MOKOLO AND CROCODILE WATER AUGMENTATION PROJECT PHASE 2 (MCWAP-2)

TENDER NO 054/2024/PMID/MCWAP2/RFB

PART C3.1
SPECIFICATION

SECTION 35

VALVES

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SECTION 35
VALVES

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SECTION 35

VALVES

35.1 SCOPE

This Section deals with the design, manufacture, installation and commissioning of all valves and ancillaries for the control of raw water. This Section furthermore covers the flange machining standards, dimensions, the range and type of gaskets, corrosion protection and jointing to be used for flange joints.

This Section shall be interpreted as follows:

a) For the Employer's design components it shall be regarded as a specification.

b) For the Contractor's design it shall be regarded as an Employer's Requirement.

This Section shall be read in conjunction with the rest of the Contract, in particular with Section 37 – Painting and Corrosion Protection, Section 28 – Mechanical General, Section 38 - Electrical General and Section 48 – Tests on Completion.

35.1.1 Scope of Work Included in this Contract

a) The Contract shall include the manufacture, shop assembly and testing, corrosion protection, delivery to site, storage and installation at site, site painting, testing and maintenance during the Defects Notification Period of all the various types of valves to be used under this Contract.

b) All valves shall be supplied, where relevant, complete with gearboxes, hand wheels, bolts, nuts, studs, washers and gaskets for mounting them to the pipe work as indicated.

c) Main isolating valves shall be supplied with electric actuators and gearbox where specified on the Drawings. These actuators shall in general conform to the requirements of Clause 35.6 – Auxiliary Drives. In cases where the actuator shall perform a control / modulation function it is described in Section 40 and Section 41.

d) Wiring between the actuator and distribution box forms part of this scope of supply.

e) The valves to be supplied under this Contract are as listed in the Bill of Quantity and indicated on the relevant Drawings.

35.2 DEFINITIONS, ABBREVIATIONS AND REFERENCES

35.2.1 Definitions

For the purpose of this Section the following definitions apply:

a) **"Face to face dimension"** means the distance between the two planes perpendicular to the body axis located at the extremities of the body and ports.

b) **"Nominal pressure (PN)"** is a numerical designation, which is a convenient round number for reference purposes. It is designated by PN followed by the maximum allowable working pressure, of which the flange is intended to be a component, will be subjected under normal working conditions. This definition is in accordance with ISO 7268. All pressure units throughout this Section will be recorded in kilopascals (kPa).

c) **"Nominal size (DN)"** is a numerical designation of size that is common to all components in a piping system other than components designated by outside diameters. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions in millimetres. Nominal size is designated by DN followed by the size in millimetres. This definition is in accordance with ISO 6708. All Plant of the same size (DN), designated by the same PN number, and shall have compatible mating dimensions.

d) **"Tight shut off valve"** means a valve that has no leakage past the sealing faces in its closed position under test conditions.

e) **"Low leakage rated valve"** means a valve that has an agreed maximum leakage rate past the sealing faces when the valve is in the closed position.

f) **"Regulating valve"** means a valve intended for regulating pressure and flow, and which may have a clearance between the sealing faces when the valve is in the closed position.

g) **"Pressure rating"** is the maximum allowable working pressure of an installation of which the flange is intended to be a component.

h) **"Factory Acceptance Test (FAT)"** shall refer to all tests done on Plant or Plant items at the factory to ensure its functionality.

i) **"Pre-commissioning"** shall refer to the functional field test done on specific part of Plant on Site. This forms part of Tests on Completion as specified in Section 48.

35.2.2 Abbreviations and Symbols

AC	:	Alternating current
AIA	:	Approved Inspection Authority
API	:	American Petroleum Industry
ASME	:	American Society of Mechanical Engineers
ASTM	:	American Society for Testing Materials
AWWA	:	American Water Works Association
BS	:	British Standard
BS EN	:	British Standard and European Norm
BSP	:	British Standard pipe thread
DC	:	Direct current
DIN	:	Deutsches Institut für Normung (German Institute for Norm)
DN	:	Nominal diameter – (ISO 6708)
ERW	:	Electrical resistance weld
FA	:	Flange adaptor
FAT	:	Factory Acceptance Test
FBE	:	Flanged both ends
FOE	:	Flanged one end
FW	:	Field weld
ID	:	Inside diameter
IP	:	Ingress protection
ISO	:	International Standards Organisation
LED	:	Light emitting diode
NDE	:	Non drive end
NPT	:	National pipe thread (American)

OD : Outside diameter
PBE : Plain both ends
PCD : Pitch circle diameter
PLC : Programmable Logic Controller
PN : Nominal pressure (Rating) - (ISO 7268)
PQI : Production Quality Inspectorate
QCP : Quality Control Plan
RFA : Restrained flange adaptor
RFC : Ready for commissioning
RFO : Ready for operation
RFTO : Ready for trial operation
SANS : South African National Standard
SOC : Slip-on coupling

Where appropriate the following abbreviations shall refer to the material designated:

AB : Aluminium bronze
AI : Austenitic cast iron
CS : Cast steel
GM : Gunmetal
IS : Integral seat
MS : Mild (carbon) steel
NC : Nickel copper
PB : Phosphor bronze
PTFE : Polyterafluoroethylene
RS : Resilient seat
SG : Spheroidal graphite cast iron
SS : Stainless steel
WDS : Weld deposited seat

35.2.3 References

When reference is made to a Code of Practice, Specification or Standard, the reference shall be taken to mean the latest edition or replacement at time of tender of the Code, Specification or Standard; including addenda, supplements, modifications and revisions thereto. Where a previous version is intentionally used, it will be indicated as such. Where reference is made to a Code, Specification or Standard that has subsequently been withdrawn and not replaced, the intended content will remain relevant unless confirmed otherwise in writing by the Engineer.

35.3 GENERAL DESIGN REQUIREMENTS

35.3.1 Operating Conditions and Climate

For water quality reference should be made to Section 28 – Mechanical General, Clause 28.4 and for climatic conditions reference should be made to Part C4 for Hydrological Data.

35.3.2 Design Requirements

Isolating valves shall be designed for various hydraulic conditions and be capable of opening and closing under these conditions.

The quality of the raw water is specified in Section 28 - Mechanical General.

Under normal operating conditions, the maximum flow rate shall result in a mean velocity not exceeding 2.5 m/s unless otherwise approved by the Engineer.

Seal arrangements shall be as described in Clause 35.4.3.

The Contractor shall ensure that the design of the valve eliminates cavitation at the design maximum flow rate for normal operating conditions.

The Contractor shall ensure that the gearbox and hand wheel arrangement of all valves supplied are as shown on the Drawings.

The flow rate through scour wedge gate valves shall under normal operating conditions not exceed a maximum flow velocity of 7 m/s.

35.3.3 Nominal Pressure

Each valve is assigned a nominal pressure (PN) rating in kPa as defined in Clause 35.2.1. Factory testing of the valve body and seal shall be done in accordance with Clause 35.5.2.

35.3.4 Minimum Pressure Rating

The minimum pressure rating for any valve and associated Plant irrespective of lower system pressures shall be 1000 kPa.

35.3.5 Design Life

All valves and appurtenant fittings shall be designed for a useful life of twenty two and a half (22.5) years under the specified operating conditions (refer to Clause 35.3.1).

35.3.6 Flanges

This clause shall be read in conjunction with Clause 28.15 under Section 28 – Mechanical General with the following additions:

a) All holes shall be drilled perpendicular to the face. Cast flanges shall either be machined or spot faced on the bolt head / nut bearing faces.

b) Sufficient clearance shall be allowed between the body and flange to enable flange bolts to be removed or tightened. Tapped holes shall be permissible only where stiffening ribs or shaft bosses interfere with bolts.

c) One flange of the valve body shall be clearly marked, identifying the respective pressure rating. (Refer to Clause 35.4.8).

d) Reference shall also be made to Section 32 - Pipes and Pipe Specials for joining of valves to adjacent pipe work and Section 33 – Laying and Pressure Testing of Steel Pipes for joining of pipes.

e) It will remain the responsibility of the Contractor to ensure that flanges between valves and pipe specials connections matches.

35.3.7 Fasteners and Jointing Material

This clause shall be read in conjunction with Clauses 28.14 and 28.15 under Section 28 – Mechanical General with the following additions:

a) Valves shall be supplied complete with bolt units, consisting of a standard length bolt, nut and two washers. The stud unit, where applicable, shall be supplied with a standard length stud, nut and washer. Washers shall be fitted under all bolt / screw heads and nuts.

b) The manufacturer shall specify a fastening sequence for bolts (if applicable) and the torque settings (in Nm) for all bolts. These torque settings and fastening sequences shall be included in the Operation and Maintenance Manual.

c) In addition each valve shall be supplied with 3 mm non-asbestos type gaskets or insulating gaskets complete with explosion-proof spark gap arrestors as indicated on the Drawings.

d) Depending on the valve location in a piping system and the atmospheric conditions, the following specifications will apply:

   i) Black bolted units: SANS 1700;

   ii) Precision bolted units: SANS 136;

   iii) Galvanised bolted units: SANS 121 (ISO 1461);

   iv) Stainless steel bolted units: DIN 931 complete with insulating kit (on all stainless steel and 3CR12 piping and specials and where specified); and

   v) Stainless steel set screws: DIN 933.

Where shown on the Drawings flange insulating kits shall be supplied with the correct size bolts and nuts together with two insulating washers, and insulating sleeve for each bolt. All insulating gaskets shall be of the full-face type so as to prevent foreign material from collecting and creating a bridge, thus shorting out the isolation.

For all valve components, i.e. bonnet covers, glands etc., drilled holes for bolts shall be perpendicular to the flange face.

All bolts and stud units shall be the same length, appropriately sized and shall be corrosion protected as per Section 37 - Painting and Corrosion Protection and comply with Section 28 – Mechanical General.

35.3.8 Contact between Dissimilar Metals

35.3.9 Corrosion Protection

Corrosion protection shall be as specified in Section 37 – Painting and Corrosion Protection or by agreement in accordance with manufacturers' standards, modified where appropriate to meet the operating parameters specified.

35.3.10 Valve Supports and Lifting

Valves of DN400 and larger shall have supports integrally cast with the valve body. These supports shall avoid obstruction to bolt access at concrete plinths, as follows:

Valves DN400 to DN1000:	100 mm below the flange OD*
Valves above DN1000:	150 mm below the flange OD*

*Note: Minimum allowable vertical dimension from support seat on concrete plinth to flange OD at six o'clock position.

Each valve over DN300 or 100 kg mass shall either have two removable eye bolts of the required strength securely attached to the valve body or lifting eyes forming an integral part of the valve body to facilitate easy handling during transport and installation.

35.3.11 Bypasses

35.3.11.1 General

Where specified, valves shall be fitted with bypasses and bypass valves. Pipes shall be flanged.

Pipes and fittings which, due to their small sizes, are difficult to be internally corrosion protected shall be manufactured from stainless steel GR 316L and pickled and passivated after fabrication.

Pipes and specials for valve bypasses shall be manufactured in accordance with SANS 719 and all referred specifications. Either longitudinal butt welding or spiral welding is acceptable.

The surface finish after fabrication shall be free of score marks, pits, weld spatter and other defects that may affect the performance of the steel in service.

Fabrication of corrosion resistant steel i.e. stainless steel and 3CR12 pipes must take place in a shop, separated from carbon steel components. All equipment used in the forming and manipulation of corrosive resistant steel pipes and specials during manufacture shall be clean and free of materials that may introduce defects or contaminate the metal with carbon steel.

35.3.11.2 Welding

Welding shall be done in accordance with API 1104 and API 5L for mild steel and BSS 4677: 1984 for corrosion resistant steel.

Welding of flanges shall be done in accordance with BS EN 13480-4: 2002.

Weld strength shall not be less than 90 % of that of the plate calculated on the original measured thickness of the plate before welding.

The welding process used should limit heat input to a minimum. Process used can include the following:

a) Manual metal arc (MMA)

b) Metal inert gas (MIG)

c) Tungsten inert gas (TIG)

35.3.12 Pressure Gauges

Where specified, valves shall be fitted with stainless steel casing glycerine filled pressure gauges complete with separate stainless steel isolating ball cocks. The pressure gauges shall conform to SANS 1062: 2010.

The gauge face shall have a minimum diameter of 100 mm with an inverted scale, black lettering and needle on a white background. A red line or needle shall where applicable indicate the maximum safe working pressure. Pressure gauges shall be calibrated in increments of 5% of the full scale reading. The normal working pressure shall be a reading of between 50 and 75% of the full scale.

35.3.13 Materials

Unless otherwise specified in this Section, valve bodies and components shall be of the materials listed below:

Mild steel	: BS 4360 Gr 43, SANS 1431 Gr 350WA
SG iron	: BS EN 1563:1997, SANS 936 - SG 420
Cast steel	: BS EN 10213-1:2007, SANS 1465 Part 1:2008
Stainless steel components	: BS EN 10090:1998

All material shall be new and of first grade quality. Material certificates for all materials shall be supplied.

Where copper alloys are used they shall have a zinc content of less than 0,5% and shall be suitably insulated against galvanic corrosion.

Cast material shall only be cast in moulds coated with a mould wash.

Cast components shall not be warped or distorted in any way.

No repair of cast components will be permitted unless approved by the Engineer.

The structure of cast components shall be homogeneous and free from non-metallic impurities or visible chaplets.

Items to be galvanized shall be fabricated from aluminium-killed steel or silicon-killed steel with < 0,04% Silicon and 0,009 < Phosphor < 0,025%.

35.3.14 South African Representation

Valve suppliers shall have substantial South African representation with comprehensive technical “know-how”, service and spares available. Refer to the Department of Trade and Industry’s decision to designate valves for local procurement by State-owned companies. The Employers requirements regarding local content for the different type of valves as reflected in the conditions of tender are aligned with the National Treasury Instruction Note issued in terms of regulation 9(2) of the Preferential Procurement Act on 6 February 2014.

35.4 MANUFACTURING REQUIREMENTS

35.4.1 Bodies

Bodies shall be of sturdy construction, capable of functioning satisfactorily under abnormal operating conditions without distortion of the body or malfunction of component parts and shall be shaped to give minimum change in waterway.

Designs of bodies and components shall be free of pockets that cause eddies or accumulate debris.

Where applicable, access openings and covers shall be well designed and the creation of stress risers shall be prevented. Any gussets applicable to the design of the valve should form an integral part of the casting.

35.4.2 Doors and Discs

Doors and discs shall, were applicable, be cast or fabricated as a unit with integrally cast hinge lugs.

Doors and discs shall operate freely. Their travel shall however be restricted by the provision of substantial stops, fitted with specified facings to minimize wear and damage to the corrosion protection.

35.4.3 Sealing Faces

Sealing faces shall be deposit welded with stainless steel. Where approved in writing by the Engineer the sealing faces may be securely fixed with corrosion resistant elements.

Faces shall be accurately machined and finished to promote seal life.

35.4.4 Bearings

Main bearings shall, were applicable, be external and accessible without emptying or removal of the valve body from the line.

Bearings shall be designed to take any unbalanced thrusts on doors or discs.

Bearings shall retain a low co-efficient of friction. Any possibility of bearings becoming tight during service due to ageing shall be eliminated.

Where possible, bearings shall be water lubricated with a proven record of reliable operation of not less than five (5) years.

Details of the type and construction of bearings shall be as specified in the relevant Valve Specification.

Where shafts protrude through the valve at the non-drive end (NDE) they shall be sealed with bolted stainless steel, grade 316, bearing cover plates. Screwed taper plug covers are not acceptable.

Sleeve type bearings shall be fully corrosion resistant and shall be fitted in the hubs in the valve body. Steel back bearings shall not be accepted.

35.4.5 Bearing and Shaft Seals

Bearing and shaft seals shall be of the "O" ring or radial cup type with machined weep holes or grooves for drainage at the gearbox mounting flange.

35.4.6 Hand Wheels

All valves shall be supplied complete with cast hand wheels of sturdy construction, which shall have the wording, “OPEN” and “CLOSE” together with directional arrows legibly cast in recesses, on the upper surface of the rim.

Closure of valves shall be through the clock-wise rotation of hand wheels. All valves shall be capable of being opened or closed under an unbalanced pressure equal to the Nominal Pressure. The effort required on hand wheels to open or close valves under these conditions shall not exceed the following:

Valve Size	Seating / Unseating	Intermittent
Up to and including DN 600	500 N	200 N
Above DN 600	800 N	300 N

Hand wheels shall be manufactured to ensure a close fit between the hand wheel and the mating spindle head and shall be firmly fixed to the spindle head. Loose fitting hand wheels are not acceptable. Shear pins or torque clutches shall be fitted to prevent damage.

35.4.7 Lubricating Points

All lubricating points for grease gun lubrication shall be fitted with 1/8" BSP stainless steel button head type grease nipples. Nipples shall be painted red for easy identification. Electro-plated nipples will under no circumstances be accepted.

35.4.8 Marking

35.4.8.1 General

Each valve shall be clearly marked in accordance with the requirements of BS EN 19:1992.

35.4.8.2 Body Marking

All valve bodies shall be permanently and indelibly marked (cast in minimum 15 mm lettering size on castings or welded on fabricated valves) as follows:

a) Nominal size (DN in mm);

b) Nominal pressure (PN in kPa);

c) Arrow to indicate the direction of flow;

d) Material of construction; and

e) The Contract number plus identification number (also item number) as per P&ID Drawings to identify each individual valve. This number is for quality control purposes only and may be cast separate from the other information.

All the above markings shall be legible after painting.

35.4.8.3 Flange Marking

In addition to the above, one flange of a flanged valve shall be clearly marked with a single set of machined notches (at least 3 mm wide, 3 mm deep across the full width of the flange) to indicate the operating (working) pressure.

For wafer type valves, the width and depth of the notch shall be identical to that of the flanged valves (the length of the notch however shall be min 12 mm long):

- One notch - 1 000 kPa operating pressure
- Two notches - 1 600 kPa operating pressure
- Three notches - 2 500 kPa operating pressure
- Four notches - 4 000 kPa operating pressure
- Five notches - 6 400 kPa operating pressure

35.4.8.4 Gate and Body Marks

One face of the gate shall be marked, corresponding to a similar mark on the body, to ensure correct replacement after dismantling. The marks shall be visible and clear after coating. The details of the marking shall be shown on the manufacturing drawings.

35.4.8.5 Identification Plate Markings

Identification plate markings shall be hard-stamped, printed or engraved on a stainless steel nameplate fitted to the valve with stainless steel cap or drive screws (Refer to Annexure 35/1 Figure 1). If necessary, a boss / raised face shall be cast integrally with the body to fit the nameplates.

Information listed on a name plate shall be as follows:

a) Manufacturer's name or trade mark;

b) Nominal size (DN) in millimetres;

c) Contract number;

d) Nominal pressure (PN) in bar;

e) Serial number;

f) Item number (also identification number);

g) Material, disc / gate and body;

h) Date of manufacture; and

i) Mass of valve in kg.

35.4.9 Position Indicators

Position indicating plates shall be embossed to clearly show the fully open, ¾, ½, ¼, and closed positions (Refer to Annexure 35/1 Figure 2).

Electronic or hydraulic position indicators are preferred. Full details shall however be as supplied with the offer. Special valve position indicators, calibrated in the specified increments of the valve opening, shall be designed, supplied and installed as required in this Section.

The indicator system shall be accurately installed and calibrated to give true linear indication of the valve opening. Calibration of the indicator scale shall be done in-situ to show actual valve position recorded against the actual valve operation.

All pulleys, brackets, pins, cables, counterweights, sleeves, indicator gears and fasteners shall be of stainless steel 304 or better.

Where specified, valves shall be supplied with electrical limit switches for fully open and fully closed positions plus any other I/O requirements as shown on the Drawings and I/O schedule. Limit switches will be connected to 24 V DC PLC input cards by the Contractor or his Subcontractor. The valve manufacturer shall make provision for all cable and wire connections to these limit switches.

Electronic position indicators (proximity switches) for fully open and fully closed position indication are required on all butterfly valves as specified.

In-line isolating valves shall be supplied with a mechanical lockout facility in both the open and closed positions.

35.4.10 Actuators

Where required, actuators shall be in accordance with Clause 35.6 – Auxiliary Drives.

35.5 TESTING AND COMMISSIONING REQUIREMENTS

35.5.1 Inspection and Quality Control

Inspection and quality control shall be in accordance with Sections 28 and 38 for Mechanical General and Electrical General respectively.

An example of a QCP's for the manufacturing valves are attached at end of this Section as Annexure 35/2 - Quality Control Plan for Manufacture of Valves.

Further specific requirements for quality control and testing of valves given in the following paragraphs:

35.5.1.1 Factory Acceptance Test (FAT)

Valves shall be pressure tested by the manufacturer at the factory to prove the structural integrity of the body and that the fully assembled valves are capable of functioning satisfactorily under the specified operating conditions. Valid calibration certificates of testing equipment to be used for pressure testing of the valves by the manufacturer should be made available to the Engineer.

35.5.1.2 Pressure Testing

Test flanges shall be used. Tie-bolts or other forms of restraint applied across the blank flanges for the testing of flanged valves will not be permitted except in the case of wafer type valves.
Note:

a) Valve undergoing pressure testing shall not be subject to shock loading.

b) Valves and connections shall be purged of air prior to pressure testing.

35.5.1.3 Test Fluid

The test fluid for all pressure tests shall be either water with the addition of a corrosion inhibitor, or another non-corrosive liquid with a viscosity at ambient temperature equal to or less than that of water.

35.5.2 Test Procedures

35.5.2.1 General

Test pressures shall be maintained for not less than five (5) minutes but maximum of thirty (30) minutes or as otherwise specified by the Engineer and the valves shall be watertight in all respects.

Structural and seat tests shall be executed on both sides of double seated valves i.e. gate valves.

All valves, fully assembled, shall be pressure tested by the manufacturer in accordance with Table 35/1.

TABLE 35/1
APPLICABILITY OF HYDROSTATIC PRESSURE TESTS

TEST	VALVE TYPE	
	TIGHT SHUT-OFF	LOW LEAKAGE
a) Structural		
(i) Body	✓	✓
(ii) Disc Strength	✓	✓
b) Seat / Seal	✓	N/A

35.5.2.2 Structural Tests

(a) Body Test

This shall be a hydrostatic pressure test at a pressure of 1.5 times the maximum permissible working pressure, at ambient temperature.

Testing of the valve bodies shall be carried out without the disc assembled and before valves are coated or lined with materials that are capable of sealing against leakages. Both ends of the body shall be blanked off so that the valve is subjected to the full pressure stresses in all directions induced by the test pressure.

There shall be no visually detectable leakage and/or signs of sweating through the shell of the valve during the test period.

(b) Disc / Gate Test

This shall be a hydrostatic pressure test at a pressure of 1.5 times the maximum permissible working pressure at ambient temperature.

The valve shall be closed in the normal manner and the test pressure applied to one side of the disc with the other side open to atmosphere. There shall be no visible evidence of structural damage to or deformation of the disc or leakage through the disc or gate during the test duration.

Seepage past gland seals during structural tests shall not be cause for rejection, provided that the gland seals are watertight when the internal test pressure is reduced to 1.1 times the maximum permissible working pressure at ambient temperature.

(c) Seat / Seal Test

This shall be a hydrostatic pressure tested at a pressure of 1.1 times the maximum permissible working pressure at ambient temperature.

Each assembled valve, with corrosion protection completed, shall be subjected to open-ended tests for drop tightness at 1.1 times the permissible working pressures at ambient temperature. Valves shall be drop tight over the complete range of pressures. Valves with symmetrical seating and double acting valves shall be tested in both directions.

The maximum permissible leakage shall be as given in Table 35/2.

TABLE 35/2
TEST PRESSURE LEAKAGE RATES

VALVE TYPE	LEAKAGE RATE
Tight shut-off (all valves except wedge gate valves)	Rate 3: No visible leakage for duration of test.
Low leakage (wedge gate valves only)	Rate 1: 0.7 mℓ/min x DN

*Note: Leakage rates are as defined in BS 5146: Part 2

35.5.2.3 Test Certificate

When a test certificate is issued it shall contain a statement by the manufacturer confirming that the valves have been tested in accordance with this standard and stating the actual pressures and medium used in the test.

35.5.2.4 Anti-static

Valves designated as anti-static shall have electrical continuity between shaft, disc and body when tested in accordance with A.2 of BS 5146: Part 1.

35.5.2.5 Functional Test Requirement

The manufacturer shall do a functional test on each valve. This shall consist of taking the valve through one complete cycle, from fully closed to fully open and back. The manufacturer shall take particular note that the valve position indicator is correctly calibrated.

35.5.3 Plant Drawings

The Contractor shall submit drawings at the following stages for the purpose stated:

i) Manufacturing - approval;

ii) Installation - approval; and

iii) As-built - records.

The Contractor shall prepare and submit drawings to an acceptable industry standard and in accordance with Section 28 – Mechanical General, an example of which shall be submitted for approval before draughting commences.

35.5.4 Operation and Maintenance Manuals

Seven copies of the approved Operation and Maintenance Manuals shall be supplied. A draft copy of the manuals shall be submitted for approval simultaneously with the drawings for manufacturing purposes.

These manuals shall be in accordance with the requirements of Section 48 – Tests on Completion.

35.5.5 Handling and Transport

All handling and transport of valves shall be done in accordance with the requirements of Section 28 - Mechanical General. In addition, the ends of valves and fittings shall be securely blanked off with temporary sturdy plywood blank flanges in order to protect the corrosion protection (lining). These items shall be clearly marked:

“DO NOT REMOVE UNTIL FINAL INSTALLATION”

Plastic sheeting will not be acceptable.

Bolts and other small parts shall be sewn up in strong bags and crated. The bags shall be tagged using metallic tags and indicate the following information:

- Manufacturer's identification and contract number;
- Part numbers;
- Description;
- Sizes; and
- Quantities.

Each bag shall have the delivery address listed on a separate metallic tag.

The use of ropes, wire or chains for lifting valves without suitable padding is strictly forbidden. For transport or storage purposes, balks of timber beams shall be used to support the valves on any surface and separate them from each other.

Precautions shall be taken to support and chock the valves to prevent movement when loading onto vehicles. Valves or components of valves shall be firmly lashed or chained with padded lashing supported on sawdust bags. The area of padded surfaces shall be adequate to prevent damage to coatings.

The Engineer shall be notified of the delivery date and of any requirements regarding off-loading and storage at site.

For site delivery, the transportation, off-loading of Plant by crane and supervision during off-loading shall be the responsibility of the Contractor. The final inspection and acceptance of Plant supplied will be undertaken on site after off-loading has been completed. Any damage that occurs during the handling, assembly and storage of Plant at the Manufacturer or Contractor's works, including transportation to Site, shall be repaired by the Contractor at his own cost, in accordance with the valve Specification and to the satisfaction of the Engineer.

35.6 AUXILIARY DRIVES

35.6.1 General Requirements

35.6.1.1 General

This Section comprises the Specification for electric actuators to be fitted to valves of various types. All actuators shall be complete with operation manual. In order to minimise the amount of spare parts required, parts such as covers, plug / sockets etc., shall be interchangeable throughout the model sizes installed.

35.6.1.2 Compliance

Actuators for the motorised operation of valves shall comply with this Section in all respects.

Should it be necessary to deviate from the Specification, the reasons for such non-compliance shall have been fully described and motivated in writing at tendering stage.

The Engineer’s written acceptance of such motivation shall be obtained before proceeding. All such documentation shall form part of the Contract and be retained for record purposes.

35.6.1.3 Design Life

The actuators shall be designed for a minimum maintenance-free life of 10 000 operating cycles, assuming maximum seating torque at the end of each stroke and an average of 33% of maximum seating torque during each stroke.

The actuators shall be designed to withstand frequent power failures of unspecified duration. Actuators shall be designed in such a way, that exposure to the environment will not interfere with the safe operation. All joints shall be sealed by radial seals or O-rings.

35.6.1.4 Actuator Selection

The available torque transmitted to a valve shaft through an actuator shall be rated to include a 50% safety factor in addition to the maximum torque required to fully open or close the valve under the maximum working pressures and prevailing flow conditions.

The Contractor shall submit to the Engineer for approval drawings and/or calculations used for specifying the valve torque.

The design shall provide simple setting, testing, maintenance, diagnostic and repair. Any actuator settings shall be performed via the push buttons at the local control station without special tools or instruments (e.g. battery backed setting tools).

In order to prevent loss of screws during commissioning or maintenance, all covers shall be fixed with captive screws.

35.6.1.5 South African Representation

Suppliers of actuators shall have substantial South African representation with comprehensive technical "know-how", service and spares available.

35.6.1.6 Duty Cycle

The duration of an open / close cycle shall be in accordance with the information supplied by the Contractor at tendering stage.

35.6.1.7 Operation

Actuators shall keep the valve opening in any fixed position for an extended period.

The actuators shall be capable of opening and closing all valves and/or sluice gates when operating under an unbalanced pressure equal to the nominal pressure.

All materials used shall be suitable to withstand operation under environmental conditions as specified in Part C4 – Hydrological Data.

35.6.1.8 Power Supply

The actuator shall be designed to operate from a 400 V three-phase or 230 V single phase, 50 Hz AC power supply. The actuator shall be capable of operating at the rated duty with a ± 15% variation of the applied voltage measured at the actuator.

The actuator shall be provided complete and equipped with the necessary auxiliary Plant to provide the low voltage power required by its control circuits.

The actuators shall have the correct phase rotation of the power supply after the Site wiring and connections have been made.

Electrical connection of actuators must be made by multi-pin plug and socket connector, to allow quick disconnection in case of maintenance or repair.

35.6.1.9 Electric Motors

(a) Purpose Design

The motor shall have a minimum duty rating of four consecutive complete cycles or a continuous duty of 30 minutes, whichever is the more onerous.

(b) Gear Driven Actuators

All motors shall be specifically designed for valve-actuator operation which is characterised by high starting torque, low stall torque and low inertia.

(c) Construction

All motors shall be of the totally enclosed fan cooled (T.E.F.C) squirrel cage or wound rotor (Slip ring) type. The motor characteristics and construction shall be suitable for the intended application.

For electrically or electrically / hydraulically operated pump delivery or main line valves the actuator motor or hydraulic pump motor shall be of the totally enclosed fan cooled three phase type suitable for direct on line starting.

Motor connections shall be internal by means of plug and socket. Motors shall be totally separated from the lubricant-filled gearing of the actuator, allowing replacement of motor without losing any lubricant regardless of mounting position.

Actuator motors shall develop full torque when the motor is energized. All motors shall be of the high starting torque type to facilitate 'unseating' of the valve.

(d) Motor Winding and Over-Temperature Protection

Insulation Class F shall be used on the motor windings and the winding temperature rise shall be designed for Class B.

Two temperature thermostat switches shall be embedded in the stator winding for rapid, accurate over-temperature protection of the motor windings.

(e) Motor Enclosure Anti-Condensation Heater

In order to prevent condensation, an anti-condensation heater shall be provided in the motor enclosure as a standard feature, suitable for continuous operation.

(f) Locked Rotor Current

The locked rotor current of motors shall be specified to permit adequate sizing of the power supply cable. The voltage at the motor during starting shall not drop below 85% of the nominal supply voltage.

(g) Phase Protection

Single phasing and phase rotation protection shall be provided to ensure that the motor is not operated without all three phases of the power supply present.

(h) Phase Rotation

Phase rotation protection shall be provided to ensure that the motor cannot be operated should phase rotation occur or may have an automatic correction of the direction of rotation as an integral feature of the AC and AM controls.

(i) Electrical Surge Protection

The contractor shall ensure that the approved surge protection is implemented.

(j) Actuator Mountings

The actuator shall be mounted directly onto the valve body or gearbox. Should a particular application require an adaptation device, any such device shall be a specific proprietary design for a particular type of valve. A comprehensive design of any such adaptation shall be submitted to the Engineer for approval.

Provision shall be made for a drain groove to release any seepage water from the valve in order to protect the gearbox / actuator from contamination.

The attachment of the actuator to the valve body shall be such that the actuator may be detached without disturbing the valve position.

The valve manufacturer shall ensure that there is no visible movement of the actuator on the mounting adapter or valve body when the actuator is in operation.

For cathodic protection purposes, electric actuators must be electrically isolated from the valve or gearbox mounting flange and input shaft. All actuators shall be supplied with non-conductive output flanges, drive couplings, bush spacers and washers and machined in accordance with EN ISO 5210. Machining tolerance must be maintained between the drive coupling and input shaft as well as between the bush spacers and flange PCD drilling. If non-standard PCD holes on the input flange of the valve and or the gearbox is required, the actuator supplier shall confirm these hole sizes before production. An open circuit shall be achieved when measuring between actuator body and gearbox adaptor flange.

35.6.1.10 Bearings and Gears

Bearings shall be of the antifriction or self-lubricating type. Bearings shall not require any maintenance between general overhauls.

Worm shafts shall be made from heat treated steel. Worm-wheels shall be made of bronze material or heat treated steel.

The actuator gear housing shall be filled with an adequate quantity of lubricant. Re-lubrication between general overhauls shall not be required.

35.6.1.11 Indicators

Actuator indicators shall be in accordance to the requirements of Clause 35.4.9.

35.6.2 Electrical Actuator

35.6.2.1 Electric Motor

For details refer to Clause 35.6.1.9.

35.6.2.2 Actuator Controls

(a) Integral Motor Starters

Integral actuator controls, whereby the entire actuator, motor and stop/start control, forward/reverse control and starter are integrally mounted in the actuator enclosure, are preferred. In cases where vibration could damage actuator controls, the actuator controls shall be installed remotely.

Where the actuator motor is of such a size that a separate mounted starter is necessary, this shall be specifically stated.

In both cases, the reversing contactor starter shall be electrically and mechanically interlocked.

(b) Integral Pushbutton Stations

The actuator shall be provided with an integral pushbutton station with the following features:

- Local/Off/Remote selector switch. This switch shall be lockable by means of a padlock in each position.
- Open/Stop/Close pushbutton station. The Open and Close pushbuttons shall only operate when a local selection is made on the selector switch. The Stop pushbutton shall be of the emergency latching type and shall operate in all positions of the Local/Off/Remote selector switch; and
- Digital or mechanical local indication of the valve percentage open or fully open/closed status.

35.6.2.3 Monitoring and Protection

The following monitoring and protection systems shall be provided:

(a) Position Indicators

See Clause 35.4.9.

(b) Torque Limit Switches

Torque limit switches shall be provided to sense an overload condition in either clockwise or counter-clockwise operation to protect the valve and actuator. These torque switches shall be adjustable over the entire torque range specified for the actuator. A back-up “system fault” warning light shall be provided to indicate trips on torque overload. The use of batteries as back-up to maintain the torque settings shall under no circumstances be permitted.

(c) Travel Limit Switches

Travel limit switches shall be provided to stop the actuator at the required extremes of travel and shall be set to trip the actuator operation before the actuator torque limit switches are activated. The use of batteries as back-up to maintain the travel limit settings shall under no circumstances be permitted.

The positions of these travel limit switches shall be adjustable, permitting adjustment to the valve shaft travel. These limit switches shall remain synchronised with the valve shaft travel for both motor and hand powered actuator operation. Provision shall be made for protection against unauthorised tampering with these limit switches.

(d) Motor Winding Thermostats

See Clause (d).

(e) Potential Free Switch Contacts

Potential free switch contacts for remote and local indication of:

- Travel limit - valve open/closed;
- Intermediate position or % open/closed via a 4-20 mA loop; and
- Torque limit exceeded.

These switches shall have both normally open and normally closed contacts rated at 2 amperes, 400 volts.

(f) Single Phasing Protection

Single phasing protection shall be provided to ensure that the motor is not operated with only two of the three phases of the power supply present.

(g) PLC Interface

PLC I/O interface shall be as shown on the Drawings and I/O schedule. Provision shall be made for position indication and remote control.

A terminal strip with potential free contacts for remote indication and control shall be provided as follows:

i) Torque limit exceeded;
ii) Remote selected;
iii) Ready;
iv) Running;
v) Valve opened;
vi) Valve closed;
vii) Open valve;
viii) Close valve; and
ix) Emergency close.

A 4-20 mA position indication signal shall also be wired to this terminal strip.

Indicator lights shall be installed to indicate whether the actuator has tripped on either limited travel or excessive torque.

35.6.2.4 Enclosures

The enclosure(s) housing the mechanical, electrical and electronic components of the actuator shall be rated to IP68 of SANS 1222. The Contractor shall provide documentary proof that this requirement has been met.

A corrosion resistant plate with red lettering, reading as follows, shall be affixed to the actuator terminal cover.

WARNING

THIS ACTUATOR IS TESTED FOR WEATHER PROTECTION DUTY I.P. 68
WATERTIGHT SEALS MUST BE MAINTAINED INTACT
REFER TO INSTRUCTION MANUAL

Cable entry into the termination compartments of the actuators and control panels shall not impair the IP rating of the enclosure. Cable entries into actuators shall be vertically up to the actuator in-situ; top entry cables shall be prohibited.

All cable glands shall be fitted with watertight UV stabilised plastic boots and shall be supplied with the actuator. All glands shall be rated to comply with IP 68 of SANS 1222 double seal compression type.

Anti-condensation heaters shall be provided in all compartments of the enclosure housing the components of the actuator.

Lead seals shall be affixed via wires through the body and cover on all electric compartment housings after final setting and wiring of the actuators by a qualified actuator Service Technician.

35.6.2.5 Manual Operation

(a) General

All valves shall have a manual backup operation in order to open and close the valve during emergency conditions.

The position indicator shall remain synchronised with the actual valve position during manual operation.

(b) Manual Operation for Electrically Operated Valves

Closure of valves shall be through the clock-wise rotation of hand wheels. All valves shall be capable of being opened or closed under an unbalanced pressure equal to the Nominal Pressure. The effort required on hand wheels to open or close valves under these conditions shall be in accordance with Clause 35.4.6.

A manual de-clutch lever shall be provided which, when operated, shall disengage the electric mechanism. Under manual operation, the hand wheel shall drive the worm shaft. Self-locking shall be maintained in hand operation.

When the motor is energised, the unit shall automatically return to motor operation without imparting any motion to the hand wheel, thereby ensuring the safety of personnel.

35.6.3 Hydraulic Operation and Power Packs

35.6.3.1 General

A hydraulic actuator shall consist of a control panel, hydraulic cylinders, and electro-hydraulic power pack consisting of an electrically powered hydraulic pump, a hydraulic fluid reservoir, a manual backup operating system, control-, check- and relief valves, breather, electrical distribution box and all hydraulic piping, fittings and anchoring.

35.6.3.2 Control Panel

The control panel, designed as part of the support frame, shall comprise the following:

a) Two 100 mm diameter glycerine filled stainless steel case pressure gauges, one on the delivery and the other on the return line, with a range of 0 to 25 MPa with the working pressure of 17.5 MPa indicated with a red line. The pressure gauges shall be installed on the control panel.

b) A stainless steel epoxy powder coated electrical distribution box protected in accordance with IP 65 of SANS 60529. The box shall include:

   i) A suitably rated isolator, lockable in its off position and a circuit breaker for over current protection;

   ii) Key operated local / remote selector switch;

   iii) A set of On/Off Push buttons interlocked to prevent dual activation;

   iv) Three red 230V LED multi-cluster type indicating lamps marked L1, L2 and L3 (one per phase). These shall illuminate when there is power on the panel;

   v) A 0-100% position indicator;

   vi) An ammeter; and

   vii) PLC I/O interface as shown on the Drawings and I/O schedule.

All components inside the control panel console shall be protected to IP 65 of SANS 60529. All electrical switch gear shall be contained in a separate compartment of the console or otherwise be shielded by a “dead end” or shroud (preferably see-through) to prevent access to connections by persons working on the hydraulic parts of the console. Where required, approved junction boxes shall be used.

A warning notice (red trafolite with white lettering) shall be displayed on the console cabinet, preventing unauthorised access to the electrical works of the console.

a) The cable from the control panel to the motor shall be fixed to brackets provided for this purpose. All cabling shall be secured at intervals of no more than 250 mm.

b) All cable glands shall be rated to comply with IP68 standards and fitted with a watertight neoprene shroud.

c) An ammeter.

d) Lever operated directional control valves with a maximum pressure rating of 18 MPa and rated for 1,6 times the design flow rate, which shall include the following:

   i) Spring return to neutral;

   ii) Open centre;

   iii) A and B working parts shall be closed in neutral position;

   iv) Built-in adjustable pressure release valve; and

   v) Power beyond.

e) A label (white Trafolite with black lettering) showing the open and closed directions as well as the valve number shall be fixed with stainless steel screws next to each directional control valve.

f) Directional control valves shall be positioned to allow manual operation to be executed by one person.

g) Double pilot operated check valves to arrest the hydraulic cylinders in the required position. For tubing lengths less than ten 10 metres the check valve(s) shall be fitted to the control panel and for tubing exceeding ten 10 metres as well as tubing exposed to direct sunlight the check valve(s) shall be fitted at the cylinders.

h) Check valves exposed to the weather conditions or water spray shall be sealed in a silicone filled stainless steel box with a removable lid. The connections shall be pressure tested before sealing.

35.6.3.3 PLC Interface

PLC I/O interface shall be as shown on the Drawings and I/O schedule. Provision shall be made for position indication and remote control. A terminal strip with potential free contacts for remote indication and control shall be provided as follows:

i) Remote selected;

ii) Healthy;

iii) Valve opened;

iv) Valve closed;

v) Open valve;

vi) Close valve;

vii) Emergency close;

viii) Pump running;

ix) High pressure;

x) High temperature; and

xi) Low Fluid Level.

A 4-20 mA position indication signal shall also be wired to this terminal strip.

35.6.3.4 Manual Operation

(a) General

All valves shall have a manual backup operation in order to open/close the valve during emergency conditions.

The position indicator shall remain synchronised with the actual valve position during manual operation.

(b) Manual Operation for Hydraulic Operated Valves

A manual changeover from normal/automatic operation to manual hydraulic operation to open/close the valve(s) shall be supplied. A chart, clearly indicating the changeover procedure to manual

hydraulic operation shall be supplied and mounted above the hand pump. All information contained on the charts shall be engraved and painted red on 2 mm thick aluminium plates (minimum size A2).

A 40-cc/stroke double action hand pump shall be mounted on the right hand side of the reservoir with the operating lever in the vertical position for horizontal stroke. The lever shall be designed that the force required on the lever at Nominal Pressure does not exceed 120 N. The manual hydraulic operation shall be capable of opening and closing the valve under an unbalanced pressure equal to the Nominal Pressure. The handle of the lever shall be 1 000 to 1 200 mm from the finished floor level.

When the hydraulic power pack is energised, the unit shall automatically return to normal operation without imparting any motion to the pump lever, thereby ensuring the safety of personnel.

A check valve shall be fitted to the hand pump outlet.

The suction pipeline to the hand pump shall be tapped after the filter system.

35.6.3.5 Pumps

(a) Gear Pump

A hydraulic gear pump with efficiency in excess of 75% and a maximum pressure rating of 20 MPa is required.

The pump delivery off take will be equipped with an adjustable, sealable and lockable pressure relief valve appropriately set to limit the system pressure to 17.5 MPa.

The gear pump shall be mounted separately from the reservoir with the suction pipeline lower than the reservoir level. The suction pipeline, protruding 30 mm minimum inside the reservoir from the bottom, shall be fitted with a lockable stainless steel ball valve for maintenance of the filter system.

A check valve shall be fitted downstream of the gear pump.

A suction filter system comprising a 10 μm filter, of the replaceable cartridge element type, with a minimum capacity of four (4) times the delivery rate and a vacuum gauge shall be installed upstream of the gear pump.

The hydraulic control switchgear shall not be mounted on the hydraulic pack but separately and conveniently close by so as to limit interconnection pilot lights to reflect the hydraulic pack and cylinder and protection equipment status. A pilot light test button will also be incorporated on the switch gear panel door.

(b) Hand Pump

For details on the manual operation of the hydraulic system refer to Clause 35.6.3.4.

35.6.3.6 Electric Motor

For details of the electric motor refer to Clause 35.6.1.9.

The hydraulic gear pump shall be driven by a totally enclosed fan cooled electric motor suitable for direct on-line starting. The motor and gear pump shall form one assembly.

35.6.3.7 Hydraulic Fluid Reservoir

The hydraulic fluid reservoir, with a capacity of two (2) times the maximum combined displacement volume of the hydraulic cylinders, shall be manufactured from 304L or coated 3CR12 or coated mild steel grade 350 WA.

A removable lid, incorporating a watertight filler cap, shall be fitted to the reservoir and sealed with a gasket.

A sight tube hydraulic fluid level indicator shall be mounted on the front of the reservoir in such a way that it is clearly visible whilst working on the control panel. Fluctuation of the hydraulic fluid level shall not exceed 80% of the scale and the minimum level, with all cylinders extended, shall be indicated with a red line on the indicator.

The reservoir shall be mounted on an angle iron support frame, 150 mm minimum from the wall, with stainless steel 304L legs fixed to the floor with M16 stainless steel wedge anchors.

The reservoir bottom shall slope 1% minimum with a drainpipe and transparent glass water trap at the lower end. The water trap shall be fitted with a stainless steel ball valve, 250 mm minimum from floor level for draining purposes and sealed with a taper plug.

The reservoir shall be fitted with a breather filled with silica gel as well as with low oil level and high oil temperature protection limit switches.

A purpose built removable drip tray shall be supplied below the power pack and reservoir in order to catch any fluid spilled during servicing and minor breakdowns.

Inverted scale pressure gauges shall be provided on both the return and delivery lines to the cylinders as well as for the pump pressure. These gauges shall be installed on the hydraulic power pack front panel.

Corrosion protection of the reservoir and auxiliary Plant shall be in accordance with Section 37 - Painting and Corrosion Protection.

35.6.3.8 Hydraulic Cylinders

(a) General

The hydraulic cylinders shall be entirely fabricated from stainless steel 316L unless otherwise specified and shall be designed for a pressure of 20 MPa and the maximum system operating pressure shall not exceed 17.5 MPa.

Where specifically required, the exposed parts of the hydraulic cylinders (rams) shall be covered with UV stabilised rubber / material bellows. The bellows shall be sized to show discernible retention of the bellows shape at the full operating range of the hydraulic cylinder.

All the stainless steel components shall be pickled and passivated in accordance with Section 37 - Painting and Corrosion Protection.

(b) Cylinders

Cylinders shall comprise the following:

i) 35 mm diameter ports drilled and tapped ½“ BSP minimum;

ii) The ports shall be positioned to exhaust all air during stroking of the cylinder;

iii) A phosphor bronze guide bearing;

iv) An adjustable screw ring to compensate for manufacturing tolerances of the rod sealing set and metal parts;

v) Chevron type rod sealing set capable of operating in submerged conditions to 10 metre;

vi) A wiper seal fitted to the cylinder cover; and

vii) The surface finish of the cylinder inner surface shall not exceed a Ra (Relative amplitude) of 0,2 μm.

(c) Piston Rod and Piston

The piston rod and piston shall comprise the following:

i) A hard chromed stainless steel rod with a surface finish not exceeding a Ra (Relative amplitude) of 0,2 μm;

ii) A double acting piston manufactured from phosphor bronze or cast iron;

iii) Guide bearings of PTFE or phosphor bronze;

iv) Pistons fitted with metal or PTFE piston sealing sets consisting of a seal and rubber ‘O’- ring combination;

v) Piston screwed to the rod and locked with a grub screw; and

vi) An adjustable male clevis with stainless steel swivel bearing and locked with a nut.

35.6.3.9 Pipes and Fittings

All hydraulic tubing (seamless), fittings, double ferrule type couplings, supports and anchorage shall be of stainless steel 316L rated for 20 MPa pressure. Connections between couplings and flexible hydraulic hoses shall be factory shrink-fitted, able to withstand the design pressures of the flexible hoses. No pipe clamps will be allowed.

35.6.4 Gearbox Drive Units

35.6.4.1 General

Worm gearbox shall be specifically designed for valves and damper operation and shall meet the typical torque / running time requirements (types of duty) for valves and electric actuators.

Worm gearbox shall be designed to be operated either manually or electrically in combination with multi turn actuators.

Gearboxes shall be sized for future fitment of actuators to an integrally cast actuator mounting flange conforming to ISO 5211 when required on site without any additional modification. Generally, it shall be possible to motorise a manually operated valve at a later stage without

replacing the complete gearbox. A removable splined coupling shall be supplied by the gearbox manufacturer which allows easy machining of the bore to suit the valve shaft.

Worm gearbox shall be available for output torques up to 250 Nm.

The gearbox shall be a worm wheel type. Gearboxes with segment / quadrant type of worm wheel shall not be allowed. Spindle or scotch - yoke type of gearbox shall not be allowed.

35.6.4.2 Design

Gearboxes shall be of the self-locking worm type with minimal backlash. The gearbox shall have a 360 degree worm wheel and worm shaft, including adjustable mechanical end stop arrangement.

Gears shall be machine cut and totally enclosed in weatherproof enclosures in accordance with IP67 of SANS 60529 to prevent the ingress of water and debris. A radial seal or O-rings shall also be provided on the input shaft of the gearbox to prevent water from entering the gearbox.

Worm wheel shall preferable be made out of bronze. For motor operation in modulating duty, the worm wheel shall generally be made out of bronze.

If required, worm gearbox shall be equipped with a primary gearbox to reduce the input torque.

The gearbox housing shall be made out of Austeninic cast iron (AI) or spherodial cast iron (SG). Aluminium housing material (torque carrying parts) is not acceptable.

Special self-lubricating bearings shall be provided to accept radial forces on the worm shaft to ensure the highest possible efficiency for minimal operating effort. A thrust bearing shall carry the resultant axial load.

The effort required on hand wheels to open or close valves shall be in accordance with Clause 35.4.6.

Gearboxes shall be provided with accurate mechanical position indicators in accordance with Clause 35.4.9.

In the case of gravity pipeline main valves the gearbox ratio must ensure that the rate at which the valve can be closed will not generate excessive water hammer.

The gearbox shall be coated internally to System Number 050 and externally to System Number 052 in accordance with Section 37 - Painting and Corrosion Protection.

A weep hole (diameter 10 mm minimum or machined groove 10 mm wide by 4 mm deep) shall be provided between the valve and gearbox to release any seepage water in the event of seal failure.

For motor operation the electric actuator supplier shall be consulted regarding torque verification. Preferably the electric actuator and the gearbox shall be manufactured by the same supplier.

35.6.4.3 End Stop Principle

The adjustable mechanical end stop shall be designed as a threaded spindle / travelling nut to protect the gearbox housing / valve stem from excessive force. The design shall guarantee a defined stop when end of travel (valve closed) is reached.

The end stop design shall accept the input torques as axial forces within the worm shaft, the load not being transmitted to the gearbox output / valve stem.

Travel limitation with stop screws (end stop screws as used for segment or quadrant type) placed in the gearbox housing shall not be allowed, as protection against over-torque cannot be guaranteed.

The mechanical end stop shall be easily adjustable at pre-commissioning to guarantee proper seating of the valve during operation.

35.1.1.2 Lubrication

Gearboxes shall be packed with water repellent grease approved by the Engineer. Gears shall be fully covered with the lubricant in order to prevent corrosion and to guarantee adequate lubrication in any mounting position and long life time.

The gearbox configuration and lubricants shall be such that the gearbox can be mounted at any angle without any lubricant leaking from the gearbox enclosure.

If a gearbox is 100% filled with lubricant, the gearbox shall be provided with a maintenance free membrane breather with sufficient capacity to accommodate the expansion of the lubricant over the full temperature range.

35.7 BUTTERFLY VALVES

35.7.1 General

Butterfly valves shall be of the doubled flanged, full-bore and “tight shut off” type.

Butterfly valves shall be of the double eccentric / off-set design with replaceable resilient seal fitted to the blade unless otherwise specified on the Drawings. Manufacturers shall certify that the valves offered are of the double eccentric / off-set design.

Wafer and lug type butterfly valves not exceeding 300 mm diameter may be considered for temporary and/or low pressure (< 1000 kPa) applications, with prior approval from the Engineer.

35.7.2 Specifications

Butterfly valves shall generally be in accordance with BS EN 593: 1998.

35.7.3 Flowrates

The valve shall be able to operate on a continuous basis for flow velocity not exceeding 7 m/s. No cavitation in the fully open position shall be accepted and the design of the seal arrangement shall be such as to withstand velocities up to 7 m/s.

Cavitation index curves (“σ vs. Q“) shall be tabled for review by the Engineer if requested.

35.7.4 Operation

The valves shall be capable of opening and closing under the maximum head and maximum specified flow rate without material cavitation distress. The valves shall be capable of operating in

any position without variation of the blade position or flutter. It is not the intention to operate the valve as a regulating device, i.e. part-open under normal operation.

There shall be no interference in the water flow pattern through a valve except for the blade, i.e. the blade stop mechanism shall not impede the flow pattern.

All valves shall be such that an approved actuator (electrical, hydraulic or pneumatic) as specified can be fitted. The actuator shall be fitted with a hand wheel so that the valve can also be operated manually. The gearbox to the valve shall comply with Clause 35.6.4.

The blade shall close with a positive action with no possibility of slamming shut during any stage of the closing operation. All valves shall be installed in a position that allows the valve to operate along the horizontal axis.

All valves shall provide bi-directional drop tight shut-off.

All valves shall be supplied with mechanical lockout facilities in both the open and closed positions.

35.7.5 Construction and Operational Requirements

35.7.5.1 Body

The hubs for the shaft-bearings and the gearbox mounting flange shall form an integral part of the valve body. A 10 mm wide by 5 mm deep drain groove shall be machined in the gearbox mounting flange to release any seepage water in the event of shaft seal failure.

35.7.5.2 Blade

The blade shall be a single casting or fabrication of optimum hydrofoil section with a smooth continuous surface. The maximum combined stresses in the blade shall not exceed 20% of the yield stress of the material when the design pressure is applied on any of the two sides.

The complete circumferential edge of the blade shall be machined to a recess of 15 mm wide by 3 mm deep on valves up to DN500 and 30 mm wide by 3 mm deep on valves larger than DN500. The recess shall be filled up with stainless steel 309L or 316L weld deposited and machined to a smooth even transition to the cast iron blade as to avoid damage to the coating of the corrodible blade material. The stainless steel weld deposit shall be coated in accordance with Section 37 - Painting and Corrosion Protection.

The blade shall be supported in the valve body, in the applicable offset manner, in maintenance-free bushes.

35.7.5.3 Seal Retaining Ring

The seal retaining ring, manufactured from stainless steel material grade 316, shall be coated in accordance with Section 37 - Painting and Corrosion Protection, to reduce the effects of galvanic corrosion.

The recess for the seal retaining ring in the valve body (for metal-metal seal) or blade (for resilient seal) shall be coated to the specified corrosion protection Specification or the seal shall be wet assembled for both cases with a coat of solvent free two-pack epoxy.

The design of the seal retaining ring shall be such as to protect the threaded holes of the screws against corrosion.

35.7.5.4 Seat and Seal

The valves shall be of the “tight shut off” type and the seals shall be of the metal-metal type for valves DN200 and larger in size and resilient seals for smaller valves. Rubber lined valve bodies and/or blades will not be acceptable.

a) For metal-metal seated valves the stainless steel seat ring shall be situated on the valve blade and secured with stainless steel fasteners. The laminated stainless steel seal ring shall be situated in the valve body and secured in position by a stainless steel bolt-on retaining ring, and together with the stainless steel seat ring shall be easily replaceable. The laminated seal ring shall be a combination of stainless steel rings and PTFE or Klinger JP6000 non-asbestos gaskets.

   The edge of the seat retaining groove in the blade shall be stainless steel 309L or 316L deposit welded before machining for a stainless steel seat. Details shall be submitted by the Contractor on the detail drawing for the Engineer’s approval.

   The inner diameter of the exposed face of the mounting flange of a removable seal in the body shall be stainless steel deposit welded and machined to a smooth even transition to the cast iron body as to avoid damage to the coating of the corrodible body material. Detail of the mounting flange to be submitted on the detail drawing for the Engineer’s approval. The stainless steel weld deposit shall be coated in accordance with Section 37 - Painting and Corrosion Protection.

b) For resilient seal type valves the elastomer seal shall be mounted on the disc with a stainless steel retaining ring secured with stainless steel fasteners.

   Preference shall be given to a resilient seal arrangement that is removable, replaceable and adjustable in situ from the downstream side of the valve, without having to remove the valve from the pipeline.

   A single moulded music note or tee type resilient seal is required for a valve specified for high velocity applications.

   The resilient seal shall have non-weathering, non-sticking, long life properties and shall be compatible with the quality of water to be conveyed.

   The edge of the seal retaining groove in the blade shall be stainless steel 309L or 316L deposit welded before machining for an O-ring or music note type seal. Details shall be submitted by the Contractor on the detail drawing for the Engineer’s approval.

   The sealing faces in the body shall be 309L or 316L or equal weld deposited or replaceable, be accurately machined and polished and shall provide adequate "lead in" for the resilient seal to open and close only on a stainless steel seat.

   The inner diameter of the exposed face of the mounting flange of a removable seat in the body shall either be stainless steel deposit welded and machined level with the seat or the seat ring manufactured to cover the seat mounting flange. Detail of the mounting flange to be submitted on the detail drawing for the Engineer’s approval.

   The seat and seal shall be of such design preventing them from becoming loose and obviate water seepage under the seals or seats during all conditions of operation and testing.

   A minimum 5 mm coating overlap is required on the stainless steel and cast steel interfaces.

   The stainless steel weld deposit shall be coated in accordance with Section 37 - Painting and Corrosion Protection.

35.7.5.5 Mechanical Stops

Mechanical stops shall comply with Clause 35.6.4.3.

35.7.5.6 Shafts

Shafts shall either be continuous or of a stub-shaft design configuration. Stub shafts shall extend into the blade hubs for a distance of at least 1.5 shaft diameters and shall not protrude from the hubs i.e. exposing the shaft.

Shafts shall be attached to the blade by means of keys, dowel pins, taper pins or any combination of the three and shall be precisely fitted as a force-closed connection. The connection shall be designed to transmit shaft torque equivalent to at least 75% of the torsional strength of the shaft. Dowel and taper pins, manufactured from stainless steel, shall be mechanically secured. The robust key connection shall ensure force transmission without play under the highest dynamic stresses.

The idle shaft cover shall be manufactured from stainless steel and secured with stainless steel fasteners or mild steel incorporating a bronze thrust bearing and secured with hot dip galvanized fasteners.

35.7.5.7 Bearings

Self-lubricating sleeve type bearings (bronze backed) shall be fitted in the hubs of the valve body.

Each valve shall be fitted with at least one adjustable thrust bearing or spacer disc set to hold the blade securely concentric with the body or seat.

35.7.5.8 Position Indicators

To simulate the blade position, the pointer of the indicator fitted to the drive shaft shall point in the flow direction when the valve is in the open position. The pointer shall accurately indicate the position of the blade.

35.7.6 Valve Test and Material Specification

Valve components shall be constructed of the material specified in the following tables:

TABLE 35/3
BUTTERFLY VALVE (DN 100-3000)

Factory Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
200 – 3 000	1 000	1 500	1 100
200 – 2 500	1 600	2 400	1 760
200 – 2 000	2 500	3 750	2 750
200 – 1 500	4 000	6 000	4 400
200 – 1 500	6 400	9 600	7 040

*Note: Butterfly valves specified to be bi-directional shall be tested from both sides.

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	SG IRON CAST STEEL MILD STEEL	BS EN 1563 Gr 450/10 / SANS 936 SG 42 BS EN 10213 Gr 480/ SANS 1465-1 SANS 1431: 2007 Gr 350WA
BLADE	SG IRON CAST STEEL MILD STEEL	BS EN 1563 Gr 450/10 / SANS 936 SG 42 BS EN 10213 Gr 480/ SANS 1465-1 SANS 1431 Gr 350WA
BODY LAMINATED SEAL RING	STAINLESS STEEL	BS EN 10090, Gr 316 S15
BLADE SEAT RING	STAINLESS STEEL	BS EN 10090, Gr 316 S15
BLADE SEAL	ELASTOMER RUBBER	EPDM 75° A NITRILE
SEAL RETAINING RING	STAINLESS STEEL	BS EN 10090, Gr 316 S15
SHAFTS	STAINLESS STEEL	BS EN 10090, Gr 431 S29
SHAFT BEARINGS / BUSHES	PHOSPHOR BRONZE SLEEVE TYPE	BS EN 1982 PB1C (Cu, Sn10, P) BRONZE BACKED (DUB)
SHAFT SEALS	RADIAL LIP SEAL / CUP SEAL / O-RING SEAL	NITRILE / VITON
IDLE SHAFT COVER	STAINLESS STEEL	BS EN 10090, Gr 304 S15
IDLE SHAFT THRUST BEARING / SPACER DISC	PHOSPHOR BRONZE	BS EN 1982 PB1C (Cu, Sn10, P)
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED) STAINLESS STEEL	SANS 1700 (SANS 121, ISO 1461) ASTM A193 Gr B8M, ASTM A439 Gr D2
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2
OPERATION ARRANGEMENT: GEARBOX		SEE AUXILIARY DRIVE SPECIFICATION
ELECTRIC ACTUATOR		SEE AUXILIARY DRIVE SPECIFICATION
HYDRAULIC ACTUATOR		SEE AUXILIARY DRIVE SPECIFICATION

TABLE 35/4
WAFER AND LUG TYPE (DN 50-300)

Factory Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
50 – 300	1 000	1 500	1 100
	1 600	2 400	1 760
	2 500	3 750	2 750
	4 000	6 000	4 400

*Note: Butterfly valves specified to be bi-directional shall be tested from both sides.

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	SG IRON CAST STEEL MILD STEEL	BS EN 1563 Gr 450/10 / SANS 936 SG42 BS EN 10213 Gr 480/ SANS 1465-1 SANS 1431 Gr 350WA
BLADE	SG IRON CAST STEEL MILD STEEL	BS EN 1563 Gr 450/10 / SANS 936 SG42 BS EN 10213 Gr 480/ SANS 1465-1 SANS 1431 Gr 350WA
BODY SEAT	STAINLESS STEEL	BS EN 10090, Gr 316 S15
BLADE / BODY SEAL	EPDM 75° A / NITRILE RUBBER	BS EN 168-1 TYPE WA
SEAL RETAINING RING	STAINLESS STEEL	BS EN 10090, Gr 304 S15
SHAFTS	STAINLESS STEEL	BS EN 10090, Gr 431 S29
SHAFT BEARINGS / BUSHES	PHOSPHOR BRONZE SLEEVE TYPE	BS EN 1982 PB1C (Cu, Sn10, P) BRONZE BACKED (DUB)
SHAFT SEALS	RADIAL LIP SEAL / CUP SEAL / O-RING SEAL	NITRILE / VITON
IDLE SHAFT COVER	STAINLESS STEEL	BS EN 10090, Gr 304 S15
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED) STAINLESS STEEL	SANS 1700 (SANS 121, ISO 1461) ASTM A193 Gr B8M, ASTM A439 Gr D2
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2

35.8 NON-RETURN VALVES

35.8.1 General

Non-return valves shall be double flanged and be of the non-reverse nozzle flow metal sealing type check valves (also known as “venture” or “non-slam” type check valves). The valve shall offer minimum hydraulic resistance, not be subject to disc flutter and give a quick non-slam closure on reversal of flow.

Preference shall be given to designs which allow inspection and or removal of doors, discs and seals without removal of the valve assembly from the line.

It is a further requirement that the non-return valves selected for this Contract do not allow any reverse flow after a pump trip condition.

35.8.2 Non-reverse Flow Check Valves (Nozzle Type)

35.8.2.1 General

(a) Type

Non-reverse flow check valves shall be double flanged and nozzle type. The valves shall typically be “Mokveld” (of Holland), “Mannesman Mehr, Erhard or Noreva” (of Germany), “Özkan” (of Turkey) “Insamcor” (South Africa) or similar approved by Engineer.

(b) Specifications

The valves shall generally conform to the requirements of BS 5153 as applicable.

(c) Design Requirements

The valve shall be able to operate on a continuous basis for pipe velocities not exceeding 7.5 m/s in normal operating conditions and up to 10 m/s in unusual operating conditions. The maximum permissible flow rates through the valves shall be quoted as well as the time span per 24-hour period over which higher velocities of up to 10 m/s can be tolerated. No cavitation in the fully open position shall be accepted.

The valves shall be capable of operating under the maximum head and maximum specified flow rate without material cavitation distress. The valves shall be capable of operating in any position without variation of the disc position or flutter. Cavitation index curves (“σ vs. Q”) shall be tabled for review if requested.

The design shall be such that the disc does not rely on back flow for closure. Closure shall be performed by a stainless steel spring that pushes the disc against the stainless steel seat.

The valve shall be fully open under normal operating conditions.

All valves shall be installed in a position that allows the valve to operate along the horizontal axis.

35.8.2.2 Construction and Operational Requirements

(a) Body

The body design will be such that the venturi principle provides a large enough force to hold the valve open. The body shall be streamlined in order to minimise friction loss through the valve.

The seat profile shall be smooth and continuous and shall provide adequate lead in on the stainless steel seat.

(b) Discs

Discs shall close with a positive action and no possibility of slamming shut during any stage of the closing or opening operation. The spring assisted low inertia internal components must ensure rapid closing and minimise secondary slam even at high flow deceleration rates. The disc shall at all times stay perpendicular to flow.

The disc shall be a single casting of approved hydrofoil section with a smooth continuous surface. The maximum combined stresses in the disc shall not exceed 20% of the minimum yield stress of the material used when the specified unbalanced pressure is applied on any of the two sides.

(c) Seats and Seals

The valves shall be of the "tight shut off" type and the water seals shall be of stainless steel. Rubber lined valve bodies and/or discs shall not be acceptable.

Preference will be given to seal arrangements that are removable, replaceable and adjustable, without having to remove the valve from the pipeline.

Seats and seals shall be of a design that prevents them from becoming loose and obviate water seepage under the seals or seats during all conditions of the operation and test.

(d) Shafts

The disc shall be mounted on a stainless steel stem, which slides in PTFE bearings.

(e) Bearings

Self-lubricating sleeve type bearings shall be fitted where applicable.

(f) Valve Test and Material Specification

Valve components shall be constructed of the material specified in the following table:

TABLE 35/5
NOZZLE TYPE NON-REVERSE FLOW CHECK VALVE (DN 200-2000)

Factory Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
200 – 2000	1 000 – 1 600	1 500 - 2 400	1000 – 1 600
	1 600 – 2 500	2 400 - 3 750	1 600 – 2 500
	2 500 – 4 000	3 750 – 6 000	2 500 – 4 000

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
BODY SEAT RING	STAINLESS STEEL (DEPOSIT WELDED)	BS EN 10090, Gr 304 S15
VALVE DISC	CAST STEEL SG IRON	BS EN 10213 Gr 480/ SANS 1465-1 BS 2789 Gr 420/12, SANS 932 SG 42

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
DISC / BODY SEAL	STAINLESS STEEL (DEPOSIT WELDED)	BS EN 10090, Gr 316 S16
VALVE SHAFT	STAINLESS STEEL	BS EN 10090 Gr 316 S16
SHAFT BEARINGS / BUSHES	PHOSPHOR BRONZE OR PTFE	BS EN 1982 PB1C (Cu, Sn10, P)
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED)	SANS 1700 (SANS 121, ISO 1461)
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2

35.8.3 Non-reverse Flow Check Valves (Swing and Wafer Type)

35.8.3.1 Construction and Operational Requirements

(a) Body

The design of the body and body seals shall be such that they are free from pockets which may cause eddies or accumulate debris. Special care shall be taken in the design to ensure that foreign objects, like bolts, cannot lodge in pockets on the downstream side of body seats and thereby prevent doors from closing fully.

Access openings and covers shall be of adequate design and the creation of stress risers shall be prevented.

(b) Specifications

Valves shall generally be manufactured in accordance with SANS 144 and SANS 192. Alternatively, valves shall conform to the requirements of BS 5153.

(c) Doors and Discs

The doors and discs shall be cast as a unit with integral cast hinge lugs allowing free door or disc operation. Their travel shall however be restricted by the provision of substantial stops fitted with rubber facings to prevent wear due to metal contact. The rubber facings shall be vulcanised onto the metal and secured by corrosion resistant countersunk screws. The area of contact on the body shall be stainless steel 304L deposit welded.

The doors or discs shall have continuous hinge shafts of grade 316 stainless steel, which shall be supported at their ends with bearings.

Shafts protruding through the valve shall have flanged and bolted stainless steel, grade 316, bearing cover plates.

Shafts entering castings shall be provided with corrosion resistant bushes to prevent galvanic corrosion.

(d) Sealing Faces

Body, door and disc sealing faces shall be deposit welded with stainless steel and the door or disk sealing faces with bronze unless otherwise stated in the tables. Corrosion protection of the contact area between steel, ductile iron and stainless steel shall be in accordance with Section 37 - Painting and Corrosion Protection.

(e) Bearings

Main bearings shall be external. Preference shall be given to a valve with bearings that are accessible without emptying or removal of the valve body from the line.

Bearings shall be designed to take the unbalanced thrust on doors or discs in the structural test.

Bearings shall preferably be self-lubricated to offer a long life and retain a low coefficient of friction. Bearings shall not become tight during service or due to ageing.

(f) Position Indicator

Each door or disc shaft shall extend through a stuffing box on one side of the body only where a stainless steel position indicator is to be fitted.

(g) Counter Weights

Adjustable counter weights shall be fitted to all valves of 400 mm diameter and larger unless indicated otherwise in the Specification.

(h) Damper

Where included, dampers shall be designed for optimum performance and soft cushioning of the disc. The design shall be such that the damper can conveniently be dismantled for inspection and repair. The damper shall be made from approved corrosion resistant materials.

(i) Valve Test and Material Specification

Valve components shall be constructed of the material specified in the following tables:

TABLE 35/6
TILTING DISC NON-RETURN VALVE (DN 150 - 1 600)

Factory Test Requirements:

SIZE DN	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
250 – 1 600	1 000	1 500	1 000
200 – 1 400	1 600	2 400	1 600
150 - 600	2 500	3 750	2 500

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	MILD STEEL SG IRON CAST STEEL	SANS 1431 Gr 350WA BS EN 1563 Gr 420/12, SANS 936 SG 32 BS 1504 -161, SANS 1465 Part 1
BODY SEAT	STAINLESS STEEL (DEPOSIT WELDED)	BS EN 10090 Gr 304 S15
VALVE DISC	CAST STEEL SG IRON	BS EN 10213 Gr 480/ SANS 1465-1 BS EN 1563 Gr 420/12, SANS 936 SG 42
DISC SEAT	STAINLESS STEEL (DEPOSIT WELDED)	BS EN 10090 Gr 316 S16
BEARING BUSHES	PHOSPHOR BRONZE	BS EN 1982 PB1C (Cu, Sn10, P)
DOOR OR DISC SHAFTS	STAINLESS STEEL	BS EN 10090 Gr 431 S29
SHAFT KEY	KEY STEEL	DIN 6885 / BS 4235
END COVER SEAL	O RING	NITRILE / VITON
DRIVE SHAFT CUP SEAL	O RING	NITRILE / VITON
COUNTERWEIGHT	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
LEVER	MILD STEEL	SANS 1431 Gr 350WA
GLAND	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
DISC OPEN STOP PIN	STAINLESS STEEL	BS EN 10090 Gr EN3
COVER PLATES	STAINLESS STEEL	BS EN 10090 Gr 316 S16
INDICATOR AND INDICATOR PLATES	STAINLESS STEEL	BS EN 10090 Gr 304 S15
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED)	SANS 1700 (SANS 121, ISO 1461)
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2

TABLE 35/7
SLANTED SEAT TILTING DISC NON-RETURN VALVE (DN 200 - 1 000)

Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
200 – 1 000	1 000	1 500	1 000
	1 600	2 400	1 600
	2 500	3 750	2 500

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	MILD STEEL SG IRON CAST STEEL	SANS 1431 Gr 350WA BS EN 1563 Gr 420/12, SANS 936 SG 32 BS 1504 -161, SANS 1465 Part 1
BODY SEAT	STAINLESS STEEL (DEPOSIT WELDED)	BS EN 10090 Gr 304 S15
VALVE DISC	CAST STEEL SG IRON	BS EN 10213 Gr 480/SANS 1465-1 BS EN 1563 Gr 420/12, SANS 936 SG 42
DISC SEAT	STAINLESS STEEL (DEPOSIT WELDED)	BS EN 10090 Gr 316 S16
BEARING BUSHES	PHOSPHOR BRONZE	BS EN 1982 PB1C (Cu, Sn10, P)
DOOR OR DISC SHAFTS	STAINLESS STEEL	BS EN 10090 Gr 431 S29
SHAFT KEY	KEY STEEL	DIN 6885 / BS 4235
END COVER SEAL	O RING	NITRILE / VITON
DRIVE SHAFT CUP SEAL	O RING	NITRILE / VITON
COUNTERWEIGHT	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
LEVER	MILD STEEL	SANS 1431 Gr 350WA
GLAND	SG IRON STAINLESS STEEL	BS EN 1563 Gr 420/12, SANS 936 SG 42 BS EN 10090 Gr 304 S15
DISC OPEN STOP PIN	STAINLESS STEEL	BS EN 10090 Gr EN3
COVER PLATES	STAINLESS STEEL	BS EN 10090 Gr 316 S16
INDICATOR AND INDICATOR PLATES	STAINLESS STEEL	BS EN 10090 Gr 304 S15
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED)	SANS 1700 (SANS 121, ISO 1461)
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2

TABLE 35/8
SWING TYPE NON-RETURN VALVE (DN 50 - 400)

Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
50 – 400	1 000	1 500	1 000
	1 600	2 400	1 600
	2 500	3 750	2 500

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	SG IRON*	BS EN 1563 Gr 420/12, SANS 936 SG 42
COVER	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
HINGE	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
SHAFTS	STAINLESS STEEL	BS EN 10090 Gr 431 S29
STOPPER	ELASTOMER	NITRILE / VITON
BODY SEAT	STAINLESS STEEL (DEPOSIT WELDED)	BS EN 10090 Gr 316 S16
DISC SEAT	BRONZE (GUNMETAL) (DEPOSIT WELDED)	BS EN 1982 Gr LG2
COVER SEAL	O RING	NITRILE / VITON
BEARING HOUSING (lever side) SEALS	U PACKING	NITRILE / VITON
BEARING HOUSINGS	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
BEARING BUSHES	PHOSPHOR BRONZE	BS EN 1982 PB1C (Cu, Sn10, P)
KEYS	KEYSTEEL	DIN 6885
LEVERS (from 500NB)	MILD STEEL	SANS 1431 Gr 350WA
COUNTERWEIGHTS (from 500NB)	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
COVER PLATES	STAINLESS STEEL	BS EN 10090 Gr 316 S16
INDICATOR AND INDICATOR PLATES	STAINLESS STEEL	BS EN 10090 Gr 304 S15
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED)	SANS 1700 (SANS 121, ISO 1461)
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2

TABLE 35/9
MULTI-DOOR NON-RETURN VALVE (DN 350 - 1 800)

Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
500 – 1 800	1 000	1 500	1 000
	1 600	2 400	1 600
350 - 500	2 500	3 750	2 500

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY (INLET AND OUTLET)	SG IRON*	BS EN 1563 Gr 420/12, SANS 936 SG 42
COVER/S	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
DISCS (UPPER & LOWER)	CAST STEEL	BS EN 10213 Gr 480/ SANS 1465-1

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
DISC SHAFT (UPPER & LOWER)	STAINLESS STEEL	BS EN 10090 Gr 431 S29
STOP PINS (UPPER & LOWER)	STAINLESS STEEL	BS EN 10090 Gr 431 S29
BUFFERS	SLEEVE	NITRILE / VITON
BODY SEATS	STAINLESS STEEL (DEPOSIT WELDED)	BS EN 10090 Gr 316 S16
DISC SEAT	BRONZE (GUNMETAL) (DEPOSIT WELDED)	BS EN 1982 Gr LG2
COVER & BEARING HOUSING (non-lever side) SEALS	O RING	NITRILE / VITON
BEARING HOUSING (lever side) SEALS	U PACKING	NITRILE / VITON
BEARING HOUSINGS	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
BEARING BUSHES	PHOSPHOR BRONZE	BS EN 1982 PB1C (Cu, Sn10, P)
KEYS	KEYSTEEL	DIN 6885
LEVERS (from 500NB)	MILD STEEL	SANS 1431 Gr 350WA
COUNTERWEIGHTS (from 500NB)	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
COVER PLATES	STAINLESS STEEL	BS EN 10090 Gr 316 S16
INDICATOR AND INDICATOR PLATES	STAINLESS STEEL	BS EN 10090 Gr 304 S15
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED)	SANS 1700 (SANS 121, ISO 1461)
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2

35.9 SLEEVE VALVES

35.9.1 General

Sleeve valves are generally required to discharge water under high pressure to atmosphere to facilitate scour operations of pipelines and to control the flow of water from dam outlet systems.

35.9.1.1 Ambient / Operating Conditions

Valves and controls will be exposed to the elements and may be non-operative for extended periods of time. Designs shall allow for reliable operation under these conditions.

35.9.1.2 Installation

The installation of this type of valve shall either be horizontal or inclined to a maximum angle of 30 degrees with the horizontal plane. The sleeve valve will normally be installed on the end of a pipe, normally downstream of a reducer.

The sleeve valve shall have an isolating gate valve in tandem.

35.9.1.3 Operation

Sleeve valves shall be operated by the following types of actuators as specified in the Scope of Work:

a) Manually operated via a stainless steel stem and thrust head mounted vertically or on a trunnion for horizontal mounting or cast into a wall where indicated. The lever operated linkage shall be designed to accommodate movement restraints that may arise as a result of casting the trunnion into the wall.

b) Hydraulically operated by a cylinder with mounted power pack.

c) Hydraulically operated by a cylinder and linkage system.

d) Hydraulically operated with cylinders mounted on either side of the valve.

When hydraulic operation is required, the hydraulic power pack and cylinders shall be in accordance with the Auxiliary Drive Specification Clause 35.6.

35.9.2 Construction and Operational Requirements

Valves shall be of the sliding sleeve, inverted cone and jet dispersing type with acceptable actuation by means of rigid hinged levers or directly mounted hydraulic cylinders.

The valve designs shall ensure that the sliding sleeve cannot be distorted, due to over travel and over stressing of the sliding sleeve at the point of closure.

Operating mechanisms in or across the waterway are not acceptable. The only acceptable obstructions in the waterway are the streamlined radial ribs carrying the valve cone and seat.

The sleeve shall be guided throughout the travel to prevent sleeve rotation during operation due to unbalanced pressures.

The valve body may be ductile iron, cast or fabricated steel or stainless steel.

The cone and ribs of a fabricated valve shall be stainless steel 304L.

All operating linkages and mounting points shall be manufactured from stainless steel with appropriate bushing material at the pins.

The radial rib edges, in the water port area, shall be protected by brass strips screwed (assembled while the paint is still wet) or deposit welded to the rib edges to prevent crevice corrosion.

The sliding surfaces of the seals shall be polished to enhance smooth, easy sliding and a long seal life.

Valves shall provide tight shut-off. There shall be no leakage past the sealing faces when a pressure equal to the working pressure is applied to the valve with the sleeve in the closed position.

Lifting points shall be provided on both the front and the back of the valves to facilitate lifting and installation of the valves.

The following two sleeve valve designs described in a) and b) are acceptable:

a) Valve design with the back seal attached to the sliding sleeve:

- A stainless steel grade 304L sleeve, on which the back seal will slide, shall be shrunk onto the barrel of the body, if the valve body is not manufactured from stainless steel.
- The back seal retaining ring on the sliding sleeve shall be manufactured of stainless steel grade 304.
- The sliding sleeve may be constructed from spheroidal graphite iron, cast steel, aluminium bronze, fabricated steel or 3CR12 and shall incorporate a stainless steel seat ring which will seat over a renewable front rubber seal when the valve is in the closed position. The sleeves shall be guided by aluminium bronze guide rings.

b) Valve design incorporating the back rubber seal in the barrel position of the body:

- The sliding sleeve shall be of stainless steel, aluminium bronze or the internal bore of the sleeve may be stainless steel clad.
- The rear seal shall be exposed to facilitate replacement without removal of the sleeve.

c) Seals

- For both concepts the EPDM rubber seals shall be replaceable in-situ. The seal shall be positively secured in position by a stainless steel clamping ring.
- The front rubber seal on the cone shall be out of the waterway and positively held in position by a stainless steel grade 304 securing ring and shall not depend on friction for retention.

d) Operating mechanism – Lever operated

- Pins shall be permanently secured to the associated lever arms or linkages. The lever arms and linkages shall be of rigid design to prevent distortion or bending of the arms during the valve operational cycle.

e) Position indicator

- A mechanical or electronic valve position indicator, calibrated in specified increments of the openings, shall be designed, supplied and installed as specified under Clause 35.4.9.
- Electronic or hydraulic position indicators are preferred. Special valve opening position indicators, calibrated in the increments as specified, shall be designed, supplied and installed as required under Clause 35.4.9.
- The indicator system shall be installed and accurately calibrated to give true linear indication of the valve opening. Calibration of the indicator scale shall be done in-situ to show actual valve position recorded against the actual valve operation.
- The indicators shall indicate in increments of at least 5%. Digital indicators shall indicate in increments of 1%.
- All pulleys, brackets, pins, cables, counterweights, sleeves, indicator gears and fasteners shall be of stainless steel 304 or better.
- Details of the position indicator/s shall be as submitted with the Tender.

f) Flow Discharge Charts

- A flow discharge chart shall be supplied for each size of sleeve valve, showing the water flow rate (m^3/s) against the head (metres) at various percentages of valve openings. The water head shall be given in increments of 1 metre and the valve opening in increments of 5% from 0 to 100% open. Each chart shall have the name of the scheme as well as the size of the valve clearly displayed.
- The small increase in flow with the initial movement of the sleeve shall be taken into consideration and indicated on the flow charts.
- All information contained in the charts shall be engraved and painted on 2 mm thick aluminium plates (minimum size A2). Information plates shall be secured to the wall using stainless steel bolts. Positioning of the plates will be indicated by the Engineer.

g) Hoods

- Should a hood be required, it shall be fabricated from 3CR12 and corrosion protected as specified under Section 37 – Painting and Corrosion Protection.
- Hoods may be mounted on support pedestals or embedded into concrete.
- The hood design shall incorporate integral support pedestals for mounting onto embedded stainless steel mounting plates and lifting lugs for handling purposes. The mounting plates shall be integrally cast into the foundation to prevent the breaking of anchor bolts due to vibration of the hood.
- Stainless steel mounting bolts and washers shall be supplied to fix the hoods to the mounting plates.
- The hood shall be designed to give a continuous flow, with minimum vibration and with the back flow kept to a minimum.
- Drainage holes, minimum 50 mm diameter, are to be provided in all pockets where water is likely to accumulate.
- The hood shall be designed to facilitate easy removal of the sleeve valve. When the design incorporates a removable segment for removal of the sleeve valve, a suitable lifting point on the segment must be provided. All stainless steel fasteners for the fitment of the segment into the hood body shall be provided. The fasteners shall be of such a design to avoid fatigue failure and galling.

35.9.3 Valve Test and Material Specification

Valve components shall be constructed of the materials as specified in the following table:

TABLE 35/10
SLEEVE VALVES

Factory Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
150-1400	1000 / 1600	1500 / 2400	1 100 / 1 760
200 – 1200	2500 / 4000	3750 / 6000	2 750 / 4 400

Material Specifications:

COMPONENT		MATERIAL TYPE	MATERIAL SPECIFICATION
BODY		MILD STEEL CAST STEEL SG IRON STAINLESS STEEL	SANS 1431 Gr 350WA BS EN 10213 Gr 480/ SANS 1465-1 BS EN 1563 Gr 420/12, SANS 936 SG 42 BS EN 10090 Gr 304 S15
SLEEVE – SLIDING SURFACE ON SLEEVE		BRONZE (GUNMETAL) DEPOSIT WELDED	BS EN 1982: 2008 LG2
SLEEVE – SLIDING SURFACE ON BODY		CAST STEEL SG IRON	BS EN 10213 Gr 480/ SANS 1465-1 BS EN 1563 Gr 420/12, SANS 936 SG 42
CLAMP RING		STAINLESS STEEL	BS EN 10090 Gr 304 S15
BEARINGS		ELASTOMER	PTFE
SPACER		STAINLESS STEEL	BS EN 10090 Gr 304 S15
SEAL RINGS		O RING	NITRILE / VITON / EPDM
HOOD (Where applicable)		CORROSION RESISTANT STEEL	3CR12
HYDRAULIC CYLINDER		STAINLESS STEEL	BS EN 10090 Gr 304 S15
COTTER PINS		STAINLESS STEEL	BS EN 10090 Gr 431 S29
ANTI –ROTATION BAR		STAINLESS STEEL	BS EN 10090 Gr 304 S15
LINK	(If actuated)	STAINLESS STEEL	BS EN 10090 Gr 304 S15
LEVER CRANK ASSEMBLY	(If actuated)	STAINLESS STEEL	BS EN 10090 Gr 304 S15
PIVOT SHAFT	(If actuated)	STAINLESS STEEL	BS EN 10090 Gr 431 S29
PIVOT SHAFT BUSH	(If actuated)	BRONZE (GUNMETAL)	BS EN 1982: 2008 LG2
CLEVIS	(If actuated)	STAINLESS STEEL	BS EN 10090 Gr 304 S15
CLEVIS SHAFT BUSH	(If actuated)	BRONZE (GUNMETAL)	BS EN 1982: 2008 LG2
CLEVIS SHAFT	(If actuated)	STAINLESS STEEL	BS EN 10090 Gr 431 S29
DRIVE SHAFT	(If actuated)	STAINLESS STEEL	BS EN 10090 Gr 431 S29
GLAND FOLLOWER	(If actuated)	PHOSPHOR BRONZE	BS EN 1982 PB1C (Cu,Sn10,P)
GLAND PACKING	(If actuated)	GRAPHITE PACKING	NOTE: NO ASBESTOS
PEDESTAL	(If actuated)	MILD STEEL CAST STEEL SG IRON	SANS 1431 Gr 350WA BS EN 10213 Gr 480/ SANS 1465-1 BS 2789 Gr 420/12, SANS 936 SG 42
GLAND BUSH	(If actuated)	PHOSPHOR BRONZE	BS EN 1982 PB1C (Cu,Sn10,P)
INDICATOR PLATE	(If actuated)	STAINLESS STEEL	BS EN 10090 Gr 304 S15
POINTER ASSEMBLY		STAINLESS STEEL	BS EN 10090 Gr 304 S15
FASTENERS		STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2

35.10 PRESSURE REDUCING, SUSTAINING AND FLOW CONTROL VALVES

35.10.1 General

The pressure reducing, pressure sustaining and flow control valves offered and installed under this Contract shall be suitable for operation with raw water.

The upstream pressure of this type of valve can vary from the maximum surge pressures in a pipeline to the minimum dynamic head during the maximum anticipated flow rate. The pilot valve

system, were applicable, shall be capable of efficient functioning under the full range of inlet pressures.

On closing, the valve shall have a linear flow velocity reduction characteristic to reduce pressure surges. Alternatively, the closing cycle should be inversely proportional to increasing dynamic pressure, by means of an automatic adjustable pressure sensitive controlled pilot valve assembly, which will induce a reduction in closing speed with increased dynamic inlet pressure. This assembly shall prevent continued closing when the inlet pressure exceeds the system design pressure.

The Contractor will further prevent prolonged valve closing rates that could result in sustained excessive velocities at high-pressure differentials across the valve seat. This could cause rapid erosion of coating, cavitation damage and possible reservoir spillage.

Resistance to cavitation damage is essential and the maximum permissible flow rates through the valve at the respective maximum differential pressures across the control valve shall be quoted. Valves which offer a built-in resistance against cavitation damage of the downstream Plant e.g. the valve, pipeline and control circuitry, shall receive preference.

Mechanical pressure loss devices i.e. orifices may be utilised to assist with pressure reduction, provided that this will not have an adverse effect on the discharge rate at the anticipated specified minimum dynamic inlet pressure and result in excessive noise and vibration.

Depending on the particular function of the valves, the control circuit shall be for control pressure or flow.

35.10.2 Construction and Operational Requirements

The Control Valve shall respond to electric / hydraulic commands by changing its opening position to control a measurable characteristic (pressure, flow and level).

The main valve shall be of diaphragm actuated oblique ("Y") or Globe (G) pattern design. The body shall have a replaceable, raised, non-threaded, stainless steel seat ring. The valve shall have unobstructed flow path, with no stem guides, bearings or supporting ribs.

All control and pilot valves shall be clearly and permanently labelled.

The actuator assembly shall be single or double chambered with preference to an inherent separating partition between the lower surface of the diaphragm and the main valve. The stainless steel valve shaft shall be centrally double guided in suitable renewable bearings in the separation partition, preventing excessive wear, during flow velocities exceeding 3 meters per second. The replaceable radial seal disk shall include a resilient seal and shall be capable of accepting a V-port throttling plug by bolting.

Preference will be given to control valves capable of accepting a visual valve position indicator for observing its seal disk opening level and accepting an electric limit (on-off) switch and position transmitter (0-100% opening).

Preference will further be given to control valves with an open assembly feature, which permits the inspection and service of the control valve’s internal operating mechanism, the seat, plunger, main shaft, etc. without the removal of the valve from the pipeline.

The hydraulic control piping circuit shall be provided with a filtering system containing a removable 100 - 200 micron strainer cartridge. This shall be situated on both the upstream and downstream sides of the valve preventing interference of the normal functioning of the pilot valve and control Plant items. The control system shall consist of 2-way solenoid pilot valves, isolating ¼-turn ball valves, filters with all necessary piping and fittings. All shall be manufactured of stainless steel.

Stainless steel trimmed control valves including the main valve seat, plunger assembly and shaft with epoxy powder coated steel or cast iron accessories are preferred to bronze trim. Pinned stainless steel valve seats are preferred to epoxy glued seats.

Tubing and fittings shall be made of Stainless Steel (1.5" - 12"; DN40- 300), Copper & Brass (14"; DN350 and above). All pilots and control accessories should be Stainless Steel, Bronze and/or Brass depending on the type of control required.

Pressure gauges and recorders where specified must be permanently mounted up and down stream of the valve on the control system to indicate all required pressures.

All pilot valves shall be supplied sealed, using sealing wire and lead seals, to prevent unauthorised tampering.

Pilot valve components subject to wear e.g. valve seats, pressure sensing membranes, shafts, hydraulic seals, resilient seats, etc. shall be readily available as replacement spare parts.

35.10.3 Hydraulically-Operated Electronic-Control Valve Assemblies

35.10.3.1 General

The control valve(s) of the control valve assembly for supplying water to the various off-takes along the pipeline shall be of the hydraulically-operated, diaphragm-actuated type and shall respond to hydraulic and electrical commands, to open or close or to control a measurable characteristic (pressure, flow and level).

More than one control valve may be installed in series should the differential pressure be too high for one valve. The control valve assembly must be able to operate satisfactorily and without any cavitation over the full range of flow and pressure conditions. The control valve assembly shall be provided complete with all valves, associated pipework, pilot valves, tubing and control accessories.

35.10.3.2 Configuration and duty

The control valve assembly shall have the following functionality:

- Open/Close on command; and
- Maintain a remotely controlled pre-set value.

The required flows at off-takes are indicated on the relevant off-take installation detail drawing.

35.10.3.3 Input Signals / Parameters

The control valve assembly shall respond to the following input signals / parameters:

- Open/close signal from the Operational Control Centre; and
- Flow rate from an inline flow meter.

The opening and closing of the control valve(s) shall proceed smoothly over a hydraulically adjustable pre-set time period. The pre-set time period shall be adjustable between the limits of 5 and 20 minutes.

When open, the control valve assembly shall maintain a constant pre-set operational flow rate regardless of changes in upstream and downstream operating pressures. The pre-set flow rate shall be adjustable.

35.10.3.4 Control Plant Items

As specified in Clause 40.9.5 under Section 40 – Control and Instrumentation General.

35.10.3.5 Hydraulic Operating Conditions

The conditions of flow and upstream / downstream pressures under which the control valve assembly will operate are indicated on the Drawings.

The assembled valve(s) shall be hydraulically tested to the test requirements as specified in Table 35/11.

35.10.3.6 Control principals for MCWAP-2 off-take installations

a) The control valve station will comprise of two parallel systems / branches both equal in design (one duty and one standby).

b) Each leg of the parallel system will comprise of two valves in series.

c) The full pressure reduction ratio across the control valve station will be shared across the two valves in series. This is to reduce the upstream pressure in steps assisting with durability of the system and to have redundancy across the system.

d) The reduction ratio for the two valves in series does not have to be equal, but have to be within acceptable working parameters.

e) The upstream valve in series, should primarily reduce the pressure onto the downstream valve.

f) The downstream valve will perform two functions, i.e. flow control and pressure reducing control.

g) The downstream valve will reduce the pressure to the required downstream pressure. The control should be by means of a control pilot, which is adjustable between 1-16bar.

h) Each control valve shall be equipped with two pilot systems for the control of the design flow and nominal flow.

i) The material of the pilot systems shall be stainless steel grade 316L.

j) The upstream valve shall fail in an open position. Failure of this valve must result in shutting down of the particular branch and activating the alternative branch.

k) The upstream valve shall have a low pressure override function.

l) The flow control function shall allow a range of flows to the downstream user up to a maximum pre-set flow rate, i.e. the downstream user may use less than the pre-defined flow rate, but will not be allowed to use in access of the said maximum demand flow rate.

m) All the control valves shall be equipped to allow local and remote control (from an Operation and Control Centre). All these valves shall be equipped with a solenoid control system to allow remote pressure monitoring and pressure control in pre-determined steps over the full open-to-close operating range of the valve. This function together with monitoring the downstream flow meters will also allow remote flow control.

n) Each valve shall be equipped with a speed control device, in order to control the speed of operation.

o) Allowance shall be made on the valve for up- and downstream pressure sensing transmitters. This is to measure the up-, down- and mid-section pressures across each leg of the parallel system for control purposes.

p) Each valve shall be equipped with a manual pressure gauge for verification during commissioning stages.

q) The valve controls shall be mounted on a panel, attached to one of the side walls of the valve chamber. Interconnection pipes will be installed to connect the panel controls to the valve.

r) A duplicate large control filter should be included on the panel mount control system. This is to clean the water used for the control system. One filter at a time should be cleaned without interruption of the system.

s) In addition to the large control filter, a first stage self-cleaning finger filter should be used at the start of the control loop to prevent larger particles from entering into the control loop circuit.

t) The complete system above shall be duplicated for the second leg of the parallel system.

35.10.3.7 Notice Board and Drawings

An approved operating instruction notice board made of engraved aluminium with painted lettering (in engraving) shall be supplied for the control valve assembly. The whole board shall be coated with a protective layer.

The following shall be indicated on the notice board:

- Concise operating instructions;
- The numbers of the valves, accessories and pilot valves; and
- General layout of the valves, accessories, pilot valves and piping.

The notice board shall be mounted against a wall of the valve chamber opposite the control valve assembly.

Drawings and the design of the control valve assembly with a full description of the complete control system and piping together with the sizing and functioning of each component shall be provided.

35.10.4 Valve Test and Material Specification

Valve components shall be constructed of the material specified in the following table:

TABLE 35/11
PRESSURE REDUCING, SUSTAINING AND FLOW CONTROL VALVES

Factory Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
50 – 600	1 000	1 500	1 000
	1 600	2 400	1 600
	2 500	3 750	2 500
	4 000	6 000	4 000

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
CORROSION PROTECTION COATING	INTERNAL & EXTERNAL	REFER CLAUSE 35.3.9
BODY	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
BONNET COVER	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
BEARING DISC	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
COVER AND DRAIN PLUGS	HIGH TENSILE BRASS	BS 2872 CZ 114
COVER BODY AND DIAPHRAGM SEAL	O RING	NBR-NITRILE BUTADIENE RUBBER
DIAPHRAGM	SYNTHETIC RUBBER	NEOPRENE (nylon reinforced)
DIAPHRAGM WASHER	GALVANIZED STEEL	BS 1504-161, SABS 1465 Part 1
SHAFT	STAINLESS STEEL	BS EN 10090 Gr 431 S29
BEARING SEALS	O RING	NBR-NITRILE BUTADIENE RUBBER
SHAFT BEARING	PHOSPHOR BRONZE	BS EN 1982 PB1C (Cu,Sn10, P)
SEAL DISC SEAL	O RING	NBR-NITRILE BUTADIENE RUBBER
SPACER DISC	HIGH TENSILE BRASS	BS EN 12163 CZ 114
SEAL DISC WASHER	PHOSPHOR BRONZE	BS EN 1982 PB1C (Cu, Sn10, P)
SEAL DISC RETAINER	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
V PORT THROTTLING PLUG	STAINLESS STEEL	BS EN 10090 Gr 304 S15
REMOVABLE SEAT	STAINLESS STEEL	BS EN 10090 Gr 304 S15
NEEDLE VALVE	AUXILIARY PLANT	MANUFACTURE'S STD SUPPLY
COCK VALVES	AUXILIARY PLANT	MANUFACTURE'S STD SUPPLY
FILTER	AUXILIARY PLANT	MANUFACTURE'S STD SUPPLY
PRESSURE REDUCING PILOT VALVE	AUXILIARY PLANT	MANUFACTURE'S STD SUPPLY
PRESSURE RELIEF PILOT VALVE	AUXILIARY PLANT	MANUFACTURE'S STD SUPPLY
PRESSURE GAUGE	AUXILIARY PLANT	MANUFACTURE'S STD SUPPLY
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANISED)	SANS 1700 (SANS 121, ISO 1461)
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2
TUBING AND FITTINGS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2
VALVE POSITION INDICATOR	AUXILIARY PLANT	MANUFACTURE'S STD SUPPLY

35.11 AIR RELEASE AND VACUUM CONTROL VALVES

35.11.1 General

Air valves shall not exhibit the characteristics of dynamic closure in exhaust and vacuum mode. The valves shall, unless otherwise specified, be dual acting and suitably sized to allow and control the intake and release of air under negative and high-pressure conditions, without creating shock or pressure surges in the pipeline.

The valve shall control the discharge of entrapped air while the pipe is under pressure and the discharge of large volumes of air during a pipeline filling operation. Similarly, should a vacuum condition occur i.e. draining a pipeline, the valve shall allow a controlled intake of air into the system.

The large intake and exhaust orifice of air valves shall be equal to the nominal size of the valve e.g. a 200 mm valve shall have a 200 mm inlet and outlet orifice. The valve shall incorporate an integral anti-shock (non-slam) orifice mechanism which shall operate automatically to limit transient pressure rise or water hammer induced by closure. An inherent feature of the valve design must be to ensure that the float does not close before all the air has been released.

Care shall be taken where air valves are mounted on sloping pipes that the air valves are mounted level. The maximum allowable “out of level” tolerance allowed after installation shall be 2.5 degrees.

All air valves shall be hydraulically drop tight when full of water and under pressures of between 5 metre (50 kPa) to 1,5 times the maximum operating pressure of the valve.

All isolating valves required isolating each of the air valves for maintenance and/or repair purposes shall be resilient seal valves as specified in Clause 35.12. Each isolating valve shall incorporate a locking facility to lock the valve in an open position or closed position.

35.11.2 Construction and Operational Requirements

35.11.2.1 Body

The valve body shall be of a compact single or dual chamber design. The ball or float(s) shall be easily accessible for maintenance purposes.

35.11.2.2 Float

The float guides shall be designed to have sufficient clearance to ensure free operation and prevent any abrasion when subjected to frequent operation in raw water conditions.

Cylindrical or ball type floats shall preferably be manufactured from polypropylene or similar polymer type material. Water absorption shall be less than 0,01%. Floats shall not be able to adhere to the orifice sealing arrangement nor be affected by deposits on the float surface.

Floats shall not distort or suffer mechanical damage in any form when subjected to a structural strength test or conditions of frequent use.

35.11.2.3 Draining Facility

Provision shall be made for the drainage of the air valve, by means of a ¼” stainless steel BSP/NPT connection nipple with stainless steel ball valve prior to removal or servicing and for the fitting of pressure gauges for testing purposes.

The stainless steel connection nipple shall extend through the lower flange assembly to cover all the threads.

35.11.2.4 Weather Covers

All air valves shall be supplied with easily removable weather covers that will allow free discharge or intake of air but shall exclude the ingress of objects that may cause damage or malfunction of the valves. Fibreglass covers are not acceptable.

Screens and fasteners shall be manufactured from stainless steel.

35.11.2.5 Corrosion Protection

Corrosion protection shall be as specified in Section 37 – Painting and Corrosion Protection.

All wet stainless steel surfaces shall be coated with two-pack Epoxy to 125 micrometres to prevent electrolytic corrosion.

35.11.2.6 Construction of Air Valve Branches and Chambers

Air valves shall be:

a) Situated in air valve chambers above ground level to limit flooding of air valves. The air valve chambers shall be vented to allow for the expelling and introduction of sufficient air;

b) Mounted on 700 mm accumulators unless specified otherwise; and

c) Spaced a maximum of 600 m apart and at all high points along the pipeline.

Air valve chambers will be provided with concrete slabs to protect the installation from vandalism. Refer to the Drawings for typical detail.

35.11.2.7 Seat

The seat and guides shall be so designed as to have sufficient clearance to prevent any abrasion of the float(s) when subjected to frequent operation.

35.11.3 Valve Test and Material Specification

Valve components shall be constructed of the material specified in the following tables:

TABLE 35/12
CYLINDER FLOAT TYPE (DN 25-200)

Factory Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
25 - 200	1 000	1 500	1 000
	1 600	2 400	1 600
	2 500	3 750	2 500
	4 000	6 000	4 000

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
UPPER BODY FLANGE	MILD STEEL / STAINLESS STEEL	SANS 1431 Gr 350W, BS 970 Part 4 Gr 304 S15
LOWER BODY FLANGE	MILD STEEL / STAINLESS STEEL	SANS 1431 Gr 350W, BS 970 Part 4 Gr 304 S15
BARREL	STAINLESS STEEL	BS EN 10090 Gr 304 S15
BARREL SEALS	COMPRESSED FIBRE GASKET	BS 1832 Gr A
INTERNAL SEALS	O RING	NITRILE / VITON
TOP COVER	ALUMINIUM / STAINLESS STEEL	BS 970 Part 4 Gr 304 S15
ANTI SHOCK ORIFICE	PLASTIC	HIGH DENSITY POLYETHYLENE
FLOATS	PLASTIC	HIGH DENSITY POLYETHYLENE
BAFFLE SPACERS	PVC	
NOZZLES	STAINLESS STEEL	BS EN 10090 Gr 304 S15
NOZZLE SEATS	ELASTOMER	NITRILE / VITON
NOZZLE RETAINING RING	STAINLESS STEEL	BS EN 10090 Gr 304 S15
BAFFLE PLATES	STAINLESS STEEL	BS EN 10090 Gr 304 S15
TIE RODS	STAINLESS STEEL	BS EN 10090 Gr 304 S15
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED	SANS 1700 (SANS 121, ISO 1461)

TABLE 35/13
BALL FLOAT TYPE (DN 50-200)

Factory Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
50 - 200	1 000	1 500	1 000
	1 600	2 400	1 600
	2 500	3 750	2 500
	4 000	6 000	4 000

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
COVER	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
COWL	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
BALL	POLYPROPYLENE	PP/PVDF
SEAL RINGS	ELASTOMER	NITRILE / NEOPRENE
STEM AND GUIDE COMPONENTS	STAINLESS STEEL	BS EN 10090 Gr 431 S29
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED)	SANS 1700 (SANS 121, ISO 1461)

TABLE 35/14
SMALL ORIFICE TYPE (DN 25)

Factory Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
25	1 000	1 500	1 000
	1 600	2 400	1 600
	2 500	3 750	2 500
	4 000	6 000	4 000

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
INNER BODY	REINFORCED NYLON	POLYAMIDE 6 (POLYRAM)
OUTER BODY	DUCTILE IRON	ASTM A-536 60-40-18
THREADED OUTLET	STAINLESS STEEL	BS EN 10090 Gr 304 S15
ROLLING SEAL	RUBBER	EPDM
CLAMPING STEM	REINFORCED NYLON	POLYAMIDE 6 (POLYRAM)
FLOAT	PLASTIC	FOAMED POLYPROPYLENE
O-RING	RUBBER	BUNA-N
INLET BASE	BRASS	ASTM B-124
STRAINER	NYLON	POLYAMIDE 6 (POLYRAM)

TABLE 35/15
KINETIC BALL TYPE (DN 50 –200)

Factory Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
50 - 200	1 000	1 500	1 000
	1 600	2 400	1 600
	2 500	3 750	2 500

Material Specifications:

MATERIALS:		
COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
COVER	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
COWL	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
BALL	POLYPROPYLENE	PP/PVDF
SEAL RING	ELASTOMER	NITRILE / NEOPRENE
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2

MATERIALS:		
COMPONENT	**MATERIAL TYPE**	**MATERIAL SPECIFICATION**
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANISED)	SANS 1700 (SANS 121, ISO 1461)
ANTI-SHOCK ORIFICE	SG IRON PLASTIC	BS EN 1563 Gr 420/12, SANS 936 SG 42 HD POLYETHYLENE

35.12 GATE VALVES

35.12.1 General

Gate valves shall be double flanged and be of the resilient seal or wedge-gate type, the gates of which shall be completely clear of the waterway in the fully open position. Generally, valves to be installed below ground level subject to flooding, shall be of the non-rising spindle type. Valves installed inside buildings and where valve status monitoring is required, shall have rising spindle, unless otherwise scheduled. The valves shall be capable of withstanding the nominal pressure (PN) and specified test pressures from both sides. The gate shall operate satisfactorily under the specified conditions.

35.12.2 Specifications

Valves shall generally be manufactured in accordance with SANS 664 and SANS 191.

35.12.3 Body

The body shall be of rigid design to minimise distortion under pressure. Bodies shall be designed and manufactured to withstand any additional gearing-related stresses.

35.12.4 Gearbox

The valve gearbox, were applicable, shall not be mounted directly onto the stuffing box but shall be mounted on a supporting bracket.

35.12.5 Operation

The gate valve shall be able to open and close satisfactorily under the specified flow rate and differential pressure. Valves shall close turning the hand wheel in a clockwise direction.

35.12.6 Position Indicator

All valves of DN300 and larger shall be fitted with a mechanical linear indicator system mounted on the valve spindle to show the position of the gate.

35.12.7 Spindle and Thrust Bearing

The spindle thrust collar shall bear against a ball thrust bearing, of approved design.

All gate valves shall be fitted with a back seal to permit the replacement of the spindle seals under pressure where appropriate.

35.12.8 Corrosion Protection

Corrosion protection of gate valves shall comply with Section 37 – Painting and Corrosion Protection. Damage to the corrosion protection or the rubber-coated gate during testing or normal operation shall be repaired to the Engineer's satisfaction.

35.12.9 Construction and Operational Requirements

35.12.9.1 Resilient Seal Gate Valves

(a) Body, Guides and Shoes

The valve body shall incorporate a straight unobstructed body passage without pockets and shall have inclined seats and prominent gate guides to eliminate deposits in the valve body.

The guides shall be as deep and as long as possible, but not protruding into the flow path to offer support in all gate positions of the gate.

The rubber coated gate shoes shall accurately fit the body guide profile to allow smooth operation of the gate with minimal shudder.

(b) Gate

The gate shall be accurately moulded and completely encapsulated in rubber and accurately moulded to ensure complete corrosion protection and drop tightness over the valve pressure range. The rubber coated gate shall be designed to offer an equal distribution of sealing pressure in all directions with a capacity to accept foreign matter up to 1 mm in particle size.

(c) Spindle

A corrosion resistant spindle seal arrangement shall include a scraper ring to prevent the ingress of foreign matter. A spindle thrust collar shall be installed between thrust bearings or anti-friction materials to ensure low operating forces.

(d) Corrosion Protection

Corrosion protection for RSV gate valves shall comply with the Specification 37 – Painting and Corrosion Protection. Damage to the corrosion protection or the rubber-coated gate during testing or normal operation shall be repaired to the Engineer's satisfaction.

35.12.9.2 Wedge Gate Valves

(a) Body, Guides and Shoes

The body channel guides and the gate shoes shall be as deep and as long as necessary to support and minimise shudder of the gate in any position during its travel.

Shoes shall be accurately fitted in the guides so as to ensure that the sealing rings do not make contact before the gate is seated and that the gate is centralised when seated.

The sliding surfaces between the shoes and the channels shall be constructed from acceptable dissimilar materials to achieve non-galling and smooth operation of the gate.

With the valve fully open, at least half of the shoe shall be supported by the guides.

(b) Stop / Jacking Screws

Jacking screws shall be provided to prevent over travel of the gate when closed. The area of contact on the gate shall be deposit welded with stainless steel or similar quality of the stop screw.

(c) Spindle

The spindle thrust collar shall bear against a ball thrust bearing of approved design.

A collar shall be fitted to the stem to prevent it from dropping into the valve.

(d) Sealing Faces

Body and gate sealing faces shall be deposit welded.

The leading edges of the sealing faces shall be chamfered and dressed.

(e) Gate and Body Marks

One face of the gate shall be marked, corresponding to a similar mark on the body, to ensure correct replacement after dismantling. The marks shall be visible and clear after coating. The details of the marking shall be shown on the drawings.

35.12.10 Valve Test and Material Specification

Valve components shall be constructed of the material specified in the following tables:

TABLE 35/16
RESILIENT SEAL GATE VALVES (DN 50-600)

Factory Test Requirements:

SIZE DN	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
50 – 600	1 000	1 500	1100
	1 600	2 400	1 760
	2 500	3 750	2 750

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
GATE	SG IRON, COATED	BS EN 1563 Gr 420/12, SANS 936 SG 42, AND VULCANISED WITH EPDM
BONNET AND STUFFING BOX	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
SPINDLE	STAINLESS STEEL	BS EN 10090 Gr 304 S15
SPINDLE NUT	BRONZE (GUNMETAL)	BS EN 1982 LG2
SPINDLE BUSH	PLASTIC	
BUSH / SPINDLE / STUFFING BOX SEALS	O RING	NITRILE / VITON
PROFILE / SCRAPER RING	O RING	NITRILE / VITON
FRICTION RING	PLASTIC	
HAND WHEEL	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED) STAINLESS STEEL	SANS 1700 (SANS 121, ISO 1461) ASTM A193 Gr B8M, ASTM A439 Gr D2

TABLE 35/17
WEDGE GATE VALVES (DN 50-1 200)

Factory Test Requirements:

SIZE DN	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
50 – 1 200	1 000	1 500	1 100
	1 600	2 400	1 760

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
GATE	SG IRON	BS EN 1563 Gr 450/10, SANS 936 SG 42
BODY SEAT	STAINLESS STEEL (DEPOSIT WELDED)	BS EN 10090 Gr 316 S16
GATE SEAT	BRONZE (GUNMETAL) (DEPOSIT WELDED) STAINLESS STEEL (DEPOSIT WELDED)	BS EN 1982 LG2 Of similar quality but 40 Vickers hardness different to the seat
BONNET AND STUFFING BOX	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
SPINDLE	STAINLESS STEEL	BS EN 10090 Gr 304 S15
SPINDLE NUT AND YOKE	BRONZE (GUNMETAL)	BS EN 1982 LG2
GLAND	CAST STEEL	BS EN 10213 Gr 480/ SANS 1465-1
PEDESTAL PLATE	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
GATE NUT	BRONZE (GUNMETAL)	BS EN 1982 LG 2
THRUST BEARINGS	CAST STEEL	BS EN 10213 Gr 480/ SANS 1465-1
HAND WHEEL	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
SEALS	O RING	NITRILE / VITON
PACKING	GRAPHITE FIBRE	NOTE : NO ASBESTOS
JACKING SCREWS	STAINLESS STEEL	BS EN 10090 Gr 304 S15
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED) STAINLESS STEEL	SANS 1700 (SANS 121, ISO 1461) ASTM A193 Gr B8M, ASTM A439 Gr D2

TABLE 35/18
WEDGE GATE VALVES (DN 50-500)

Factory Test Requirements:

SIZE DN	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
50 – 500	2 500	3 750	2 750
	4 000	6 000	4 400

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	CAST STEEL SG IRON	BS EN 10213 Gr 480/ SANS 1465-1 BS EN 1563 Gr 450/10, SANS 936 SG42
GATE	CAST STEEL SG IRON	BS EN 10213 Gr 480/ SANS 1465-1 BS EN 1563 Gr 450/10, SANS 936 SG42
BODY SEAT	STAINLESS STEEL (DEPOSIT WELDED)	BS EN 10090 Gr 316 S16
GATE SEAT	BRONZE (GUNMETAL) (DEPOSIT WELDED)	BS EN 1982 LG2
BONNET AND STUFFING BOX	CAST STEEL SG IRON	BS EN 10213 Gr 480/ SANS 1465-1 BS EN 1563 Gr 420/12, SANS 936 SG 42
SPINDLE	STAINLESS STEEL	BS EN 10090 Gr 431 S29
SPINDLE AND YOKE NUT	BRONZE (GUNMETAL)	BS EN 1982 LG2
GLAND	CAST STEEL	BS EN 10213 Gr 480/ SANS 1465-1
PEDESTAL PLATE	SG IRON	BS EN 1563 Gr 420/12, SANS 936 SG 42
GATE NUT	BRONZE	BS EN 1982 LG2
THRUST BEARINGS	CAST STEEL	BS EN 10213 Gr 480/ SANS 1465-1
HAND WHEEL	SG IRON	BS EN 1563 Gr 450/10, SANS 936 SG 42
SEALS	CUP SEALS	NITRILE / VITON, BS 1658
PACKING	GRAPHITE FIBRE	NOTE : NO ASBESTOS
JACKING SCREWS	STAINLESS STEEL	BS EN 10090 Gr 304 S15
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED) STAINLESS STEEL	SANS 1700 (SANS 121, ISO 1461) ASTM A193 Gr B8M, ASTM A439 Gr D2

35.13 RING NEEDLE (PLUNGER) VALVES

35.13.1 General

Ring needle (plunger) valves are required as a control valve to control flow rates, reduce or sustain pressures in a pipeline and to release water from pipelines.

35.13.2 Construction and Operational Requirements

Valves with operating mechanisms exposed in, or across the waterway are not acceptable.

The only acceptable obstructions within the waterway are the radial ribs carrying the valve cone.

The body and seats shall be designed and constructed to prevent seats from becoming loose and obviate water seepage behind the seats during all conditions of operation and test.

The plunger shall be guided by long, low friction guide rails that shall be impervious to debris deposits.

Preference shall be given to valves which operate without cavitation and vibration over the full range of flow rates and pressure differences. The valve design shall be capable of accommodating vane ring and slotted cylinder elements, should the application of the valve call for these requirements.

The valve needle position indicator system shall be accurately installed and adjusted to give a true linear indication of the valve opening. The calibration of the indicator scale shall be carried out in situ and shall be directly linked to the actual valve operation.

Provision shall be made for the rigid mounting of the drive mechanism to the valve body.

35.13.3 Pump Control Valves

The opening time of the control valves shall be determined by the Contractor as to satisfy both the hydraulic and electrical characteristics of the Plant with any combination of pumpsets operating. The opening time of control valves is normally set between 60 and 180 seconds depending on the hydraulic characteristics of the pipeline.

The control valves shall fulfil the following functions:

- Electrical operation (isolating and control) suitable for opening and closing against the specified pressure and for continuous operation in any intermediate position;
- Automatic as well as manual mode control; and
- Adjustable closing time and adjustable closing characteristic.

The control valves shall be arranged for selection of either manual-electric or automatic-electric operation and be controlled from the pump control console. Push buttons "open", "close" and "stop" for piloting these valves, when throttling is required, shall be incorporated in each pump control console, as well as indicator lamps showing "closed" (green) "intermediate" (amber) "open" (red) positions. In addition, a selector switch "manual/automatic" shall be incorporated, the automatic position being in conjunction with pump starting.

In the “automatic” mode the valve shall open automatically from the fully closed to fully open position when the pumpset is started, likewise closing automatically when the pumpset is to be shut down.

In the "manual" mode the valve shall open automatically to at least the "10% open" intermediate position, where after manual selection of the valve position shall be enabled.

Each valve shall be interlocked with the pump starter. To minimise water hammer, when the pump is to be stopped, the valve shall close slowly by means of the electric actuator before the pumpset is tripped and stopped by interlocked relays.

Similarly, the valve shall be arranged so that the pump can be started only when the valve is fully closed. The valve shall open only when the starting operation is completed and the motor is up to speed.

Control valves shall be designed to operate free of cavitation in intermediate (throttling) positions.

The operator shall be able to operate the valve manually from the LCP for test purposes and for emergency pumping when the automatic control is not operational.

35.13.4 Valve Test and Material Specification

Valve components shall be constructed of the material specified in the following tables:

TABLE 35/19
RING NEEDLE (PLUNGER) VALVES (DN 150 - 1200)

Factory Test Requirements:

SIZE DN	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
150 – 1 200	1 000	1 500	1 000
	1 600	2 400	1 600
	2 500	3 750	2 500
	4 000	6 000	4 000

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	SG IRON	BS EN 1563 Gr 450/10, SANS 936 SG42
PLUNGER	STAINLESS STEEL	BS EN 10090 Gr 304 S15
SEAT ARRANGEMENTS: (Where applicable) A. STD SEAT RING B. SHORT DIFFUSER C. SLOTTED SLEEVE D. ANTI-CAVITATIONAL CYLINDER	 STAINLESS STEEL STAINLESS STEEL CAST STAINLESS STEEL STAINLESS STEEL	 BS EN 10090 Gr 304 S15 BS EN 10090 Gr 304 S15 BS EN 10090 Gr 304 S15 BS EN 10090 Gr 304 S15
OUTLET PIECE: (Where applicable) A. FOR STD SEAT RING B. FOR SHORT DIFFUSER C. FOR SLOTTED SLEEVE D. FOR ANTI-CAVITATIONAL CYLINDER	 SG IRON CAST STEEL SG IRON SG IRON	 BS EN 1563 Gr 420/12, SANS 936 SG 42 BS EN 10213 Gr 480/ SANS 1465-1 BS EN 1563 Gr 420/12, SANS 936 SG 42 BS EN 1563 Gr 420/12, SANS 936 SG 42

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
CONNECTING ROD BEARING	SG IRON	BS EN 1563 Gr 450/10, SANS 936 SG42
CRANK	STAINLESS STEEL	BS EN 10090 Gr 304 S15
CONNECTING ROD	CAST STEEL	BS EN 10213 Gr 480/ SANS 1465-1
CRANK SHAFT	STAINLESS STEEL	BS EN 10090 Gr 304 S15
BEARING AND CRANK PIN	STAINLESS STEEL	BS EN 10090 Gr 304 S15
SHAFT BEARING BUSHES	PHOSPHOR BRONZE	BS EN 1982: 2008 PB1C (Cu,Sn10,P)
SHAFT BEARING SEALS	O-RING	NITRILE / VITON / EPDM
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED)	SANS 1700 (SANS 121, ISO 1461)
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2
OPERATION ARRANGEMENT (✓): GEARBOX		SEE AUXILIARY DRIVE SPECIFICATION
ELECTRIC ACTUATOR		SEE AUXILIARY DRIVE SPECIFICATION
HYDRAULIC ACTUATOR		SEE AUXILIARY DRIVE SPECIFICATION

35.14 SAFETY RELIEF VALVES

35.14.1 General

Safety relief valves shall be supplied with separate auxiliary isolating valves complete with locking devices.

All valves shall be flanged and rated to the applicable nominated pressure rating and calibrated to the specified system pressure requirements.

There shall be no flutter of the disc or vibration during relief operations.

The pressure relief valve shall preferably discharge in a vertical upwards direction without the possibility of damage to Plant or injury to personnel.

35.14.2 Construction and Operational Requirements

All valves shall be fitted with a lifting lever mechanism. The disc holder shall be central and aligned in hard stainless steel guides for durability and high performance.

The disc shall be a thermally balanced and finely lapped two piece assembly protected by ball joints above and below the guides and at the spring washers to prevent rotational damage, ensure proper alignment and maintain seat tightness.

All valves shall be fitted with a reducer pipe and the valve bonnets vented to remove any pressure build-up which could affect the relieving operation of the valve.

35.14.3 Valve Test and Material Specification

Valve components shall be constructed of the material specified in the following tables:

TABLE 35/20
SAFETY RELIEF VALVES (DN 25 - 250)

Factory Test Requirements:

SIZE DN	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
25 - 50	1 030	1 600	1 030
	2 060	3 000	2 060
200 - 250	4 130	6 200	4 130
	10 340	15 400	10 340

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY	CARBON STEEL	ASTM A216 Carbon Steel Casting
BONNET	CARBON STEEL	ASTM A216 Carbon Steel Casting
NOZZLE	STAINLESS STEEL	BS EN 10090 Gr 316 S15
DISC	STAINLESS STEEL	BS EN 10090 Gr 316 S15
ADJUSTING RING	STAINLESS STEEL	BS EN 10090 Gr 316 S15
ADJUSTING RING HOLDER	STAINLESS STEEL	BS EN 10090 Gr 316 S15
DISC HOLDER	STAINLESS STEEL	BS EN 10090 Gr 316 S15
GUIDE	STAINLESS STEEL	BS EN 10090 Gr 316 S15
STEM	STAINLESS STEEL	BS EN 10090 Gr 431 S29
STEM RETAINER	STAINLESS STEEL	BS EN 10090 Gr 410
SPRING	ALLOY STEEL	SANS 1465 – 1: 2008
SPRING WASHER	CARBON STEEL	ASTM A216 Carbon Steel Casting
ADJUSTING SCREW	STAINLESS STEEL	BS EN 10090 Gr 416
ADJUSTING SCREW LOCK NUT	STAINLESS STEEL	BS EN 10090 Gr 416
EDUCTOR TUBE	STAINLESS STEEL	BS EN 10090 Gr 416
CAP	CARBON STEEL	ASTM A216 Carbon Steel Casting
BONNET GASKET	SOFT IRON	
GUIDE GASKET	COMPRESSED FIBRE GASKET	BS 1832 Gr A
ADJUSTING RING PIN GASKET	STAINLESS STEEL – ASBESTOS FREE	
CAP GASKET	STAINLESS STEEL – ASBESTOS FREE	
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED)	SANS 1700 (SANS 121, ISO 1461)
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2

35.15 GLOBE VALVES

35.15.1 General

Globe valves shall be used specifically to regulate the flow of water to heat exchangers and motor bearings associated with main water transfer Plant. All valves shall be fitted with a regulatory disc ("V" Port) indication and locking devices.

35.15.2 Construction and Operational Requirements

The valve body shall be designed to minimise dislocation under pressure.

The valve body and disc seals shall be designed and constructed so as to prevent the seals from breaking loose and water passing behind the seals under all operating conditions.

The valves shall incorporate a reversible and renewable seat design together with a revolving stopper to ensure non-rotating seat contact.

35.15.3 Valve Test and Material Specification

Valve components shall be constructed of the material specified in the following tables:

TABLE 35/21
GLOBE VALVES (DN 50 - 300)

Factory Test Requirements:

SIZE DN	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
50 - 300	1 600	2 400	1 600

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
YOKE BUSH	BRASS	BS EN 12165 CZ114
STEM: 50 – 200 250 - 300	BRASS ALUMINIUM BRONZE	BS EN 12165 CZ114 BS EN 12163 CA104
GLAND	SG IRON	BS EN 1563 Gr 450/10, SANS 936 SG42
GLAND PACKING	ASBESTOS FREE	
BONNET	SG IRON	BS EN 1563 Gr 450/10, SANS 936 SG42
BONNET GASKET	ASBESTOS FREE	
DISC STEM NUT	BRASS	BS EN 12165 CZ114
DISC: 50 – 125 150 - 300	BRONZE (GUN METAL) SG IRON	BS EN 1982 LG2 BS EN 1563 Gr 450/10, SANS 936 SG42
BODY SEAT RING	BRONZE (GUN METAL)	BS EN 1982 LG2
BODY	SG IRON	BS EN 1563 Gr 450/10, SANS 936 SG42

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
DISC FACE RING (150 – 300)	BRONZE (GUN METAL)	BS EN 1982 LG2
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED)	SANS 1700 (SANS 121, ISO 1461)
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2
OPERATION ARRANGEMENT (✓): GEARBOX		SEE AUXILIARY DRIVE SPECIFICATION
ELECTRIC ACTUATOR		SEE AUXILIARY DRIVE SPECIFICATION
HYDRAULIC ACTUATOR		SEE AUXILIARY DRIVE SPECIFICATION

TABLE 35/22
GLOBE VALVES (DN 15 - 50)

Factory Test Requirements:

SIZE DN	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
15 - 50	1 600	2 400	1 600

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
STEM	MAGANESE BRONZE BRASS	BS EN 12163 CZ116 BS EN 12163 CZ121
GLAND PACKING	ASBESTOS FREE	
BONNET	BRONZE (GUN METAL) BRASS	BS EN 1982 LG2 BS EN 12163 CZ122
SWIVEL NUT	MAGANESE BRONZE BRASS	BS EN 12163 CZ116 BS EN 12163 CZ121
SEAT	40/52 NI / CU ALLOY	
BODY	BRONZE (GUN METAL)	BS EN 1982 LG2
DISC CASE	BRONZE (GUN METAL) BRASS	BS EN 1982 LG2 BS EN 12163 CZ122
DISC (RENEWABLE)	BRASS	BS EN 12163 CZ122
DISC NUT: 5 mm 20 – 50 mm	BRASS BRASS	BS EN 12163 CZ121 BS EN 12163 CZ122
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED)	SANS 1700 (SANS 121, ISO 1461)
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2

35.16 SPHERICAL / BALL VALVES

35.16.1 General

All valves shall be capable of being opened or closed under an unbalanced pressure equal to the design pressure. There shall be no flutter of the ball during the valve operation.

35.16.2 Construction and Operational requirements

Hubs for shaft bearings shall be integral with the valve body. Valves shall be full-bore with minimum pressure losses when fully open. There shall be no abrupt changes in cross-section between the ball and body inside surfaces. Valves shall be manually operated via a spindle gearbox. Gearbox shall fulfill the requirements as specified under Clause 35.6.4.

Replacement of the main seals shall be possible without the need to remove the valve from pipeline and/or a pipe section. The rubber seal of a spherical valve shall be mounted with a one-piece stainless steel retaining ring fastened on the ball and sealing against the stainless steel seats in the body. In fully opening position the profile seal shall be located outside the flow path.

The profiles of seats and seals shall be smooth and continuous. Seats and seals shall be of a design which prevents them from becoming loose and prevent water seepage under the seals or seats during all conditions of operation and test.

The ball plug of valves DN450-2000 shall be double-eccentric supported in the body to lift free of the seat during opening to ensure maximum lifetime of the seal. Ball plug and drive shaft with keyed connection shall be free of any play.

Sleeve type bearings shall be corrosion resistant and shall be fitted into the hubs on the valve body. These bearings shall be self-lubricating with a proven record of dependable operation of not less than five (5) years.

35.16.3 Valve Test and Material Specification

Valve components shall be constructed of the material specified in the following tables:

TABLE 35/23
SPHERICAL / BALL VALVES (DN 450-2000)

Factory Test Requirements:

SIZE DN (mm)	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
450 – 2000	1 000	1 500	1 000
	1 600	2 400	1 600
450 – 1500	2 500	3 750	2 500
450 - 1000	4 000	6 000	4 000

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY INLET HALF	CAST STEEL SG IRON	BS EN 10213 Gr 480/ SANS 1465-1 BS EN 1563 Gr 420/12, SANS 936 SG 42
BODY	CAST STEEL SG IRON	BS EN 10213 Gr 480/ SANS 1465-1 BS EN 1563 Gr 420/12, SANS 936 SG 42
BODY OUTLET HALF	CAST STEEL SG IRON	BS EN 10213 Gr 480/ SANS 1465-1 BS EN 1563 Gr 420/12, SANS 936 SG 42
BALL PLUG	CAST STEEL	BS EN 10213 Gr 480/ SANS 1465-1
SEAL	ELASTOMER	EPDM 75A NITRILE
SEATS	STAINLESS STEEL	BS EN 10090 Gr 316 S16
RETAINING RING	STAINLESS STEEL	BS EN 10090 Gr 316 S16
SHAFT – DRIVE SIDE	STAINLESS STEEL	BS EN 10090 Gr 431 S29
SHAFT- NON DRIVE SIDE	STAINLESS STEEL	BS EN 10090 Gr 431 S29
INLET & OUTLET BODY SEALING RING	O RING	NITRILE / VITON
THRUST RING	STAINLESS STEEL ALLOY	ASTM A439 Gr D2
BEARINGS	PHOS BRONZE	BS EN 1982 PB1C (Cu,Sn10, P)
BEARING SEALS	O RING	NITRILE / VITON
BEARING FLANGES	CAST STEEL	BS EN 10213 Gr 480/ SANS 1465-1
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED)	SANS 1700 (SANS 121, ISO 1461)
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2
OPERATION ARRANGEMENT (✓):		
LEVER		CAST STEEL BS EN 10213 Gr 480 / SANS 1465-1
GEAR BOX		SEE AUXILIARY DRIVE SPECIFICATION
ELECTRIC ACTUATOR		SEE AUXILIARY DRIVE SPECIFICATION
HYDRAULIC ACTUATOR		SEE AUXILIARY DRIVE SPECIFICATION

TABLE 35/24
SPHERICAL / BALL VALVES (DN 25-400)

Factory Test Requirements:

SIZE DN	PRESSURE RATING (kPa)	HYDRAULIC TEST PRESSURE (kPa)	
		STRUCTURAL	SEAT
25 – 400	1 000	1 500	1 000
	1 600	2 400	1 600
	2 500	3 750	2 500
	4 000	6 000	4 000

Material Specifications:

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BODY INLET HALF	CAST STEEL STAINLESS STEEL	BS EN 10213 Gr 480 / SANS 1465-1 BS 970 Part 4 Gr 316 S16
BODY OUTLET HALF	CAST STEEL STAINLESS STEEL	BS EN 10213 Gr 480 / SANS 1465-1 BS EN 10090 Gr 316 S16
STEM	STAINLESS STEEL	BS EN 10090 Gr 316 S16

COMPONENT	MATERIAL TYPE	MATERIAL SPECIFICATION
BALL	STAINLESS STEEL	BS EN 10090 Gr 316 S16
SEAT SEAL	ELASTOMER	GLASS FILLED PTFE
THRUST WASHER	ELASTOMER	NYLON REINFORCED PTFE
BODY JOINT GASKET	ELASTOMER	PTFE
STEM PACKING	ELASTOMER	PTFE
STEM WASHER	ELASTOMER	PTFE
GLAND FOLLOWER	CAST STEEL	BS EN 10213 Gr 480 / SANS 1465-1
ANTI STATIC DEVICE	STAINLESS STEEL	BS EN 10090 Gr 316 S16
EXTERNAL FASTENERS	STEEL (HOT DIP GALVANIZED)	SANS 1700 (SANS 121, ISO 1461)
INTERNAL FASTENERS	STAINLESS STEEL	ASTM A193 Gr B8M, ASTM A439 Gr D2
OPERATION ARRANGEMENT (✓):		
LEVER		CAST STEEL BS EN 10213 Gr 480 / SANS 1465-1
GEAR BOX		SEE AUXILIARY DRIVE SPECIFICATION
ELECTRIC ACTUATOR		SEE AUXILIARY DRIVE SPECIFICATION
HYDRAULIC ACTUATOR		SEE AUXILIARY DRIVE SPECIFICATION

35.17 STANDARDS FOR VALVES

The following Standards and Codes of Practice are referred to in this Section:

American Water Works Association

AWWA M11 : Steel pipe – A guide for design and installation

AWWA: C207 – 18 : Steel pipe flanges 4” through 144”

AWWA: C208 – 12 : Dimensions for fabricated steel water pipe fittings

South African National of Standards

SANS 1062: : Pressure & Vacuum Gauges

SANS 936: : Spheroidal Graphite Iron Castings

SANS 1465: : Carbon and Low Alloy Steel Castings

SANS 1700 : ISO metric precision hexagon-head bolts, screws and nuts (coarse thread medium fit series)

SANS 1431 : Weldable Structural Steels

SANS 136: : Metallic Coatings

SANS 191: : Cast Steel Gate Valves

SANS 664: : Cast Iron Gate Valves for Waterworks

SANS 121 : Hot-dip galvanised coatings on fabricated iron and steel articles

British Standards Institution

BS EN 593: : Specifications for Butterfly Valves

BS EN 19: : Marking of Valves

BS EN 12266-1:	:	Testing of Valves
BS 4360:	:	Specifications for Weldable Structural Steel
BS EN 1563:	:	Speroidal Graphite Cast Iron
BS EN 10213:	:	Steel Casting for Pressure Purposes
BS 2633:	:	Specifications for Class 1 arc Welding of Ferritic Steel Pipework
BS EN 1011-1:	:	Specification for Arc Welding of Carbon and Carbon Manganese Steels
BS EN 1011-2:	:	Welding. Recommendations for welding of metallic materials. Arc welding of ferritic steels
BS 4677:	:	Specifications for Arc Welding of Austenitic Stainless Steel Pipework
BS EN 13480-2:	:	Metallic Industrial Piping
BS EN:	:	Copper and Copper Alloys
BS EN 1092-1:	:	Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated. Steel flanges
BS EN ISO 683-1:	:	Heat-treatable steels, alloy steels and free-cutting steels. Non-alloy steels for quenching and tempering
BS EN ISO 683-2:	:	Heat-treatable steels, alloy steels and free-cutting steels. Alloy steels for quenching and tempering

American Society for Testing of Materials

ASTM A 193	:	Standard Specification for Alloy-steel and Stainless Steel Bolting Materials
ASTM A 439	:	Standard Specification for Austenitic Ductile Iron

35.18 SPARE PARTS REQUIREMENTS

The Contractor shall list and price the spare parts considered to be necessary as required for the continued operation of all mechanical, electrical and electronic Plant based not only on a reliability analysis of the Plant, but also on the reliability and availability of local suppliers of spare parts. The lists shall also include all long lead maintenance items and special maintenance tools that will be required during the maintenance of the plant by the Contractor. The lists of additional critical spare parts must be submitted to the Engineer prior to achieving RFTO.

The total amount for spares derived from for each part of the Works shall be carried forward to the Bill of Quantities. A provisional sum will be allocated in the Bill of Quantity for the complete list of spare parts as listed by the Contractor.

35.19 MEASUREMENT AND PAYMENT

The rates tendered under this Section shall not include for the general obligations, Contractor's Equipment and work deemed to be covered by the items provided in Section 1 – General.

35.19.1 General

Payment items are provided for:

- Supply of all design and pre-manufacture documentation for approval;
- Procurement / manufacture of valves and delivery to Contractor's site store;
- Installation and testing of valves and valve actuators;
- Valves spares;
- Factory Acceptance Testing.

35.001 Design and documentation **Unit : lump sum (Sum)**

The rates tendered shall include for full compensation of all costs incurred in the design and preparation and obtaining approval of the design, pre-manufacture, detail working drawings for all Plant items, specifications, schematic diagrams, operation and maintenance instructions, programmes of work (manufacture and on-site) and any other work as specified for the design of the complete installation. Payment will be made per sum. Payment will only be effected after the design and associated documentation has been approved by the Engineer.

Measurement and Payment for submission of O&M Manuals shall be covered under payment clause 48.11 of Section 48 – Tests on Completion and paid elsewhere.

35.002 Manufacture, Supply and Delivery to Site **Unit : number (No) or Lump Sum (Sum)**

The rates tendered shall include for full compensation of all costs incurred in the manufacture, procurement, inspections, quality assurance and quality control, Factory Acceptance Test, corrosion protection, packaging and delivery into storage on Site of the specified valves, jointing material and fasteners, insurance, harbour dues etc., during transport, loading and unloading, storage under appropriate conditions from date of delivery until final installation. Payment will be made per unit. Payment will only be effected after full compliance of the Plant items with this Section and associated documentation has been approved by the Engineer. Payment of insulating gasket sets are made under Section 34: AC Mitigation and Cathodic Protection.

35.003 Installation and testing of valves and valve actuators

Payment will be made under Section 33 – Laying and Pressure Testing of Steel Pipes as relevant. Measurement and Payment for Test on Completion shall be covered under Clause 48.11 of Section 48 – Tests on Completion and paid elsewhere.

35.004 Spares **Unit : lump sum (Sum)**

The cost of spares, considered to be necessary by the Contractor other than spares required by the Employer, delivered to Site and handed over will be paid as a lump sum. A Spare Part Schedule by the Employer is available in Section 48 – Tests on Completion, The spares identified by the Contractor are to adhere to Clause 35.18 Spare Parts Requirements.

The payment for specific spare items required by the Employer shall be made per item listed in the Commissioning and Trial Operation parts of the Bill of Quantities. Payment Item 48.007 is relevant in this regard.

Payment for spares identified by the Contractor as per Clause 35.18 and approved by the Engineer, shall be made from the provisional sums allowed for this in the Bill of Quantities. The rates provided for these spares shall provide for the manufacture, supply, delivery to Site and handing over of the spares ordered and shall include permanent packing for long term storage. The spares shall be manufactured at the same time as the installed items.

ANNEXURE 35/1
STANDARD DRAWINGS

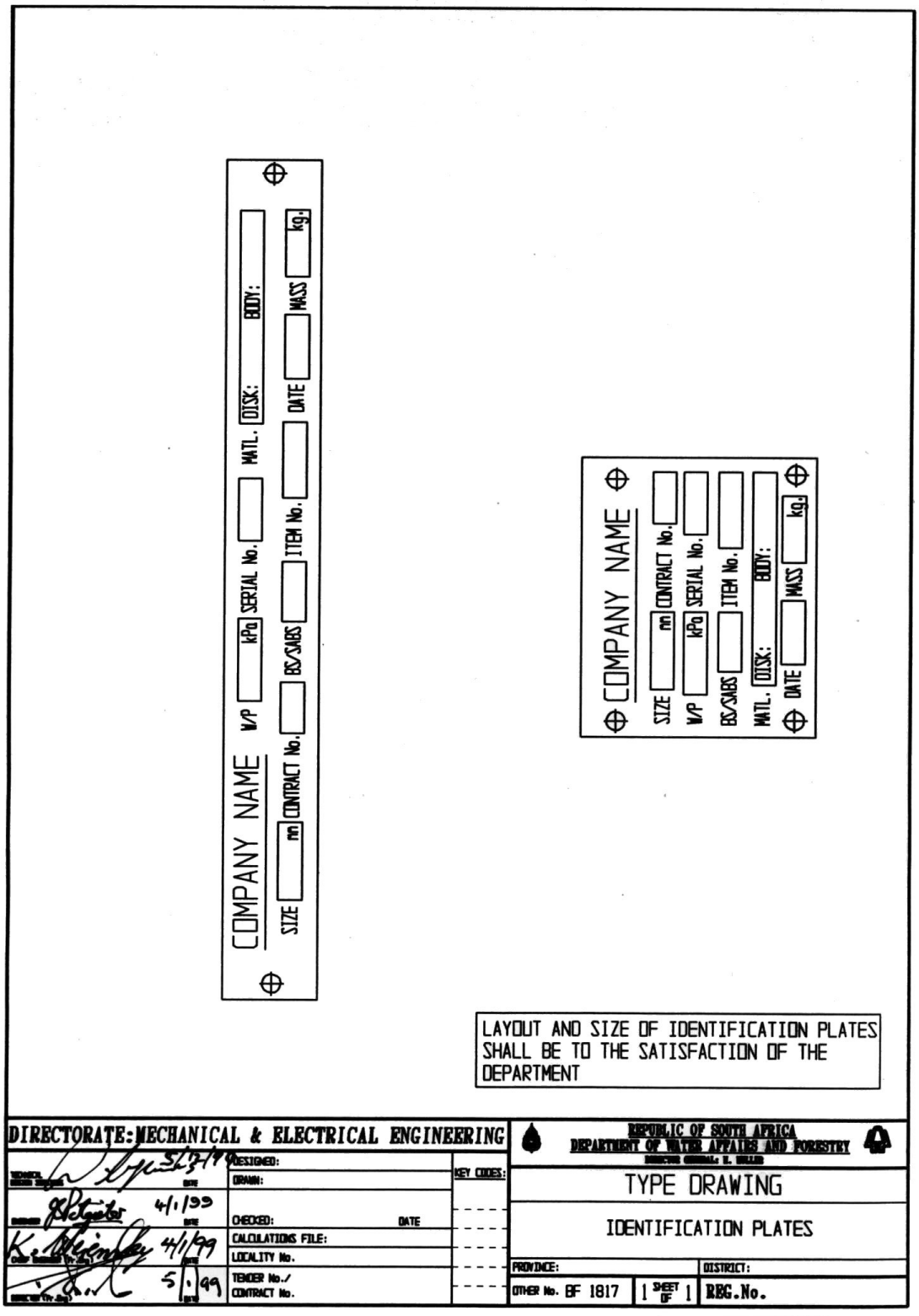

FIGURE 1: NAME PLATE MARKINGS

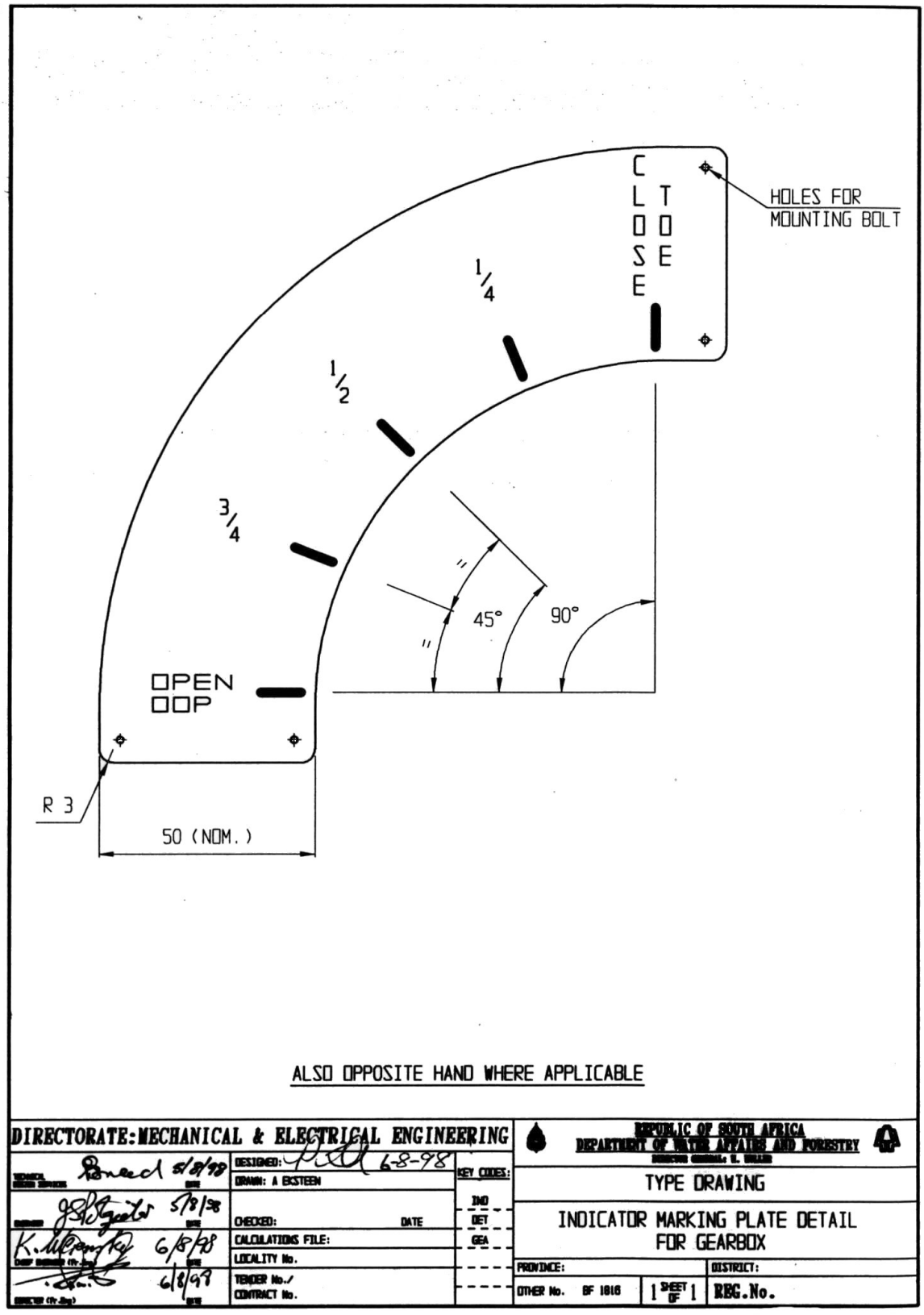

FIGURE 2: POSITION INDICATOR PLATE

ANNEXURE 35/2
QUALITY CONTROL PLAN FOR MANUFACTURE OF VALVES

QUALITY CONTROL PLAN FOR MANUFACTURING OF VALVES

PROJECT:			QCP NO.
EQUIPMENT:		SECTION:	REVISION:
DRAWING NO.:	QTY:	FACTORY ID NO.:	COMPILED BY: DATE:
CLIENT:		CONTACT NO.:	ORDER NO.:
CONTRACTOR:		CONTACT PERSON:	
APPLICATOR:		CONTACT PERSON:	

APPROVALS

CONTRACTOR	ENGINEER	INSPECTOR
NAME: SIGNATURE: DATE:	NAME: SIGNATURE: DATE:	NAME: SIGNATURE: DATE:

LEGEND

H - HOLD POINT	W - WITNESS POINT	S – SURVEILLANCE	R – REVIEW

INSPECTION CODE

1 – APPROVAL	3 - TESTING	5 - REPORT EQUIRED	7 – DIMENSIONAL
2 – MATERIAL CERTIFICATE	4 - VISUAL	6 - RECORD REVIEW	8 – DRAWINGS

QUALITY CONTROL

	OPERATION	INSP. CODE	INSPECTION INTERVENTIONS			ACCEPTANCE CRITERIA
			CONTRACTOR	ENGINEER	INSPECTOR	
1.	**DOCUMENTATION APPROVALS**					
1.1	Drawing(s)	1				
1.2	Manufacturing Programme	1				
1.3	Corrosion Protection Programme	1				
1.4	QCP – Manufacture	1				
1.5	QCP – Corrosion Protection	1				
1.6	Draft O & M manual	1				
1.7	Draft data book	1				
2.	**MANUFACTURE**					
2.1	Verify Drawings for Manufacture					
2.2	Compile BOM					
2.3	Order Castings/Materials					
2.4	Patters Inspection	8				
2.5	Casting pour – valve components					
2.5.1	– Body	7,8				
2.5.2	– Disc	7,8				
2.6	Receive Castings/Materials and Verify	2				
2.7	Casting/material Inspection – valve components:					
2.7.1	– Check material certificates	2				
2.7.2	– Check material reference	4,8				
2.7.3	– Check casting ID Numbers	4,8				
2.7.4	– Check casting pressure PN	4,8				kPa
2.7.5	– Check nominal size DN	4,8				mm
2.7.6	– Check supporting feet	4,8				
2.7.7	– Check eye bolts	4,8				
2.7.8	– Check flow arrow	4,8				

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QUALITY CONTROL PLAN FOR MANUFACTURING OF VALVES

PROJECT:			QCP NO.
EQUIPMENT:		SECTION:	REVISION:
DRAWING NO.:	QTY:	FACTORY ID NO.:	COMPILED BY: DATE:
CLIENT:		CONTACT NO.:	ORDER NO.:
CONTRACTOR:		CONTACT PERSON:	
APPLICATOR:		CONTACT PERSON:	

APPROVALS

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LEGEND

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QUALITY CONTROL

	OPERATION	INSP. CODE	INSPECTION INTERVENTIONS			ACCEPTANCE CRITERIA
			CONTRACTOR	ENGINEER	INSPECTOR	
2.8	Pre-machining – valve components for Pressure Test					
2.8.1	– Body	7,8				
2.8.2	– Disc	7,8				
2.8.3	– Shafts	7,8				
2.8.4	– Seat ring	7,8				
2.8.5	– Retaining ring	7,8				
2.8.6	– Disc seal	7,8				
2.8.7	– Gearbox	7,8				
2.8.8						
2.9	Dimensional Inspection Valve Body					
2.9.1	– Check face-to-face dimension	4,8				mm
2.9.2	– Drain groove in Gearbox Flange	4,8				
2.9.3	– Machining of Support Feet	4,8				
2.10	Flange inspection					
2.10.1	– Check flange outside diameter	7,8				mm
2.10.2	– Check flange thickness	7,8				mm
2.10.3	– Check PCD	7,8				mm
2.10.4	– Check number of holes drilled and tapped	7,8				.....off drilled and .....off tapped M
2.10.5	– Check diameter of drilled holes	7,8				mm
2.10.6	– Check spotfacing of drilled holes	7,8				mm diameter
2.10.7	– Check fit of tapped holes	7,8				With HDG bolt
2.10.8	– Check flange marking – notches	7,8				.....off notches
2.10.9	– Check bolt/nut clearances	7,8				Test

QUALITY CONTROL PLAN FOR MANUFACTURING OF VALVES

PROJECT:			QCP NO.
EQUIPMENT:		SECTION:	REVISION:
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CLIENT:		CONTACT NO.:	ORDER NO.:
CONTRACTOR:		CONTACT PERSON:	
APPLICATOR:		CONTACT PERSON:	

APPROVALS

CONTRACTOR	ENGINEER	INSPECTOR
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QUALITY CONTROL

	OPERATION	INSP. CODE	INSPECTION INTERVENTIONS			ACCEPTANCE CRITERIA
			CONTRACTOR	ENGINEER	INSPECTOR	
2.11	Hydrostatic test valve body uncoated to 1.5 x Operating Pressure for minimum period of 5 minutes	3,4				No leakage or signs of sweat allowed through the body of the valve
2.12	Pre-preparation / Fettling Valve Components	4				Radius 2 mm min. Grind surfaces smooth
2.13	Check arrows	4				Arrow in direction of Flow
2.14	Release Valve Components for Corrosion Protection	4				
3.	**CORROSION PROTECTION**					
3.1	Valve Components					
3.1.1	– Body	4				Corrosion protection QCP
3.1.2	– Disc	4				Corrosion protection QCP
3.1.3	– Shafts	4				Corrosion protection QCP
3.1.4	– Seat ring	4				Corrosion protection QCP
3.1.5	– Retaining ring	4				Corrosion protection QCP
3.1.6	– Gearbox	4				Corrosion protection QCP
3.1.7	– Hand wheel	4				Corrosion protection QCP
3.2	Release Valve Components for Assembly					
4.	**ASSEMBLY**					
4.11	Fastener inspection	4				
4.2	Bearing Inspection	4				
4.3	Assemble Valve	4				
4.4	Assemble Gearbox	4				
4.5	Hydrostatic Test Assembled Valve Body					
4.5.1	– Disc for sealing	3,4				1.1 x Operating Pressure for minimum period of 5 minutes
4.5.2	– Discs for strength	3,4				1.5 x Operating Pressure for minimum period of 5 minutes
4.5.3	– Operational Test Set Gearbox stops	3,4				Open valve under pressure

QUALITY CONTROL PLAN FOR MANUFACTURING OF VALVES

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OPERATION		INSP. CODE	INSPECTION INTERVENTIONS			ACCEPTANCE CRITERIA
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4.6	Repair Corrosion Protection and EID	3,4				Corrosion protection QCP
4.7	Corrosion Protection – Body Final Cosmetic Coat (Identification Colour)	4				Brilliant Green SANS 1091 Code H10 (25µm min.)
4.8	Corrosion Protection – Handwheel Final Cosmetic Coat (Identification Colour)	4				Golden Yellow SANS 1091 Code B49 (25µm min.)
4.9	Colour code Arrow and Pressure Rating Grooves and Handwheel Arrow	4				Signal Red SANS 1091 Code A11
4.10	Fill Information Plate	4				
4.11	Fit Gearbox indicator plate	4				
4.12	Timber blank flange inspection	4				
4.13	Final inspection prior to dispatch	4				
4.14	Documentation review (Data Pack and O&M Manual)	6				
4.15	Final release	5				Release Certificate