discs shall be grit blasted to a Sa 2½ of SIS 05 59 00 finish. Successive coats of an approved non-toxic epoxy resin paint suitable for spray application (Copon EP2300 or similar) shall then be applied to give a final dry film thickness of 400 µm. Drying times between successive layers will depend on environmental conditions and will be strictly in accordance with the requirements of the paint manufacturer.

Where the specification does not call for an external surface consisting of an epoxy coating, the following shall apply:

External surfaces of valve bodies shall be wire brushed to a Sa 3 of SIS 05 59 00 standard and painted with one layer zinc chromate primer to SANS 679 Type I (dried film thickness 50 µm).

This shall be followed by two alkyd-based undercoats (each coat 25 µm thick) and one alkydbased enamel finishing coat to SANS 630 Grade I (dried film thickness 25 µm). Final colour shall be as specified by the Engineer.

Machined flanges shall be painted with a protective coating of shellac or similar.

Refer to Particular Specification: Corrosion Protection

M-PVA 18 TOLERANCES

The tolerances as specified in the appropriate SANS or BS standards shall apply to this Contract.

M-PVA 19 COLOUR CODES

The standard final colour codes for equipment supplied under this Contract shall be in accordance with Particular Specification: Colour Codes.

M-PVA 20 TESTING AND INSPECTION

M-PVA 20.1 Testing by Manufacturer

The Manufacturer shall carry out all tests to ensure that valve materials conform to the requirements of the relevant SANS or BS Specification. The Engineer shall not necessarily attend these tests but records must be kept and all test results and tests certificates must be provided to the Engineer.

M-PVA 20.2 Testing by Independent Body

The Engineer may appoint an independent recognised body to conduct control tests. The Manufacturer shall provide samples required for such tests free of charge and the independent body in accordance with the relevant SANS or BS Specification shall do sampling.

The cost of such control tests shall be borne by the Employer.

M-PVA 20.3 Inspection

Visual, operational and dimensional inspection of valves as well as inspection of protective coatings shall be carried out by the Engineer and/or the Manufacturer in the Manufacturer's workshop prior to the despatch of valves to site.

The Engineer's inspection will in no way relieve the manufacturer of any of his obligations to design, manufacture and supply valves strictly in accordance with the Specification.

M-PVA 20.4 Hydrostatic Testing

The Engineer shall witness all hydrostatic tests and the Manufacturer shall give at least one week notification to the Engineer of the proposed dates for such tests.

Valve bodies shall be close ended tested to 2 x working pressure. Test pressures shall be maintained for at least 5 minutes and valve bodies shall be water tight in all respects.

Assembled valves shall be open-ended tested to 1.5 x working pressure for material strength and soundness. Valves shall be drop tight over the complete range of pressures from 0 to 1.5 x working pressure.

Each valve shall be supplied with a test certificate certifying that it complies in all respects with the requirements of this Specification.

M-PVA 21 MEASUREMENT AND PAYMENT

Payment under scheduled items shall be made per complete installation as specified.

Measurement and payment will distinguish between supply / delivery and installation / commissioning of the equipment.

The tendered rates or sums shall cover the cost of design, drawings, manufacture, supply, testing at the manufacturers works, delivery to site, off-loading, installation, site testing, setting into operation, the supply of O & M manuals, commissioning and maintenance during the warranty period of all equipment specified and also for anything not specifically mentioned but obviously required, (e.g. all ancillaries, including all bolts, fastenings and brackets, safety guards and any work or material required for the proper installation of such equipment) to enable the equipment to be installed and/or function safely and correctly as specified. No claims whatsoever for extras will be allowed on the grounds that a necessary piece of equipment or a part thereof is not specifically mentioned.

PARTICULAR SPECIFICATION M-PWGRSV – WEDGE GATE AND RESILIENT SEAL VALVES

CONTENTS

M-PWGRSV 1 DESIGN GUIDELINES

M-PWGRSV 1.1 Gate Valves

Gate valves shall not be used in flow or pressure control applications without the approval of the Engineering Manager.

M-PWGRSV 1.1.1 Wedge Gate Valves

The typical application for Wedge Gate Valves is for valves in “normally closed” locations (e.g. scour valves) and for valves in “normally open” locations, (eg. In-line isolating valves <250NB) where the maximum differential pressures across the valve is likely to exceed 16 Bar under operating conditions. The medium may be potable water, raw water or sludge.

M-PWGRSV 1.1.2 Resilient Seal Gate Valves

The typical application for resilient seal valves is for valves in “normally open” locations (eg air valve, isolating valves, in-line valves <250NB where the maximum differential pressure across the valves is not likely to exceed 16 Bar under any operating conditions. Resilient seal valves shall not be used in terminal positions (eg as scour valves) without the approval of the Engineer.

The medium may be potable water, raw water or sludge.

M-PWGRSV 1.2 General

Gate valves shall be double flanged and be resilient seated and unless otherwise specified, the valves shall be of the non-rising spindle type. The valves shall be capable of withstanding the nominal pressure and specified test pressure and shall have the capability to seal drip tight bi-directionally.

The valves shall generally be manufactured in accordance to SABS 664.

M-PWGRSV 1.3 Gate Design

The gate shall be fully rubber encapsulated inside and outside therefore to ensure drip tight sealing and avoid corrosion. The gate shall further have a drain hole, preventing stagnant water or impurities from collecting.

Rubber utilized in the coating of the wedge shall be inert and shall not impart odour, taste and colour and shall be suitable for drinking water applications.

The gate nut shall not be fixed to the wedge, thereby reducing opening torques.

M-PWGRSV 1.4 Gate and Body Design

The gate shall have optimally placed guides of wear resistant plastic so as to reduce the torques as well as reduce wear between the rubber and the coating on the body.

The bore of the body shall be straight through design in order to allow cleaning with a badger.

M-PWGRSV 1.5 Valve Bonnet

The valve shall utilize 3 independent bonnet seals which shall include a set of stem steel embedded in non-corrosive material, a back seal to prevent leakage when changing seals and wiper ring to protect against debris entering the valve.

Two friction washers (sizes 50mm – 200mm) and thrust ball bearings (250mm – 600mm) shall be incorporated to ensure smooth spindle operation as well as to reduce opening and closing torques.

A full circle thrust collar shall be utilized to ensure low torque operation.

O-ring stem seals shall be replaceable under pressure for sizes 50mm – 200mm.

M-PWGRSV 1.6 Spindle

Spindles shall be made of stainless steel. The stem threads shall be rolled to maintain steel structure

and increase strength and to ensure smooth thread edges and consequently a low operating torque.

M-PWGRSV 1.7 Body and Bonnet Assembly

The rubber bonnet gasket shall fit in a recess in the valve bonnet preventing blow out of the seal under surge conditions. The bonnet bolts shall pass through the gasket and sunk into the bonnet and sealed for corrosion protection.

M-PWGRSV 1.8 Corrosion Protection

Every valve shall be internally and externally fusion bonded epoxy powder coated as standard.

An edge protecting ring shall permanently be fitted around the body and bonnet joint in order to protect the coating during transportation and installation (50NB to 200NB only).

M-PWGRSV 2 ESSENTIAL ITEMS TO BE ADDRESSED IN THE PROJECT SPECIFICATION

The following items shall be addressed in the Project Specification, on the Drawings or in the Schedule of Quantities.

WEDGE GATE OR RESILIENT SEAL VALVE		
Item	**Option**	**Clause Reference**
Medium	Potable Raw Water Other (Specify	3.1
Size	Nominal Bore	3.4
Pressure Class	10, 16, 25, 40 100 Bar	3.4
Closing Direction	Clockwise Counter Clockwise	3.4
Ends	Flanged Socket (uPVC) Spigot (AC)	3.4
Flange Drilling Table	SANS 1461 (e.g. 1600/3)	3.4
Pressure Rating	10, 26, 25, 40 or 100 Bar	3.4
Spindle	Non-rising (Typical) Rising	3.4
Hand Wheel	Hand wheel Valve cap	3.4
Valve Trim	316 Stainless steel unless otherwise agreed with the Engineer	3.4
Corrosion Protection	Option 1 or 2 (Standard Option 1 only Option 2 only	6.1

EXTENSION SPINDLES		
Item	**Option**	**Selection to Project Specification**
Length (m)		4.5
Off-Set (m)		4.5
Material of Construction	Galvanized Mild Steel (Standard) 1461 Stainless Steel	4.2

M-PWGRSV 3 VALVE SPECIFICATION

M-PWGRSV 3.1 Scope

This specification covers the material, constructional and corrosion protection requirements for Wedge Gate and Resilient Seal Valves for use on raw water, potable water and sludge.

M-PWGRSV 3.1.1 General

The definitions as contained in SANS 191:2008 and SANS 664:1999 are applicable to this specification.

Valve sizes to which reference is made in this specification are nominal bore sizes. Details and/or requirements on supporting drawings, in the project specification or in any letter of invitation to quote etc may conflict with certain aspects of this specification, and in such cases are to take precedence over this specification. The Tenderer should check all the requirements of drawings and supporting documentation and submit when tendering a full Certified Copy of COMPLIANCE Test Report (size 100NB and or larger NB) from SABS, that the valves submitted on tender conform to the relevant specification SANS 664:1999 unless waivered by the Client: Technical Department in Writing.

Lifting lugs are to be fitted on all valves that have a mass in excess of 100kg, to be hot dip galvanized to SANS 121:2000/IAO 1461:1999.

Each valve shall have a plate made of corrosion-resistant metal securely fixed to the body with corrosion-resistant fastenings, on which the following information shall be stamped:

- The Manufacturer's name
- Size of Valve
- Class of Valve
- Arrow indicating the direction of flow, where relevant
- The contract number
- The serial number
- The material designations of the body and trim (see material specifications below)

Each valve shall be so protected as to minimize the possibility of damage during transit and storage. The gates of wedge gate valves shall be placed in the closed position. The body ends of all new valves shall be effectively sealed to prevent entry of foreign matter. Valves of 150mm NB and smaller shall be individually wrapped. Larger valves shall be individually crated.

All valves shall be supplied with a copy of the relevant factory test certificate that reflects the test pressure and valve serial number. Original factory test certificates, together with the Quality Control

Plans for each valve, shall be issued on completion of delivery of the valve consignment.

Valve bodies shall be pressure tested to twice the rated working pressure of the valve.

M-PWGRSV 3.2 Quality Control Plan

A comprehensive Quality Control Plan (QCP) shall be prepared by the Contractor and submitted to the Engineer for approval. Valve manufacture shall not commence prior to approval of the QCP.

M-PWGRSV 3.3 Wedge Gate Valves

Gate valve shall be constructed according to the stipulations of the following specifications:

SANS 664:1999, SANS 664-1:2009, SANS 664-2:2009, SANS 664-3:2009

For valves operating under working pressures up to 2.5 MPa and of diameter up to 600mm. These valves shall be constructed of spheriodal graphite iron.

Gate valves subject to working pressures up to 1,6 MPa and of diameter over 600mm, but not exceeding 1000mm, shall either comply with the relevant requirements of SANS 664:1999 and SANS 664-1,-2,-3:2009 or comply with the material and construction requirements of SANS 191:2008.

SANS 191:2008

Valves operating under working pressure over 1.6 MPa, and of diameter exceeding 600mm, shall be of cast steel and shall comply with the material and construction requirements of this specification.

All gate valves of diameter exceeding 1000mm, as well as all valves with a working pressure exceeding 2.5 MPa, shall be of cast steel and shall comply with the material and construction requirements of SANS 191:2008.

Unless the valves are to be installed in fibre cement or plastic pipelines and unless otherwise specified, valves shall have double flanged ends. Flange drilling shall be as specified in the Project Specification or Schedule of Quantities. Unless otherwise stated, all valves are to be the non-rising spindle type.

Every valve shall be provided with a hand wheel, unless otherwise specified. Hand wheels for Classes 10 and 16 valves shall be manufactured from cast iron and for Classes 24, 40 and 100, from cast steel.

The direction of closing shall be clockwise unless otherwise stated in the Project Specification. The direction of closing shall be indicated on the hand wheel. Clockwise closing valve hand wheels shall be painted (1 coat red oxide plus 2 coats alkyd enamel) brilliant green and counter clockwise closing valve hand wheels shall be painted signal red.

Position indicators shall be fitted to all valves larger than 200NB and shall clearly indicate the fully open and closed positions.

Channel-guides and shoes shall be fitted to valves falling within the following pressure and size ranges:

PRESSURE	VALVE SIZE
Class 10	600mm and above
Class 16	350mm and above
Class 25	350mm and above
Class 40	All Sizes
Class 100	All Sizes

TABLE 1

The valves shall be capable of being easily operated by one man against the maximum, unbalanced pressure and the effort required to operate each valve shall not exceed a torque of 180Nm. In order to comply with the above requirements, it has been found that the following is normally necessary:-

PRESSURE	VALVE SIZE	DRIVE
Class 10	300mm and above	Ball thrust
Class 16	300mm and above	Ball thrust or spur-gear
Class 25	300mm and above	Ball thrust or spur-gear
Class 40	150mm and above	Ball thrust or spur-gear
Class 100	All sizes	Ball thrust or spur-gear

TABLE 2

NOTE: The spur-gear ratio shall be selected by the manufacturer to suit his design and satisfy the torque requirements

The Tenderer shall state the spur-gear ratio offered and whether the valves are fitted with ball thrust bearings, together with the maximum torque required to operate the valves against the working pressure. Shear pins shall be fitted to gearboxes in order to provide protection against damage.

Class 10 and Class 16 valves are to be fitted with a means of preventing leakage past the spindle of a type specified in SANS 664:1999, in order to permit the re-packing of the gland while the valve is under pressure.

Multiple “O” ring seals are preferred to gland packings.

Valve-trim shall be 316 stainless steel, highly polished to prevent galling, unless otherwise indicated in the project specification. Trim rings should be pinned into the body and plug. Trim rings secured by pressing are not permitted. Bonding liquids are not acceptable as the primary means of securing trim rings.

Supporting feet are to be fitted on all valves of sizes 300mm and larger.

Where Allen-type screws are used to fasten the stuffing box to the bonnet and the bonnet to the valve body, these should be of stainless steel. In addition they should be recessed and wax encapsulated to ensure corrosion resistance.

In addition to the marking requirements listed in SANS 191:2008 and SANS 664:1999, one flange edge shall have the following number of 3mm wide by 3mm deep grooves, cut across it, at top, dead-centre:

PRESSURE	VALVE SIZE
Class 10	1 groove
Class 16	2 grooves
Class 25	3 grooves
Class 40	4 grooves
Class 100	5 grooves

TABLE 3

The metal identification plate, permanently fixed to each valve shall also include the material designations for the body and trim (symbols used and their sequence to be as specified in SANS 664:1999).

The design of the valves shall be such that the cast iron/steel sections are not subject to excessive tension by the tightening of connecting bolts, as can happen when the faces of the bonnet and the stuffing box flanges are not fully machined for a full-faced gasket.

M-PWGRSV 3.4 Resilient Seal Valves

Resilient seal gate valves shall be in accordance with SANS 664:1999 and a certificate to be submitted at time of tender that the valves shall bear the SABS mark.

Valves shall be of spheriodal graphite iron.

Valve gates shall be bonded nitrile-rubber or vulcanized EPDM (Ethylene Propylene). The gates shall be capable of being replaced without removing the valve body from the pipeline.

The valves shall have non-rising spindle of high tensile stainless steel and replacement of the spindle seal (gland packing) shall be possible under full working pressure. The spindle seal shall be housed in a corrosion resistant bush.

The valve seal shall drop tight at all pressures up to the rated working pressure.

The valve shall have substantial guides of the tongue and groove type and the gate nut (spindle nut) shall be easily replaceable.

Valve markings shall be similar to wedge gate valve requirements.

M-PWGRSV 4 EXTENSION SPINDLES

M-PWGRSV 4.1 General

Where specified, valves shall be supplied complete with extension spindles.

M-PWGRSV 4.1.1 Materials of Construction

The spindle and brackets shall be fabricated from galvanized mild steel, unless otherwise state in the Project Specification. Prior to galvanizing, all burrs and weld splatter shall be removed. Galvanizing shall be to SANS 121:2000/IAO 1461:1999.

Fasteners shall be M10 stainless steel (HILTI LKD or similar approved) and shall be supplied with the extension spindle.

M-PWGRSV 4.1.2 Spindle

The spindle shall be a hollow round tube with a minimum diameter of 50mm. The design of the spindle shall be such that it has adequate torsional rigidity for the length and operating torque of the valve.

M-PWGRSV 4.1.3 Brackets

Brackets shall be fabricated from angle section and shall be sufficiently rigid to prevent deflection of the spindle. At least two fasteners per bracket shall be used to secure the bracket to the wall.

Brackets shall be spaced at no more than 2m centres.

The uppermost bracket shall be fitted with a Brass/Vesconite bush that shall be designed to fully support the mass of the spindle and ensure that no load is imposed on the valve.

M-PWGRSV 4.1.4 Caps and Hand Wheels

Spindle ends shall be designed and fabricated to accommodate the supplier's recommended caps and hand wheels that shall comply with this specification.

Hand wheels shall be removable

For the purpose of tendering, the length of the spindle in metres (measured from valve centre-line to the top of the spindle) and the offset of the spindle centre-line to the mounting wall in metres will be provided.

Prior to fabrication, the Contractor shall furnish the Engineer with fabrication details for approval within 14 days.

M-PWGRSV 4.1.5 Bolts, Nuts and Fasteners

Bolts, nuts and fasteners shall be hot dipped galvanized to SANS 121:2000/IAO 1461:1999.

M-PWGRSV 5 VALVE ACTUATORS

The term 'valve actuator' is used in this specification to describe a unit that will act upon a signal and proceed to open, close or position a valve. There is a natural split in the provision and utilization of valve actuators in the service of Umgeni Water and this largely determines the actuators preferred for the two different applications, viz. main water supply lines and applications within Umgeni Water Works' installations such as potable water treatment plants and wastewater treatment works.

M-PWGRSV 5.1 Water Supply Lines Located Mainly External to Client's Works Installations

For these applications, the installation of actuators is mainly, but not exclusively, intended for the provision of applied power, depending on size. Actuators incorporating the utilization of the reduction gearboxes only are generally preferred, but pneumatic and electrically powered actuators, either independent or in combination with reduction gears, as particularly specified in the Project Specification, may be used.

Unless otherwise specified in the Project Specification, the direction of valve closing shall be clockwise as specified elsewhere in this Valve Specification.

The factors which will play a prominent role in the selection and approval of valve actuators for particular applications will be largely influenced by the existence of existing power sources/supplies, fail safe features, proven reliability, particularly in existing and comparable Umgeni Water applications and the need for and frequency of maintenance requirements.

M-PWGRSV 5.2 Valve Actuators Located within Client's Installations

For these applications, materials and products supplied by specialists as separate units are preferred. The utilization of pneumatic, hydraulic, electric and manual valve actuators is provided for, as required, in the project specification.

The greater use of computerization in plant control, the need for standardization and the ever-changing refinements in chemical dosing techniques, the physical location of valves, the increase in plant size, the need for remote control, the availability, range and reliability of power sources (voltages and whether AC or DC, compressed air, water pressure etc), actuator speed of operation and ability to operate in series and/or in parallel, actuator reliability and finally and importantly maintenance needs and demands are matters which are taken into consideration when valve actuators are specified in detail in the project specification. Reference must also be made to UW's Standard Specifications for Instruments and Instrumentation Installations and in the event of repugnancy; the matter is to be referred to the Engineer.

M-PWGRSV 6 CORROSION PROTECTION OF VALVES

M-PWGRSV 6.1 General

M-PWGRSV 6.1.1 Options

All valves shall be coated (external) and lined (internal) as specified hereunder. Unless otherwise specified in the Project Specification, the use of either a Fusion Bonded Epoxy Power Coating System (Option 1) or a Solvent Based Epoxy Coating System (Option 2) may be used.

M-PWGRSV 6.1.2 Toxicity and Tainting of Conveyed Water

All products shall be approved by a recognized national body (SABS or similar) as suitable for use on potable water systems.

The cured material shall be chemically unaffected by free chlorine or chloramines in water in concentrations up to 10mg/□ and to ozone concentration up to 5mg/□ in water and by pH ranging from 4 to 10.

M-PWGRSV 6.1.3 Inspection during Manufacture

Umgeni Water reserves the right to insist upon inspection of valves following grit-blasting and following application of coating in the event of there being a problem with coatings or linings

In the event that inspections are required, the Contractor shall give Umgeni Water 24 hours notice for inspection. All costs due to any delays for such inspections shall be to the Contractor's account.

M-PWGRSV 6.2 Surface Preparation

M-PWGRSV 6.2.1 Substrate Condition

The surface shall be free of all weld splatter, slag and loose scale.

M-PWGRSV 6.2.2 Degreasing

Valves shall be degreased by the use of water rinsable solvent degreaser such as that complies with SANS 1344:2009 or, for use in enclosed systems, with SANS 1365:2009.

After complete removal of oil or grease contamination, the valve shall be thoroughly washed with clean potable water to remove all residues. The surface shall be water break free. The valve shall then be allowed to dry.

Abrasive used for blast cleaning shall be free from oil or grease, as shall be the compressed air used in air blast cleaning.

M-PWGRSV 6.2.3 Blast Cleaning

The valve shall be blast cleaned by air blast cleaning methods, then vacuum cleaned or blown off to achieve the following standards:

- Cleanliness shall be equal to SA3 of Swedish Standard SIS 05 5900 when tested in accordance with SANS 130-1:2007/ISO 1167-1:2006 (SABS Method 769).
- The profile produced by blast cleaning shall be angular and shall have an average peak to valley height of 60 to 100 micrometers, when tested in accordance with SANS 130-1:2007/ISO 1167-1:2006 (SABS Method 769). Hackles shall be removed with coarse abrasive paper.
- Residual dust and debris shall not exceed 0.2% when tested in accordance with SABS Method 769.
- Water-soluble salts shall not exceed 100mg/m² at any point when tested with the Weber-Reilly Reagent.
- Any laminations revealed by blast cleaning shall be ground out and re-blasted. If grinding penetrates the body to a depth greater than 8% of the nominal wall thickness, the valve shall be rejected.

M-PWGRSV 6.2.4 Handling of Cleaned Valve

After cleaning, the valve surface shall not be contaminated in any way. Operators shall take all reasonable precautions to ensure that valve surface shall be clean and free from oil, grease, grit, dirt and other contamination.

M-PWGRSV 6.2.5 Chemical Treatment

Chemical pre-treatment of the blast cleaned pipe may be applied provided that:

- The process to be used is approved by the Engineer in writing.
- The process is applied in a manner and in such quantities as specified by the manufacturer of the process.

M-PWGRSV 6.3 Corrosion Protection of Flanges

The mating face of flanges shall be masked and left uncoated. All runs or drips of epoxy shall be removed from the mating faces of the flanges and the flange profiling shall be clearly visible over the entire flange face.

The mating flange face shall then receive one coat of rust inhibitor (Plascon Rustrix 84 or equal approved) or maximum 80 microns of coating.

Care shall be exercised to ensure that after application of all coatings there are no runs or drips and that the flange profiling is clearly visible over the entire flange face.

Excessive coating build-up in flange bolt holes that could snag bolts will not be permitted.

M-PWGRSV 6.4 Fusion Bonded Epoxy Powder Coating System (Option 1)

M-PWGRSV 6.4.1 Heating of the Valve

Heating of the valve shall be affected by heat soak in an oven provided that:

- The valve surface is not contaminated by fumes, soot deposition, acid deposits or other harmful contamination.
- The valve surface is not discoloured by excessive heat.
- The surface temperature of the valve is uniform and does not vary by more than ± 5ºC from optimum coating temperature when measured immediately prior to coating. Valve temperature shall not exceed 275ºC at any point.
- Infra red pyrometers for measurement of pipe temperature shall be calibrated by thermo-couple, heat sensitive crayon or other approved method.

M-PWGRSV 6.4.2 Requirements in Respect of Fusion Bonded Epoxy Powder

M-PWGRSV 6.4.2.1 Approval of Supplier

The epoxy coating shall be a fusion bonded epoxy powder coating, Mobilox 1004-R1, Vedoc VPC 2001 or similar approved.

To obtain approval, the supplier shall provide manufacturer's test results in writing that demonstrate that the powder is capable of meeting the requirements specified in Table 4.

QUALIFICATION REQUIREMENTS OF EPOXY POWDER			
No.	**PROPERTY**	**REQUIREMENT**	**TEST METHOD**
1	IR Specrogram	For reference against Contract supplies	Potassium Bromide disc
2	Thermal Characteristics	For reference against Contract supplies Delta H (Enthalpy) Delta H (Enthalpy) Tg1 and Tg2 (Glass transition	Differential Scanning Calorimetry 20ºC/min scan rate

QUALIFICATION REQUIREMENTS OF EPOXY POWDER			
No.	**PROPERTY**	**REQUIREMENT**	**TEST METHOD**
		temperatures uncured and cured) to be supplied	
3	Gel Time at 180ºC	For reference against Contract supplies	Hot plat
4	Sieve analysis	Sieve sized in micrometers Zero retained on 500. Not more than 1% retain on 250	Mechanically agitated stack of sieves
5	Dielectric Strength	Not less than 30kV/mm	SANS 1217:2001. Section 8.10
6	Cathodic Disbonding	Total disbanded area not to exceed 20mm diameter after 30 days. Current flow not to exceed 5 mA.	AST< G8. Method B – Magnesium Anode - 20ºC 7mm diameter holiday
7	Accelerated Cathodic Disbonding	Total disbanded area not to exceed 12mm diameter inclusive of artificial holiday	Impressed current -3,5 volts potential at 75ºC for 48 hours 3mm diameter holiday
8	Adhesion (Hot water Soak)	Disbonded length not to exceed 5mm from point of V.	Immerse in water at 75ºC 48h. Remove and make V-cut at 30º angle. Test adhesion when cooled to 25ºC
9	Flexibility Test	No electrical insulation defects after bending	Bend at 0º to 2% strain
10	Impact Resistance	No electrical insulation defects after impact	ASTM G14 but using flat panel clamped firmly to a rigid base such as 12mm thick flat steel, impacted at 2 Joules

TABLE 4

NOTE: Tests 5-10 are carried out on 6mm thickness steel test panels, blast cleaned, prepared, coated and cured in accordance with the powder manufacturer's recommendations.

M-PWGRSV 6.4.3 Approval of Batches

The Contractor shall satisfy himself as to the suitability of the powder in terms of the requirements of Table 4 prior to commencement of coatings.

Before commencing work, the Contractor shall furnish Umgeni Water with documentation indicating that the proposed Epoxy Powder will comply with requirements of Table 4.

M-PWGRSV 6.4.4 Application of Coating

M-PWGRSV 6.4.4.1 Method of Application

Powder shall be applied by electrostatic spray guns.

Powder shall pass through a magnetic separator (which shall be regularly cleaned) in order to remove any iron or steel particles.

Powder reclaimed from the spray booth shall not be mixed with virgin powder.

The specified thickness shall be achieved in one application. In the event of thickness being less than the minimum specified the coating shall be removed and the valve shall be re-blasted and re-coated to comply with the specification.

M-PWGRSV 6.4.5 Handling of Coated Valve

Until the coating has cured, the valve shall be handled in such a manner as to ensure that the coating is not damaged and remains blemish free.

M-PWGRSV 6.4.6 Quenching of the Coated Valve Quenching of the valve with clean water is permitted provided that the coating is fully cured and complies in all respects with the requirements of the specification.

M-PWGRSV 6.4.7 Requirements of Cured Fusion Bonded Epoxy Powder Coating

The cured fusion bonded epoxy powder coating shall meet the requirements specified in Table 5.

REQUIREMENTS OF CURED FUSION BONDED EPOXY POWDER COATING				
	PROPERTY	**REQUIREMENT**	**TEST METHOD**	**FREQUENCY**
1	Visual	Smooth glossy or semi-glossy finish, free from excessive runs, sags, orange peel, occlusions or other visible defects	Use an experienced observer	Each Valve
2	Coating Thickness	Min. 150 (lining) : 200 (coating) µm Max. 500µm	SANS 121:2000/ISO 1461:1999. Minimum 6 readings/valve	
3	Electrical	Nil defects at 3500	SANS	Each valve

	Insulation Defects	Volts. For conditions for repair see Clause 3.4.7	1217:2001 Section 8.12.2	
4	Impact Resistance	Nil defects a 2 Joules	SANS 1217:2001 Section 8.7	Random 5% of valves
5	Degree of cure: Dynamic Test	No softening or discolouration	20 Double rubs with cotton wool swab soaked in MEK	Each valve

TABLE 5

M-PWGRSV 6.4.8 Repair of Small Areas of Mechanical Damage

This procedure describes the method of repair of small areas of mechanical damaged to the coating film.

- Thoroughly degrease the affected area and surround by washing with water - rinsable solvent or detergent to achieve a water break-free surface. Rinse the washed area with running clean, potable water and allow to dry.
- Remove any loose or cracked paint, by suitable mechanical means such as grinding or sanding. If the metal substrate is exposed, clean to rough bright metal during this process. Be sure not to burnish or polish the metal substrate if sanding is the selected method, as this may result in poor adhesion.
- Thoroughly roughen the paint surface to minimum of 1000mm radius around the areas treated as above, feathering the coating towards the outer perimeter of the repair. Brush off any dust formed.
- Immediately apply an approved repair “squish pack” (Plascon Hicote 151 or similar approved).
- On completion a 100mm halo of feathered sound coating should be evident around the entire repair.
- Holiday testing of all repairs shall comply with the original coating specification.

M-PWGRSV 6.5 Solvent Based Epoxy Coating System (Option 2)

M-PWGRSV 6.5.1 Materials

The materials shall comply with SANS 1217:2001 Type 1A solvent borne chemically cured epoxies.

The following proprietary products are acceptable to Umgeni Water:

- Carboline 891
- Sigmaguard EHB

The applied coating and lining shall comply with the requirements of Table 6 and with the relevant product data sheet.

M-PWGRSV 6.5.2 Dry Film Thickness

- Solvent Borne Epoxy (Type 1 A)
- Coating: 350 µm ± 50 µm

- Lining: 200 µm ± 50 µm

The number of coats to achieve these coating thicknesses will be addressed in the Quality Control Plan (Annexure A).

M-PWGRSV 6.5.3 Repair of Small Areas of Mechanical Damage

This procedure describes the method of repair for small areas of mechanical damage to the coating film.

- Thoroughly degrease the affected area and surround, by washing with water – rinsable solvent or detergent, to achieve a water break free surface. Rinse the washed area with running clean, potable water and allow to dry.
- Remove any loose or cracked paint, by suitable mechanical means such as grinding or sanding. If the metal substrate is exposed, clean to rough bright metal during this process. Be sure not to burnish or polish the metal substrate if sanding is the selected method, as this may result in poor adhesion.
- Thoroughly roughen the paint surface to minimum of 100mm radius around the areas treated as above, feathering the coating towards the outer perimeter of the repair. Brush off any dust formed.
- Immediately apply a repair coat (repair kits available in small packages) to the prepared area, in accordance with the original coating specification. Build up with successive coats to achieve required total dry film thickness, observing application and curing conditions as stated on the relevant product data sheet.
- On completion a 10mm halo of feathered sound coating should be evident around the entire repair.
- Holiday testing of all repairs shall comply with the original Coating Specification.

REQUIREMENTS OF SOLVENT BASED EPOXY				
	PROPERTY	**REQUIREMENT**	**TEST METHOD**	**FREQUENCY**
1	Visual	The lining shall be smooth, free from excessive runs, sags, orange peel, occlusions or other visible defects	Use an experienced observer	Each Valve
2	Coating Thickness	Minimum: 200 microns Maximum: 500 microns	SANS 121:2000/ISO 1461:1999.	Minimum 6 readings/valves
3	Electrical Insulation Defects	Nil defects when tested at 90 Volts 2 Megaohms	SABS 1217:2001 Section 8.12.	Each valve

4	Degree of Cure	No softening or discolouration	20 double rubs with cotton wool swab soaked in MEK	Each valve
5	Adhesion	Destructive testing not recommended		

TABLE 6

C3.5 STANDARD MECHANICAL SPECIFICATIONS

MGD GENERAL MECHANICAL MPW PIPEWORK, VALVES AND FITTINGS MT INSTRUMENTS AND ANCILLARIES

MGD : GENERAL

MECHANICAL MGD 1

SCOPE

This section covers workmanship, materials of construction and other miscellaneous items of a general nature. Where specifications are not given in the following Sections of the Standard Mechanical and Electrical Specifications, these specifications shall be applicable.

MGD 2 MATERIALS AND WORKMANSHIP

All submerged moving parts of the Plant, or the pins and spindles, etc., of the submerged moving parts or the faces, etc., in contact with them shall be of corrosion-resistant metals. All parts in direct contact with various chemicals, shall be completely resistant to corrosion, or abrasion by these chemicals, and shall also maintain their properties without ageing due to the passage of time, exposure to light or any other cause.

Particular attention shall be made to the prevention of seizure by fretting where two corrosion- resistant metals are in contact, by the selection of materials of suitable relative hardness and surface finish and the application of lubricants. Where bronze is specified or used it shall be zinc-free.

Particular attention shall be paid to the prevention of corrosion due to the close proximity of dissimilar metals. Where it is necessary to use dissimilar metals in contact, they shall be selected so that the bimetallic corrosion is as low as possible.

Workmanship and general finish shall be of first class commercial quality and in accordance with best workshop practice.

All similar items of Plant and their component parts shall be completely interchangeable. Spare parts shall be manufactured from the same materials as the originals and shall fit all similar items of Plant. Machining fits on renewable parts shall be accurate and to specified tolerances so that replacements made to manufacturer's drawings may be readily installed.

All Plant shall operate without excessive vibration and with the minimum of noise. All revolving parts shall be dynamically balanced so that when running at all operating speeds and any load up to the maximum there shall be no vibration due to lack of balance.

All parts that can be worn or damaged by dust shall be totally enclosed in dustproof housings. All materials used in the manufacture and construction of plant and equipment shall be new, unused and shall be the best of their

respective kinds. The Contractor shall ensure that the materials are selected in accordance with the best engineering practice to suit the working conditions and the extremely corrosive environment.

MGD 2.1 Steel

All structural steel shall comply with the requirements of SANS 1431 grade 300W and shall be legibly marked with the maker's name or trade mark and identification marks.

MGD 2.2 Stainless Steel

The AISI grade of stainless steel to be used will normally be specified in the Variations to the Standard Specifications and the Particular Specifications.

Unless otherwise specified, rolled material shall be supplied with a matt, annealed and pickled or otherwise de-scaled surface finish. For wrought steels, the equivalent BS 970 grade may in each case be used. The common applications are as follows:

APPLICATION	AISI	BS 970
Wastewater Treatment Works (all applications)		
Welded	316L	316S12
Not welded	316	316S16
Low Corrosion Interior		
Welded	304L	304S12
Not Welded	304	304S15
Exterior and Corrosive Interior		
Welded	316L	316S12
Not Welded	316	316S16

A manufacturer's test certificate shall be provided for each batch of stainless steel giving details of the material analysis and any mechanical tests carried out on the material. Each stainless steel item supplied shall be clearly and permanently marked with the grade of stainless steel and cross-referenced to the applicable test certificate.

Where grades 316 and 304 are mentioned in the Tender Documents, these shall be taken synonymously with grades 316L and grade 304L, respectively.

MGD 2.3 Fabrication of Carbon Steels

Standards

Steelwork shall be constructed, fabricated and erected in accordance with SABS Standard Building Regulations, Chapter 6, "Structural Steelwork", and with SANS 1200 H where applicable.

Finish

Edges shall be rounded to a radius of at least 2 mm. Weld spatter and other protrusions shall be removed.

MGD 2.4 Requirements for Corrosion Protection

In addition to finishing requirements, the requirements of corrosion protection application shall be taken into consideration. Surfaces must be accessible for surface preparation and coating. Inaccessible pockets and open hollow sections and similar hidden surfaces shall not be permitted unless the corrosion protection system specified for the fabrication is hot-dip galvanizing without painting.

Pits, undercuts, indentations, etc. which would prevent access to blast material are unacceptable.

MGD 2.5 Drawings

General and detailed fabrication drawings shall be submitted by the Contractor for approval by the Employer's Agent. Full details of the welding procedures and standards which he proposes to use shall be shown on these drawings.

MGD 2.6 Inspections

The Contractor shall arrange for the Employer's Agent to inspect fabrications, including fabricated pipework, in the fabrication workshop and prior to corrosion protection.

MGD 2.7 Fabrication of Stainless Steels

The requirements regarding the fabrication of carbon steels apply to the fabrication of stainless steels as well. In addition, the following requirements apply to the fabrication of stainless steels:

Fabrication of stainless steels and 3CR12 shall follow the recommendations in "The Stainless Steel User Manual" and "The 3CR12 Fabrication Guide" issued by Columbus Stainless. Only fabricators experienced with stainless steel will be considered acceptable. Such fabricators shall use permanently dedicated storage and fabrication areas and shall use machines, tools and handling equipment suited and permanently dedicated to this type of material.

Surfaces which become contaminated with steel or otherwise stained or otherwise marked so as to be of uneven colour, shall be cleaned by pickling or electro-cleaning rather than by grinding. The Contractor shall arrange for the Employer's Agent to inspect fabrications, including fabricated pipework, in the fabrication workshop.

MGD 3 DESIGN LIFE

Unless otherwise specified, all items of Plant shall be rated for continuous service at the specified duties under the prevailing atmospheric and operational conditions on site. All materials and Plant shall be designed for long life with a minimum of maintenance and the Contractor may be called upon to demonstrate this for any component either by the service record of similar Plant elsewhere or by records of extensive type tests.

Routine maintenance and repair shall, as far as possible, not require the services of highly skilled personnel.

Except for consumable items such as gland packings, carbon brushes, etc., which normally require replacement more frequently, no part subject to wear shall have a life from new to replacement or repair of less than three years of continuous normal operation and where major dismantling is required to replace a part, such life shall be not less than ten years.

MGD 4 WELDING

MGD 4.1 General Welding Requirements

Standards

Standards complying with good modern practice, and acceptable to the Employer's Agent, shall be adopted. These include the following:

BS EN 1011 - Arc welding carbon and carbon manganese steelwork. BS 4677 - Arc welding austenitic stainless steel pipework.

BS 2633 - Class 1 Arc welding of steel pipework.

BS 2971 - Class II Arc welding of steel pipework.

BS 806 - Design and construction of ferrous piping in connection with land boilers (used for arc welding specification of all pipe flanges).

Welders shall be experienced competent artisans approved in accordance with BS 4872. Continuous Welding

and Elimination of Crevices

Welding shall be continuous on all sides of any joint. All crevices, including those arising from welding on one side only, shall be eliminated. This requirement applies to the welding of all metals and, in this respect, it should be noted that welding deformation results from incorrect welding procedure rather than from continuous welding.

In special cases only, non-continuous welding might be approved in writing by the Employer's Agent. The resulting crevices shall be sealed with either a coal tar product which can be applied at thicknesses of up to 1 000 µm such as Carboline Bitumastic 50 or equivalent; or a two part solvent free epoxy which can be applied at thicknesses of up to 600 µm such as Sigmaline 523 or equivalent.

Weld Appearance

Welding shall be free of blowholes, projections, pinholes, splatter and undercuts and all welding flux shall be removed. All weld spatter and other sharp imperfections shall be removed prior to abrasive blasting. Prior to painting, weld beads with a surface irregularity exceeding 3 mm or with sharp crests having a radius under 2 mm shall be ground. Weld grinding must not be performed on 304L or 316L stainless steel, however, unless unavoidable and in approval by the Employer's Agent.

MGD 4.2 Site Welding

Site welding shall be kept to a minimum and shall only be undertaken with the approval of the Employer's Agent.

MGD 4.3 Welding of Stainless Steel and 3CR12

The following apply in addition to all of the above. Stainless Steel Welding

Stainless steels shall be welded strictly as recommended in "The Stainless Steel User Manual" issued by Columbus Stainless.

3CR12 Welding

3CR12 shall be welded strictly as recommended in "The 3CR12 Fabrication Guide" issued by Columbus Stainless.

Stainless Steel Type

Austenitic stainless steels to be welded shall be of the low carbon grade (i.e.: 304L, 316L, etc.). Welding Rods

The welding rods used shall be the most suitable for the metal and purpose. Type 309 stainless steel welding rods shall be used for welding 3CR12 unless otherwise approved in writing.

Welders

Only welders experienced with welding stainless materials shall be used.

General

All possible steps shall be taken to ensure maximum corrosion resistance and strength of the welds and welded material. Special care shall be taken to avoid prolonged heating. Welds shall

be passivated. Discolouration and steel contamination must be removed by pickling or electro-cleaning as approved by the Employer's Agent but should rather be avoided by taking the appropriate measures.

MGD 5 CASTINGS

Castings shall comply with the relevant South African or British Standard for the material used, including the following:

Grey Cast Iron	SANS 1034	BS 1452
S. G. Iron	SANS 936/7	BS 2789
Steel (General Purpose)	SANS 1465	BS 3100
Aluminium	SANS 989/992	BS 1490
Copper and Copper Alloy	SANS 200	BS 1400

Particular attention shall be paid to cleanliness, soundness and neat fettling and dressing of castings. Surfaces shall be smooth and irregularities caused by mould washaways, and the presence of porosity and sand and slag inclusions will not be tolerated. Areas under bolt heads, nuts and washers, shall be machined or spot faced to ensure a flat and smooth pressure bearing area, and sufficient space shall be provided for the use of ring or socket spanners.

All pressure retaining castings shall be hydrostatically tested to not less than 1,5 times the maximum working pressure after machining and shall be pressure tight.

No repairs shall be undertaken to castings without the written permission of the Employer's Agent and welding will not be permitted on cast iron castings.

Castings shall be heat treated to provide optimum corrosion resistance and toughness combined with reasonable machinability. In particular, stainless steel castings shall be heat treated so as to ensure that all carbides are in solution, to ensure optimum grain size, and to provide maximum corrosion resistance.

The Contractor shall provide a test certificate for each casting or batch of castings, except for those made of grey cast iron, giving details of the material analysis, the heat treatment and any mechanical tests carried out.

MGD 6 FORGINGS

All major, stress-bearing forgings shall be made to a standard specification that shall be submitted to the Employer's Agent for approval before work is commenced. They shall be subject to internal examination and non-destructive tests for the detection of flaws, and shall be heat treated for the relief of residual stresses. The name of the maker and particulars of the heat treatment proposed for each such forging shall be submitted to the Employer's Agent. The Employer's Agent may arrange for such forgings to be inspected at the place of manufacture with a representative of the Contractor.

MGD 7 FIXINGS

Nuts, bolts, studs and washers for incorporation in the Plant shall conform to the requirements of the appropriate South African or other approved standard. Nuts and bolts for pressure parts shall be of the best quality bright steel, machined on the shank and under the head and nut. Bolts shall be of sufficient length such that one thread shall show through the nut when in the fully tightened condition.

Fitted bolts shall be a light driving fit in the reamed holes they occupy, shall have the screwed portion of a diameter such that it will not be damaged in driving and shall be marked in a conspicuous position to ensure correct assembly at Site.

Washers, locking devices and anti-vibration arrangements shall be provided where necessary and shall be subject to the approval of the Employer's Agent.

Where bolts pass through structural members taper washers shall be fitted where necessary to ensure that no bending stress is caused in the bolt.

Where there is a risk of corrosion, bolts and studs shall be designed so that the maximum stress in the bolt and nut does not exceed half the yield stress of the material under all conditions.

All bolts, nuts and screws which are submerged in water shall be made of nickel-bearing stainless steel.

MGD 8 ALLOWANCE FOR WASTAGE

The Contractor shall supply as specified and to the satisfaction of the Employer's Agent reasonable excess quantities to cover wastage of those materials which will normally be subject to waste during erection, commissioning and setting to work.

MGD 13 GUARDING

Guards shall be provided to prevent access to electrical apparatus and moving parts of machinery. They shall be designed to be secure but removable without disturbing other parts of the Plant. The Contractor shall ensure that stationery points, requiring access, are located safely, outside the guards. Large guards shall be equipped with small removable panels for the inspection and checking of enclosed components.

MGD 14 NOISE AND VIBRATION

The Contractor shall provide a quiet installation. All items of Plant shown on the drawings shall be carefully chosen with a view to quiet operation.

All Plant must be capable of being operated without excessive vibration and the minimum amount of noise. Should the overall sound level of any item of Plant exceed 85dB(A) at one metre radius the Contractor shall include for suitable sound attenuation to achieve this level. This will apply in the audible frequency range 20 Hz - 20 kHz. Above 20 kHz, the Contractor must state whether any fundamental frequencies are generated in the ultrasonic region. Where Plant is operating in the vicinity of residential buildings then the sound level at one metre radius from the outside of the pump or plant house enclosure or building shall not exceed 65dB(A).

The Contractor shall provide and fix all material for the prevention of transmission of noise and vibration through the structure. All fans, motors, A/C package units, compressors, diesel engines and other motive Plant shall be mounted on resilient mountings in such a manner that the Plant foundations are isolated from the floor or structure. In addition, all rotating Plant shall be statically and dynamically balanced. Mechanical vibration shall be isolated by the use of anti-vibration mountings and flexible connections to ensure an isolation efficiency of 95% from the building structure.

Vibration in equipment, pipework, valves, etc., under all conditions, including when one, two or more units are in operation, shall be limited so that have the instantaneous acceleration due to vibration in any axis is limited to 0.2g (where g is gravity).

MGD 18 TAGGING OF EQUIPMENT

Identification tags shall be attached to all plant, equipment, motors, control gear, cables and control panels. Tags and labels shall be manufactured from an approved non-corrosive material, and shall be attached to the appropriate item with non-corrosive screws. Tags shall display the following information (as relevant): Manufacturer's name, Serial number, Model number and type, Impeller type/diameter installed, Performance specifications like operating head and flow, Rotational speed, Bearing numbers, Lubricant details, Lubrication intervals.

The nameplate shall have clearly legible punched or embossed lettering and shall be affixed to the pump in a position where it can be easily read.

Electrical cables shall be labelled at each end, and on each side of a permanent obstruction through which the cable passes.

Tag lettering shall be black on a white background, and the information to be included on the tag shall be as instructed by the Employer's Agent. The wording shall be in English, and the character size shall be as prescribed by the Employer's Agent.

MGD 19 PAYMENT ITEMS

Payment for actions to be taken and specifications to be applied in accordance with this specification shall be deemed included in the tendered rates and prices for the items to which such actions and specifications relate.

MPW : PIPEWORK, VALVES AND FITTINGS MPW 1 SCOPE

This specification covers the manufacture, supply, delivery, installation, testing and commissioning of pipework, valves and fittings associated with mechanical equipment.

MPW 2 PIPEWORK

MPW 2.1 Pipes and Fittings

Stainless Steel Pipework

Stainless steel pipework shall be to ASTM 312. Schedule 10 pipes and fittings shall be used except where otherwise specified.

Butt Weld Fittings

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

Plastic Pipework

Polyethylene or Polypropylene pipes shall comply with SANS 533 and SANS 1315 respectively and shall carry the SABS mark. The contractor manufacturing and installing the pipework shall satisfy the requirements of SANS 9001. PVC pipework is not acceptable except where specified.

An operating life of 50 years shall be designed for and appropriate derating factors shall be applied to suit the application. The rated maximum working pressure at operating conditions of the class of pipe selected shall be not less than 1,5 times the actual maximum operating pressure. If the material used has insufficient resistance to solar radiation (U.V. light) for the application, suitable protection must be provided to achieve the required life.

Note that nominal bores and pipe diameters specified must be regarded as the minimum inside diameter.

MPW 2.2 Pipework Design

Pipe Type and Material

The type and material of pipe to be used will be given in the Project Specifications.

Pipe Diameters

Unless otherwise specified in the Detailed Mechanical Specification, pipe diameters shall be based on the following velocities. The velocities shall be based on the compressed volume at the operating pressure in the case of steam, air and other gases. Valves and other ancillaries shall generally be of the same nominal diameter as the pipe. Non-standard sizes shall not be used.

FLUID	FLUID FLOW [ℓ/s]			
	0-2,5	2,5-15	15-100	100-500
	ALLOWABLE FLOW VELOCITY [m/s]			
LIQUID: GRIT FREE: HIGH SOLIDS OR GRIT:	0.75 max	1,25 max 0,8 min 1,5 max	1,5 max 1 min 1,75 max	2 max min max
FLUID	FLUID FLOW [ℓ/s]			
	0-2,5	2,5-15	15-100	100-500
	ALLOWABLE FLOW VELOCITY [m/s]			
STEAM	10 max	15 max	20 max	25 max
AIR AND GAS: above 10 kPa below 10 kPa	5 max 2,5 max	8 max 3 max	10 max 4 max	12 max 5 max

Grit free liquids include potable water, final effluent, centrate, supernatant, etc. Liquids considered to have high solids content will include raw sewage, sludge and grit slurry.

If anomalies occur within the same system using the above table, the larger pipe diameter shall generally be used.

Coupling Arrangement

Screwed fittings may be used on DN 50 and smaller provided that sufficient unions or flanges are provided for disassembly and removal of equipment. Reducing sockets and reducing bushes shall be used where required.

All steel pipes larger than DN 50 shall be flanged or fitted with mechanical pipe couplings as applicable.

Suitable pipe couplings shall be incorporated wherever necessary to facilitate maintenance or isolate vibration. A coupling shall be provided on each pump suction. Couplings shall be adequately restrained by harnesses as specified in the Clause "Pipe Couplings".

Draining, Venting and Purging

On liquid lines provision shall be made for draining and venting where necessary. Vents shall be provided at all vertical down bends on gravity lines. On gas lines provision shall be made for purging.

Condensate Drains for Air Lines

Automatic condensate traps with isolating valves and valved by-passes shall be provided at all necessary points including ahead of any globe type valve, orifice plate or concentric reducer in a horizontal line, at each change of level and immediately ahead of the user equipment.

A suitable well of a diameter equal to the pipe diameter with a bottom drain shall be provided at each condensate removal point. Condensate traps and valves shall be accessible and condensate shall be piped to the nearest drain. Pipework shall be sloped in the direction of flow towards a drain point with a slope of 1 in 150 and care shall be taken to avoid sagging at any point.

By-Passes

Isolating valves and valved by-passes shall be provided around condensate traps, pressure reducing valves and valves with solenoid or other actuation which do not have provision for manual operation.

Encased Pipes

Pipework to be permanently encased in concrete, cement or similar shall be of cast iron or 316 SS, or better, for steel and stainless steel pipework respectively. The encased portion shall be a short, straight length of pipe, flanged both ends with adequate clearance between the wall surface and the flanges for inserting flange bolts. Victaulic type couplings may in some instances be permitted instead of flanges.

Pipe sections through walls below ground or water level shall be provided with a puddle flange the same diameter as a standard flange.

Isolation

The layout design shall make provision for isolation and easy removal of mechanical equipment. Nozzles for Fittings,

Gauges, etc.

Nozzles on pipework (for installation of gauges, transmitters, drain pipes, cooling water take-offs, air release valves, etc.) shall be designed so that the pipework corrosion prevention system is not affected.

Nozzles shall consist of a flanged, welded tee-off of at least 100 mm diameter, and provided with a blank flange, all in grade 316 stainless steel. The blank flange shall be provided with tapped holes suitable for the equipment installation.

MPW 2.3 Pipework Installation

Appearance

Pipes and fittings shall be conservatively selected to suit the application, neatly installed, straight to line and level, adequately supported and shall operate without vibration.

Valve Orientation

On sludge or raw sewage pipelines, check valves shall, wherever possible, be mounted horizontally and isolating valves with spindles vertical. Valve handwheels shall be arranged so that they are accessible to the operators.

Supports

Proposed designs of pipe supports shall be submitted to the Employer's Agent for acceptance prior to manufacture. Specific requirements are:

Steel supports shall be fabricated from heavy duty hot-rolled steel sections. The complete assembly shall be hot-dip galvanised after all fabrication is completed.
Welds shall be "all-round".
Each foot shall feature at least four anchor fasteners.
For cantilevered pipe supports, the spacing between anchor fasteners shall be not less than one third of the cantilevered length

The spacing between pipe supports shall be as follows:

APPROXIMATE DISTANCE BETWEEN SUPPORTS FOR STEEL PIPE	
Pipe Diameter (DN)	Distance Between Supports (mm)
0 – 15	800
20 – 50	1 500
65 – 100	2 500
125 – 200	3 500
250 – 500	5 000
> 500	6 000
Distance between supports must be halved for pipe materials other than carbon steels and stainless steels.	

Pipe supports shall be so located that when an item of mechanical equipment is removed, the associated valves and pipework are still adequately supported. Supports shall be provided close to heavy items such as valves. No external loads shall be placed on items of mechanical equipment such as pumps, compressors, etc. Adequate provision shall be made for expansion and contraction due to variations in temperature or pressure.

3 mm thick neoprene strips shall be placed between pipes and supports or clamps to protect the paintwork and limit corrosion. Where roller or sliding supports are used to accommodate movement, suitable wear blocks shall be fixed to the pipe to prevent damage.

Floor pipe supports shall be aligned using a nut above and below the foot. A space of at least 20 mm shall be left between the foot and the floor and this space shall be filled using non-shrink grout in accordance with the manufacturer's recommendations once alignment has been completed. Alternative designs and installations may be submitted by the Contractor. Wall pipe supports shall be similar.

Where the Employer's Agent approves the use of concrete pipe supports to be built by a civil contractor under a separate contract, these will be constructed after installation of the pipework and temporary supports shall be provided by the Contractor in positions which will not interfere with the construction of the concrete supports.

MPW 2.4 Pipework Testing

The cost of all specified testing as required in this specification shall be borne by the Contractor and include in the rates.

The frequency and level of inspection and testing on steel pipework (i.e. pipes, fittings and specials) including corrosion protection shall be adequate to prove compliance with the specifications.

The following tests shall be done on steel pipework:

Hydrostatic testing in accordance with the clauses contained in this section.
Radiographic examination of all factory welded joints at the place of manufacture in accordance with the clauses contained in this section.
Radiographic examination of field welded joints on site in accordance with the clauses contained in this section
Dye penetration tests in accordance with the clauses contained in this section, on all field welded joints not subject to radiographic examination.

Hydraulic field tests in accordance with the clauses contained in this section.

The Contractor shall adopt an acceptable quality control procedure that includes the records and results of inspections and tests for at least at the following stages:

After fit up but before welding
After welding but before surface preparation
After surface preparation
After application of the primer or first coat (as applicable)
After the final coat
At each of the above-mentioned hydraulic and radiographic or dye penetrations tests

A copy of the final report of the inspections and tests shall be forwarded to the Employer's Agent before delivery of the equipment to site.

If requested by the Employer's Agent, inspections and tests shall be conducted or witnessed (as the case may be) on his behalf by an independent competent inspector (3rd party inspector) appointed by the Contractor. The 3rd party inspector shall have adequate experience and hold an appropriate qualification from either the CISA, the SAIW or the SAQCC and his credentials shall be presented to the Employer's Agent for approval.

The Contractor shall notify the Employer's Agent timeously of all inspections and tests. Although each one may not be conducted or witnessed by the Employer's Agent (or the 3rd party inspector or any other representative) it shall not relieve the Contractor of any obligations under the Contract.

<u>Radiographic Examination</u>

For each section of pipeline of the same nominal diameter, the Contractor shall make provision for a total of 25% of the field welded joints to be tested by the use of approved X-ray equipment. In the initial stages of pipe laying for a particular diameter, all field welds shall be X-rayed. Thereafter, the Employer's Agent shall, at his own discretion, select welds to be tested. The percentage of joints to be tested may be varied at the sole discretion of the Employer's Agent.

All welds shall also be visually inspected by the Employer's Agent or his representative.

All welded joints found to be defective in the opinion of the Employer's Agent shall be repaired and re-X-rayed to the approval of the Employer's Agent at no extra cost to the Employer. Such repaired joints shall not form part of the required test sample.

The Contractor shall submit details of the apparatus and method he proposes to use to carry out these X-ray tests and these shall be to the approval of the Employer's Agent.

The fact that a joint passes the X-ray test does not relieve the Contractor of his obligations. Hydrostatic Testing

Before being cleaned, lined or sheathed, all straight pipes, fittings and specials shall be

hydrostatically tested, under cover at the Contractor's factory, in a testing machine to a pressure which will stress the steel circumferentially to 85% of its yield stress. Tees shall have their flanged branches closed during this test by means of a bolted-on blanking plate of sufficient thickness to withstand the test pressure.

The testing machine shall be of a design which will allow a steady application of the test pressure and shall be equipped with an accurate pressure gauge. Provision shall be made for attaching the Employer's Agent's pressure gauge. Provision shall also be made for expelling all air from any pipe, fitting or special under test during filling and before application of the pressure. Records of all hydrostatic tests shall be kept and submitted to the Employer's Agent prior to delivery of the pipe.

The pressure shall be steadily applied and be maintained sufficiently long for proof and inspection but in no case for less than three minutes. Each pipe, fitting and special shall withstand this test without showing any leakage, weep, sweat or other defect. Should leakage occur at any weld, such weld shall be repaired in accordance with the specification.

If required, this test shall be carried out in the presence of the Employer's Agent.

All pipes, fittings and specials which have passed the hydrostatic test shall be stamped with the Contractor's test stamp.

Dye Penetration Testing of Fittings and Specials

All bends, other fittings and specials whose shape precludes their being tested in terms hydrostatic testing, shall be tested by the application of an approved penetrant dye to all welds. No trace of the dye shall appear on the other side of the weld.

Defective welds shall be repaired in accordance with the fabrication requirements.

Fittings and specials which have passed the penetrant dye test shall be stamped with the Contractor's stamp.

Where fittings and specials tested in terms of this Clause have been manufactured from straight pipe, such pipe, before being cut, shall be hydrostatically tested in accordance with this Specification.

Visual Inspection

All finished pipes and specials shall be visually examined and shall be free of injurious defects as defined in API 5L section 10.7.

MPW 4 FLANGES

MPW 4.1 Standards

All standard flanges shall comply with SANS 1123. For flange sizes not included in the SANS, BS 4504 shall be used. Cast iron flanges and their mating flanges shall have flat faces. The flange table shall be as specified or, if not specified, selected to suit the maximum possible operating pressure but not less than Table 1000. Drilling and installation of flanges shall be "off-centre".

MPW 4.2 Flange Fixing

Flanges DN 50 and smaller may be of the screwed on type. Metal flanges above DN 50 shall be welded on in accordance with BS 806 Type 6 unless otherwise agreed or specified.

MPW 4.3 Machining of Flanges

All flanges shall be machined on the sealing face. Flanges cut from plate shall also be machined on the bore and outside diameter. Cast iron flanges shall also be machined or spot faced on the back of the flange to ensure a flat bearing surface for the fastener's head or nut and washer. All edges, including bolt-holes, shall be chamfered or rounded to a 2 mm radius.

MPW 4.5 Gaskets

The jointing material used on flange joints shall be of rubber or compressed asbestos fibre at least 3 mm thick complying respectively with BS 2494 or BS 1832, as applicable. Full face gaskets shall be used for full face flanges. Inner bolt circle gaskets shall be used on raised face flanges and when clamping items such as wafer type valves between flanges inside the bolt circle. Properly designed O-ring seals are also acceptable.

MPW 4.6 Puddle Flanges

Puddle flanges shall be fitted to pipes where the structure through which they pass is required to take thrust resulting from the pipe. Puddle flanges shall also be fitted where a water barrier is required.

MPW 5 PIPE COUPLINGS

MPW 5.1 General

Where pipework movement, misalignment or dismantling must be allowed for, or if necessary for any other reason, pipe couplings may be used if approved by the Employer's Agent. Pipe couplings shall be of the mechanical type, stainless steel bellows type or rubber bellows type.

MPW 5.2 Supports and Anchors

Pipework using couplings shall be supported and anchored strictly in accordance with the coupling manufacturer's recommendations.

If the pipework configuration does not provide axial restraint, harnesses against separating forces shall be provided. Systems incorporating additional flanges or lugs and connected by tie bars or positively fixed to anchors will be acceptable. Systems relying purely on friction will not be acceptable. Tie bar harnesses shall incorporate three tie bars or more.

MPW 5.3 Mechanical Pipe Couplings

Mechanical pipe couplings shall:

be of rolled steel, forgings or of high grade castings;
be coated;
have rubber seals of a suitable grade;
shall have stainless steel fasteners, and,
be supplied without centre register unless otherwise specified.

Pipe ends shall be in accordance with the coupling manufacturer's recommendations. Where machining is required, as in the case of cast iron pipes, the length of machining on each pipe shall be approximately equal to the total length of the coupling to ensure that the coupling can be separated for pipe removal.

Couplings for air applications below 60 ºC shall be hot-dip galvanized for air applications above 60 ºC shall be of stainless steel. Couplings for stainless steel pipework shall be stainless steel.

Fasteners, including coupling studs, stub studs (i.e. studs welded to the flanges of flange adaptors), washers and nuts shall be of grade 316 SS, or better.

When couplings are part of a buried pipeline, the metallic surfaces shall be coated as specified above and then covered and wrapped. Couplings shall be covered with mastic to a smooth finish, wrapped with tape and then wrapped with a polythene sheet which is strapped in place. "Denso mastic" and "Denso tape", or equivalent products, are suitable. If the operating temperature is likely to exceed 70ºC, the mastic and tape shall be replaced with a suitable grease or a suitable sealer.

MPW 5.4 Stainless Steel Bellows Pipe Couplings

Stainless steel bellows shall incorporate stainless steel flanges and fasteners.

MPW 5.5 Rubber Bellows Pipe Couplings

Rubber bellows couplings are acceptable for machinery which is flexibly mounted and also in applications which require isolation of driven machinery from the surrounding pipework and/or structures.

The flexible material used for rubber expansion joints shall be chosen specifically for maximum resistance to bursting.

Metal backing flanges for rubber expansion joints shall be of stainless steel.

MPW 6 VALVES FOR LIQUIDS OR GASES

MPW 6.1 General

The valves to be used on the more common applications are specified below.

Where special valves are necessary for special applications, these will be specified in the Project Specifications but, if not, tenderers must select suitable valves and provide details in the tender. For the purpose of this Specification the latest issues of the following standard specifications will apply:

SANS 1700		Fasteners
SANS 135		Isometric Bold Screws and Nuts (Lexagon & square/coarse thread free fit series)
SANS 136		Isometric Precision Hexagon Head Bolts and Screws and Hexagon Nuts (coarse thread medium fit series)
SANS 144		Cast Iron Single-door Reflux Valves
SANS 191		Cast Steel Gate Valves
SANS 192		Cast Steel Single-door Reflux Valves
SANS 644		Cast Iron Gate Valves for Waterworks and Heavy Industrial Purposes
SANS 936		Cast Iron Spheroidal Graphite Iron Castings
SANS 1431		Steel
BS 3100		Cast Steel
BS 4504		Flange Drilling
BS 5155		Cast Iron and Carbon Steel Butterfly Valves

SIS 05 59 00		Pictorial Surface Preparation Standards for Painting Steel Surfaces
ISO 2441		Pipe Line Flanges for General Use – Shapes and Dimensions of Pressure Tight Surfaces
SANS 1123		Steel Pipe Flanges

MPW 6.2 Requirements for All Valves

All valves shall comply with the following (unless inapplicable):

Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.
Valves shall be double-flanged unless unavailable or otherwise specified.
Valves and their method of actuation shall be designed to operate under the full pressure rating of the valve.
If not obvious from the configuration, all valves, including valves with gearboxes and valves with actuators, shall be provided with an indication of the current position as well as an indication of the closing and/or the opening direction.
Spindle covers shall be provided for valves with rising spindles.
The specific application shall be taken into account in the corrosion protection of valves.
Cast iron valve components, including valve bodies, shall be protected with a fusion bonded epoxy or a hot-applied thermoplastic system.
Metal plating of ferrous materials is not an adequate corrosion protection system.
Lever handles on small bore valves and position indicator plates shall be of stainless steel.
Fasteners shall be of grade 316 SS, or better.

MPW 6.3 Cast Iron Gate Valves with Resilient Seals

Resilient seal gate valves may be used on raw sewage, raw water, effluent and general duties where some solids may be present but must not be used on high solid applications such as sludge and grit duties. The valves shall comply with the following:

The valves shall comply with SANS 664 or SANS 665, Class 10 or higher as required.
The valves shall be double flanged.
Valves shall have rising spindles unless otherwise specified or necessary because of space restrictions. Non-rising spindle valves shall be fitted with indicators showing the valve opening position.
Handwheels shall be of cast-iron.
The spindle shall be of grade 316 SS.
Fixing lugs for end of travel limit switches shall be provided
Handwheel size and construction shall permit easy opening of the gate when subjected to a differential pressure equal to the maximum operating pressure anticipated. Suitable gearboxes shall be fitted to provide easy opening when necessary. These gearboxes shall be grease filled.
Valves larger than DN 150 shall be provided with bypass arrangements.

MPW 6.4 Cast Iron Gate Valves (Wedge Gate)

Wedge gate valves shall be used on raw water and treated water duties but shall not be used on raw sewage, raw water, effluent, sludge and general duties where some solids may be present. The valves shall comply with the following:

The valves shall comply with SANS 664 or SANS 665, Class 10 or higher as required.
The valves shall be double flanged.
The material of the body seat and the material of the gate trim shall be of copper alloy or stainless steel.
The body shall be provided with channel guides for gate travel. The gate shall be provided with shoes which slide within the channel guides. Guides and shoes shall be of a copper based alloy or of stainless steel and shall guide the gate along the complete travel distance.
Fixing lugs for end of travel limit switches shall be provided.
Valves shall have rising spindles unless otherwise specified or necessary because of space restrictions. Non-rising spindle valves shall be fitted with indicators showing the gate position.
The spindle shall be of grade 316 SS.
Handwheels shall be of cast-iron. Handwheel size and construction shall permit easy opening of the gate when subjected to a differential pressure equal to the maximum operating pressure anticipated. Suitable gearboxes shall be fitted to provide easy opening when necessary. These gearboxes shall be grease filled.
Valves larger than DN 150 shall be provided with bypass arrangements, normally isolated by brass ball valves.
Valves larger than DN 250 shall be provided with doors for inspection and cleaning.

MPW 6.5 Knife-Gate Valves

Knife-gate valves shall be used on water sludges as well as on primary, waste activated and digested sludge duties. They shall also be used on raw sewage and other liquid/solids application and may be used for duties specified under Clause "Cast Iron Gate Valves with Resilient Seals".

The valves shall comply with the following:

Valves shall have cast iron bodies, stainless steel blades, cast handwheels, and shall have no carbon steel parts.
Valves shall be clockwise closing.
Valves shall have chamfered blade edges and resilient body seals.
Blade faces shall be surface ground or otherwise provided with two flat, parallel surfaces.
The blade seal shall be protected by a non-metallic scraper or similar device.
Suitable sealing shall be provided to prevent leakage from the valve and it shall be possible to adjust these seals while the valve is in line under pressure.
Valves shall be droptight but need not be designed for bi-directional flow.
Internal and external surfaces of the valve body shall be protected with a water resistant, non-toxic and non-tainting, fusion bonded epoxy coating.
Valves shall be double-flanged and shall suit the standard flange ratings.

MPW 6.6 Waterworks Type Butterfly Valve

These are the type which utilise a replaceable rubber seal with retaining ring and shall be used on raw and potable water duties.

MPW 6.7 Resilient Seal Butterfly Valves

These are the type which either utilise a resilient body liner with a stainless steel disc or utilise a resilient-lined disc for sealing. They may be used on air, gas and clean liquid duties where approved by the Employer's Agent and shall comply with the following:

Shafts and fittings shall be of stainless steel and bearing bushes shall be of Teflon or similar. Seals shall be selected to suit the application. No carbon steel components shall be permitted internally and externally such components shall be properly protected.
Valves shall be air, gas and water tight when closed, as applicable.
Hand lever valve actuation with a locking system for incremental valve setting from fully shut to fully open shall be provided for valves up to and including DN 200. Valves larger than DN 200 shall be equipped with robust, weatherproof grease-filled gearboxes with an indicator to show the degree of valve opening.
For normal usage, the valves may be of the type which is clamped between two flanges. Where it is necessary to remove equipment on either side for maintenance purposes, suitable spacer pipes must be provided or the valves shall be flanged and provided with drilled and tapped holes.
The valves shall be installed with their disc shafts in horizontal orientation.

MPW 6.8 Bronze Isolating Valves

These may be used for isolating duties on clean air and liquid duties up to DN 50. Bronze gate valves shall be to SANS 776.

Ball or plug valves of appropriate construction may also be used where preferred.

MPW 6.9 Needle Valves (above DN 150)

Needle valves, VAG Plunger Valve or equivalent, shall be used for the regulation of flow and/or pressure in pipelines containing water where the size is DN 150 or greater unless this is overridden by the Project Specifications. The configuration shall be double-flanged with co-axial flanges unless otherwise specified.

The seal seat and associated downstream parts shall be selected to prevent any cavitation for the application. Such parts shall be of stainless steel or copper based alloy.

MPW 6.10 Telescopic Overflow Valves

Telescopic overflow valves, (Fulton, or equivalent), shall be vertically mounted and shall be specifically designed for the purpose intended.

Operation shall be by handwheel mounted on an independently mounted headstock. Rising spindles are preferred. The outer tube shall be flanged and bolted to a similarly flanged vertical pipe. The inner tube shall

incorporate a conical bellmouth. The bridge connnecting the inner tube to the valve's spindle shall be attached to the outside of the bellmouth in order to limit the effect of fouling rags, etc.

The spindle, outer and inner tube, headstock and handwheel shall be of grade 316 SS.

MPW 6.11 Check Valves

General

Where special valves are necessary for special applications, these will be specified in the Project Specifications but, if not, tenderers must select suitable valves and provide details in the tender. Check valves to be used on the more common applications are specified below.

Single-door and double-door check valves shall comply with SANS 1551-1 unless overridden by the requirements of this Clause.

Bronze swing type check valves may be used for pipework up to DN 50. Requirements for All

CheckValves

Check valve installations shall comply with the following:

Valves shall be designed and constructed to ensure reliable operation after long periods of non-operation.
Valves shall be double-flanged unless unavailable or otherwise specified.
Valves shall be designed to function correctly under the full pressure rating of the valve.
The specific application shall be taken into account in the corrosion protection of valves. Steel and cast iron valve components, including valve bodies, shall be protected with fusion bonded epoxy or a hot-applied thermoplastic system.
Fasteners shall be of grade 316 SS.
Check valves shall be sized to open fully at the system's design flow rate.
The check valve installation shall ensure that the valve is able to operate without interference from a physical obstruction such as a shut-off valve, bend, mortar lining, etc. Where a check valve is located close to another valve, a straight pipe shall be provided and this shall have a flange-to-flange length of not less than 1,5 times the valve diameter.
Indelible body markings, as per SANS 1551-1, shall include the manufacturer's name, pressure rating (PN), nominal size (DN) and the direction of flow.
A shut-off valve shall be installed downstream of each check valve.

Axially-Sprung Check Valves for Water

Axially-sprung check valves (nozzle check valves) for treated water and raw water duty shall be double-flanged; RGR Concentric, Vent-O-Mat Maxiflo or equivalent.

The valve design shall prevent shock closing and shall incorporate a hydrodynamically efficient flow path to minimise head loss.

The spring shall be of stainless steel and the guide rod shall be supported within a non-corroding, non-galling bearing material.

Double-Flap Check Valves for Water

Double-flap check valves for treated water and raw water duty shall be of the positive-closing type; Crane Duo-Chek II or equivalent.

Bodies shall be of cast-iron or cast-steel. Flaps shall be of the light, leaf type, shall be of bronze or stainless steel with machined sealing faces, shall be specifically designed to be non-sticking, and shall have teflon bearing washers. Seals shall be of resilient material.

The axis of rotation of the flaps shall be vertical, pins shall be of 316 SS, or better, and closure shall be initiated by stainless steel springs, suitably rated for the duty so that closing is initiated prior to the onset of reverse flow.

Positive, external indication of the position of both plates shall be provided.

Rubber Diaphragm Check Valves

Rubber diaphragm check valves shall be of the double-flanged configuration and shall incorporate a hydrodynamically efficient flow path to minimise head loss; VAG Top-Stop or equivalent. Valves featuring multiple small orifices will only be acceptable for nominal flow speeds below 0,5 metres/second.

The flexible rubber diaphragm shall be replaceable.

Ball Check Valves

Ball check valves, AVK Series 53 or equivalent, may be used on sewage, sludge or similar applications.

The ball shall be rubber coated and it shall be possible to inspect and/or replace it without removing the valve from the pipework.

Swing Check Valves

Suitably designed swing check valves may be used on sewage, sludge or similar applications. Orientation of the valve shall comply with the manufacturer's recommendation.

Swing check valves shall:

be of double-flanged configuration.
have ductile iron bodies.
be suitable for a working pressure of at least 1 000 KPa.
be fitted with a side lever and adjustable weight.
be provided with a bolted cover which provides access, without dismantling or removing the valve, to the swing flap.
have stainless steel hinge pins.
have engineered plastic or non-ferrous bearings.

MPW 6.12 Air Release Valves

General

Air release valves for water pipework shall be of the non-slamming type, A.R.I. or Vent-O-Mat or equivalent.

Valves for sewage and similar duties shall be specifically designed for the application. Arrangement and Installation

Air valves shall be installed above pockets designed to collect the air entrained with the water flow. The pockets shall be designed in accordance with the requirements for nozzles in the Clause "Pipework". The diameter of the nozzle shall be at least half the diameter of the parent pipework.

Valves shall have flanged connections and shall be provided with upstream isolating cocks.

MPW 6.13 Pressure Relief and Vacuum Breaker Valves

The valve is generally used to protect anaerobic digesters and shall selected to suite suit this duty.

The valve shall be of a type using removable lead weights on the pressure pallet. Each lead weight shall represent a pressure of 25 mm w.g. and the valve shall be supplied with sufficient weights for the operating pressure given in the Particular Specifications for Valves for Liquids and Gases. Below this operating pressure setting the valve shall not leak. The vacuum pallet shall be set to 50 mmw.g.

The valve shall be of aluminium construction with 316 stainless steel wire mesh screens over the intake and exhaust ports. Pallets shall be centre and side guided and provided with seat inserts of a suitable material which is not subject to distortion. Seat rings and pallets shall be removable.

MPW 6.14 Payment Items

The payment of pipework, valves, fittings and specials shall be as detailed under SANS 1200 L and Clause PSL 8.2.5.

MT : INSTRUMENTS AND ANCILLARIES

MT 1 GENERAL

All instruments, gauges and control gear that perform similar duties shall be of uniform type and manufacture throughout the Works in order to facilitate maintenance and the stocking of spare parts.

Panel mounted instruments shall have damp-protecting and dust-protecting cases. Instruments mounted outside instrument panels shall have weatherproof and dustproof cases. Instrument cases shall be of corrosion-resistant material or finish. Instrument screws (unless forming part of a magnetic circuit) shall be of brass or bronze. Access to terminal compartments of instruments mounted outside panels or other enclosures shall not expose any working part. Moving parts and contacts shall be adequately protected from the ingress of dust.

Unless otherwise specified instruments shall be finished in the manufacturer's standard colour. Instrument dials shall be of such material that no peeling or discoloration will take place with age. Plant-mounted indicators and gauges shall be sized to give full legibility when viewed from a position with convenient and easy access or from the point at which any operation requiring observation of the gauge is performed. The minimum diameter for any gauge shall be 100mm except where forming part of standard instruments and accessories such as airsets.

Dials and bezels shall be of bronze and internal components shall be of stainless steel, bronze or other corrosion-resistant material.

Plant mounted in enclosures shall be suitable for continuous operation at the maximum internal temperature possible in service, due account being taken of internally-generated heat and heat dissipated by other Plant. All components shall be rated adequately and circuits shall be designed so that changes of component characteristics within the manufacturers' tolerances shall not affect the performance of Plant. All Plant shall be designed to operate without artificial cooling. Instruments shall be easily withdrawable from cases without interrupting their circuits. Plant provided with anti-condensation heaters shall be capable of operating without damage if the heaters are left on continuously.

Measuring instruments shall have zero and span adjustment.

Instruments not mounted in panels shall be supplied complete with all brackets, stands, supporting steelwork and weatherproof enclosures (separate from the instrument cases) necessary for securing them in their working positions and affording complete protection at all times including periods of servicing, adjustment, calibration and maintenance. Instruments mounted in open areas that could be vandalised shall be mounted in lockable vandal proof boxes.

MT 2 MECHANICAL WATER METERS

Mechanical water meters shall be of the in-line helical vane type conforming to the Class B requirements of BS 5728.

Meters shall have flanged spheroidal graphite iron casings to BS EN 1563:1997 coated with two- pack epoxy enamel.

The rotors shall be manufactured from polypropylene with stainless steel shafts.

The counter housing shall be sealed and be provided with a seven figure straight reading digital counter and have a centre sweep hand calibrated to give 10% of the smallest unit on the counter per revolution. The units shall be cubic metres or litres, dependant on the application.

The counter covers shall be provided with a hinged polyacetal or brass cover to protect the counter face from dirt and damage.

The meter shall be flanged to BS EN 1092: 1997 and be supplied complete with a low loss strainer to prevent any large particles in the water from clogging or damaging the meter.

MT 3 ELECTROMAGNETIC FLOW METERS

Electromagnetic flowmeters shall comply with the requirements of BS EN ISO 6817:1997. They shall operate on electromagnetic induction principles and give an output signal directly proportional to the liquid rate of flow.

Each meter shall have a stainless steel metering tube (detector head) and a non-conductive liner suitable for potable water. End connections shall be steel flanged. The detector head shall be complete with corrosion resistant earthing rings and matching flange adapters of the self-locking type suitable for use on the pipes. One flange of the detector head shall be connected to a flanged pipe, while the other shall be connected with the flange adapter to facilitate removal.

The flow meter shall be carefully sited in the process pipework in accordance with BS 5792 and the flow meter supplier's instructions. Particular attention should be paid to the provision of the correct velocity range, earthing rings and the correct number of upstream and downstream clear diameters. A bypass and isolating valves shall be provided to allow the removal of the flow meter for maintenance.

The Contractor shall provide any taper pieces necessary to give the correct velocity range through the flowmeter.

The primary flowhead shall be suitable for continuous submersion to BS EN 60529:1992 IP68 or better. The maximum depth of submergence shall be three metres. The primary flowhead shall have electrodes that may be removed for cleaning or replacement without interrupting the flow. Plant mounting enclosures for signal converters shall be to IEC 529, standard IP65 or better. Measuring ranges shall be continuously adjustable from 1 to 9.999 metres per second with facility to change to 0.5 to 5.5 m/s for high accuracy measurement of low flows.

For flows between 50-100% of the range, the accuracy shall be better than or equal to ±0.5% of the actual flow rate; for flows between 10-50% of the range accuracy shall be better than or equal to ±0.3% of the actual flow rate; and for flows between 1-10%, accuracy shall be better than or equal to ±0.1% full scale value.

The effects of ambient temperature on the output signals shall not exceed 0.15% per 10°C.

MT 4 LEVEL SWITCHES AND INDICATORS

Level transmitters shall be of the float, pressure bulb, displacer, diaphragm or air-bubbler types. Float-operated transmitters shall have counterweights. Floats and displacers of transmitters and switches shall be of corrosion-resistant material or shall be coated with epoxy resin.

Level switches of the buoyancy type shall consist of a mercury switch with changeover action enclosed in a non-corrosive material. A balance weight shall also be incorporated in the switch to counteract the buoyancy effect for the specific gravity of the particular fluid. The connecting cable shall be sealed into the switch.

Buoyancy switches shall be installed with a minimum of two metres of spare connecting cable neatly coiled at a supporting bracket. The connecting cable fixing shall facilitate any alteration in operating level within the limit of the spare cable.

Level switches operating on the conductivity principle shall have three electrodes per relay or control unit except where a differential between the "cut-in" and "cut-out" values is not required or where two or more relays are associated with the same vessel, when a common "earth" electrode shall be used.

Electrodes for the same vessel shall be mounted on a common plate that shall be made in sections if desirable to facilitate handling. Electrode heads shall permit an adjustment in operating levels of not less than 90mm without necessitating cutting or extending electrodes.

Electrodes shall be of a noble metal to resist corrosion, and shall be insulated for most of their lengths. The thickness of electrodes and points of intermediate support shall be chosen so that no bending of the electrodes occurs under Plant operation conditions. This includes temporary bending.

Relay units operating with level electrodes shall have adjustable sensitivity. Electrodes for use in fluids of low or variable conductivity shall have conductivity discs.

MT 5 PRESSURE GAUGES

The equipment shall be supplied and installed, complete with mountings, housings, tubing, fittings, etc. necessary for the display of pressure in pipes.

The Contractor shall be responsible for the provision of detail information for the successful and complete installation of his equipment, and for carrying out the installation, testing and commissioning.

Pressure gauges shall comply with BS EN 837-1:1998. Pressure gauges, transmitters and switches shall have over range protection. No plastic material shall be used in their construction. Internal parts shall be of stainless steel, bronze or approved corrosion-resistant material. Pressure gauges shall have concentric scales.

Where compensation of more than 2% of the instrument span is needed for the difference in level between the instrument and the tapping point, the reading shall be suitably adjusted and the amount of compensation shall be marked on the dial.

The gauge shall have a range of measurement not less than 1.25 times the operational range of the equipment to which it is connected. In cases where gauges are used to indicate pressures above and below atmospheric pressure, the gauge range shall be not less than 125% of the maximum positive and maximum negative pressure.

The normal working pressure shall be indicated at a point between 50% and 75% of the full-scale deflection of the gauge.

The instrument shall indicate accurately to within 3% of the full-scale deflection.

All pressure gauges shall be equipped with an isolating valve or a gauge cock to allow it to be isolated from the pipe. The cost of the valve or gauge cock shall be deemed included in the tendered rate for the equipment.

Where a pressure gauge is to be installed on a pipe conveying corrosive liquids or slurries, or where there is a risk that the pressure ports of the gauge could become blocked as a result of the properties of the medium conveyed, such gauges shall be equipped with gauge protectors. Glycerine-filled gauges shall be used for applications involving hydraulic pipelines, while vacuum-damped gauges shall be employed where they are to be installed on air or gas lines.

Labels shall be provided, especially on remote-mounted gauges, to indicate the locations where pressure is measured.

The operating set point of all meters and indicators shall be clearly marked in red.

After installation, pressure gauges shall be tested and commissioned together with the equipment to which they are connected, such as pumps or compressors and their associated pipework.

MT 6 ELECTRICAL INDICATORS AND INTEGRATORS

Indicators for use with analogue signal transmission systems shall comply with BS 89 and have an accuracy class index of 1.0. Indicator movements shall be critically damped (dead-beat). Indicators for use on more than one circuit shall have rotary switches to select the circuit, with engraved plates to show the circuit selected.

Indicators shall have circular scales or shall be of the vertical edgewise type and shall be designed to avoid parallax error. Scales shall be clearly marked in the specified units and shall comply with BS 3693. All instruments that are mounted on one panel or board, or are in adjacent groupings, shall have similar styles of figures and letters. Dials shall be white with black scales and lettering not subject tofading.

The material for scales shall be such that no peeling or discoloration will take place with age under all environmental conditions.

Major scale marks and numerals shall be of the same size and thickness and shall be separated by not more than twenty five minor marks. Pointers shall taper to the width of the scale marks. Integrators shall be of the multi-digit cyclometer type. Each integrator shall have an integral or separate current-to-pulse converter with sufficient adjustment of the pulse rate to avoid the use of any multiplying factor except in integer power of ten. Each integrator shall incorporate an adjustable limiter whereby any input below a preset value is inoperative. Unless otherwise specified, integrators shall have a minimum of eight digits with a decimal point where applicable.

MT 7 LEVEL INSTRUMENTATION

MT 7.1 Ultrasonic Devices

Ultrasonic level measuring devices shall offer the minimum facilities described below:
Level sensor

The sensor head shall be protected to IP68.

Sensing heads shall be mounted on stainless steel brackets and positioned with due regard given to an unhindered beam path and within easy reach of maintenance personnel.

Signal converter

The signal converter shall be supplied in an IP55 (indoors) or IP65 (outdoors) minimum polycarbonate enclosure and shall comprise a base unit and a programming device.

Communication between the programmer and signal converter shall be in such a manner that the IP rating is not prejudiced.

A 3.5" or larger digit liquid crystal display shall be used to indicate key programming features, setting and output conditions. The display shall be in the English language. The unit shall also be provided with a keypad for calibration and configuration.

The unit shall be suitable for either 24 V dc or 240 V ac operation.

Accuracy of the signal converter shall be better than ± 0.5% of reading. The

signal converter shall have the following programmable outputs:

4-20 mA proportional to user definable engineering units;

SPDT relay contact output closing upon failure of the signal converter or lost echo;
off SPDT contact outputs with independently set trip points. These outputs shall be programmed to energise upon high/low level, rate of change or to allow a number of pump sequencing operations.

MT 7.2 Float Switches

Level switches of the buoyancy type shall consist of a mercury switch with changeover action enclosed in a non-corrodable material. A balance weight shall also be incorporated in the switch to counteract the buoyancy effect of the specific gravity of the particular fluid. The connecting cable shall be factory sealed into the switch.

Level switches shall be installed with a minimum of two metres of spare connecting cable neatly coiled at a supporting bracket. The connecting cable fixing shall facilitate any alteration in operating level within the limit of the spare cable.

MT 7.3 Conductivity Electrodes and Level Relay Systems

Conductivity electrodes shall be formed from stainless steel tubes encapsulated in PVC sleeving down to 75mm from the end of the electrode. The electrode shall be sealed.

Where necessary, intermediate insulated support brackets shall be installed to prevent the electrodes swaying. The intermediate supports shall be installed above normal top water level at the

particular location. An earth electrode shall be provided at each electrode installation. Pipework shall not be used for the earth.

The electrode holders shall comprise a moulded back phenolic body capable of accepting 20mm BS pipe. Plated clamping collars complete with cable termination shall be provided to locate the electrode. The holder cap shall also be of moulded phenolic material. A gasket shall be placed between body and cap. The body shall be arranged to receive screwed conduit.

Electrode holders shall permit adjustment in operating levels of not less than 100mm without necessitating cutting or extending electrodes.

Relay units operating with level electrodes shall have adjustable sensitivity. Electrodes for use in fluids of low or variable conductivity shall have conductivity discs. Electrodes shall be energised with an alternating voltage not exceeding 25 V open circuit.

MT 7.4 Pressure Devices

Pressure transducer level measuring sensors shall be of the stainless-steel submersible type operating on the piezo-resistive silicon strain gauge principle. Compatible power supply and signal processing units shall be provided with protection against radio frequency interference and supply transients. The final output shall be a 4-20 mA signal proportional to level. Lightning protection shall be provided where applicable.

The transducer/cable shall be suitably supported with stainless steel brackets. A bracketed stainless steel restraining tube shall be provided in deep sumps etc.

This specification covers the manufacture, supply, delivery, installation, testing and commissioning of pipework, valves and fittings associated with mechanical equipment.

C3.6 HIV/AIDS REQUIREMENTS

1. SCOPE

This specification contains all requirements applicable to the Contractor for creating HIV/AIDS awareness amongst all of the Workers involved in this project for the duration of the construction period, through the following strategies:

- Raising awareness about HIV/AIDS through education and information on the nature of the disease, how it is transmitted, safe sexual behaviour, attitudes towards people affected and people living with HIV/AIDS, how to live a healthy lifestyle with HIV/AIDS, the importance of voluntary testing and counselling, the diagnosis and treatment of Sexually Transmitted Infections and the closest health Service Providers
- Informing Workers of their rights with regard to HIV/AIDS in the workplace
- Providing Workers with access to condoms and other awareness material that will enable them to make informed decisions about sexual practices

2. DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

Service Provider: The natural or juristic person recognised and approved by the Lepelle Northern Water as a specialist in conducting HIV/AIDS awareness programmes.

Service Provider Workshop Plan: A plan outlining the content, process and schedule of the training and education workshops, presented by a Service Provider which has been approved by the Representative/Agent.

Worker: Person in the employ of the Contractor or under the direction or supervision of the Contractor or any of his Sub-contractors, who is on site for a minimum period of 30 days in all.

2.2 Abbreviations

HIV : Human Immunodeficiency Virus

AIDS : Acquired Immune Deficiency Syndrome

STI : Sexually Transmitted Infection

3. BASIC METHOD REQUIREMENT

The Contractor shall, through a Service Provider, conduct onsite workshops with the Workers.

The Service Provider shall develop and compile a Service Provider Workshop Plan to be presented at the workshops and which will be best suited for this project to achieve the specified objectives with regard to HIV/AIDS awareness.

The Service Provider Workshop Plan shall be based on the following information provided by the Contractor:

- Number of Workers and Sub-contractors on site
- When new Workers or Sub-contractors will join the construction project
- Duration of Workers and Sub-contractors on site
- How the maximum number of Workers can be targeted with workshops
- How the Contractor prefers workshops to be scheduled, *e.g.* three hourly sessions per Worker, or one 2.5 hour workshop per Worker
- Profile of Workers, including educational level, age and gender (if available)
- Preferred time of day or month to conduct workshops
- A Gantt chart reflecting the construction programme, for scheduling of workshops
- Suitable venues for workshops The Contractor shall submit the Service Provider Workshop Plan for approval within 21 days after the tender acceptance date. After approval by the Lepelle Northern Water Representative/Agent, the Contractor shall make available a suitable venue that will be conducive to education and training.

The Service Provider Workshop Plan shall address, but will not be limited to the following:

3.1 The nature of the disease;

3.2 How it is transmitted;

3.3 Safe sexual behaviour;

3.4 Post exposure services such as voluntary counselling and testing (VCT) and nutritional plans for people living with HIV/AIDS;

3.5 Attitudes towards other people with HIV/AIDS;

3.6 Rights of the Worker in the workplace;

3.7 How the Awareness Champion will be equipped prior to commencement of the HIV/AIDS awareness programme with basic HIV/AIDS information and the necessary skills to handle questions regarding the HIV/AIDS awareness programme on site sensitively and confidentially;

3.8 How the Service Provider will support the Awareness Champion;

3.9 Location and contact numbers of the closest clinics, VCT facilities, counselling services and referral systems;

3.10 How the workshops will be presented, including frequency and duration;

3.11 How the workshops will fit in with the construction programme;

3.12 How the Service Provider will assess the knowledge and attitude levels of attendees to structure workshops accordingly;

3.13 How the video will be used;

3.14 How the Service Provider will elicit maximum participation from the Workers;

3.15 A questions and answers slot (interactive session)

The Service Provider Workshop Plan shall encompass the Specific Learning Outcomes (SLO) as stipulated.

4. HIV/ AIDS AWARENESS EDUCATION AND TRAINING

4.1 Workshops

The Contractor shall ensure that all Workers attend the workshops.

The workshops shall adequately deal with all the aspects contained in the Service Provider Workshop Plan. A video of HIV/AIDS in the construction industry, which can be obtained from all Offices of the Lepelle Northern Water, is to be screened to Workers at workshops. In order to enhance the learning experience, groups of not exceeding 25 people shall attend the interactive sessions of the workshops.

4.2 Recommended practice

4.2.1 Workshop Schedule

Presenting information contained in the Service Provider Workshop Plan can be divided in as many workshop sessions as deemed practicable by the Contractor, provided that all Workers are exposed to all aspects of the workshops as outlined in the Service Provider Workshop Plan. Breaking down the content of information to be presented to Workers into more than one workshop session however, has the added advantage that messages are reinforced over time while providing opportunity between workshop sessions for Workers to reflect and test information. Workers will also have an opportunity to ask questions at a following session.

4.2.2 Service Providers

A database of recommended Service Providers is available from all Offices of the Lepelle Northern Water.

4.2.3 HIV/AIDS Specific Learning Outcomes and Assessment Criteria

Workers shall be exposed to workshops for a minimum duration of two-and-a-half hours. In order to set a minimum standard requirement, the following specific learning outcomes and assessment criteria shall be met

4.2.3.1 UNIT 1: The nature of HIV/AIDS

After studying and understanding this unit, the Worker will be able to differentiate between HIV and AIDS and comprehend whether or not it is curable. The Worker will also be able to explain how the HI virus operates once a person is infected and identify the symptoms associated with the progression of HIV/AIDS.

Assessment Criteria:
1. Define and describe HIV and AIDS
2. List and describe the progression of HIV/AIDS

4.2.3.2 UNIT 2: Transmission of the HI virus

After studying and understanding this unit, the Worker will be able to identify bodily fluids that carry the HI virus. The Worker will be able to recognise how HIV/AIDS is transmitted and how it is not transmitted.

Assessment Criteria:
1. Record in what bodily fluids the HI virus can be found
2. Describe how HIV/AIDS can be transmitted
3. Demonstrate the ability to distinguish between how HIV/AIDS transmitted and misconceptions around transmittance of HIV/AIDS

4.2.3.3 UNIT 3: HIV/AIDS preventative measures

After studying and understanding this unit, the Worker will comprehend how to act in a way that would minimise the risk of HIV/AIDS infection and to use measures to prevent the HIV virus from entering the bloodstream.

Assessment Criteria:
1. Report on how to minimise the risk of HIV/AIDS infection
2. Report on precautions that can be taken to prevent HIV/AIDS infection
3. Explain or demonstrate how to use a male and female condom.
4. List the factors that could jeopardize the safety of condoms provided against HIV/AIDS transmission

4.2.3.4 UNIT 4: Voluntary HIV/AIDS counselling and testing

After studying and understanding this unit, the Worker will be able to recognise methods of testing for HIV/AIDS infection. The Worker will be able to understand the purpose of voluntary HIV/AIDS testing and pre- and post-test counselling.

Assessment Criteria:
1. Describe methods of testing for HIV/AIDS infection
2. Report on why voluntary testing is important
3. Report on why pre- and post-test counselling is important

4.2.3.5 UNIT 5: Living with HIV/AIDS

After studying and understanding this unit, the Worker will be able to recognise the importance of caring for people living with HIV/AIDS and be able to manage HIV/AIDS.

Assessment Criteria:
1. List and describe ways to manage HIV/AIDS
2. Describe nutritional needs of people living with HIV/AIDS

3. Describe ways to embrace a healthy lifestyle as a person living with HIV/AID
4. Explain the need for counselling and support to people living with HIV/AIDS

4.2.3.6 UNIT 6: Treatment options for people with HIV/AIDS

After studying and understanding this unit, the Worker will be familiar with the various treatments available to HIV/AIDS infected or potentially HIV/AIDS infected people.

Assessment Criteria:
1. Discuss anti-retroviral therapy
2. List methods of treatment to prevent HIV/AIDS transmission from mother-to-child
3. Describe the need for treatment of opportunistic diseases for people living with HIV/AIDS
4. Describe post exposure prophylactics.

4.3 Displaying of plastic laminated posters and distribution of information booklets

The Contractor shall obtain a set of four laminated posters conveying different key messages and information booklets, which are available from Offices of the Lepelle Northern Water.

The above-mentioned posters and information booklets have been prepared to raise awareness and to share information about HIV/AIDS and STI's.

Posters or display stands shall be displayed on site as soon as possible, but not later than 14 days after the date of site handover.

Posters shall be displayed in areas highly trafficked by Workers, including toilets, rest areas, the site office and compounds.

The posters on display must always be intact, clear and readable.

Information booklets must be distributed to all Workers as soon as possible, but not later than 14 days after site handover, or as soon as the Worker joins the site.

5. PROVIDING WORKERS WITH ACCESS TO CONDOMS

The Contractor shall provide and maintain condom dispensers and make both male and female condoms, complying with the requirements of SABS ISO 4074, available at all times to all Workers at readily accessible points on site, for the duration of the contract. The Contractor may obtain condom dispensers from the Department of Health and condoms may be obtained from the Local Clinic or the Department of Health.

At least one male and one female condom dispenser and a sufficient supply of condoms, all to the approval of the Representative/Agent, shall be made available on site within 14 days of site hand over. Contractors should note that arrangements to obtain condoms from the Department of Health Clinics prior to site hand over may be necessary, to ensure that condoms are available within 14 days of site handover.

Condoms shall be made available in areas highly trafficked by Workers, including toilets, the site office and compounds.

6 ENSURING ACCESS TO HIV/AIDS TESTING AND COUNSELLING FACILITIES AND TREATMENT OF SEXUALLY TRANSMITTED INFECTIONS (STI)

The Contractor shall provide Workers with the names of the closest Service Providers that provide HIV/AIDS testing and counselling and Clinics providing Sexually Transmitted Infection

(STI) diagnosis and treatment. Information on these Service Providers and Clinics must be displayed on a poster of a size not smaller than A1 in an area highly trafficked by Workers.

7. APPOINTMENT OF AN HIV/AIDS AWARENESS CHAMPION

Within 14 days of site handover the Contractor shall appoint an Awareness Champion from amongst the Workers, who speaks, reads and writes English, who speaks and understands all the local languages spoken by the Workers and who shall be on site during all stages of the instruction period.

The Contractor shall ensure that the Awareness Champion has been trained by the Service Provider on basic HIV/AIDS information, the support services available and the necessary skills to handle questions regarding the HIV/AIDS programme in a sensitive and confidential manner.

The Awareness Champion shall be responsible for:

7.1 Liaising with the Service Provider on organizing awareness workshops;
7.2 Filling condom dispensers and monitoring condom distribution;
7.3 Handing out information booklets;
7.4 Placing and maintaining posters

8 MONITORING

The Contractor shall grant to the Representative/Agent reasonable access to the construction site, in order to establish that the Contractor complies with his obligations regarding HIV/AIDS awareness under this contract.

The Contractor must report problems experienced in implementing the HIV/AIDS requirements to the Representative/Agent.

C3.6 OCCUPATIONAL HEALTH AND SAFETY

C3.6.1 OHS GENERAL

C3.6.1.1 TENDER DOCUMENT

This document is the pre-contract Health and Safety Specification which must be used by the Principal Contractor and Sub Contractors appointed by the Principal Contractor to compile Health and Safety Plans for this project and forms part of the tender documentation.

The Principal Contractor and Sub Contractors' particular attention is drawn to this specification whereby

"Upon award of the contract, the contractor is to assume and adopt the function and duties of the Principal Contractor as set out in the Construction Regulations 2014 No. 10113 promulgated 07 February 2018."

The health and safety specifications outlined herein must be taken into account and due allowance made within the pricing of appropriate items contained within the specification. Where the tenderer is of the opinion that a requirement is missing or is not adequately specified then this shall be drawn to the Client attention during the tender period. In the absence of any direction to the contrary, the tenderer shall as part of the tender submission, set out the details of such discrepancy together with the costs associated therewith, separately identified and included within the tender figure.

C3.6.1.2 PRINCIPAL CONTRACTOR

The successful tenderer will on signing of the contract for:

Project Name: LNW 04/20/21 - CONSTRUCTION OF CRITICAL INFRASTRUCTURE SECURITY FENCE IN VARIOUS LNW SCHEMES (RE-ADVERT).

be required to fulfil the function and duties of the Principal Contractor as set out in the Construction Regulations 2014 No. 10113 promulgated 07 February 2018.

C3.6.1.3 START OF CONSTRUCTION PHASE

The construction phase shall not commence until the Principal Contractor's Health and Safety Plan was considered and approved by the Client and Design Team. The Client shall discuss and negotiate with the Principal Contractor the contents of the Health and Safety Plan submitted by the Principal Contractor before finally approving it for implementation.

The construction phase shall not commence until written permission is received from the Client. In this respect the Client may rely on the advice of the Technical Team as to the adequacy and comprehensiveness of the Plan offered by the Principal Contractor.

In preparing their detailed Health and Safety Plan based on the relevant sections of this Health and safety Specifications supplied to them by the Client, contractors must allow for the adoption of safe working procedures and co-ordinate and rationalize activities to avoid controllable hazards arising due to clashes of activities.

C3.6.1.4 SUB-CONTRACTORS, SUPPLIERS & DESIGNERS

The Principal Contractor shall ensure that all direct appointments in connection with this project include provisions for the compliance of his sub-contractors, suppliers and designers, etc, with the relevant provision of the Occupational Health and Safety Act (Act 85 of 1993) and it's Regulations, in particular the Construction Regulations 2014 No. 10113 promulgated 07 February 2018.

C3.6.1.5 LIAISON

The Principal Contractor shall together with all his appointees, liaison with the Client as required under the Regulations and agrees procedures for the transfer of relevant Information in respect of designs and in connection with the preparation of the Health and Safety File.

C3.6.1.6 ADVICE

The tenderer shall, as part of the tender submission, indicate where advice will or may be required of the Client in respect of the competence of the tenderer's designers and the adequacy of resources allocated or to be allocated by them.

C3.6.1.7 UNDERTAKING BY PRINCIPAL CONTRACTOR AND SUB-CONTRACTORS APPOINTED BY THE PRINCIPAL CONTRACTOR.

The Principal Contractor as well as Sub-Contractors appointed by him / her shall undertake in writing to ensure that the provisions of the Occupational Health and Safety Act (Act 85 of 1993) and it's Regulations, in particular the Construction Regulation of 2014 No. 10113 promulgated 07 February 2018 and any amendments or re-enactments thereto are complied with.

The attached Occupational Health and Safety provisions undertaking form for the Principal Contractor shall be completed and signed by the Project Manager of the company / firm awarded the tender.

Client's Occupational Health and Safety Agent: To be appointed

C3.6.2 INFORMATION REQUIREMENTS

The contractor must provide the following information.

C3.6.2.1 GENERAL

- The Principal Contractor / Sub-Contractor shall have an OHS Policy in accordance with the OHS(Occupational Health and Safety Act, Act 85 of 1993) and include a copy of the Policy in the Health and Safety Plan to be submitted by the Principal Contractor / Sub-Contractor.

- The Principal Contractor / Sub-Contractor shall promptly display a copy of the Company's OHS Policy on the OHS Notice Board for the duration of the contract and include it into information provided to persons at the contract OHS induction.

- The Principal Contractor shall develop a Contract specific OHS Management Commitment Statement based on the Company's OHS Policy.

- The Principal Contractor's Project Managing shall sign the Commitment statement and prominently display a copy on the OHS Notice Board for the duration of the contract. A copy of the Commitment Statement shall be included in information provided to persons at the Contract OHS induction and a copy shall also be supplied to each sub-contractor.

C3.6.2.2 MANAGEMENT

- Details of the personnel and management systems to be put in place to prepare, manage, implement, conduct and monitor the Health and Safety Plan for the project.

  Broadly speaking your:

- Organization's internal structure that establishes SHE (Safety, Health and Environmental) ROLES, RESPONSIBILITIES, ACCOUNTABILITIES, and REPORTING RELATIONSHIPS,

- SHE (Safety, Health and Environmental) PLANS, POLICIES, PROCEDURES, DIRECTIVES and STANDARDS that provide instructions as to how activities and functions are to be carried out,
- SHE (Safety, Health and Environmental) CONTROLS, INSPECTIONS, REVIEWS, etc. built into construction operations to ensure that performance is consistent with SHE (Safety, Health and Environmental) objectives and requirements,

- SHE (Safety, Health and Environmental) COMMUNICATION MECHANISMS for collecting, handling and reporting information.

  In other words Management Systems that specifies WHO is going to do WHAT, WHERE, WHEN, WHY and HOW.

- Details of relevant qualifications and experience held by the persons nominated above, including recent health and safety education and training undertaken.

- Procedures for determining the competence of contractors engaged on the project, whether employed by the contractor directly or by others, to fulfil their duties under the Construction Regulations 2014 No. 10113 promulgated 07 February 2018.

C3.6.2.3 HAZARD IDENTIFICATION, RISK MANAGEMENT AND CONTROL

- The Principal Contractor / Sub-Contractor shall detail and implement procedures that will identify hazards, assess risks and determine suitable control measures as they arise throughout term of the contract. These procedures shall both comply with and be implemented and managed in accordance with the specification.

- The Principal Contractor / Sub-Contractor shall detail and implement procedures that ensure control measures are evaluated for effectiveness and modified as necessary. The evaluation procedure shall detail the responsibilities, timelines and records that will be kept as part of the process.

- Where Risk is controlled through administrative control measures, the Principal Contractor / Sub-Contractor shall ensure that the administrative measures are:

a) Clearly documented and those personnel responsible for implementation and management are explicitly defined;

b) Understood by all relevant personnel through training and assessment;

c) Implemented as documented and promptly reviewed for effectiveness following initial implementation;

d) Amended and authorised as required;

e) Adequately supervised, managed and audited to ensure continuing compliance;

f) Available at all times wherever the measures are being implemented.

❖ Any piece of plant or equipment not complying with the specification shall cease operation until the Principal Contractor / Sub-Contractor can demonstrate to the satisfaction of the Client / Client's Agent that the piece of non-conforming plant or equipment conforms to these requirements.

C3.6.2.4 HEALTH AND SAFETY PLAN

The Principal Contractor / Sub-Contractor shall develop a Health & Safety Plan to reflect variations in design or changes in site conditions and liaise with the Client /
Client's Agent.

The Principal Contractor shall develop this Heath and Safety Plan so that it:

a) Incorporates the contractor's approach to managing the construction work to ensure the health and safety of all persons carrying out the construction work and all persons who may be affected by their work.

b) Includes the risk assessments prepared by all Contractors under their duties set out in the Construction Regulations 2014 and any other relevant legislation (i.e. the OHS Act and Regulations, etc).

c) Includes the arrangements for ensuring that, where appropriate or specifically requested, all Contractors / Sub-Contractors prepare suitable and sufficient method statements for their construction works which incorporate adequate measures for ensuring the health and safety of all persons who may be affected by these works.

d) Incorporates the common arrangements for site safety, statutory notices and registers etc.

e) Includes the site rules to be adopted for controlling the risks to health and safety during the construction phase(s) or the project.

f) Includes reasonable arrangements for monitoring compliance with health and safety legislation and site rules.

g) g)Includes reasonable measures to ensure co-operation between all Contractors and Sub-Contractors in respect of health and safety provisions and prohibitions.

h) Includes the steps to be taken to ensure that only authorised persons are allowed into any premises or parts of the site / premises where construction work is being carried out.

i) Includes arrangements for emergency procedures.

j) Includes arrangements for ensuring that, so far as is reasonably practicable, every Contractor and Sub-Contractor is provided with comprehensible information about the risks to health and safety of that Contractor / Sub-Contractor, or of any employees or other persons under their control, arising out of the construction works, including the emergency procedures

k) Includes details of the arrangements for ensuring, so far as is reasonably practicable, that the employees or other persons under the control of any Contractor / Sub-Contractor, and any visitors to the site, receive adequate information about the risks to their health and safety arising out of the construction works and, where necessary, adequate training to carry out their work in a safe and healthy manner.

l) Includes arrangements for providing all persons at work on the site and visitors to the site with the opportunity and means of discussing and offering advice on health and safety issues relating to the construction works.

m) Includes arrangements for the reporting of any accidents, injuries or dangerous occurrences, including conforming with the statutory requirements.

n) Can be modified as the work proceeds to take account of any information received from Contactors / Sub-Contractors, any experience gained during the course of the project or any changes necessary as a result of unforeseen circumstances or alterations to the design.

C3.6.2.5 PROGRAMME

A time estimate required by the contractor to implement the Health & Safety Plan sufficiently for works to commence on site.

C3.6.2.6 COST

A detailed breakdown of costs allowed in the contractor's tender for preparing, managing, implementing and monitoring the Health and Safety Plan, and for complying with the requirements imposed on the Principal Contractors under the Construction Regulations of 2014 No. 10113 promulgated 07 February 2018.

C3.6.3 GENERAL SITE SAFETY

C3.6.3.1 SAFETY TRAINING & EDUCATION

The Principal Contractor shall detail the OHS competencies and training received by its contract management personnel.

The Principal Contractor's Health and Safety Plan shall have a detailed register of the skills and competencies for all personnel for the activities that the personnel will undertake under the contract. (E.g. Mobile plant operators, crane operators etc.)

The Principal Contractor shall demonstrate and maintain documentary evidence of competencies on site for the duration of the contract.

C3.6.3.2 INDUCTION TRAINING

The Principal Contractor / Sub-Contractor shall develop and detail a Site Induction Training Programme as part of the Occupational Health and Safety Plan to be submitted to the Client prior to commencement of construction that includes as a minimum:

a) Training related to hazards likely to be encountered on Site and control measures that have been developed in response to these hazards;
b) Roles and Responsibilities;
c) The requirements of the Health and Safety Plan submitted and approved
d) Address the identified issues in the Fire Safety, Emergency, Evacuation and Rescue Plan to ensure that all Site personnel are aware of procedures in the event of an incident or emergency occurring;

The Principal Contractor / Sub-Contractor shall evaluate all persons undertaking the site Induction Training through a written test to ensure that inductees have an understanding of the OHS (Occupational Health and Safety) requirements for the contract. The written tests shall be signed and dated by the person undertaking the induction training to attest to their understanding and be retained by the Principal Contractor / Sub-Contractor as a record that the training has been completed.

C3.6.3.3 INDUCTION TRAINING FOR SPECIFIED WORK

The Principal Contractor / Sub-Contractor shall conduct Site Specific Occupational Health and Safety Induction Training for all personnel, the Client and all visitors not escorted on Site by inducted persons.

The Principal Contractor / Sub-Contractor shall evaluate all persons undertaking the Site Induction Training through a written test to ensure that inductees have an understanding of the OHS (Occupational Health and Safety) requirements for the contract. The written tests shall be signed and dated by the person undertaking the induction training to attest to their understanding and be retained by the Principal Contractor / Sub-Contractor as a record that the training has been completed.

C3.6.3.4 RECORDING & REPORTING OF INJURIES

Make arrangements for all contractors to report accidents, ill health and dangerous occurrences notifiable to the Department of Labour under Section 24 of the OHS Act (Occupational Health and Safety Act, Act 85 of 1993) (Reporting to DOL (Department of Labour) Inspector regarding certain incidents).

All lost time incidents associated with the contract works or reportable as defined by **Section 24** of the OHS Act shall be immediately reported to the Client.

The Principal Contractor / Sub-Contractor shall provide a detailed report of all accidents / incidents, including events that could have become lost time incidents were it not for fortuitous circumstances to the Client within 5 days of the incident occurring. The Principal Contractor / Sub-Contractor shall provide copies of all reports and information associated with the incidents to the Client. Copies of reports must be placed on the Health and Safety File.

Where the Principal Contractor / Sub-Contractor has been:

- Served with a prohibition, contravention or improvement notice under the OHS Act; or
- Required to comply with any order issued by an inspector for the Department of Labour;

  - The Principal Contractor / Sub-Contractor shall immediately supply a copy of that notice, order or notification to the Client.

  - Where the Principal Contractor / Sub-Contractor have been served with a summons or is convicted of any offence in relation to occupational health and safety, the Principal Contractor / Sub Contractor shall immediately supply a copy of that summons to the Client.

  - The Principal Contractor / Sub-Contractor shall detail the reporting and investigation procedures for incident investigation. The procedures shall include the investigating officer responsible and the time limits imposed for reporting and investigating the incident and to implement corrective action in a timely manner so as to prevent a recurrence.

  - The client may participate in or undertake an investigation into the incident, injury or illness at its discretion and the Principal Contractor / Sub-Contractor shall cooperate with and provide assistance to the investigation organized and undertaken by the Client.

C3.6.3.5 FIRST AID

- Establish and implement a first-aid programme to provide emergency treatment to victims of accidents, chemical substances or excessive exposure to toxic substances.

The programme shall include:

- proper first aid facilities administered by qualified personnel,
- first-aid boxes,
- first-aid room, where there are 500 or more workers on site,
- training and re-training of first-aiders,
- first-aid treatment procedures,
- standard procedures,
- special procedures, e.g. for poisoning,
- maintenance of first-aid facilities

- All first-aid provisions shall comply with the OHS Act (Act 85 of 1993)

C3.6.3.6 FIRE PROTECTION AND PREVENTION

- Appropriate measures must be taken to avoid the risk of fire.
- Sufficient and suitable storage must be provided for flammable liquids, solids and gases.
- Smoking must be prohibited and notices in this regard must be prominently displayed in all places containing readily combustible or flammable materials;
- Combustible materials must not accumulate on the construction site.
- Welding, flame cutting and other hot work may only be done after the appropriate precautions have been taken to reduce the risk of fire.
- Suitable and sufficient fire-extinguishing equipment must be placed at strategic locations and such equipment must be maintained in good working order.
- A sufficient number of workers must be trained in the use of fire-extinguishing equipment.

C3.6.3.7 SITE EMERGENCY PROCEDURES

The Principal Contractor / Sub-Contractor shall establish an Emergency Evacuation and Rescue plan.

The plan shall include the following detail:

- The role and responsibility of every individual in the work area on fire safety emergency evacuation and rescue;
- General work area precautions, fire prevention, detection, protection and warning alarm systems;

- Fire fighting and rescue equipment including types of fire extinguishers;
- Fire safety measures for Site accommodation;
- Escape and communication;
- Fire brigade access, facilities and coordination;
- Fire drills and training including the use of fire fighting equipment;
- Material storage including flammable liquids, gasses and waste;

The Principal Contractor / Sub-Contractor shall ensure that all procedures, precautionary measures and safety standards stipulated in the Plan are communicated, implemented and complied with by all workers including other interfacing contractors on Site.

The Principal Contractor / Sub-Contractor shall practice their emergency preparedness within six (6) weeks of the commencement of work and at least four (4) monthly intervals thereafter.

The Principal Contractor / Sub-Contractor shall review and ensure the adequacy of the Plan as the work progress.

The Principal Contractor / Sub-Contractor shall conduct monthly checks on fire fighting equipment and test alarms and detection devices installed on Site and document findings in a register which shall be on site at all times for inspection.

The Principal Contractor / Sub-Contractor shall conduct weekly inspections of escape routes, fire brigade access, fire fighting facilities and working areas to ensure that the requirements stipulated in the Fire Safety, Emergency, Evacuation and Rescue Plan are complied with. All inspection records shall be documented in registers and kept in the Health and Safety file for inspection at any time.

C3.6.3.8 HOUSEKEEPING

Suitable housekeeping must continuously be implemented on the construction site, including:

- proper storage of materials and equipment
- removal of scrap, waste and debris at appropriate intervals;

Loose materials shall not be placed or allowed to accumulate on the site so as to obstruct access and egress from workplaces and passageways.

C3.6.3.9 STACKING & STORAGE

- Adequate storage areas are must be provided.
- Storage areas must be kept neat and under control.

C3.6.3.10 ILLUMINATION

Provide adequate artificial lighting when work is carried out after dark or inside buildings.

C3.6.3.11 SANITATION / HYGIENE

Provision of site hygiene facilities:

- One sanitary facility for every 30 workers.
- Adequate washing facilities.
- One shower facility for every 15 workers;

Drying sheds, huts, rooms or other accommodation for sheltering during bad weather, storing clothes and taking meals. Facilities should include tables and chairs, suitable means for boiling water and a supply of wholesome drinking water.

The contractor shall provide reasonable and suitable living accommodation for the workers at construction sites which are remote from their homes and where adequate transportation between the site and their homes, or other suitable living accommodation, is not available.

C3.6.3.12 PERSONAL PROTECTIVE EQUIPMENT

The Principal Contractor / Sub-Contractor shall provide and maintain suitable PPE (Personal Protective Equipment) for all employees employed on the Site.

The Principal Contractor / Sub-Contractor shall ensure that such PPE comply with the requirements of the OHS Act (Occupational Health and Safety Act, Act 85 of 1993).

The Principal Contractor / Sub-Contractor shall also ensure that all equipment is properly used by his / her employees during the course of their work.

The Principal Contractor / Sub-Contractor shall record all issues of all equipment to his / her employees in documented registers and such registers shall be kept in the Health and Safety File on site and made available for inspection at all times.

The Principal Contractor / Sub-Contractor shall provide the Client / Client's Agent with a colour code by which employees will be identified with regard to occupations, responsibilities, accountabilities, reporting relationships and access to different locations on site. (e.g. hard hats, overalls).

PPE shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards.

All personal protective equipment shall be of safe design and construction for the work to be performed.

C3.6.3.13 PERMIT TO WORK REQUIREMENTS

Institute a "hot work" permit system in respect of:

- metalwork flame cutting,
- site welding,

C3.6.3.14 LOCK-OUT

Institute a "Lock-out" procedure in respect of controlling energy so as to prevent unexpected operation or activation of machinery or equipment. This procedure must include a written policy, specific procedures, rules and supervisory follow-up, covering the positive locking of switches and valves to ensure that alterations, maintenance, set-up and or other work can be performed safely.

C3.6.3.15 MONTHLY HEALTH AND SAFETY AUDITS

The Principal Contractor shall carry out monthly Health and Safety Audits on the measures contained within his / her Health and Safety Plan submitted to the Client as well as Health and Safety Plans submitted by Sub-Contractors appointed by the Principal Contractor to demonstrate that the required level of health and safety are being achieved and maintained and compile a full report to the Client on such audit.

The Client will audit the Principal Contractor as well as his / her Sub-contractor's Health and Safety Plans from time to time and will advise the Principal Contractor of any matter with which he / she is not satisfied and the Principal Contractor shall take such steps as are necessary to satisfy the Client.

The Client will carry out such audits as he / she considers necessary but not less than monthly.

The Principal Contractor shall make available, specialist personnel as the Client may consider necessary for the performance of such audits.

The Principal Contractor shall develop and maintain an Audit Schedule that details the audits planned to be undertaken by the Principal Contractor of the work under the contract, including sub-contractors, for the duration of the contract. The Audit Schedule shall form part of the Health and Safety Plan that needs to be submitted by the Principal Contractor.

Audit reports shall detail the scope of the audit, the audit questions and the audit findings.

The Client shall be promptly provided with copies of all audit reports together with other documentation to show that all matters raised have been appropriately addressed.

Unless otherwise directed by the Client the Principal Contractor / Sub-Contractor shall undertake its initial OHS Audit within 4 weeks of commencement of work. The Principal Contractor / Sub-Contractor shall undertake subsequent OHS Audits at a frequency not less than once every 3 months.

All Principal Contractor's OHS Audits shall include an assessment of Sub-Contractor compliance with the approved OHS Plan.

C3.6.3.16 MANAGEMENT REVIEW

The Principal Contractor shall undertake an independent review of the Health and Safety Plan for the contract in accordance with the requirements of the OHS Act, relevant Regulations and in particular the Construction Regulations 2014.

A review shall be undertaken 3 months after commencement of the contract and every 6 months thereafter for the duration of the contract.

Following the completion of the review, the Principal Contractor shall submit a written report that details the suitability, adequacy and effectiveness of the OHS Plan and to certify that the Site procedures, practices and operations are in accordance with the contract.

C3.6.3.17 PROVISION OF INFORMATION

- Provide Sub-Contractors appointed by him / her with the relevant sections of the Health and Safety specifications pertaining to the construction work which has to be performed.
- Where changes are brought to the design and construction, provide sufficient information and appropriate resources to the Sub-Contractor to execute the work safely.
- Discuss and negotiate with Sub-Contractors the contents of the Health and Safety Plan / Plans submitted by them and finally approve such plans for implementation.
- Ensure that copies of Health and Safety plans compiled by the Principal Contractor and his / her Sub-Contractors are available on request to an employee, DOL Inspector, contractor, Client.
- The Principal Contractor / Sub-Contractor shall detail procedures that will ensure that personnel are suitably consulted and communicated with during the planning and application of work activities associated with the contract.
- The Principal Contractor / Sub-Contractor shall detail the procedures for the identification, assessment and control of hazards associated with the day-to-day work activities. These procedures shall include requirements for consultation with personnel involved in the work activity.
- The Principal Contractor / Sub-Contractor shall have procedures for ensuring that OHS information is communicated to and from its personnel. The Principal Contractor / Sub-Contractor shall hold OHS meetings with all personnel or their representatives at the site on a weekly basis.

- Minutes shall be recorded for all OHS meetings and posted on OHS notice boards within 48 hours of the meeting.

- The Principal Contractor / Sub-Contractor shall maintain at the Site an OHS Notice Board located in a prominent position and accessible to all personnel, for the distribution of OHS information.

- The Principal Contractor / Sub-Contractor shall as a minimum, establish and implement procedures for reporting relevant and timely information with regard to OHS Performance and incidents.

- The Principal Contractor / Sub-Contractor shall establish, implement and maintain a controlled copy of all Contract OHS documentation on Site.

- Where the Principal Contractor / Sub-Contractor's Health and Safety Plan references other documentation including the contract, the Principal Contractor / Sub-Contractor shall ensure that section and clause numbers are clearly denoted in its Health and Safety Plan. All documentation referenced in the Health and Safety Plan shall be available on Site for the duration of the contract.

- Ensure that Health and Safety Files kept by Sub-Contractors appointed by the Principal Contractor is kept on site and made available to an inspector, Client.

- Hand over a consolidated health and safety file to the Client upon completion of construction work, including all drawings, designs, materials used and other similar information concerning the completed structure.

- In addition to the Health and Safety File compile a comprehensive and updated list of all contractors on site accountable to the Principal Contractor as well as the agreements between the parties and the type of work done by them.

C3.6.3.18 STOP THE EXECUTION OF CONSTRUCTION WORK

Stop any construction / construction related work conducted by any person on the construction site, which is not in accordance with the Principal Contractor's health and safety plan and or the health and safety plans of Sub-Contractors which possess a threat to the health and or safety of persons.

C3.6.3.19 HANDING OVER OF PROJECT HEALTH AND SAFETY FILE

- Hand over a consolidated health and safety file to the Client upon completion of construction work, including all drawings, designs, materials used and other similar information concerning the completed structure.

- In addition to the Health and Safety File compile and hand over a comprehensive and updated list of all contractors on site accountable to the Principal Contractor as well as the agreements between the parties and the type of work done by them.

C3.6.3.20 RECORDS AND RECORDS MANAGEMENT

- The control of records shall be in accordance with the Principal Contractor's / Sub-Contractor's approved Health and Safety Plan for the contract.

- Records shall be registered, ordered and retained on Site in the Health and Safety File for the duration of the contract.

C3.6.4 CHEMICAL HAZARDS

The following construction materials and substances to be used in the works have been identified as potentially posing special health and/or safety hazards during the project:

NOTE:

The above mentioned is not a definitive list of all potential harmful products. Other materials and substances commonly used during construction may also present health or safety hazards, however, it is deemed that these should be familiar to the average competent Contractor as part of routine risk and OHSH (Occupational Health, Safety and Hygiene) assessments and are therefore not included here.

Adopt all precautionary measures provided by manufacturers for storage, use and application of specified materials.

Data sheets for these, and any other materials that will be used for the works, are to be obtained by the contractor from the manufacturers.

C3.6.5 SAFETY HAZARDS

C3.6.5.1 TOOLS

C3.7.5.1.1 Hand tools

- Employers shall not issue or permit the use of unsafe hand tools.
- Wrenches, including adjustable, pipe, end, and socket wrenches shall not be used when jaws are sprung to the point that slippage occurs.
- Impact tools, such as drift pins, wedges, and chisels, shall be kept free of mushroomed heads.
- The wooden handles of tools shall be kept free of splinters or cracks and shall be kept tight in the tool.

C3.6.5.2 PORTABLE ELECTRICAL TOOLS

No person shall use a portable electric tool with an operating voltage which exceeds 50 to earth unless –

- it is connected to a source of electrical energy incorporating an earth leakage protection device which meets the requirements of section 36 of the OHS Act or,
- it is connected to a source of high frequency electrical energy derived from a generator which is used solely for supplying energy to such portable electric tool and which arrangement is approved by the chief inspector; or
- it is clearly marked that it is constructed with double or reinforced insulation.

Portable electric tools, together with its flexible cord and plug shall be maintained in a serviceable condition.

C3.6.6 EXCAVATIONS

- The contractor shall ensure that all excavation work is carried out under the supervision of a competent person who has been appointed in writing.
- The contractor shall evaluate the stability of the ground before excavation work begins.
- The Contractor shall take suitable and sufficient steps in order to prevent any person from being buried or trapped by a fall or dislodgement of material in an excavation;
- The contractor shall not permit any person to work in an excavation which has not been adequately shored or braced.
- Shoring and bracing may not be necessary where-

- the sides of the excavation are sloped to at least the maximum angle of repose measured relative to the horizontal plane; or
- such an excavation is in stable material:
- Provided that-

➢ permission being given in writing by the appointed competent person upon evaluation by him or her of the site conditions; and

➢ where any uncertainty pertaining to the stability of the soil still exists, the decision from a professional engineer or a professional technologist competent in excavations shall be decisive and such a decision shall be noted in writing and signed by both the competent person and a professional engineer or technologist, as the case may be;

- Take steps to ensure that the shoring or bracing is designed and constructed in such manner rendering it strong enough to support the sides of the excavation in question;

- Ensure that no load, material, plant or equipment is placed or moved near the edge of any excavation where it is likely to cause its collapse and thereby endangering the safety of, any person, unless precautions such as the provision of sufficient and suitable shoring or bracing are taken to prevent the sides from collapsing;

- Cause convenient and safe means of access to be provided to every excavation in which persons are required to work and such access shall not be further than 6m from the point where any worker within the excavation is working;

- Cause every excavation, including all bracing and shoring, to be inspected-

i. daily, prior to each shift;
ii. after every blasting operation;
iii. after an unexpected fall of ground;
iv. after substantial damage to supports; and
v. after rain,

- by a competent person in order to pronounce the safety of the excavation to ensure the safety of persons, and those results are to be recorded in a register kept on site and made available to an inspector, client, client's agent, contractor or employee upon request;

- Cause every excavation which is accessible to the public or which is adjacent to public roads or thoroughfares, or whereby the safety of persons may be endangered, to be-

o adequately protected by a barrier or fence of at least one meter in height and as close to the excavation as is practicable; and
o provided with warning illuminates or any other clearly visible boundary indicators at night or when visibility is poor
o Cause warning signs to be positioned next to an excavation within which persons are working or carrying out inspections or tests.

C3.6.7 FORMWORK & SUPPORT WORK

The contractor shall ensure that-

- all formwork and support work operations are carried out under the supervision of a competent person who has been appointed in writing for that purpose;
- all formwork and support work structures, are adequately designed, erected, supported, braced and maintained so that they will be capable of supporting all anticipated vertical and lateral loads that may be applied to them and also that no loads are imposed onto the structure that the structure is not designed to withstand.
- The designs of formwork and support work structures are done with close reference to the structural design drawings and where any uncertainty exists, the structural designer should be consulted.
- All drawing pertaining to the design of formwork or support work structures are kept on the site and are available on request by an inspector, contractor, client, client's agent or employee.
- All equipment used in the formwork or support work structure are carefully examined and checked for suitability by a competent person, before being used.
- All formwork and support work structures are inspected by a competent person immediately before, during and after the placement of concrete or any other imposed load and thereafter on a daily basis until the formwork and support work structure has been removed and the results have been recorded in a register and made available on site.
- If, after erection, any formwork and support work structure is found to be damaged or weakened to such a degree that its integrity is affected, it shall be safely removed or reinforced immediately.
- Adequate precautionary measures are taken in order to-
- Secure any deck panels against displacement, and
- Prevent any person from slipping on support work or formwork due to the application of formwork or support work release agents.
- The health of any person is not affected through the use of solvents or oils or any other similar substances.
- Upon casting concrete, the support work or formwork structure should be left in place until the concrete has acquired sufficient strength to support safely, not only its own weight but also any imposed loads and not removed until authorization has been given by a competent person.
- Provision is made for safe access by means of secure ladders or staircases for all work to be carried out above the foundation bearing level.

- All employees required to erect, ,move or dismantle formwork and support work structures are provided with adequate training and instruction to perform these operations safely
- The foundation conditions are suitable to withstand the weight caused by the formwork and support work structure and any imposed loads, such that the formwork and support work structure are stable.

C3.6.8 CONSTRUCTION VEHICLES

The contractor shall ensure that all construction vehicles and mobile plants-

- are of an acceptable design and construction;
- are maintained in a good working order;
- are used in accordance with their design and the intention for which they were designed, having due regard to safety and health;
- are operated by workers who-

i. have received appropriate training and been certified competent and been authorised to operate such machinery; and
ii. are physically and psychologically fit to operate such construction vehicles and mobile plant by being in possession of a medical certificate of fitness;

- have safe and suitable means of access;

- are properly organized and controlled by providing adequate signalling or other control arrangements to guard against the dangers. relating to the movement of vehicles and plant, in order to ensure their continued safe operation;
- are prevented from falling into excavations, water or any other area lower than the working surface by installing adequate edge protection, which may include guardrails and crash barriers;
- where appropriate, are fitted with structures designed to protect the operator from falling material or from being crushed should the vehicle or mobile plant overturn;
- are equipped with an electrically operated acoustic signalling device and a reversing alarm;
- are on a daily basis inspected prior to use, by a competent person who has been appointed in writing and the findings of such inspection is recorded in a register.

The contractor shall furthermore ensure that-

- no person rides or be required or permitted to ride on any construction vehicle or
    - mobile plant otherwise than in a safe place provided thereon for that purpose;
- every construction site is organized in such a way that pedestrians and vehicles can move safely and without risks to health;
- the traffic routes are suitable for the persons using them, sufficient in number, in suitable positions and of sufficient size;
- every traffic route is, where necessary indicated by suitable signs.
- all construction vehicles and mobile plant left unattended at night, adjacent to a freeway in normal use or adjacent to construction areas where work is in progress, shall have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, in order to identify the location of the vehicles or plant;
- bulldozers, scrapers, loaders, and other similar mobile plant are, when being repaired or when not in use, fully lowered or blocked with controls in a neutral position, motors stopped and brakes set;
- whenever visibility conditions warrant additional lighting, all mobile plant are equipped with at least two headlights and two taillights when in operation;
- tools and material are secured in order to prevent movement when transported in the same compartment with employees;
- vehicles used to transport employees have seats firmly secured and adequate for the number of employees to be carried; and
- when workers are working on or adjacent to public roads, reflective indicators are provided and worn by the workers.

C3.6.9 ELECTRICAL INSTALLATIONS

- Before construction commences and during the progress thereof, adequate steps must be taken to ascertain the 'presence of and guard against danger to workers from any electrical cable or apparatus.
- All parts of electrical installations and machinery must be of adequate strength to withstand the working conditions on construction sites;
- In working areas where the exact location of underground electric power lines unknown, employees using jackhammers, shovels or other hand tools which may make contact with a power line, must be provided with insulated protective gloves or otherwise that the handle of the tool being used is insulated;
- All temporary electrical installations must be inspected at least once a week and electrical machinery on a daily basis before use on a construction site by competent persons and the records of these inspections must be recorded in a register to be kept on site.
- The control of all temporary electrical installations on the construction site must be designated to a competent person who has been appointed in writing.

C3.6.10 USE & STORAGE OF FLAMMABLE LIQUIDS

- Where flammable liquids are being used, applied or stored it must be done in such a manner that would cause no fire or explosion hazard, and that the workplace is effectively ventilated:

o Provided that where the workplace cannot effectively be ventilated-

i. every employee involved is provided with a respirator, mask or breathing apparatus of a type approved by the chief inspector, and
ii. steps are taken to ensure that every such employee, while using or applying flammable liquid, uses the apparatus supplied to him or her;

- No person smokes in any place in which flammable liquid is used or stored, and the contractor shall affix a suitable and conspicuous notice at all entrances to any such areas prohibiting such smoking;
- Flammable liquids on a construction site is stored in a well-ventilated reasonably fire resistant container, cage or room and kept locked with proper access control measures in place;
- An adequate amount of efficient fire-fighting equipment is installed in suitable locations around the flammable liquids store with the recognized symbolic signs;
- Only the quantity of flammable liquid needed for work on one day is to be taken out of the store for use;
- All containers holding flammable liquids are kept tightly closed when not in actual use and, after their contents have been used up, to be removed from the construction site and safely disposed of;
- Where flammable liquids are decanted, the metal containers are bonded or earthed;
- No flammable material such as cotton waste, paper, cleaning rags or similar material is stored together with flammable liquids.

C3.6.11 WELDING & CUTTING

No contractor shall require or permit welding or flame cutting operations to be undertaken, unless –

- the person operating the equipment has been fully instructed in the safe operation and use of such equipment and in the hazards which may arise from its use;
- effective protection is provided and used for the eyes and respiratory system and, where necessary, for the face, hands, feet, legs, body and clothing of persons performing such operations, as well as against heat, incandescent or flying particles or dangerous radiation;
- leads and electrode holders are effectively insulated; and
- the workplace is effectively partitioned off and where not practicable all other persons exposed to the hazards are warned and provided with suitable protective equipment.

No contractor shall require or permit electric welding to be undertaken in wet or damp places, inside metal vessels or in contact with large masses of metal, unless –

- the insulation of the electrical leads is in a sound condition;

- the electrode holder is completely insulated to prevent accidental contact with current-carrying parts;
- the welder is completely insulated by means of boots, gloves or rubber mats; and
- at least one other person who has been properly instructed to assist the welder in case of an emergency is and remains in attendance during operations

No contractor shall require or permit welding, flame cutting, grinding, soldering or similar work to be undertaken in respect of any tube, tank, drum, vessel or similar object or container where such object or container –

- is completely closed, unless a rise in internal pressure cannot render it dangerous; or

- contains any substance which, under the action of heat, may –
  i. ignite or explode; or
  ii. react to form dangerous or poisonous substances,

Where hot work involving welding, cutting, brazing or soldering operations is carried out at places, other than workplaces which have been specifically designated and equipped for such work, the employer shall take steps to ensure that proper and adequate fire precautions are taken.

C3.6.12 BLASTING & USE OF EXPLOSIVES

C3.6.12.1 SAFETY DISTANCES

The contractor shall –

- apply the safety distances for the respective categories of explosives as stipulated in Annexure 1 of the Explosives regulations;
- where less than five kilograms of explosives is used, apply to the chief inspector of occupational health and safety for a determination of a safety distance which the employer shall enforce;

C3.6.12.2 SUPERVISION OF EXPLOSIVES

In order to ensure that the provisions of the Act and it's regulations in relation to explosives workplaces are complied with, the contractor shall in writing appoint a competent and certified person in a full-time capacity to be explosives manager in respect of every workplace where explosives are being used, tested, stored or manufactured:
The contractor shall appoint one or more persons, who are suitably qualified and experienced, as authorized supervisors to assist the explosives manager.

The contractor shall ensure that –

- the explosives manager
  a. approves in writing the rules, methods, materials, equipment and tools to be used in the danger area;
  b. ensures that ail persons under his or her control are informed of the hazards related to their tasks and are thoroughly trained in safe work procedures, in particular with respect to shock, friction risk of fire, or static electricity, and are familiar with the requirements of the Explosives regulations
  c. prescribes all protective clothing and equipment to be used in the danger area
  d. ensures that the processes and equipment specified in schedule licences are safe and appropriate for the manufacturing processes envisaged for the workplace.

- the supervising official
  a. is at all times in a position to exercise control over the operations
  b. reports without delay to the explosives manager any plant or
  c. equipment under his or her control that has or may have posed a risk:
  d. ensures that all rules implemented in the interest of health and safety are at all times complied with;
  e. stops all work involving explosives if he or she becomes aware of any risk posed to the health and safety of persons.

C3.6.12.3 SAFE HANDLING OF EXPLOSIVES

The contractor shall ensure that –

- all explosives or ingredients thereof are at all times free of foreign material;
- all reasonable precautions are taken to prevent the spillage of explosives;
- cleaning procedures in the case of a spillage of explosives are prescribed in writing by the explosives manager: Provided that where no cleaning procedures have been prescribed any unusual spillage of explosives shall be reported immediately to the supervising official:
- all waste, paper, timber, rags, cotton and similar materials that have been in contact with explosives or an ingredient of an explosive are disposed of in a manner prescribed in writing by the explosives manager: Provided that at the end of the working day all waste and floor sweepings from danger areas shall be deposited in the designated places;
- the explosives or partly mixed explosives are conveyed as soon and as carefully as possible and taking such precautions and in such a manner as will effectively guard against any accidental ignition or explosion
- only containers provided for the conveyance of explosives are used for transporting explosives or partly mixed explosives and that such containers are at all times kept clean, free from grit and in a good state of repair:
- vehicles containing explosives are left unattended only in designated places

The contractor shall ensure that –

- all material, equipment, tools or similar articles used in a danger area are decontaminated after such use, and that no person makes use of any such article that has not been decontaminated after use in a contaminated area;
- the certification of the decontamination process is certified and approved by the explosives manager or a person authorized by the explosives manager.

- Unless permission has been granted by the chief inspector of occupational health and safety, no contractor shall use –

- explosives in workplaces other than explosives workplaces approved by the chief inspector of occupational health and safety;
- any explosives for which no provision is made in Explosives regulations.

No contractor shall allow unauthorized access to such explosives or bury, dump, hide or abandon any explosives.

No contractor shall use any explosive material for blasting purposes unless

- he or she is in possession of a written permission issued by or under the authority of the chief inspector of occupational health and safety;
- he or she is undergoing training while using such blasting material under the immediate and constant supervision of a person who is in possession of permission

C3.6.12.4 DANGEROUS AREAS

The contractor shall ensure that entry and exit from danger areas is only permitted

- at the permanent authorized point of entry or exit: Provided that entry or exit at any other point may be authorized by the explosives manager or a person authorized by him if the authorized gatekeeper has been informed thereof;
- for persons and vehicles authorized thereto by the explosives manager or a person authorized by him:
- to visitors under escort by an authorized person who is aware of the hazards attached to the danger area.

The contractor shall keep a register of the entries and exits and that register shall be available on the premises for inspection by an inspector.

No person shall –

- enter the danger area with –
    a. tobacco;
    b. matches, cigarette lighters or other devices capable of generating heat or spark sources;
    c. intoxicating liquor or narcotics;
    d. food, medicine or drinkable fluids: Provided that authorization to enter with such articles may be granted by the explosives manager for purposes of consumption in licensed mess rooms and smoking areas: Provided further that special rules for the control of such consumption and smoking, approved by the chief inspector of occupational health and safety shall be made in writing and shall be enforced by the employer, self-employed person or user; or
    e. radio transmitters or cellular telephones; or

The contractor shall ensure that hazard warning signs are clearly displayed at the entrance to any danger area.

C3.6.12.5 VESSELS UNDER PRESSURE

C3.6.12.6 MANUFACTURER'S DATA PLATE

Every user of a boiler or pressure vessel shall cause a manufacturer's plate with the following minimum particulars to be securely fixed in a conspicuous place to the shell of every such a boiler or pressure vessel:

a) Name of manufacturer;
b) country or origin;
c) year of manufacture;
d) manufacturer's serial number;
e) name, number and date of the standard of design;
f) design gauge pressure in Pascal's; (design pressure)
g) maximum permissible operating pressure in Pascal's;
h) operating temperature;
i.) capacity in cubic meters; and
j) mark of an approved inspection authority.

No person shall remove such a manufacturer's plate or wilfully damage or alter the particulars stamped thereon.

C3.6.12.7 PORTABLE GAS CONTAINERS

No user shall use or require or permit a portable gas container to be used, and no user shall fill, place in service, handle, modify, repair, inspect or test any portable gas container, other than in compliance with standards incorporated into the Vessels under Pressure regulations.

C3.6.12.8 HAND HELD FIRE EXTINGUISHERS

No user shall use, require or permit the use of a hand held fire extinguisher unless designed, constructed, filled, recharged, reconditioned, modified, repaired, inspected or tested in accordance with a safety standard incorporated into the Vessels under Pressure regulations.
No person shall fill, recharge, recondition, modify, repair, inspect or test any hand held fire extinguisher unless a holder of a permit issued by the South African Bureau of Standards in terms of SABS 1475.

C3.6.12.9 GAS FUEL USE, EQUIPMENT AND SYSTEMS

No person shall handle, store or distribute a gas fuel in any manner, including the filling of a container, other than in accordance with a health and safety standards.

C3.6.12.10 INSPECTION AND TEST

Any user of a boiler or pressure vessel shall cause, where reasonably practicable, such a boiler or pressure vessel, including the appurtenances and automatic controls and indicators, to be subjected to an internal and external inspection, and a hydraulic pressure test to 1.25 times the maximum permissible safe operating pressure as the case may be –

- by an approved inspection authority before commissioning after installation, re-erection or repairs;
- by a person appointed in writing by the user and who is competent to do such inspections and tests by virtue of their training, knowledge and experience in the operation, maintenance, inspection and testing of a boiler or pressure vessel within 36 months from the date of the previous internal and external inspection and hydraulic pressure test: Provided that where a pressure vessel is not subjected to corrosion, the user may dispense with the internal inspection and hydraulic pressure test subject to the written approval of an approved inspection authority:

Provided further that an inspector may require a specific boiler or pressure vessel to be inspected or tested more frequently or permit a specific boiler or pressure vessel to be inspected or tested less frequently:

C3.6.12.11 RECORDKEEPING

Any user of a vessel under pressure shall keep on his premises a record which shall be open for inspection by an inspector in which the results of inspections, tests, modifications and repairs shall be recorded, dated and signed by the competent person.

C3.6.12.12 MAINTENANCE

No user shall use, cause or permit a vessel under pressure or gas fuel system, including all automatic controls, indicators and appurtenances, to be used unless it is at all times maintained in a safe working condition and the efficiency thereof is proved by regular testing.

No user shall use or cause or permit a vessel under pressure to be used unless it is kept clean and free from any:

- carbonized oil or other inflammable material which may ignite under working conditions;
- material which may cause corrosion; or
- material which is liable to chemical reaction which may cause an uncontrolled rise in pressure.

C3.6.13 PHYSICAL HAZARDS

C3.6.13.1 ERGONOMICS

- Ensure that assigned tasks do not exceed the limits of the performance capacities of the worker.
- Prevent injury or any detrimental effects to the health of the worker
- Provide that tasks and working conditions will not lead to impairments.

C3.6.13.2 NOISE

No contractor shall require or permit an employee to work in an environment in which he is exposed to an equivalent noise level equal to 85 dB(A) or higher. The contractor shall reduce the equivalent noise level to below 85 dB(A) or, where this is not reasonably practicable, he shall reduce the level to as low as is reasonably practicable and take all reasonable steps to isolate the source of the noise acoustically. Where the equivalent noise level in any workplace cannot be reduced to below 85 dB(A) the contractor shall –

- prohibit any person from entering a noise zone unless such person wears hearing protectors.

The contractor shall provide, free of charge, hearing protectors to each employee who works in or, to any person who is required or permitted to enter a noise zone, and no contractor shall require or permit any person to work in or enter such noise zone, and no person shall work in or enter such noise zone, unless he wears such hearing protectors in the correct manner: Provided that where the

equivalent noise level to which employees are exposed, is such that the attenuation of the hearing protectors does not reduce the said noise to below 85 dB(A) the employer concerned shall limit the time during which employees work in that noise zone in such a way that they are not exposed to an equivalent noise level equal to 85 dB(A) or higher.

The contractor shall properly instruct any person who is required to wear hearing protectors in the use of such protectors and inform him of noise zones where the wearing thereof is compulsory.
The contractor shall –

- ensure that every employee employed in a noise zone is subjected to audiometric examinations conducted in accordance with section 7 of SABS 083, by an audiometrist approved by the chief inspector;
- keep records of the results of each audiometric examination and make such records available for inspection by an inspector if he so requires; and

- keep such records for a minimum period of 30 years after termination of employment: Provided that if the employer ceases activities all such records shall be forwarded to the regional director.

C3.6.13.3 VIBRATION

Whole-body vibration occurs when the body is supported on a surface which is vibrating (e.g., when sitting on a seat which vibrates, standing on a vibrating floor or recumbent on a vibrating surface). Whole-body vibration occurs in all forms of transport and when working near some industrial machinery.

Hand-transmitted vibration is the vibration that enters the body through the hands. It is caused by various processes where vibrating tools or work pieces are grasped or pushed by the hands or fingers. Exposure to hand-transmitted vibration can lead to the development of several disorders.

C3.6.14 SITE WIDE ELEMENTS

C3.6.15 SITE ACCESS AND EGRESS

- Access to the site will involve crossing the public footpath.
- Store materials and plant away from means of access for the general public and occupants.
- Remove rubbish and demolition materials regularly. Do not allow to accumulate on flat roofs.
- Maintain free access through designated means of escape at all times
- Agree with the Client / Client's Agent delivery points for materials before commencing works.

C3.6.15.1 VISITORS TO THE SITE

- All visitors to report to the Principal Contractor's reception area for OHS Induction training.
- All visitors to sign the visitor's registration document.
- All visitors to be provided with a Visitors Permit to enable them to access the construction site.
- All un-inducted visitors must be accompanied on the construction site by an inducted person.
- No visitors shall be allowed to access the construction site without wearing the necessary PPE.

C3.6.15.2 DELIVERIES

Access will involve crossing the public footpath.

C3.6.15.3 EMERGENCIES

Ensure that there are adequate escape routes and that they are kept clear at all times.

C3.6.15.4 LOCATION OF TEMPORARY SITE ACCOMMODATION

See Site Lay-out Plan.

C3.6.15.5 LOCATION OF MATERIALS UNLOADING AND STORAGE

Materials are to be unloaded and stored in locations which will not in any way affect access or egress to the site nor the works.

C3.6.15.6 TRAFFIC AND PEDESTRIAN ROUTES

The road, public footpaths and access way are to be kept open at all times. All necessary signage and barriers are to be put in place to protect pedestrians at the site entrance and access and egress points.

C3.6.15.7 SAFETY

- Ensure that all employees are aware of the Health and Safety policy and put into place arrangements to ensure that all visitors and workers new to the site are aware of the site safety provisions.
- Locate underground electricity cables, mark and take precautions to avoid.
- Ensure that cartridge operated tools are operated by trained personnel and in accordance with the maker's instructions that the gun is cleaned regularly and kept in a secure place when not in use.
- Protect people who may be exposed to health risks arising from hazardous substances.

C3.6.16 CONTINUING LIAISON

The procedures for consideration and evaluation of the health and safety implications of Contractor designed elements of the works must follow the recognised principles of prevention and protection and take account of the issues highlighted in this OHS Specification.

The following information is to be submitted by the Contractor to the Client / Client's Agent in sufficient time to allow adequate consideration by the Client / Client's Agent and, where appropriate, the design team, and the provision of relevant information to those persons affected by the works, prior to the commencement of the relevant works:

- Suitable and sufficient information to demonstrate that health or safety issues have been adequately considered.
- Risk assessments.
- A list of health and/or safety hazards identified which cannot be designed out.
- A list of any materials or substances which are specified or inherent in the design which is potentially hazardous to health and/or safety.

C3.6.16.1 UNFORESEEN EVENTUALITIES

The following action is to be taken in the event of unforeseen eventualities arising during the construction stage of the project which require significant design changes, or affect the resources required to carry out the work without risk to health and/or safety, or have other health or safety implications.

The Client / Client's Agent and, where possible, the Principal Contractor are to be advised as soon as possible.

Full details of the relevant health and safety issues involved are to be reviewed with the Client / Client's Agent and Principal Contractor as soon as possible.

Full details of any revised designs, risk assessments and identified hazards and/or hazardous materials and substances are to be issued to the Client / Client's Agent and Principal Contractor in sufficient time to allow for the revision of the Health and Safety Plan and notification of all persons affected by the health and/or safety implications of the changes prior to the commencement of the affected works.

C3.6.16.2 SITE LIAISON

Liaise with all other contractors and implement any agreed changes to the Health and Safety Plan arising from such liaison. Set up regular training for all operatives including induction training for all staff upon arrival to site.

C3.6.16.3 HEALTH AND SAFETY FILE

Provide the Planning Supervisor with any relevant information which the contractor believes should be incorporated into the Health and Safety File.

C3.6.16.4 DESIGN DEVELOPMENT

Provide the Client with all design information prepared by sub-Contractors.

Arrange liaison meetings with sub-contractors to discuss and review health and safety issues arising from the sub-contractors' designs.

C3.6.17 CONCLUSION

The hazards listed above were identified posing potential threats to the health and or safety of persons that will work on the contract. Although every effort were made to ensure that every possible hazard was identified the Employer cannot guarantee this, therefore it is imperative for the contractor to conduct a comprehensive risk identification and hazard assessment in order to make certain that all hazards are identified.

C3.6.18 MANAGEMENT

Management of the works

The management of the site shall be in accordance with the provisions of the SANS Standard Specification for Road and Bridge Works for State Authorities (1998 edition).

C3.7 GENERAL CONDITIONS OF CONTRACT (GOVERNMENT)

GENERAL CONDITIONS OF CONTRACT (GCC)

NOTES:

The purpose of this document is to:

(i) Draw special attention to certain general conditions applicable to government Bids, contracts and orders; and

(ii) To ensure that clients be familiar with regard to the rights and obligations of all parties involved in doing business with government.

In this document words in the singular also mean in the plural and vice versa and words in the masculine also mean in the feminine and neuter.

• The General Conditions of Contract (GCC) will form part of all Bid documents and may not be amended.

TABLE OF CLAUSES

1. Definitions

1. The following terms shall be interpreted as indicated:

1.1 **"Acceptable bid"** means any bid, which, in all respects, complies with the specifications and conditions of the bid as set out in the bid document.

1.2 **"Bid"** means a written offer in a prescribed or stipulated form in response to an invitation by an organ of State for the provision of goods, works or services.

1.3 **"Black enterprise"** means an enterprise that is 50,1% owned by black persons and where there is substantial management control. Ownership refers to economic interest while management refers to the membership of any board or similar governing body of the enterprise.

1.4 **"Black empowered enterprise"** means an enterprise that is at least 25,1% owned by black persons and where there is substantial management control. Ownership refers to economic interests. Management refers to executive directors. This is whether the black enterprise has control or not.

1.5 **"Black people"** includes all African, Coloured or Indian persons who are South African citizens by birth or by descent or who were naturalised prior to the commencement of the constitution in 1993. In addition, the term also includes black people who became South African citizens after the constitution's commencement but who would have been able to be naturalised prior to this, were it not for the Apartheid laws which prohibited naturalisation of certain persons. This means that an African, Coloured or Indian person who was not a South African citizen before the commencement of the constitution in 1993 but who would have been entitled to apply to be naturalised prior to 1993, will also be considered a black person and therefore a beneficiary of BEE.

1.6 **"Black woman-owned enterprise"** means an enterprise with at least 25,1% representation of black women within the black equity and management portion.

1.7 **"Closing time"** means the date and hour specified in the bidding documents for the receipt of bids.

1.8 **"Comparative price"** means the price after the factors of a non-firm price and all unconditional discounts that can be utilised have been taken into consideration.

1.9 **"Community or broad-based enterprise"** means an enterprise that has an empowerment shareholder who represents a broad base of members such as a local community or where the benefits support a target group, for example black women, people living with disabilities, the youth and workers. Shares are held via direct equity, non-profit organisations and trusts.

Benefits from the shareholding should in a measurable sense be directed towards the uplifting of the community through job creation, welfare, skills development, entrepreneurship and human rights. At the same time, directors and management of groups should significantly comprise black persons.

These arrangements are appropriate in situations where the activities or operations of an enterprise or industry directly impact on a community or are located in a community, or may benefit a community. Notable examples are large industrial projects, mining and tourism. Other instances, which do assist in broadening the

shareholder base, are employee share ownership schemes; these are a viable empowerment shareholder option. In this and other circumstances, these arrangements should not detract from the ability of the shareholder to exercise significant influence or control over the operations of the business.

1.10 **"Consortium or joint venture"** means an association of persons for the purpose of combining their expertise, property, capital, efforts, skills and knowledge in an activity for the execution of a contract.

1.11 **"Contract"** means the written agreement entered into between the purchaser and the supplier, as recorded in the contract form signed by the parties, including all attachments and appendices thereto and all documents incorporated by reference therein.

1.12 **"Contract price"** means the price payable to the supplier under the contract for the full and proper performance of his contractual obligations.

1.13 **"Control"** means the possession and exercise of legal authority and power to manage the assets, goodwill and daily operations of a business and the active and continuous exercise of appropriate managerial authority and power in determining the policies and directing the operations of the business.

1.14 **"Co-operative or collective enterprise"** is an autonomous association of persons who voluntarily join together to meet their economic, social and cultural needs and aspirations through the formation of a jointly-owned enterprise and democratically controlled enterprise.

1.15 **"Corrupt practice"** means the offering, giving, receiving, or soliciting of any thing of value to influence the action of a public official in the procurement process or in contract execution.

1.16 **"Countervailing duties"** are imposed in cases where an enterprise abroad is subsidized by its government and encouraged to market its products internationally.

1.17 **"Country of origin"** means the place where the goods were mined, grown or produced or from which the services are supplied. Goods are produced when, through manufacturing, processing or substantial and major assembly of components, a commercially recognized new product results that is substantially different in basic characteristics or in purpose or utility from its components.

1.18 **"Day"** means calendar day.

1.19 **"Delivery"** means delivery in compliance with the conditions of the contract or order.

1.20 **"Delivery ex stock"** means immediate delivery directly from stock actually on hand.

1.21 **"Delivery into consignees store or to his site"** means delivered and unloaded in the specified store or depot or on the specified site in compliance with the conditions of the contract or order, the supplier bearing all risks and charges involved until the supplies are so delivered and a valid receipt is obtained.

1.22 **"Disability"** means, in respect of a person, a permanent impairment of a physical, intellectual, or sensory function, which results in restricted, or lack of, ability to perform an activity in the manner, or within the range, considered normal for a human being.

1.23 **"Dumping"** occurs when a private enterprise abroad markets its goods on own initiative in the RSA at lower prices than that of the country of origin and which have the potential to harm the local industries in the RSA.

1.24 **"Equity Ownership"** means the percentage ownership and control, exercised by individuals within an enterprise.

1.25 **"Force majeure"** means an event beyond the control of the supplier and not involving the supplier's fault or negligence and not foreseeable. Such events may include, but is not restricted to, acts of the purchaser in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes.

1.26 **"Fraudulent practice"** means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of any bidder, and includes collusive practice among bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the bidder of the benefits of free and open competition.

1.27 **"GCC"** means the General Conditions of Contract.

1.28 **"Goods"** means all of the equipment, machinery, and/or other materials that the supplier is required to supply to the purchaser under the contract.

1.29 **"Historically Disadvantaged Individual (HDI)"** means a South African citizen -

1.29.1 who, due to the Apartheid policy that had been in place, had no franchise in national elections prior to the introduction of the Constitution of the Republic of South Africa, 1983 (Act 110 of 1983) or the Constitution of the Republic of South Africa, 1993, (Act 200 of 1993) ("the interim Constitution); and/or

1.29.2 who is a female; and/or

1.29.3 who has a disability:

provided that a person who obtained South African citizenship on or after the coming to effect of the Interim Constitution, is deemed not to be a HDI.

1.30 **Imported content"** means that portion of the bidding price represented by the cost of components, parts or materials which have been or are still to be imported (whether by the supplier or his subcontractors) and which costs are inclusive of the costs abroad, plus freight and other direct importation costs such as landing costs, dock dues, import duty, sales duty or other similar tax or duty at the South African place of entry as well as transportation and handling charges to the factory in the Republic where the supplies covered by the bid will be manufactured.

1.31 **"Local content"** means that portion of the bidding price which is not included in the imported content provided that local manufacture does take place.

1.32 **"Management"** means an activity inclusive of control and performed on a daily basis, by any person who is a principal executive officer of the company, by whatever name that person may be designated, and whether or not that person is a director.

1.33 **"Manufacture"** means the production of products in a factory using labour, materials, components and machinery and includes other related value-adding activities.

1.34 **"Order"** means an official written order issued for the supply of goods or works or the rendering of a service.

1.35 **"Owned"** means having all the customary elements of ownership, including the right of decision-making and sharing all the risks and profits commensurate with the degree of ownership interests as demonstrated by an examination of the substance, rather than the form of ownership arrangements.

1.36 **"Parliament"** means Parliament of the Republic of South Africa as set out in Chapter Four of the Constitution.

1.37 **"Person"** includes reference to a juristic person.

1.38 **"Project site"** where applicable, means the place indicated in bidding documents.

1.39 **"Purchaser"** means the organization purchasing the goods.

1.40 **"Rand value"** means the total estimated value of a contract in Rand denomination that is calculated at the time of the bid invitations, and includes all applicable taxes and excise duties.

1.41 **"Republic" or "RSA"** means the Republic of South Africa.

1.42 **"RFP"** means Request for Proposal.

1.43 **"RFT"** means Request for Tender.

1.44 **"RFQ"** means Request for Quotation.

1.45 **"SCC"** means the Special Conditions of Contract.

1.46 **"Secretary"** means the Secretary to Parliament.

1.47 **"Services"** means those functional services ancillary to the supply of the goods, such as transportation and any other incidental services, such as installation, commissioning, provision of technical assistance, training, catering, gardening, security, maintenance and other such obligations of the supplier covered under the contract.

1.48 **"Specific contract participation goals"** means the goals as stipulated in the Preferential Procurement Regulations, 2001. In addition to above-mentioned goals, the Regulations [12. (1)] also make provision for organs of State to give particular consideration to procuring locally manufactured products.

1.49 **"Small, Medium and Micro Enterprises (SMMEs**) bears the same meaning assigned to this expression in the National Small Business Act, 1996 (Act 102 of 1996).

1.50 **"Sub-contracting"** means the primary contractor's assigning or leasing or making out work to, or employing another person to support such a primary contractor in the execution of part of a project in terms of the contract.

1.51 **"Trust"** means the arrangement through which the property of one person is made over or bequeathed to a trustee to administer such property for the benefit of another person.

1.52 **"Trustee"** means any person, including the founder of a trust, to whom property is bequeathed in order for such property to be administered for the benefit of another person.

1.53 **"Written"** or **"in writing"** means handwritten in ink or any form of electronic or mechanical writing.

2. Application

2.1 These general conditions are applicable to all bids, contracts and orders including bids for functional and professional services, sales, hiring, letting and the granting or acquiring of rights, but excluding immovable property, unless otherwise indicated in the bidding documents.

2.2 Where applicable, special conditions of contract are also laid down to cover specific supplies, services or works.

2.3 Where such special conditions of contract are in conflict with these general conditions, the special conditions shall apply.

3. General

3.1 Unless otherwise indicated in the bidding documents, the purchaser shall not be liable for any expense incurred in the preparation and submission of a bid. Where applicable a non-refundable fee for documents may be charged.

3.2 With certain exceptions, invitations to bid can be accessed electronically from www.parliament.gov.za

4. Standards

4.1 The goods supplied shall conform to the standards mentioned in the bidding documents and specifications.

5. Use of contract documents and information; inspection

5.1 The supplier shall not, without the purchaser's prior written consent, disclose the contract, or any provision thereof, or any specification, plan, drawing, pattern, sample, or information furnished by or on behalf of the purchaser in connection therewith, to any person other than a person employed by the supplier in the performance of the contract. Disclosure to any such employed person shall be made in confidence and shall extend only as far as may be necessary for purposes of such performance.

5.2 The supplier shall not, without the purchaser's prior written consent, make use of any document or information mentioned in GCC clause 5.1 except for purposes of performing the contract.

5.3 Any document, other than the contract itself mentioned in GCC clause 5.1 shall remain the property of the purchaser and shall be returned (all copies) to the purchaser on completion of the supplier's performance under the contract if so required by the purchaser.

5.4 The supplier shall permit the purchaser to inspect the supplier's records relating to the performance of the supplier and to have them audited by auditors appointed by the purchaser, if so required by the purchaser.

6. Patent rights

6.1 The supplier shall indemnify the purchaser against all third-party claims of infringement of patent, trademark, or industrial design rights arising from use of the goods or any part thereof by the purchaser.

7. Performance security

7.1 Within thirty (30) days of receipt of the notification of contract award, the successful bidder shall furnish to the purchaser the performance security of the amount specified in SCC.

7.2 The proceeds of the performance security shall be payable to the purchaser as compensation for any loss resulting from the supplier's failure to complete his obligations under the contract.

7.3 The performance security shall be denominated in the currency of the contract or in a freely convertible currency acceptable to the purchaser and shall be in one of the following forms:

(a) a bank guarantee or an irrevocable letter of credit issued by a reputable bank located in the purchaser's country or abroad, acceptable to the purchaser, in the form provided in the bidding documents or another form acceptable to the purchaser; or

(b) a cashier's or certified cheque

7.4 The performance security will be discharged by the purchaser and returned to the supplier not later than thirty (30) days following the date of completion of the supplier's performance obligations under the contract, including any warranty obligations, unless otherwise specified in SCC.

8. Inspections, tests and analyses

8.1 All pre-bidding testing will be for the account of the bidder.

8.2 If it is a bid condition that supplies to be produced or services to be rendered should at any stage during production or execution or on completion be subject to inspection, the premises of the bidder or contractor shall be open, at all reasonable hours, for inspection by a representative of Parliament or an organisation acting on behalf of Parliament.

8.3 If there are no inspection requirements indicated in the bidding documents and no mention is made in the contract, but during the contract period it is decided that inspections shall be carried out, the purchaser shall itself make the necessary arrangements, including payment arrangements with the testing authority concerned.

8.4 If the inspections, tests and analyses referred to in clauses 8.2 and 8.3 show the supplies to be in accordance with the contract requirements, the cost of the inspections, tests and analyses shall be defrayed by the purchaser.

8.5 Where the supplies or services referred to in clauses 8.2 and 8.3 do not comply with the contract requirements, irrespective of whether such supplies or services are accepted or not, the cost in connection with these inspections, tests or analyses shall be defrayed by the supplier.

8.6 Supplies and services which are referred to in clauses 8.2 and 8.3 and which do not comply with the contract requirements may be rejected.

8.7 Any contract supplies may on or after delivery be inspected, tested or analysed and may be rejected if found not to comply with the requirements of the contract. Such rejected supplies shall be held at the cost and risk of the supplier who shall, when called upon, remove them immediately at his own cost and forthwith substitute them with supplies which do comply with the requirements of the contract. Failing such removal the rejected supplies shall be returned at the suppliers cost and risk. Should the supplier fail to provide the substitute supplies forthwith, the purchaser may, without giving the supplier further opportunity to substitute the rejected supplies, purchase such supplies as may be necessary at the expense of the supplier.

8.8 The provisions of clauses 8.4 to 8.7 shall not prejudice the right of the purchaser to cancel the contract on account of a breach of the conditions thereof, or to act in terms of Clause 23 of GCC.

9. Packing

9.1 The supplier shall provide such packing of the goods as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage. Packing, case size and weights shall take into consideration, where appropriate, the remoteness of the goods' final destination and the absence of heavy handling facilities at all points in transit.

9.2 The packing, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the contract, including additional requirements, if any, specified in SCC, and in any subsequent instructions ordered by the purchaser.

10. Delivery and documents

10.1 Delivery of the goods shall be made by the supplier in accordance with the terms specified in the contract. The details of shipping and/or other documents to be furnished by the supplier are specified in SCC.

10.2 Documents to be submitted by the supplier are specified in SCC.

11. Insurance

11.1 The goods supplied under the contract shall be fully insured by the bidder in a freely convertible currency against loss or damage incidental to manufacture or acquisition, transportation, storage and delivery in the manner specified in the SCC.

12. Transportation

12.1 Should a price other than an all-inclusive delivered price be required, this shall be specified in the SCC.

13. Incidental services

13.1 The supplier may be required to provide any or all of the following services, including additional services, if any, specified in SCC:

(a) performance or supervision of on-site assembly and/or commissioning of the supplied goods;

(b) furnishing of tools required for assembly and/or maintenance of the supplied goods;

(c) furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied goods;

(d) performance or supervision or maintenance and/or repair of the supplied goods, for a period of time agreed by the parties, provided that this service shall not relieve the supplier of any warranty obligations under this contract; and

(e) training of the purchaser's personnel, at the supplier's plant and/or on-site, in assembly, start-up, operation, maintenance, and/or repair of the supplied goods.

13.2 Prices charged by the supplier for incidental services, if not included in the contract price for the goods, shall be agreed upon in advance by the parties and shall not exceed the prevailing rates charged to other parties by the supplier for similar services.

14. Spare parts

14.1 As specified in SCC, the supplier may be required to provide any or all of the following materials, notifications, and information pertaining to spare parts manufactured or distributed by the supplier:

(a) such spare parts as the purchaser may elect to purchase from the supplier, provided that this election shall not relieve the supplier of any warranty obligations under the contract; and

(b) in the event of termination of production of the spare parts:

(i) Advance notification to the purchaser of the pending termination, in sufficient time to permit the purchaser to procure needed requirements; and

(ii) following such termination, furnishing at no cost to the purchaser, the blueprints, drawings, and specifications of the spare parts, if requested.

15. Warranty

15.1 The supplier warrants that the goods supplied under the contract are new, unused, of the most recent or current models and that they incorporate all recent improvements in design and materials unless provided otherwise in the contract. The supplier further warrants that all goods supplied under this contract shall have no defect, arising from design, materials, or workmanship (except when the design and/or material is required by the purchaser's specifications) or from any act or omission of the supplier, that may develop under normal use of the supplied goods in the conditions prevailing in the country of final destination.

15.2 This warranty shall remain valid for twelve (12) months after the goods, or any portion thereof as the case may be, have been delivered to and accepted at the final destination indicated in the contract, or for eighteen (18) months after the date of shipment from the port or place of loading in the source country, whichever period concludes earlier, unless specified otherwise in SCC.

15.3 The purchaser shall promptly notify the supplier in writing of any claims arising under this warranty.

15.4 Upon receipt of such notice, the supplier shall, within the period specified in SCC and with all reasonable speed, repair or replace the defective goods or parts thereof, without costs to the purchaser.

15.5 If the supplier, having been notified, fails to remedy the defect(s) within the period specified in SCC, the purchaser may proceed to take such remedial action as may be necessary, at the supplier's risk and expense and without prejudice to any other rights which the purchaser may have against the supplier under the contract.

16. Payment

16.1 The method and conditions of payment to be made to the supplier under this contract shall be specified in SCC.

16.2 The supplier shall furnish the purchaser with an invoice accompanied by a copy of the delivery note and upon fulfilment of other obligations stipulated in the contract.

16.3 Payments shall be made promptly by the purchaser, but in no case later than thirty (30) days after submission of an invoice or claim by the supplier.

16.4 Payment will be made in Rand unless otherwise stipulated in SCC.

17. Prices

17.1 Prices charged by the supplier for goods delivered and services performed under the contract shall not vary from the prices quoted by the supplier in his bid, with the exception of any price adjustments authorized in SCC or in the purchaser's request for bid validity extension, as the case may be.

18. Variation orders

18.1 In cases where the estimated value of the envisaged changes in purchase does

not vary more than **15%** of the total value of the original contract, the contractor may be instructed to deliver the goods or render the services as such. In cases of measurable quantities, the contractor may be approached to reduce the unit price, and such offers may be accepted provided that there is no escalation in price.

19. Assignment

19.1 The supplier shall not assign, in whole or in part, its obligations to perform under the contract, except with the purchaser's prior written consent.

20. Subcontracts

20.1 The supplier shall notify the purchaser in writing of all subcontracts awarded under this contract if not already specified in the bid. Such notification, in the original bid or later, shall not relieve the supplier from any liability or obligation under the contract.

21. Delays in the supplier's performance

21.1 Delivery of the goods and performance of services shall be made by the supplier in accordance with the time schedule prescribed by the purchaser in the contract.

21.2 If at any time during performance of the contract, the supplier or its subcontractor(s) should encounter conditions impeding timely delivery of the goods and performance of services, the supplier shall promptly notify the purchaser in writing of the fact of the delay, its likely duration and its cause(s). As soon as practicable after receipt of the supplier's notice, the purchaser shall evaluate the situation and may at his discretion extend the supplier's time for performance, with or without the imposition of penalties, in which case the extension shall be ratified by the parties by amendment of contract.

21.3 No provision in a contract shall be deemed to prohibit the obtaining of supplies or services from a national department, provincial department, or a local authority.

21.4 The right is reserved to procure outside of the contract small quantities or to have minor essential services executed if an emergency arises, the supplier's point of supply is not situated at or near the place where the supplies are required, or the supplier's services are not readily available.

21.5 Except as provided under GCC Clause 25, a delay by the supplier in the performance of its delivery obligations shall render the supplier liable to the imposition of penalties, pursuant to GCC Clause 22, unless an extension of time is agreed upon pursuant to GCC Clause 21.2 without the application of penalties.

21.6 Upon any delay beyond the delivery period in the case of a supplies contract, the purchaser shall, without cancelling the contract, be entitled to purchase supplies of a similar quality and up to the same quantity in substitution of the goods not supplied in conformity with the contract and to return any goods delivered later at the supplier's expense and risk, or to cancel the contract and buy such goods as may be required to complete the contract and without prejudice to his other rights, be entitled to claim damages from the supplier.

22. Penalties

22.1 Subject to GCC Clause 25, if the supplier fails to deliver any or all of the goods or to perform the services within the period(s) specified in the contract, the purchaser shall, without prejudice to its other remedies under the contract, deduct from the contract price, as a penalty, a sum calculated on the delivered price of the delayed goods or unperformed services using the current prime interest rate calculated for each day of the delay until actual delivery or performance. The purchaser may also consider termination of the contract pursuant to GCC Clause 23.

23. Termination for default

23.1 The purchaser, without prejudice to any other remedy for breach of contract, by written notice of default sent to the supplier, may terminate this contract in whole or in part:

(a) if the supplier fails to deliver any or all of the goods within the period(s) specified in the contract, or within any extension thereof granted by the purchaser pursuant to GCC Clause 21.2;

(b) if the Supplier fails to perform any other obligation(s) under the contract; or

(c) if the supplier, in the judgment of the purchaser, has engaged in corrupt or fraudulent practices in competing for or in executing the contract.

23.2 In the event the purchaser terminates the contract in whole or in part, the purchaser may procure, upon such terms and in such manner as it deems appropriate, goods, works or services similar to those undelivered, and the supplier shall be liable to the purchaser for any excess costs for such similar goods, works or services. However, the supplier shall continue performance of the contract to the extent not terminated.

24. Anti-dumping and countervailing duties and rights

24.1 When, after the date of bid, provisional payments are required, or antidumping or countervailing duties are imposed, or the amount of a provisional payment or anti-dumping or countervailing right is increased in respect of any dumped or subsidized import, the State is not liable for any amount so required or imposed, or for the amount of any such increase. When, after the said date, such a provisional payment is no longer required or any such anti-dumping or countervailing right is abolished, or where the amount of such provisional payment or any such right is reduced, any such favourable difference shall on demand be paid forthwith by the contractor to the State or the State may deduct such amounts from moneys (if any) which may otherwise be due to the contractor in regard to supplies or services which he delivered or rendered, or is to deliver or render in terms of the contract or any other contract or any other amount which may be due to him.

25. Force Majeure

25.1 Notwithstanding the provisions of GCC Clauses 22 and 23, the supplier shall not be liable for forfeiture of its performance security, damages, or termination for default if and to the extent that his delay in performance or other failure to perform his obligations under the contract is the result of an event of force majeure.

25.2 If a force majeure situation arises, the supplier shall promptly notify the purchaser in writing of such condition and the cause thereof. Unless otherwise directed by the purchaser in writing, the supplier shall continue to perform its obligations under the contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the force majeure event.

26. Termination for insolvency

26.1 The purchaser may at any time terminate the contract by giving written notice to the supplier if the supplier becomes bankrupt or otherwise insolvent. In this event, termination will be without compensation to the supplier, provided that such termination will not prejudice or affect any right of action or remedy which has accrued or will accrue thereafter to the purchaser.

27. Settlement of Disputes

27.1 If any dispute or difference of any kind whatsoever arises between the purchaser and the supplier in connection with or arising out of the contract, the parties shall make every effort to resolve amicably such dispute or difference by mutual consultation.

27.2 If, after thirty (30) days, the parties have failed to resolve their dispute or difference by such mutual consultation, then either the purchaser or the supplier may give notice to the other party of his intention to commence with mediation. No mediation in respect of this matter may be commenced unless such notice is given to the other party.

27.3 Should it not be possible to settle a dispute by means of mediation, it may be settled in a South African court of law.

27.4 Mediation proceedings shall be conducted in accordance with the rules of procedure specified in the SCC.

27.5 Notwithstanding any reference to mediation and/or court proceedings herein,

(a) the parties shall continue to perform their respective obligations under the contract unless they otherwise agree; and

(b) the purchaser shall pay the supplier any monies due the supplier.

28. Limitation of liability

28.1 Except in cases of criminal negligence or wilful misconduct, and in the case of infringement pursuant to Clause 6;

(a) the supplier shall not be liable to the purchaser, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, provided that this exclusion shall not apply to any obligation of the supplier to pay penalties and/or damages to the purchaser; and

(b) the aggregate liability of the supplier to the purchaser, whether under the contract, in tort or otherwise, shall not exceed the total contract price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment.

29. Governing language

29.1 The contract shall be written in English. All correspondence and other documents pertaining to the contract that is exchanged by the parties shall also be written in English.

30. Applicable law

30.1 The contract shall be interpreted in accordance with South African laws, unless otherwise specified in SCC.

31. Notices

31.1 Every written acceptance of a bid shall be posted to the supplier concerned by registered or certified mail and any other notice to him shall be posted by ordinary mail to the address furnished in his bid or to the address notified later by him in writing and such posting shall be deemed to be proper service of such notice

31.2 The time mentioned in the contract documents for performing any act after such aforesaid notice has been given, shall be reckoned from the date of posting of such notice.

32. Taxes and duties

32.1 A foreign supplier shall be entirely responsible for all taxes, stamp duties, license fees, and other such levies imposed outside the purchaser's country.

32.2 A local supplier shall be entirely responsible for all taxes, duties, license fees, etc., incurred until delivery of the contracted goods to the purchaser.

32.3 No contract shall be concluded with any bidder whose tax matters are not in order. Prior to the award of a bid, Parliament must be in possession of a tax clearance certificate, submitted by the bidder. This certificate must be an original issued by the South African Revenue Services (SARS).

33. Transfer of contracts

33.1 The contractor shall not abandon, transfer, cede assign or sublet a contract or part thereof without the written permission of the purchaser

34. Amendment of contracts

34.1 No agreement to amend or vary a contract or order or the conditions, stipulations or provisions thereof shall be valid and of any force unless such agreement to amend or vary is entered into in writing and signed by the contracting parties. Any waiver of the requirement that the agreement to amend or vary shall be in writing, shall also be in writing.

35. Prohibition of restrictive practices

35.1 In terms of section 4 (1) (b) (iii) of the Competition Act No. 89 of 1998, as amended, an agreement between, or concerted practice by, firms, or a decision by an association of firms, is prohibited if it is between parties in a horizontal relationship and if a bidder(s) is / are or a contractor(s) was / were involved in collusive bidding.

35.2 If a bidder(s) or contractor(s) based on reasonable grounds or evidence obtained by the purchaser has / have engaged in the restrictive practice referred to above, the purchaser may refer the matter to the Competition Commission for investigation and possible imposition of administrative penalties as contemplated in section 59 of the Competition Act No 89 0f 1998.

35.3 If a bidder(s) or contractor(s) has / have been found guilty by the Competition Commission of the restrictive practice referred to above, the purchaser may, in addition and without prejudice to any other remedy provided for, invalidate the bid(s) for such item(s) offered, and / or terminate the contract in whole or part, and / or restrict the bidder(s) or contractor(s) from conducting business with the public sector for a period not exceeding ten (10) years and / or claim damages from the bidder(s) or contractor(s) concerned.

C3.8 LABOUR INTENSIVE CONSTRUCTION

Not applicable to Contract

C4 SITE INFORMATION

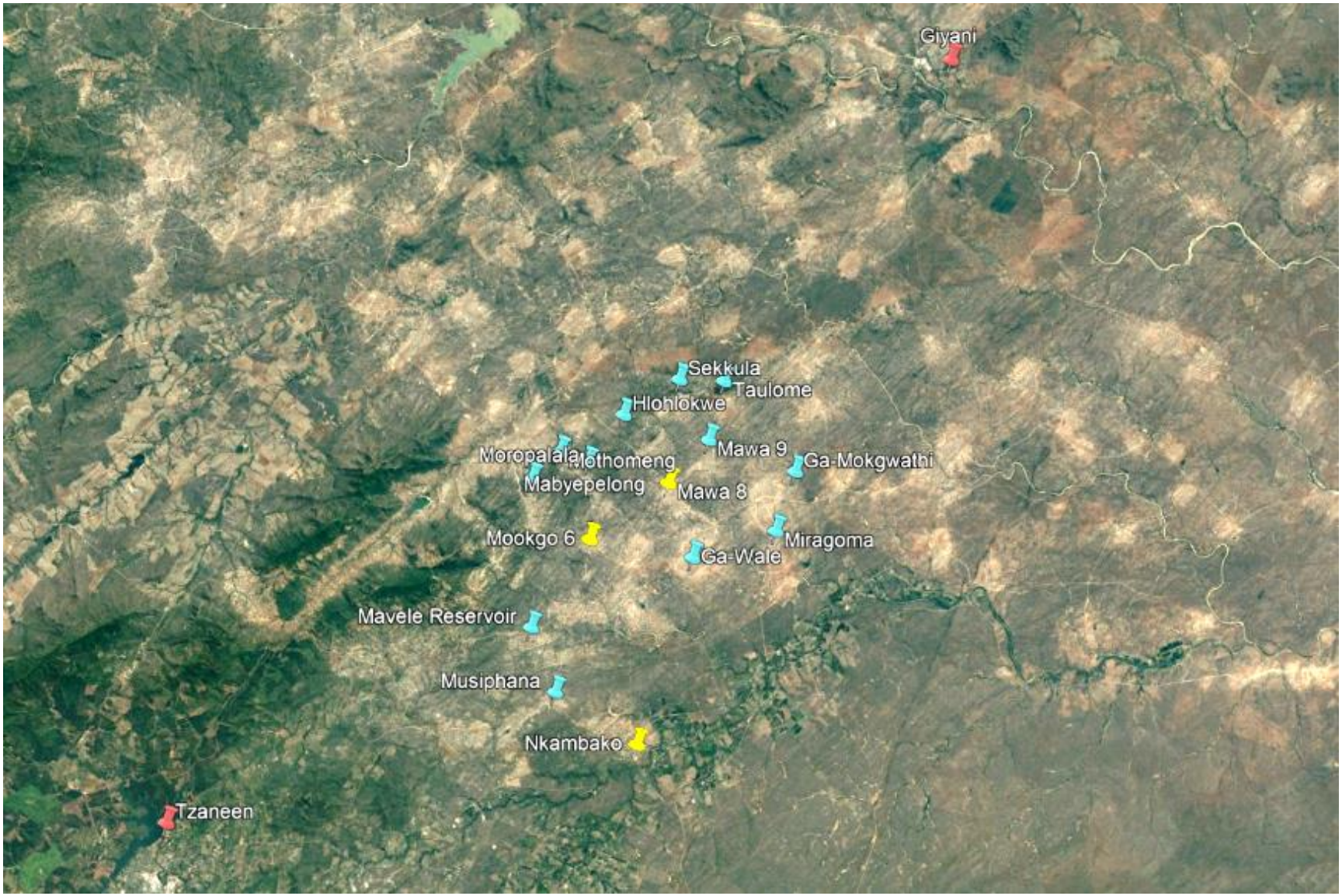
C4.1 LOCATION OF SITE

The project locality is as indicated on a locality map appended overleaf.

Table 1: Approximate Project Location Areas

Village	Latitude	Longitude
Nkambako	23°44'59.42" S	30°29'27.67" E
Musiphana	23°42'59.68" S	30°26'04.98" E
Babanana	23°41'57.57" S	30°23'17.02" E
Mawa 8	23°35'01.90" S	30°30'46.05" E
Hlohlokwe	23°32'28.02" S	30°28'53.68" E
Sekula	23°31'10.69" S	30°33'02.46" E
Mookgo 6	23°37'11.75" S	30°27'30.06" E
Mothomeng	23°33'49.79" S	30°26'34.44" E
Ga-Wale	23°37'44.90" S	30°31'27.34" E
Miragoma	23°36'52.32" S	30°35'11.66" E
Ga-Mokgwathi	23°34'35.76" S	30°35'59.65" E

SITE INFORMATION



ANNEXURE 1: MATERIALS LIST AND GENERAL ARRANGEMENT DRAWINGS

DRAWINGS

The drawings issued to tenders as part of the tender documents must be regarded as provisional and preliminary for the tenderer's benefit to generally assess the scope of work. The drawings may be issued as a separate book of drawings or else bound in as part of this document.

The work shall be carried out in accordance with the latest available revision of the drawings approved for construction (AFC)

At commencement of the contract, the Engineer shall deliver to the Contractor copies of the AFC drawings and any instructions required for the commencement of the works. From time to time thereafter during the progress of the works, the Engineer may issue further drawings for construction purposes as may be necessary for adequate construction, completion and defects correction of the works.

Tender drawings are issued separately and are listed hereunder:

LIST OF DRAWINGS

LIST OF DRAWINGS			
DESCRIPTION	**REV NO.**	**SHEET**	**REG NO.**
PART I: GENERAL			
DRAWING LIST	00	1 OF 1	C1201–1010
PART II: PIPELINE CHAMBERS			
LINE 2 CHAMBERS:			
AIR VALVE CHAMBER TYPE 1	00	1 OF 1	C1201–1015
AIR VALVE CHAMBER TYPE 2	00	1 OF 1	C1201–1016
SCOUR VALVE CHAMBER TYPE 1	00	1 OF 1	C1201–1017
SCOUR VALVE CHAMBER TYPE 2	00	1 OF 1	C1201–1018
ISOLATING VALVE CHAMBER TYPE 1	00	1 OF 1	C1201–1019
FLOW METER CHAMBER AT SEKHULA AND TAULOME RESERVOIR SITE	00	1 OF 1	C1201–1020
LINE 3 CHAMBERS:			
AIR VALVE CHAMBER TYPE 1	00	1 OF 1	C1201–1025
SCOUR VALVE CHAMBER TYPE 1	00	1 OF 1	C1201–1026
SCOUR VALVE CHAMBER TYPE 2	00	1 OF 1	C1201–1027
ISOLATING, SCOUR VALVE CHAMBER AND OFF–TAKE TYPE 1	00	1 OF 2	C1201–1028
ISOLATING, SCOUR VALVE CHAMBER AND OFF–TAKE TYPE 1	00	2 OF 2	C1201–1029
ISOLATING SCOUR VALVE CHAMBER TYPE 1	00	1 OF 1	C1201–1030
FLOW METER CHAMBER AT MORAPALALA EXISTING RESERVOIR	00	1 OF 1	C1201–1031
LINE 4 CHAMBERS:			
AIR VALVE CHAMBER TYPE 1	00	1 OF 1	C1201–1032
SCOUR VALVE CHAMBER TYPE 1	00	1 OF 1	C1201–1033
PART III: RESERVOIR CHAMBERS			
5000KL COMMAND RESERVOIR CHAMBERS:			
5000KL COMMAND RESERVOIR PIPE LIST	00	1 OF 1	C1201–1205
OUTLET CHAMBER AT 5000KL COMMAND RESERVOIR CIVIL ARRAIGNMENT	00	1 OF 2	C1201–1206
OUTLET CHAMBER AT 5000KL COMMAND RESERVOIR PIPE LIST	00	2 OF 2	C1201–1207
INLET CHAMBER AT 5000KL COMMAND RESERVOIR CIVIL ARRAIGNMENT	00	1 OF 2	C1201–1208
INLET CHAMBER AT 5000KL COMMAND RESERVOIR PIPE LIST	00	2 OF 2	C1201–1209
DRAINAGE CHAMBER AT 5000KL COMMAND RESERVOIR CIVIL ARRAIGNMENT	00	1 OF 2	C1201–1210
DRAINAGE CHAMBER AT 5000KL COMMAND RESERVOIR PIPE LIST	00	2 OF 2	C1201–1211
GA–MOKGWATHI CHAMBERS:			
GA–MOKGWATHI RESERVOIR DRAINAGE CHAMBER	00	1 OF 1	C1201–1244
GA–MOKGWATHI RESERVOIR INLET CHAMBER	00	1 OF 2	C1201–1245
GA–MOKGWATHI RESERVOIR OUTLET CHAMBER	00	2 OF 2	C1201–1246
MOTHOMENG CHAMBERS:			
MOTHOMENG RESERVOIR PIPE SPECIALS	00	1 OF 1	C1201–1251
MOOKGO 6 CHAMBERS:			
MOOKGO 6 RESERVOIR CIVIL ARRAIGNMENT	00	1 OF 1	C1201–1261
MOOKGO 6 RESERVOIR PIPE LIST	00	1 OF 2	C1201–1264