

1. HIGH DENSITY POLYETHYLENE PIPES AND FITTINGS

1.1.1. HIGH DENSITY POLYETHYLENE PIPES

Technical Specifications

The polyethylene pipes shall conform to the requirements of Polyethylene (PE) pipes for water supply under pressure – Specification (ISO 4427-1/2:2007), (EN12201-1, EN12201-2), or equivalent in which a supplier must submit a copy of that standard and a proof of equivalency to the above specifications.

Material of pipes must be PE 100; raw material used shall be according to ISO4427 or equivalent standards and has to be from the positive PE100+ Association list.

Conformity to standard certificate must be supplied at time of tender where this certificate must be issued from a certified third party and valid up to date.

The pipes should have the following properties:

Pressure class: PN 16 (According to contract documents).

The Standard Dimension Ratio (SDR): SDR 11.

Material Designation: PE 100.

Length of Pipes

The following table shows the length of the pipes according to the diameter.

Table: Length of Pipe

Diameter of pipe(mm)	Length of pipe (m)
Up to 63	50 or 100
125	(50 or 100: coils) (upon request), Or (12 m: standard pipes) (for maintenance dept. uses) (upon request)
180 and above	12 or standard pipes

Markings of Pipes

All PE pipes shall be indelibly marked at maximum intervals of one meter.

The marking shall show at least the following information:

“JVA”.

Manufacture’s name, logo and/or trademark.

Dimensions (nominal diameter).

Materials, material class (i.e. PE 100) and pressure class.

Production period (date and code).

Serial number.

Batch number.

Standard number.

Standard Dimension Ratio (SDR).

For direct purchase procurements order the marking depends on the value of the procurements order.

1.1.2. High Density Polyethylene Fittings

Technical Specifications

Fittings Types

All fittings shall be installed using electro-fusion technology; table 6.1 shows the standards for the fittings.

Table: Fittings for new installation Tenders

No.	Description	Installation/ Type	Standard No	Testing method
1.	PE Connector (25mm,32 mm, 63 mm)	Electro Fusion	ISO 4427 or Equivalent	ISO 13955, ISO 13954, ISO 11413
2.	PE EF Collar (125mm, 180 mm,250mm,25 mm,32mm, 63mm)	Electro Fusion		
3.	PE Reducer	Electro Fusion		
4.	PE Adaptor (2" (63mm), 1" (32mm), 3/4" (25mm))	Electro Fusion-one side		
5.	PE Flange Adaptor (125mm, 180 mm, 250 mm)	Electro Fusion-one side		
6.	PE Tee b PE Tee (63X63X63mm, 32X32X32mm, 25X25X25mm, 63X63X32 ,63X63X25,32X32X25) b	Electro Fusion		

No.	Description	Installation/ Type	Standard No	Testing method
7.	PE EF Tee (socket) or saddle branch (line to line) (180X125, 180X180,)	Electro Fusion		
8.	PE End Cap (63mm, 32 mm, 25 mm, ..)	Electro Fusion		
9.	PE Elbow 63mm	Electro Fusion		
10.	PE EF Elbow (socket) (180 mm, 125mm, 250mm)	Electro Fusion		
11.	Electro fusion end cap (125mm, 180mm)	Electro Fusion		
12.	PE EF Tapping (125*25, 180*25, 125*63, 125*32, 63*32, 63*25,)	Electro Fusion		
13.	Connector (25 mm, 32 mm) c	Compression	ISO 14236	ISO 3501, ISO 3503, ISO 3458, ISO 3459

- a. Adapter is used to connect Polyethylene pipes to pipe made from another material, and it should be compression from one side and male threaded from the other side.
- b. It is not allowed to use the weldable outlet Kit.
- c. When the installation is near to the customer cabinet, whether the connection was straight connection or using elbow, compression fittings should be used.

Connection Type

Table: Connection Type

Diameter of pipe(mm)	Connection Type	Standard
25-125	Mechanical or Electro-fusion	According to tables: 6.1 and 6.2
125 and above	Butt welding or Electro-fusion	Machine: ISO 12176 ISO 13953, ISO 11414

The Butt-welding machine must be fully automatic

Design Requirements

The design of fittings must ensure that the wires which coiled around the inner part of electro fusion fittings are built in the body of fittings not separated from it.

2. VALVES AND APPURTENANCES

2.1. GENERAL

All valves and gates shall be designed and constructed for the working pressure and the fluid as specified.

Valve ends shall be flanged ends except where otherwise specified. Where flanged ends are used, mating dimensions and drilling shall be in accordance with the pipe and fitting flange. Thickness of flanges shall be determined based on the working pressure specified and shall conform to internationally accepted standards.

The equipment shall be the product of an established and reputable manufacturer who has had experience in the manufacture of the type of equipment herein specified.

Unless otherwise specified, all valves and gates shall be butterfly valves type for diameters from 250mm and above and seal gate valves type for diameters less than 250 mm.

All valves of the same type shall be from one manufacturer.

The Contractor shall make evidence of the hydraulic performance of the valves proposed.

Valves shall be equipped with, hand wheel or electric actuator except where otherwise specified. Actuators shall have arrows cast thereon to indicate the direction of rotation for opening the valve.

All shut-off devices must shut in a clockwise direction. This will be indicated by 'O' (open) and 'C' (closed) with arrows either on the hand wheel or the head of a piece. Operation of shut-off devices must be easy both for opening and closing.

All valves shall have closing, opening indicators and an arrow cast in the metal to indicate the direction to open.

2.1.1. Third Party Witness

The Supplier/contractor is requested to provide in his technical offer three options for accredited international third party companies; the JVA will choose one of them to perform the needed inspections.

The supplier/contractor is requested to call the chosen company to attend and witness the tests to be done at the manufacturer's testing premises or any place the manufacturer chooses.

The third-party inspection agency shall under this contract, have witnessed the manufacture and testing operation to verify compliance with the technical specifications and the relevant standard. The third-party inspection agency shall verify that all materials used are eligible for the relevant standard production's requirements. All certification should be from a certified and approved third party, and the certificates must be related to the same batch delivered to JVA. All certificates must be in English.

A sample (5% of each size and class should be tested with a minimum (one valve of each size and class)) is to be randomly chosen by the third party representatives; those tests must be witnessed by the third party representative.

The Supplier/contractor shall bear all costs of inspection including (fees of third party, all travelling and accommodation, the cost should be included in the tender unit price).

2.1.2. Testing after delivery

All valves supplied to the site in Jordan shall be subjected to acceptance tests carried out by the Royal Scientific Society or an equivalent accredited institution. Final inspection tests must be done in accordance with the test requirements of EN 12266-1/2, ANSI/ASME, or AWWA Standards. If any of the tests mentioned in the standards cannot be performed by the Royal Scientific Society, then the supplier should provide a third-party certificate for those tests taking into considerations the requirements stipulated in Section Third Party Witness.

All testing costs should be borne by the supplier in all cases.

2.1.3. Valves Packing and Protection

All valves must be packed in such a way to allow instantaneous use on site without additional cleaning.

All valves shall be securely packed in crates and boxes to prevent damage during delivery. The cost of packing shall be deemed to be included in the Tender rates, noting that crates will not be returned back to the bidder/supplier.

2.1.4. Identification

The supplier shall be responsible to ensure that each separate item, crate, or package has permanently attached to it, in a visible position, an identification plate of weather - resistant material on which the following is engraved or stamped;

- The Manufacturers Name.
- Contents Description and Quantity.
- Serial Number or Reference Number Identifiable on the Delivery Note and Cross Referenced to the Purchase Order Item References.
- Weight.

The shipment containers shall be marked with the following address:

Jordan Valley Authority (JVA)

Tender Number – Variable

In addition, the container shall be marked with the following information;

- Total gross weight.
- Total net weight.
- Packing list reference number.

2.1.5. Handling and Transportation

- The handling and transportation shall be in accordance with the manufacturer's recommendations.
- Care shall be taken during loading, transporting, and unloading. Under no circumstances shall materials be dropped or rolled against one another. All materials shall be examined. Any damaged materials must be rejected by JVA.
- The cost of packing shall be included in the contractor rates.
- All materials shall be securely packed in crates or boxes for protection against damage during transportation.
- The materials supplied shall be of the appropriate grade and quality and shall be adequately protected against the climatic conditions in the Middle East.
- All plastic materials shall be protected from direct sunlight and appropriate coverings supplied for use at the delivery and storage areas.

2.1.6. Transport and Deliveries

- The Contractor shall send to the Engineer, one-week advance notice of all consignments of materials. Every consignment shall be accompanied by a detailed delivery note.
- The Contractor shall deliver to and off load the materials onto the storage area as directed by the Engineer. All delivered materials will be examined and inspected by the Engineer and taken over by him.
- The Contractor shall provide necessary details to the shipping line on precautions to be taken during loading/unloading, handling & transport of the pipes & fittings, valves and other components. Contractor shall provide to the Engineer the manufacturer's recommendations for handling, loading, unloading, transporting and storing of pipes & fittings, valves and other components.
- The Contractor shall arrange reception and storage areas only. also, shall be responsible for off-loading all materials.
- The Contractor shall also be responsible for all handling and transport activities up to and from JVA store-yard, Materials provided by JVA)

- **The Contractor's rate shall include all costs relating to above-mentioned requirements.**

2.1.7. Document to be provided at the time of tender:

1. Conformity to standard certificate from a certified third party or Affidavit from the manufacturer that the items provided comply with the latest revision ANSI/AWWA
2. The supplier/contractor shall supply full technical specifications and catalogues for the items to be supplied.
3. Quality assurance certificate (ISO 9001) and ISO 14001 accredited and certified.
4. Any alternative standards proposed including demonstration of equivalency or superiority to the standard specified, if allowed.
5. Any alternative materials proposed including demonstration of equivalency or superiority to the standard specified shall be subjected to the client's approval.
6. Where the supplier offers alternative standards and/or materials to those specified, the supplier shall provide prices for those specified and the alternatives proposed.
7. The supplier/contractor shall include in its price the training elements related to the materials it proposes to supply and shall list the elements of training offered, if needed or requested.
8. The supplier/contractor shall provide prices for the equipment applicable to the sections of the schedule of requirements it intends to price.
9. The supplier/contractor shall provide full details of its materials tests and procedures.
10. Any alternative proposed specification for combined tracer and marker tape.
11. ISO, AWWA, ANSI, ASME, or EN certification for management and product.
12. CV's of proposed training staff, if necessary.
13. Costs of Trainers expenses, if requested.
14. Training program, if requested.

2.1.8. Documents to be provided upon delivery

The contractor shall submit at least the following documents:

1. Certificate of origin.
2. Packing list
3. Third Party certificates (Affidavit of Compliance)
4. Warranty

5. installation and maintenance manual
6. Any other documents requested by the Engineer and the hand over committee

All above documents must be valid and in English.

2.1.9. Marking

Markings shall include size, working pressure, body material, name of manufacturer, and year of manufacture cast into the body of the valve.

2.2. GATE VALVES

Gate valves shall conform to the latest version of AWWA Standard C515 covering Resilient Seated gate Valves for Water Supply Service or EN 1171 and EN 1074-1/2.

The valves shall have short body or long body as specified in the Bill of Quantities, hand wheel, bonnet cap and bonnet made of ductile iron ASTM A536 70-50-5, A536 65-45-12 or EN-GJS-400-18, EN-GJS-400-15, EN-GJS-500-7/ EN-JS 1030 according to EN 1563. The wedge shall be totally encapsulated with rubber.

Wedge (gate) shall be constructed of ductile iron ASTM A536 70-50-5, A536 65-45-12 or EN-GJS-400-18, EN-GJS-400-15 / EN-JS 1030 according to EN 1563 fully encapsulated in EPDM rubber as per AWWA C-515. The wedge shall be symmetrical and seal equally well with flow in either direction.

The sealing rubber shall be made of EPDM and permanently bonded to the wedge to meet ASTM tests for rubber metal bond ATSM D249 or equivalent.

Valves shall be supplied with O-Rings made of EPDM seals at all joints.

The valves shall be non-rising stem, opening by turning counter clockwise and provided with 2" square operating nut or a hand wheel epoxy powder coated as specified in the Bill of Quantities and have closing, opening indicators and an arrow cast in the metal to indicate the direction to open.

All gate valves shall have closing, opening indicators and an arrow cast in the metal to indicate the direction to open.

Gate valve shall be flanged according to EN 558-1/5752 series 14-short or 15 long as specified in the Bill of Quantities, ISO 7005-2 or EN 1092-2 PN 10, PN16 or PN25 and shall be suitable for a nominal working pressure of 10, 16 or 25 bars as specified in the Bill of Quantities.

Stems for non-rising stem assemblies shall be cast bronze ASTM A584 C86700, copper alloy, stainless steel 304 or 316 with integral collars in full compliance with AWWA or (St 1.4021 / X20Cr13) in accordance to EN 10088 - 3.

All exterior nuts and bolts shall be Type 18-8 stainless steel or equivalent.

All stems shall operate with bronze stem nuts, independent of stem. Stems shall have two O-Rings located above thrust collar and O-Ring below. All stem O-Rings shall be replaceable with valve fully opened and subjected to full pressure. The stems shall also have two low torque thrust

bearings located above and below stem collar to reduce friction during operation.

Waterway shall be smooth, unobstructed and free of all pockets, cavities and depressions in the seat area.

The body, bonnet and stuffing plate shall be coated with fusion bonded epoxy, both interior and exterior on body and bonnet. Epoxy shall be applied in accordance with AWWA C550 or epoxy powder coated according to EN14901 with minimum thickness 250µm.

Extension spindles shall be galvanized steel and the associated guide brackets shall be of approved type (PE) and shape, manufactured from fabricated steel (galvanized after manufacture). All universal joints shall be supplied and installed in accordance with the details stated on the Drawings and in the Bill of Quantities.

Valve has been cyclically tested full opened to close 5,000 times without loss of bubble-tight seal or **Minimum** life cycle shall be 2500 cycles according to EN 1074-2.

The valve size, pressure rating, year of manufacture and manufacturer's name and model shall be cast onto the valve body or engraved on a permanently attached nameplate.

Table 1: Valve Testing

Test	AWWA	EN
Hydrostatic body test	2 x maximum nominal pressure	1.5 x maximum nominal pressure
Hydrostatic seat test	1.5 x maximum nominal pressure	1.1 x maximum nominal pressure

Prior to shipment from the factory, all valves shall be tested by hydrostatic pressure equal to requirements of AWWAC515, EN 1074 ½ and ISO 5208: or EN 12266-1/2 standards.

Each valve shall be supplied with a factory inspection certificate outlining body pressure test, leakage test, valve size, valve serial number, pressure rating, body heat No., disc heat No., stem heat No. seat material and seat heat No.

2.3. BUTTERFLY VALVES

DIESEL

The butterfly valves shall be double eccentric type and shall conform to the latest edition of AWWA-C504, C-516, C-519 Standards, EN 593 and EN 1074-1 and 2 Standards or equivalent,

The butterfly valves shall be with face to face dimensions, short body or long body to AWWA-C504 or EN 558-1/5752 series 13-short or 14 long as specified in the Bill of Quantities, flange

dimensions and drilling shall conform to ISO 7005-2, EN 1092-2 PN 10, PN16 or PN25, and shall be suitable for a nominal working pressure of 10, 16 or 25 bars as specified in the Bill of Quantities.

The valve size, pressure rating, year of manufacture and manufacturer's name and model shall be cast onto the valve body or be on a permanently attached nameplate.

Butterfly valves shall be horizontal shaft mounting unless otherwise necessary for proper operation or as acceptable by JVA.

MATERIALS

Body: Valve bodies shall be ductile iron conforming to ASTM A536 65-45-12, A536 60-40-18 or EN-GJS-400-18, EN-GJS-400-15 / EN-JS 1030 acc. to EN 1563 (GGG 400 - DIN 1693) with predrilled lifting holes lugs provided in each flange to assist in the installation and removal of valve from the pipeline.

Disc: The disc shall be ductile iron conforming to ASTM A536 65-45-12 or ASTM A536 60-40-18 or EN-GJS-400-18, EN-GJS-400-15 / EN-JS 1030 acc. to EN 1563 (GGG 400 - DIN 1693). The disc shall be secured to the valve shaft using mechanically retained stainless steel shaft locking bolts

Shaft: Both upper and lower valve shafts shall be made of stainless steel 304, 316, 316L, high strength ASTM 2205 or Duplex Stainless Steel.

Body seat shall be made of stainless steel 304, 316 or high nickel alloy and applied to the valve body by means of a machined weld overlay process eliminating the possibility of leakage through the body/seat joint.

Rubber seats can be applied to either the body or the disc and shall meet with corrosion resistance metal surfaces (stainless steel 304, 316 or high nickel alloy).

All bolts, nuts and internal bolts and pins shall be made of A2 stainless steel quality minimum or stainless steel 304.

Shaft Bearings: Valve shaft bearings shall be corrosion resistant, self-lubricating sleeve type.

O-rings shall be of EPDM.

Elastomeric Seal: Valve seats shall be EPDM or BUNA-N mounted on the valve disc with AISI 316 stainless steel seat retainer. The seat retainer shall be counter bored and drilled. Seat retaining fasteners shall be AISI 316 Stainless-steel and shall not extrude above the seat retaining ring. Seat shall be field replaceable and adjustable with common tools.

The iron surfaces of the valve body and disc shall be coated with fusion bonded epoxy, both interior and exterior. Epoxy shall be applied in accordance with AWWA C550 or epoxy powder coated according to EN 14901 with minimum thickness 250µm.

ACTUATION

All butterfly valves shall be equipped, if not otherwise requested in the Bill of Quantity, with gear

box and hand wheel.

Manual Actuators: Actuators shall conform to ANSI/AWWA C504 or equivalent.

All actuators shall be self-locking worm gear type and shall hold the valve disc in the closed, open and any intermediate position without creeping or fluttering and be supplied from known and reputable gear manufacturer.

All manual operators shall have a position indicator.

All bearings shall be maintenance-free and of a self-lubricating or sealed-for-life type suitable for at least 10,000 operation cycles.

Table 2: Valve Testing

Test	AWWA	EN
Hydrostatic body test	2 x maximum nominal pressure	1.5 x maximum nominal pressure
Hydrostatic seat test	1.5 x maximum nominal pressure	1.1 x maximum nominal pressure

Prior to shipment from the factory, all valves shall be tested by hydrostatic pressure equal to requirements of AWWAC504/C519, EN 1074- 1/2 and ISO 5208: or EN 12266-1/2 standards.

Each valve shall be supplied with a factory inspection certificate outlining body pressure test, leakage test, valve size, valve serial number, pressure rating, body heat No., disc heat No., stem heat No. seat material and seat heat No.

2.4. SPINDLES (STEMS) AND CAPS

Operating and extension spindles for valves operated by tee key (tee wrenches) shall be provided with stem caps.

Extension spindles shall be circular in section. For valves installed in chambers, extension spindles shall be provided with suitable bearings rigidly held on brackets spaced no more than 1500mm apart. For buried valves, the spindle shall be installed inside a protecting tube supported on a purpose-made support fixed to the top of the valve and shall be provided with spindle guides as necessary.

Bearings and spindles shall be suitably protected against corrosion. Spindles shall be galvanized mild steel or stainless steel except where otherwise specified. Bearings for galvanized spindles shall include bearing parts fixed to the spindle by clamp.

Extension spindle couplings shall be robust and provided with adequate pinning to carry the shear and prevent pull-out. Spindles including all fixing, mountings and couplings shall be designed for

the maximum operating torque with a factor of safety of 2 times the ultimate strength for mild steel or 3 for stainless steel.

Buried valves with floor boxes shall be furnished with 2 operating keys or 1 key per valves whichever is greater. Tee wrenches sized so that the tee handle will be 0.6 to 1.2 meter above ground and shall fit the operating nuts.

2.5. AIR VALVES

Air valves shall conform to the latest edition of AWWA C512 or BS EN 1074-4.

Air valves smaller than DN 50 mm shall be female thread inlet connection and larger air valves shall have Flanged inlet, the flange shall comply with EN 1092-2, ISO 7005 or equivalent.

The valve size, pressure rating, year of manufacture and manufacturer's name and model shall be cast onto the valve body or be on a permanently attached nameplate.

Each valve shall be supplied with a factory inspection certificate outlining body pressure test, leakage test, valve size, valve serial number, pressure rating, and body heat number.

2.5.1. Single Air Valve

The air release valve shall be float -operated, simple lever or compound lever design, and capable of automatically releasing accumulated air from a fluid system while the system is pressurized and operating.

Air Valves shall be single automatic air valves, PN 10,16 or 25, with body and cover made of ductile iron ASTM A536 65-45-12 or EN-JS 1030 (GGG 40) according to EN 1563 or cast iron to ASTM A126 Class B or BS EN 1561 EN-GJL-250.

Air Valves shall be inside and outside coated with fusion bonded epoxy. Epoxy shall be applied in accordance with AWWA C550 with minimum 250µm fusion bonded epoxy or epoxy powder coated according to EN 14901 with a minimum thickness of 250 µm.

Orifice and float balls shall be of corrosion free material stainless steel.

All seals shall be of EPDM, Buna-N rubber or better materials.

All internal components shall be made of stainless-steel 316 or better.

Air Valves shall be suitable for a nominal working pressure of 10, 16 or 25 bars in accordance with the details stated in the Bill of Quantities.

2.5.2. Combination Air Valve

Combination Air Valves shall have operating features of both Air/Vacuum Valves and Air Release Valves.

Combination Air Valves shall be in dual body style or single body style; large orifice air and vacuum valve and small orifice air release valve.

These valves are also called Double Orifice Valves.

Combination air valves shall be of the triple function with a flanged inlet ISO 7005-2, EN 1092-2 PN 10, PN16 or PN25 and shall be suitable for a nominal working pressure of 10, 16 or 25 bars in accordance with the details stated in the Bill of Quantities.

Body and cover shall be of ductile iron ASTM A536 65-45-12 or EN-JS 1030 (GGG 40) according to EN 1563 or cast iron to Cast Iron ASTM A126 Class B or BS EN 1561 EN-GJL-250. The body and cover shall be inside and outside coated with fusion bonded epoxy. Epoxy shall be applied in accordance with AWWA C550 with minimum thickness 250µm fusion bonded epoxy or epoxy powder coated according to EN 14901 with a minimum thickness of 250 µm.

Orifice and float balls shall be of corrosion free material stainless steel grade 304, 316 or better.

All seals shall be of EPDM, Buna-N rubber or better materials.

All internal components shall be made of stainless-steel 316 or better.

2.6. DISMANTLING JOINTS

Dismantling joints shall be installed where indicated on the drawings for convenient installation or re-installation of valves or similar items.

For prevention of any movement of the pipe joints adjacent to closed valves, meters or flanged equipment dismantling joints shall be provided in general by restrained dismantling pieces (short version).

Dismantling joints shall meet the applicable latest edition of AWWA C219 (short version) or equivalent.

Flange dimensions and drilling to EN 1092-1, ISO 7005 PN 10, PN16, PN25 or equivalent and shall be suitable for a nominal working pressure of 10, 16 or 25 bars as specified in the Bill of Quantities.

Dismantling joint shall Equipped with the following:

- Flange adaptor.
- Flanged spigot piece.
- Gasket
- Tie-rods and nuts
- Studs/Nuts/Washers

Materials specifications and Relevant Standards

Flange adapter shall be made of ductile iron per ASTM A536 65-45-42 or ductile iron per EN-GJS-450-10, EN-GJS-400-15 or shall be made of carbon steel per ASTM A36 or Steel per BS EN10025 Grade S275.

Flanged spigot piece shall be made of ductile iron per ASTM A536 65-45-42 or ductile iron per EN-GJS-450-10, EN-GJS-400-15 or shall be made of carbon steel per ASTM A36 or steel to BS EN10025 Grade S275.

Gasket shall be made of EPDM, perbunan material, nitrile rubber or equivalent quality shall be used.

Tie-rods, nuts, studs and washers shall be made of stainless steel.

Coating: coated (internal & external) with a minimum 250 µm thickness Fusion Bonded Epoxy.

2.7. FLANGE ADAPTORS, FLEXIBLE COUPLINGS, STEPPED COUPLINGS, END CAP COUPLINGS

Stepped coupling, flexible couplings and flange adaptors for ductile iron or steel pipes shall be of mild steel and of an approved type suitable for making a watertight flexible connection between plain-ended pipes, or between a plain-ended pipe and a flanged fitting (flange adaptor).

Stepped coupling, flexible couplings and flange adaptors shall meet the applicable latest edition of AWWA C219 (short version) or equivalent.

Stepped coupling, flexible couplings and Flange adapters shall be of restrained type in order to resist end load due to the internal pressure.

All mechanical couplings shall be of appropriate internal diameter and shall be capable of adapting to different pipe materials or different pipe diameters. They shall be capable of withstanding the maximum working test pressure specified for the pipes to which they connect, including the accommodation of a joint deflection of up to 3° in any direction.

Flange adapter shall be made of ductile iron per ASTM A536 65-45-42 or ductile iron per EN-GJS-450-10, EN-GJS-400-15 or shall be made of steel per ASTM A36 steel, ASTM A283 Grade C or Steel to BS EN10025 Grade S275/ S275JR.

Flange dimensions and drilling to EN 1092-1, ISO 7005 or equivalent and shall be suitable for a nominal working pressure of 10, 16 and 25 bars according to the Bill of Quantities.

Coupling body shall be made of ductile iron per ASTM A536 65-45-42 or ductile iron per EN-GJS-450-10, EN-GJS-400-15 or shall be made of steel ASTM A36, ASTM A283 Grade C or Steel to BS EN10025 Grade S275/ S275JR.

Gasket shall be made of EPDM, perbunan material, nitrile rubber or equivalent quality shall be used.

Tie-rods, nuts, studs and washers shall be made of stainless steel

Coating: coated (internal & external) with a minimum 250 µm thickness Fusion Bonded Epoxy.

2.8. PRESSURE REDUCING VALVE (PRV)

2.8.1. Design

The Pressure Reducing Valve shall conform to the latest version of AWWA Standard C530 Pilot-Operated Control Valves.

The Pressure Reducing Valve shall be a pilot operated diaphragm valve designed to automatically reduce a higher inlet pressure to a steady lower downstream pressure regardless of varying flow rates and varying inlet pressure.

The main valve shall be a hydraulically operated, single diaphragm actuated, globe pattern valve. The valve shall contain a disc and diaphragm assembly that forms a sealed chamber below the valve cover, separating operating pressure from line pressure.

The main valve shall consist of three major components: the body; the cover and the internal trim assembly.

The valve components shall be accessible and serviceable without removing the valve from the pipeline.

All necessary repairs shall be made from the top of the valve while the body remains in line.

For valves that must provide a large range of downstream flows that cannot be covered by the main valve, provide a low capacity bypass pilot valve assembly mounted on the main valve with settings coordinated with the main valve settings to allow the main valve to close completely and the bypass to provide low flow pressure control.