

شركة مياه الأردن - مياهانا ذ.م.و.

JORDAN WATER COMPANY – MIYAHUNA LLC

C-T-22-0023 FARA PHASE II NO.2

عطاء توريد وتركيب وتشغيل نظام ادارة الضغط في مناطق الواحة والرشيد
والخرايشة وشفا بدران وطبربور وام الشجيرات والمحطة في عمان ضمن ادارة
شركة مياهانا

VOLUME III

TECHNICAL SPECIFICATIONS

- اخر موعد لبيع وثيقة العطاء هو الساعة الرابعة من مساء يوم الخميس الموافق
2022/06/23

- يبدأ موعد تسليم العروض على العنوان المذكور أدناه من الساعة 8:30 صباحاً لغاية الـ
11:30 ظهراً من يوم الاربعاء الموافق 2022/07/06.

- سيتم فتح العروض في تمام الساعة الثانية عشرة ظهراً من يوم الاربعاء الموافق
2022/07/06.

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ACRONYMS

ANSI	American National Standards Institute
AWWA	American Water Works Association
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
BS	British Standards
BOQ	Bill of Quantities
DAP	Delivered At Place
DI	Ductile Iron
DN	Nominal Diameter
DZ	District Zone
EN	European standards
EPDM	Ethylene-Propylene-Diene Terpolymer
FARA	Fixed Amount Reimbursement Agreement
GIS	Geographic Information System
HDPE	High Density Polyethylene
ISO	International Organization for Standardization
NBR	Nitrile Butadiene Rubber
NRW	Non-Revenue Water
NSF	National Science Foundation
PN	Nominal Pressure
PRV	Pressure Reducing Valve
RPM	Revolution Per Minute
SDR	Standard Dimension Ratio
SS	Stainless Steel
USAID	United States Agency for International Development

TECHNICAL SPECIFICATIONS

- All Items shall be procured according to item O under Part IX: Responsibilities of the Parties in the Umbrella FARA, which states that: the authorized USAID Principal Geographic Code for the procurement of goods and services under this associate FARA is Code 937. The intent of these specifications is to allow fair competition for suppliers in these geographical locations.
- Certificate of Conformity shall be submitted upon shipping.

I. GENERAL

I.1 AMBIENT CONDITIONS

All pipes, materials and equipment shall be in every respect suitable for storage, installation, use and operation in the conditions of temperature, humidity and The PH and water quality appertaining in Jordan.

Atmospheric temperature in Jordan varies between -10°C and 50 °C.

I.2 POTABLE WATER CERTIFICATION

All pipes, valves, gaskets and materials shall be certified for potable water use by an independent testing laboratory. All material in contact with or likely to come into contact with water for public shall introduced with the requirements of NSF/ANSI 61 (Drinking Water System Components) or BS 6920 (suitability for non metallic products for use in contact with drinking water) and the requirements of EN 15664 (influenceof metallic materials on water intended for human consumption) as well as the Jordanian standard (JS 286/2008), and whenever the regulation is changed it is the supplier responsibility to ensure conformity with any new requirements.

Potable water certificate shall also besubmitted for the same batch delivered to Miyahuna, certificates must be in English.

I.3 TOXIC MATERIALS

Pipes and pipeline components, including their protective coatings and joint materials, that will or may come into contact with potable water shall not constitute a toxic hazard, shall not support microbial growth, shall not cause taste or odour, cloudiness or discoloration of the water and shall contain no ingredients that may migrate into water in amounts that are considered to be toxic or otherwise dangerous for health. Non toxicity certificate should be provided in English.

I.4 THIRD PARTY WITNESS

The supplier/contractor shall furnish an original accredited certificate of conformity from the third party inspection agency showing all test results and analysis required by the applicable standard according to which the materials have been manufactured. 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. All certification should be from a certified third party, and the certification should be valid and up to date, in English, and it must be shown in the certificate which batch is being tested to make sure that this certificate is for the right batch delivered to Miyahuna.

The supplier shall propose in his offer at least 3 different international third party companies where Miyahuna will choose one of them.

The third party inspection agency shall verify that all materials used are eligible for the relevant standard productions requirements. No material shall be accepted unless all type and batch release tests have been passed. The third party must clearly identify the material production date / code marked on the pipes, with each batch test performed.

The third party inspection tests certificates shall include the following stages:

1. During manufacturing.
2. Final.
3. Packing.

And the kind of inspection:

1. Review document.
2. Witness inspection at least (visual and tests).

And the test certificates must show the results.

The manufacture place of all materials, the pipes, specials, fittings and accessories shall be open to inspection by the third party team. If any of the supplies, whether complete or in the course of production, were rejected by the Employer, they shall be marked or segregated in such a manner satisfactory to the Employer as to ensure their subsequent identification as rejected supplies. Disposal of rejected supplies shall be done by and at the Contractor's own expense.

I.5 TESTING AFTER DELIVERY

All materials supplied shall be subjected to acceptance tests carried out by the Royal Scientific Society to confirm that the pipes are manufactured according to the applicable standards.

In the case the delivery was made on more than one consignment, each consignment will be tested to confirm the compliance with above standard.

NOTE:

ALL TESTS' COSTS BEFORE AND AFTER THIS ITEM AND WHETHER LOCAL OR ABROAD SHALL BE BORNE BY THE CONTRACTOR AND THE COSTS SHALL BE INCLUDED IN THE TENDER UNIT RATES.

I.6 HANDLING AND TRANSPORTATION

The handling and transportation shall be in accordance with the manufacturer's recommendations.

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.

All plain ends shall be adequately protected by straw rope secured in place by binding wire or strap. None of the packing will be returnable. 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.

I.7 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 materials delivered 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 and other components. Contractor shall provide to the Engineer a set of recommendations of manufacturer for handling, loading, unloading, transporting and storing of polyethylene pipes and fittings

The Contractor shall arrange reception and storage areas only. aslo shall be responsible for off-loading all materials.

The Contractor shall also be responsible for all handling and transport activities up to and from Miyahuna store-yard, Amman.(Materials provided by Miyahuna)

- **The (Delivared Duty Paid) price shall include all costs relating to above-mentioned requirements.**

I.8 IDENTIFICATION

The contractor shall be responsible to ensure that each separate item, crate, or package has permanently attached to it, in a conspicuous position, an identification plate of weather - resistant material on which are 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 Water Company/ MIYAHUNA L.L.C.

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

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

I.9 MARKINGS OF PIPES AND FITTINGS

Each pipes and fittings shall bear clear and permanent markings. Markings on pipe lengths shall always be at the same end. Painting of data shall be acceptable for all pipe material.

The first five marking given below shall be cast on or cold stamped, the other marking applied by permanent painting.

The marking shall show at least the following information:

- The manufacturer's name or mark.
- The identification of the year of manufacture.
- The identification as ductile iron.
- The DN.
- The PN rating of flanges when applicable.
- The reference tops this standard.
- The class designation of centrifugally cast pipes when other than K9.
- Third party.
- MIYAHUNA tender No.
- Dimension (wall thickness).
- Production period ((YEAR)).
- Water," to indicate that pipes or fittings are intended for potable water".
- Serial number.
- Batch number.
- Ladle number.

I.10 DOCUMENTS TO BE PROVIDED AT TIME OF TENDER

- Manufacturer's Authorization Form.
- Potable water certificate.
- Manufacturer experience certificates; a certificate from the manufacturer (self declaration) that he has at least 10 years in the field of production for pipes and fittings.
- Quality assurance certificate (ISO 9001).
- Internal Quality System.
- The supplier/ contractor shall supply full technical specifications and catalogues highlighting the items to be supplied at the time of tender.
- Method of traceability system followed by the manufacturer.

All above documents must be valid and in English.

I.11 DOCUMENTS TO BE PROVIDED UPON DELIVERY

The contractor shall submit at least the following documents:

- Certificate of origin.
- Packing list.
- Third Party certificates.
- Full instruction manuals, which describe the correct methods and procedures necessary to construct the pipeline system in accordance with best practice.
- Upon request, the Contractor has to provide test certificates from the manufacturer's internal quality control.
- Any other documents requested by the Engineer and the hand over committee.

All above documents must be valid and in English.

Traceability System

At the time of tender the manufacturer shall clearly mention the method by which he can keep records and trace of the manufactured pipes, fittings,...etc. to ensure the capability of going back to the records for the manufactured item in case any problems accrues after the installation.

I.12 SCOPE (FOR SUPPLY AND INSTALL TENDERS)

The Contractor shall furnish and deliver to the site, all pipes and fittings, bolts, nuts, and gaskets, jointing materials and appurtenances as specified and required, to the correct standards and specifications to complete the Works. Pipe fittings and valves shall, if required be suitable for buried installation.

The Contractor shall check for compatibility between all pipes and fittings, either existing or new prior to installation.

I.13 STORAGE OF MATERIALS (SUPPLY AND INSTALL TENDERS)

The Contractors shall be responsible for the storage of all materials purchased under this Contract.

The Contractor shall manage and maintain stockyards that can accommodate all materials purchased and approved by the Engineer under this Contract.

All the materials shall be stored under cover (indoor) and all the fittings should be on sleeves, as required by the manufacturer/supplier /contractor instructions, and shall be regularly inspected by the Engineer staff and maintained to the Engineer's satisfaction.

The contractor should have a Stock Inventory Material System on software (computerized) and he should generate reports upon request.

I.14 OPERATION AND MAINTENANCE MANUALS, AND FUNCTIONAL DESIGN SPECIFICATION

The Contractor shall submit to the Engineer not later than one month before commissioning, triplicate draft copies of the operating and maintenance instructions in English for all sections of the works. The draft operating instructions shall be prepared in such a way as to provide a step by step description of the preparation and setting to work of the whole of the works and its shutting down. Following successful commissioning and before issuing the taking over certificate, the draft copies, suitably corrected where necessary, shall be assembled into their final form and shall be submitted to the Engineer for approval prior to handing over to the Client. The Contractor shall provide four copies of the final instruction manuals, in English, of those operating, maintenance and safety procedures necessary for the routine operation of the works. Any additions, alternations or deletions, which may be required by the Engineer following the experience, gained during the running period and further maintenance shall be incorporated in these four copies in the form of additional or complete replacement pages. The Contractor attention must ensure that the following items are included in the operating and maintenance instructions manuals:

Schedule of equipment supplied giving Manufacture's name and address and appropriate make/model number/catalogue number.

Full-year schedule of routine maintenance for all equipment supplied.

Schedule of spares supplied.

Schedule of tools and lubricants supplied.

Sectional arrangement drawings of major items with dismantling instructions.

Layout drawings showing the "As Built" installation.

General arrangement and schematic diagrams of the "As Installed" control panels.

"As Built" diagrams of all electrical connections, for the power and control panels and installed equipment. The wires and connections shall be fully numbered wherever they are terminated at instruments, relays power and control panels, etc. The numbering shall be done on site using the numbering scheme shown on the drawings. The labeling shall be done in a permanent and proper manner using good rubber sleeve type or other type approved by the Engineer.

Full and comprehensive instructions for all items of equipment supplied.

Schedule of recommended lubricants and their equivalents.

FUNCTIONAL DESIGN SPECIFICATION (FDS)

This document is not just concerned with software functions but shall address the overall, integrated control concept of ICA equipment. The FDS shall be fully indexed on A4 sheets and bound. Contents shall include but not be limited to the following areas, in so far as they are applicable to the particular application:

- Automatic process control description containing P&I references for equipment.
- Ranges of analogues and set-point values in engineering units.
- List of analogue displays also alarm and status indications together with a description of their origins (i.e. software generated or hardwired from a particular field item etc.).

- System operation design criteria descriptions including fall-back operation and failure modes, also manual control.
- System hardware and configuration descriptions.
- I/O listings with alarm status points highlighted.
- Operator Interface description.
- Graphical display layouts.
- Software description and block diagrams.
- Flow chart for each process control function.
- Alarm definitions.
- Access security system description.
- Communications and protocol descriptions.
- Programming method and hardware description.
- Calculations for design basis.
- List of available commands, set-point adjustments, control enable/inhibit and other operator interventions which are available, together with a description of access.

I.15 TRAINING OF EMPLOYER PERSONNEL

The Contractor shall provide training for the Employer's staff as part of the Tests on Completion. Training shall be in all aspects of the pressure management system including the Host software suite, communications equipment, instrumentation, RTUs, Data loggers, controllers and any other aspect that the Employer is required to know in order to successfully operate the complete system. The purpose of training is to give the Employer the knowledge and experience to run the project and this experience includes both operational experience & maintenance.

The Contractor shall present, structured training courses on site with regular full time training instructors covering both operation and maintenance of the system equipment furnished by the Contractor.

The number of courses required and the number of trainees are stated below. The training shall be in English unless stated otherwise below.

The Employer will send the following personnel to attend courses for each session:

(i) Operator Training Course (8 Persons):

Provide course covering the structure and the functions of the System components and devices. The course shall familiarize the operator with the procedures for applying the system to process control problems and develop participant programming capability.

As a minimum, the course shall be of one week duration, including not less than 20 hours of tuition, and shall cover the following topics:

- Overview of Systems Functional Capabilities.
- Equipment overview including system component functions, operating principals and proper use.
- Loading and start-up of the digital system hardware components.
- Use of system commands.

(ii) Maintenance Training Course (6 Persons):

Provide course covering preventive and troubleshooting maintenance for the system components. The course shall familiarize participants with diagnostic capabilities of the system, both software and hardware, and also the routine maintenance procedures on the system and the common peripheral devices.

As a minimum course shall be of two weeks duration, include 50 hours of tuition, and shall cover the following topics:

- System overview description including the power subsystems and logic components of the processor bus.
- Description of the maintenance and troubleshooting aids of the system including software diagnostic programs.
- Description of all bus operations.
- Description of peripheral and process interface devices.
- The use of hardware diagnostic routines, test equipment/test procedures as required enabling the Employer's personnel to detect and isolate system faults and to implement repairs.
- Report configuration, generation, printing, and customization.
- System security
- Alarm configuration and management.
- System backup and recovery.
- System overview and capabilities.
- Database configuration.
- System startup and shutdown procedures.
- Project network communication.
- Preventive maintenance procedures.

I.16 REFERENCE STANDARDS

Table I-1: Reference Standards

Standard Number	Description
EN 545-2010	Ductile iron pipes, Fittings, accessories and their joints for water pipe lines Requirements and test methods
EN 15664	influence of metallic materials on water intended for human consumption
ISO 4427-1 :2007	Plastics piping systems -- Polyethylene (PE) pipes and fittings for water supply Part 1 - General
ISO 4427-2 :2007	Part 2 – pipes
ISO 4427-3 :2004	Part 3 - Fittings
EN12201-1 :2010	Plastic piping System for Water Supply – polyethylene (PE) Part 1-General.
EN12201-2 :2003	Part 2 – pipes
EN12201-3 :2003	Part 3 - Fittings
BS 6920	Testing of non-metallic components with regards to their effect of the quality of water
ISO 14236 :2000	Plastics pipes and fittings – Mechanical joint compression fittings for use with polyethylene pressure pipes in water supply system

Standard Number	Description
ISO 11413: 1996	Plastics pipes and fittings – preparation of test piece assemblies between a polyethylene (PE) pipe and electro fusion fittings
ISO 13954: 1997	Plastics pipes and fittings – peel decohesion test for polyethylene (PE) electro fusion assemblies of nominal outside diameter greater than or equal to 90 mm
ISO 13955	Plastics pipes and fittings – Crushing decohesion for polyethylene (PE) electro fusion assemblies
ISO 3458: 1976	Assembled joints between fittings and polyethylene (PE) pressure pipes – Test of leakproofness under internal pressure
ISO 3459: 1976	Polyethylene (PE) pressure pipes – Joints assembled with mechanical fittings – Internal under pressure test method and requirements.
ISO 3501 : 1976	Assembled joints between fittings and polyethylene (PE) pressure pipes – Test of resistance to pull out
ISO 3503 :1976	Assembled joints between fittings and polyethylene (PE) pressure pipes – Test of leakproofness under internal pressure when subjected to bending.
ISO 3506	Mechanical properties of corrosion-resistant stainless steel fasteners - Part 1: Bolts, screws and studs
EN 681-1	Elastomeric seals - Material requirements for pipe joint seals used in water and drainage applications - Part 1: Vulcanized rubber
EN 681-2	Elastomeric seals - Material requirements for pipe joint seals used in water and drainage applications - Part 2: Thermoplastic elastomers
EN 601	Aluminium and aluminium alloys - Castings - Chemical composition of castings for use in contact with foodstuff
ISO 12176	Plastics pipes and fittings -- Equipment for fusion jointing polyethylene systems -- Part 1: Butt fusion
ISO 13953	Determination of the tensile strength and failure mode of test pieces from a butt-fused joint
ISO 11414	Preparation of polyethylene (PE) pipe/pipe or pipe/fitting test piece assemblies by butt fusion

2. DUCTILE IRON PIPES

2.1 TECHNICAL SPECIFICATIONS

2.1.1 General

DI pipes shall be centrifugally cast, with socket and spigot ends, EPDM rubber gaskets.

Pipe Selection:

Ductile Iron Pipes and joints shall be C class according to EN 545-2010.

Outside protection coating:

Ductile Iron Pipes C class shall be in accordance with EN 545-2010, the external coating shall be of 400 g/m² metallic zinc Aluminium Alloy (85%+15%) plus epoxy finishing coat according to EN 545-2010, applied also on socket inside, suitable for ground condition I and II and III.

Inside protection lining:

The pipe or fitting interior shall be of sulphate resisting blast furnace cement mortar according to EN 545.

2.1.2 Length of Pipes

Standard length for pipes is 6 meter for transport in bundles or 5.5 -5.8 meters for transport in open top containers.

2.1.3 Testing

The manufacturer shall demonstrate the conformity of his products with the standards by submitting the below performance tests specified in the standards:

- Compressive strength of the cement mortar lining.
- Leak tightness of flexible joints to positive internal pressure.
- Leak tightness of flexible joints to negative internal pressure.
- Leak tightness of flexible push-in joints to positive external pressure.
- Leak tightness of flexible joints to dynamic internal pressure.
- Leak tightness and mechanical resistance of flanged joints.
- Leak tightness and mechanical resistance of screwed and welded flanges.

The test should include: Dimensions Examination.

- Wall Thickness.
- External Diameter.
- Internal Diameter.

- Length
- Straightness of the pipes
- Ovality Test of the Pipes.
- Cement Lining Thickness.
- Tensile Test.
- Elongation test
- Hydrostatic pressure test.
- Hardness Test.
- Microstructure Examination supported by pictures
- Thickness of external paint coating
- Works leak tightness test for pipes and fittings

3. HIGH DENSITY POLYETHYLENE PIPES

3.1 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.

3.1.1 Length of Pipes

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

Table 3-1: 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

3.1.2 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:

- “MIYAHUNA”.
- Manufacture’s name, logo and/or trade mark.
- Dimensions (nominal diameter).
- Materials, material class (i.e. PE 100) and pressure class.
- Production period (date and code).
- “Water” to indicate that pipes are intended for potable water.
- 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.

4. GALVANIZED IRON PIPES

4.1 TECHNICAL SPECIFICATIONS

Galvanized steel pipes must be seam-welded or seamless, galvanized threaded pipes (Heavy series) in accordance with BS.EN 10255 latest edition or equivalent.

The dimensions of the pipes must be according to EN 10255:2004 or equivalent as shown in table below:

Table 4-1: Dimensions of pipes

Nominal Size (DN)	Designation of Thread	Outside diameter		Wall Thickness	Mass per unit length of bare tube "Socketed" (kg/m)
		Max (mm)	Min(mm)		
15	1/2"	21.8	21	3.2	1.45
20	3/4 "	27.3	26.5	3.2	1.88
25	1"	34.2	33.3	4	2.95
50	2"	60.8	59.7	4.5	6.26
80	3"	89.5	88	5	10.5
100	4"	115	113.1	5.4	14.8

1. The pipe shall be supplied screwed in accordance to BS EN 10226-1 part (1) and EN 10226-2 part (2) pipe Threads or equivalent. And shall have the screw threads clean, well cut and square with axis of the pipe and be free from excessive burrs. Each pipe shall be supplied with a socket at one end and shall have protecting ring affixed to the unsocketed end, to prevent damage to the leading thread. The end of each socket shall be chamfered internally.
2. The galvanization shall be done by hot-dip zinc coating process according to EN10240.
3. All pipes shall be straight, cleanly finished, and free from cracks, surface flaws laminations and other defects and shall have reasonably smooth surface. The overall pipe length when one socket has been fitted to be (6) meters plus or minus 150 mm.
4. The socket shall be in accordance with EN 10255 latest editions or equivalent.
5. Galvanization test as in EN 10255 latest edition or equivalent.
6. Each pipe and fitting shall bear the mark of the year of manufacturer, nominal diameter, and the letter GS on the body of the pipe and fitting. The marks maybe cast on, painted or cold stamped.

5. DUCTILE IRON FITTINGS

5.1 TECHNICAL SPECIFICATIONS

5.1.1 General

1. Ductile iron fittings shall be sand cast in accordance with EN 545-2010.
2. Each Socket joint shall be supplied with its EPDM gasket.
3. All fittings must confirm with the requirements of norms and standards, and should be suitable to be used in conjunction with pressure pipes to the appropriate EN standards.
4. All fittings must have molded-in identification and appropriate product information
5. All fittings must be packed in such a way as to avoid surface oxidation and should only require cleaning before installation.
6. The joints of ductile iron (DI) fittings shall be according to the above mentioned standards, and all flanged for Tapers and T-Piece and for bends spigot-socket TYTON.

5.1.2 Materials

1. Of ductile iron EN-GJS-400-18 acc. to EN 1563 (GGG 400 - DIN 1693) or equivalent.
2. All gaskets shall be of EPDM rubber according to EN681-1:2006.
3. Flat gaskets shall be fiber reinforced for PN16, or flat gaskets of NBR rubber, according to EN681-1:2006.

5.1.3 Design

1. Dimension Range: above DN 100
2. Working pressure: PN 16, PN25 or PN40 (based on BOQ)
3. Fittings unless otherwise specified shall be of flanged type compatible with the pipe system.
4. Flange dimensions and drilling according to EN 1092-2.
5. Flanged fittings shall be supplied with flat gasket, straps, bolts, nuts and washers shall be stainless steel type 304.
6. The DI bends shall be designed and manufactured as automatic push-on joint type installed along and with DI pipes of type socket-spigot, fittings such as T-pieces and tapers shall be of flanged type drilled to required PN.
7. Nuts and Bolts shall be according to ISO 4016 and EN 24034 or equivalent inclusive washers.

5.1.4 Coating

Epoxy powder coated inside and outside according to DIN 30677-T2 in accordance with quality and test requirements of RAL –GZ 662, RAL 5015 or RAL 5005.

- Coating thickness: min. 250 µm.
- Adhesion: min. 12 N/mm².

6. HIGH DENSITY POLYETHYLENE FITTINGS

6.1 TECHNICAL SPECIFICATIONS

6.1.1 Fittings Types

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

Table 6-1: 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		
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.

6.1.2 Connection Type

Table 6-2: 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

6.1.3 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.

The cutter of PE EF Tapping shall be certified for potable water use.

7. GALVANIZED IRON FITTINGS

7.1 TECHNICAL SPECIFICATIONS

7.1.1 Scope of Use

The fitting must be according to EN 10255 or BS 143 or equivalent and shall be used with heavy series of pipes according to BS EN 10255 or equivalent.

It must also be suitable for potable water use.

7.1.2 Designation

The fittings shall be Malleable Cast-Iron Screw down pipe fittings in accordance with BS EN 10242-1995 or approved equivalent.

7.1.3 Threading

Threads must be in accordance with EN 102266-1 or equivalent and EN 10226-2 or equivalent and EN 10226-3 or equivalent

7.1.4 Working pressure

Working pressure shall not be less than 16 bar with 24 bar hydrostatic pressure test.

7.1.5 Galvanization

The fittings shall be (EE, GF, CRANE or equivalent in quality) and shall have an adequate corrosion protection of internal and external surfaces by mean of hot dip galvanization according BS EN ISO 1461:1999 galvanization test is required.

7.1.6 Marking

Each fitting shall bear the mark of the year of manufacturer, nominal diameter, and the letter GS on the body of fitting. The marks maybe cast on, painted or cold stamped.

8. REPAIR CLAMPS

8.1 SCOPE

This Specification specifies the requirements for the design, materials and in-service performance of mechanical stainless steel repair clamps for waterworks purposes.

This Specification designated for applications involving rigid pipes, typically ductile iron (DI), grey cast iron (CI), and steel (S). Also, for applications involving flexible pipes, typically unplasticized polyvinylchloride (PVC-U) and high-density polyethylene (HDPE).

All materials and equipment shall be in every respect suitable for storage, installation, use and operation in the conditions of temperature, humidity and The PH and water quality appertaining in Jordan.

Atmospheric temperature in Jordan varies between -10°C and 50 °C.

8.2 APPLICATION

Stainless steel repair clamps complying with this specification are intended for use in repair of water supply pipelines of the size designated in Table 8-1, with a maximum service temperature of 50°C and up to an allowable operating pressure of 16 bars for ranges diameter up to 250 mm. Repair clamps have limited ability to accommodate axial deflection and are, therefore, not generally intended for use as couplings to join two pipes together. However, they are commonly utilized for repair situations at full pipe break, where the pipe ends are considered stable. In addition, repair clamps complying with this specification are intended to provide a permanent means of preventing loss from or contamination of pipelines that have been affected by corrosion or mechanical damage in both above-ground and buried applications.

8.3 MATERIALS

The material of Clamps shall be in accordance with the following standards or any other equivalent standards.

Bands: Stainless Steel Grade AISI 304(A2) to BS1449:1991: part 2 or Grade AISI 316(A4) stainless steel to BS 1449:1991: part 2, for corrosion resistance.

Bolts shall be Stainless Steel A2, Teflon coated, or mild steel. Nuts & washers shall be Stainless Steel A2, or mild steel class 4.6 to BS EN20898: Part 1. Receiver bars shall be TIG-welded to shell to form strong fusion, and fully passivated after welding,

Gasket shall have a gridded pattern for positive sealing, and to be made of specially compounded NBR rubber specially formulated for water service or EPDM. Compound Grade E to BS2494:1990

8.4 DESIGN

The Clamps shall be used for permanent repair of cracks, holes, or complete breakages of steel, ductile Iron, PVC and HDPE pipes.

The Clamps shall be suitable for potable water for Temperature range (-10 to 50) C. Potable water certificate must be submitted.

Repair Clamps shall be standard full circle single band for diameter 150mm or less. And full circle double band for diameter more than 150mm, length and number of bolts not less than the values in Table 8-I for each diameter.

Gasket shall provide a 360o sealing surface and of such size and shape to provide an adequate compressive force against the pipe after assembling to affect a positive seal under all combinations of joint and gasket tolerances. And heavy gauge Type 304 stainless Steel bridge plate shall be attached into the gasket end to span the lug area and to make installation quick and easy.

Bolt retainer assembly or lugs shall be of a type 304 stainless steel, and shall be MIG welded to receiver bar and fully passivated after welding. Lugs may be cast, forged or cold formed of type 304 stainless steel, and may include a high impact polycarbonate plastic, non corrosive retainer. Lug design shall be such that the band fully compresses the gasket to the complete working width of the repair clamp without deformation of the band.

Table 8-I: Repair clamps sizes

Bands	Nominal Pipe Size (Inch)	Clamps O.D Rang				Length (mm)	No. bolts
		Inches		Millimetres			
		Min	Max	Min	Max		
Single Band	2	2.32	2.64	59	67	150	2
	3	3.39	3.66	86	93	150	2
	4	3.94	4.33	100	110	150	2
	5	4.88	5.28	124	134	150	2
	6	6.06	6.38	154	162	200	3
	6(PE)	6.93	7.32	176	186	200	3
Double Bands	8	8.268	9.06	210	230	300	3*
	10	10.63	11.22	270	285	300	3*
	12	12.40	13.189	315	335	500	5*
	16	16.34	17.32	415	440	600	6*
	24	24.41	25.59	620	650	600	6*
	32	32.28	33.46	820	850	800	8*
	36	36.61	37.8	930	960	1000	10*

* Number of bolts for each band side.

* Clamps O.D Range could be acceptable within (±4%) for the minimum and maximum dimensions.

9. INSTALLATION OF PIPES AND FITTINGS

9.1 GENERAL

The installation of pipes and fittings including: excavation, laying and backfilling, reinstatement, etc. shall be according to the specifications of Miyahuna attached in annex I.

10. DISINFECTION OF PIPELINES

10.1 GENERAL

All pipes, fittings, valves and appearances shall be disinfected according to the specification of Miyahuna listed below.

10.2 DISINFECTION OF PIPELINES

After the completed pipeline is tested, approved and backfilled, disinfections shall be performed in the following manner: after flushing the pipes, the system shall be drained completely, all valves shall be closed carefully and the system filled with a chlorine solution.

All pipes, fittings, valves and appurtenances shall be disinfected by the Contractor as specified herein unless otherwise directed by the Engineer's Representative. The Contractor is also responsible for conducting bacteriological test for all pipe laying through a laboratory. The cost of disinfection and the bacteriological test shall be borne by the Contractor.

The contractor should use potable water to execute the bacteriological test, and has three options to fulfil the specs:

- Using Miyahuna water direct from the network by installing a bypass connection and as instructed by the concerned people in Miyahuna. The costs for the mentioned connection as well as required material, labour, etc. will be borne by the contractor.
- Using Miyahuna tankers
- By using private tankers the water should be tested first by Miyahuna to ensure that the delivered water is potable water before executing any bacteriological tests. The costs to ensure the water quality will be borne by the contractor.

The attention of the Contractor is directed to the requirements of the Contract whereby he is responsible for preventing the entry of foreign material of any kind from entering the pipe. The Contractor shall take extreme care to keep the interior of the pipelines free of dirt and other foreign material. If in the opinion of the Engineer's or the Employer, dirt or other foreign material entered a pipe which cannot be removed by flushing, then the Contractor shall clean and swab the interior of the pipe with a five percent hypo-chlorite disinfecting solution to the satisfaction of the Engineer's Representative.

The Contractor shall, during the initial filling of the pipeline, concurrently introduce feed of chlorine at the same point where the pipeline is being filled. The rate of filling and the feed rate of the chlorine shall be proportioned so that the initial concentration of the chlorine in the water in the pipeline is between 50 and 100 milligrams per litre. To assure that this concentration is maintained, the chlorine residual shall be measured at blow-off, combination air valves, or other locations during the filling operation.

The following is the amount of chlorine required, if either liquid chlorine (gas at atmospheric pressure) or a one percent chlorine solution is used, to produce a 100 milligram per litre concentration in 100 meters of pipe for the various diameters of pipe to be disinfected under this Contract.

Table 10-1: Liquid Chlorine Required for Disinfecting 100 Meters of Pipes

Nominal Pipe Diameter (mm)	100% Liquid Chlorine (kg)	1% Chlorine Solution (Litres)
800	3.60	360
600	2.97	297
400	1.30	130
300	0.75	75
250	0.51	51
200	0.33	33
150	0.18	18
100	0.08	8
80	0.05	5
50	0.02	2

The use of liquid chlorine shall only be permitted when suitable equipment consisting of a solution feed chlorinator together with a booster pump of injecting the chlorine gas-water mixture into the pipeline to be disinfected is used. Introduction of chlorine gas directly from the supply cylinder shall not be allowed.

After completion of the disinfections operation for one pipeline section the Contractor may reuse this chlorinated water to disinfect adjacent sections of the pipeline by adding additional chlorine as required to produce the specified concentration of chlorine.

The Contractor shall submit a detailed description of the procedure he proposes to use to disinfect the pipeline including a description of all equipment to be used for the Engineer's Representative approval prior to starting the disinfections operations.

Payment for all labour, material, and equipment, including the cost of all water and chlorine required to disinfect the pipeline and appurtenances shall be included in the costs for meter run of the pipe.

The chlorinated water shall remain in each section of the pipeline for at least 24 hours and during this period all valves and blow-off shall be operated in order to disinfect these appurtenances. At the end of the 24-hour period, the water in the pipeline shall contain no less than 25 milligrams chlorine per litre throughout the length of the pipeline. Shall the pipeline fail to have the specified chlorine concentration at the end of the 24-hour period, the Contractor shall repeat the operation as necessary to provide complete disinfections.

10.3 FLUSHING OF THE PIPELINE

All pipelines shall be flushed by the Contractor after all hydrostatic pressure tests and disinfections operations have been performed and accepted by the Engineer's Representative.

Water for flushing the pipes shall be provided by the contractor as indicated under section – Disinfection of Pipelines.

After draining the chlorine solution the pipe system shall be flushed with potable water until the free chlorine content is between 2 to 4 milligrams per litre.

II. VALVES AND ACCESSORIES

II.1 GENERAL

Valves and accessories must conform to current EN standards, ISO standards or equivalent with respect to nomenclature, classification, symbols, and conditions of manufacturing, properties and tolerances, conditions for the preparation of specimen, test rules, identification labels and acceptance clauses.

Moulded pieces must have perfect outer surfaces without chips and must be finished by means of debarring or filing.

Connecting surfaces of all flanges have to be machined. Flanges must also have one or several circular grooves in order to facilitate grip. All surfaces which are subject to friction must be machined; bore holes in covers, blind flanges, and flanges which connect pipes have to be produced by means of drills. Manual precision grinding of valve seats and surfaces of sluice valves is required for purposes of stability and accuracy of shut-off elements.

Operating stems must be made of stainless steel. They must be machined complete with straight edges and show no defects or scarcity of material. Toric ring seals must be used for sealing.

Seal bush must be replaceable under pressure.

Manufacturer's marks, flow diameter and an arrow indicating flow direction must be visible on the device's outer surface.

Punched or forged special elements will have this information stamped upon them.

Before materials are accepted or used the Contractor may be required to supply the Supervisor with a sample piece of every hydraulic equipment, fitting, valve and accessory, etc.... that he wishes to install.

All shut-off devices shut in a clockwise sense. 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 will be flanged.

The following nominal pressures are stipulated:

Table II-1: Nominal Pressure

Nominal Pressure	Pressure Test Body	Seat (Sealing)
10 bar	16 bar	10 bar
16 bar	25 bar	16 bar
25 bar	37.5 bar	25 bar
40 bar	60 bar	40 bar

11.1.1 Third Party Witness

The supplier shall furnish an original accredited certificate of conformity from the third party inspection agency showing all test results and analysis required by the applicable standard (EN 12266-1/2), where test certificates is required. 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 productions requirements. All certification should be from a certified and approved third party, and the certificates must be related to the same batch delivered to Miyahuna, all certificates must be valid and written in English.

11.1.2 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 similar accredited authority. Final inspection tests must be done in accordance with the test requirements of EN 12266-1/2. 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 all the statements mentioned in “third party witness” section.

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

11.1.3 Valves Packing and Protection

- All valves must be packed in such a way to allow instant 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 Contract Rates and crates will not be returned.
- Valves are normally supplied in separate cartons together with any associated small items, such as bolts and gaskets.

11.1.4 Identification

The supplier shall be responsible to ensure that each separate item, crate, or package has permanently attached to it, in a conspicuous position, an identification plate of weather - resistant material on which are 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 Water Co. – MIYAHUNA L.L.C.

Tender Number – Variable

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

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

11.1.5 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 materials delivered 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 and other components. Contractor shall provide to the Engineer a set of recommendations of manufacturer for handling, loading, unloading, transporting and storing of polyethylene pipes and fittings

The Contractor shall arrange reception and storage areas only. aslo shall be responsible for off-loading all materials.

The Contractor shall also be responsible for all handling and transport activities up to and from Miyahuna store-yard, Amman.(Materials provided by Miyahuna)

- **The (DDP) price shall include all costs relating to above-mentioned requirements.**

11.1.6 Handling

Care shall be taken during loading, transporting, and unloading. Under no circumstances shall valves be dropped or rolled against one another. All valves shall be examined. Any damaged materials must be rejected by the Purchasers.

11.1.7 Details to be provided at the time of tender

1. Conformity to standard certificate from a certified third party.
2. Manuals and technical catalogues.

3. Dates of batches or consignment deliveries.
4. The supplier shall state which of the sections of the schedule of requirements he proposes to price and supply.
5. Any alternative standards proposed including demonstration of equivalency or superiority to the standard specified, if allowed.
6. Any alternative materials proposed including demonstration of equivalency or superiority to the standard specified, these alternative materials should be subjected to the clients approval.
7. Where the supplier offers alternative standards, materials to those specified, the supplier shall provide prices for those specified and the alternatives proposed.
8. The supplier shall include in his price for the training elements related to the materials he proposes to supply and shall list the elements of training offered, if needed or requested.
9. The supplier shall provide prices for the equipment applicable to the sections of the schedule of requirements he intends to price.
10. The supplier shall provide full details of his materials tests and procedures.
11. Any alternative proposed specification for combined tracer and marker tape.
12. ISO or EN certification for management and product.
13. CV's of proposed training staff, if necessary.
14. Costs of Trainers expenses, if requested.
15. Training program, if requested.

11.1.8 Manuals and Technical Specifications.

The supplier shall supply full technical specifications for the items to be supplied at the time of tender. In addition he shall provide full instruction manuals, which describe the correct methods and procedures necessary to construct the pipeline system in accordance with best practice. 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.

11.1.9 Additional Services

The supplier shall provide details of additional services, which he can provide e.g. technical advice and support and, in particular, shall state his capability for supporting the project in the Amman location at the time of tender.

11.2 BALL VALVES

11.2.1 Technical specifications

- Working pressure: 16 bar or higher
- Nominal Diameter: 1/2" , 3/4" , 1" and 2"
- The design of the ball valve must ensure completely clear of the waterway when valve is full open, in such away permitting a “full flow” throw the valve equal to the nominal pipe diameter.

11.2.2 Material

The Material of each part of the ball valve is shown in Table 11-2 below.

Table 11-2: Material

NO	PART NAME	MATERIAL
1	Body	Stainless Steel : EN -10088-3-2 Or CW617N according to EN 12165:2011 EN 1982
2	Ball	CW617N according to EN 12165:2011 chromium plated Ball Or Stainless Steel : EN -10088-3-2
3	Handle	Steel or Aluminium

11.2.3 Design of valve

1. Full bore ball valve.
2. Two piece design.
3. Double female threaded in accordance with BS 21.
4. Lever operated.

11.2.4 Coating

Coating material if applicable must be suitable for potable water uses.

11.2.5 Marking

Markings shall be in accordance with EN 19 and shall include the following:

- Nominal Size.
- Working pressure.
- name of manufacturer,
- Year of manufacture.
- “Miyahuna”.

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

11.3 GATE VALVES

The Gate valves shall be resilient seated gate valves ductile iron in both the Non-Rising Stem and Outside Stem versions as specified. All valves will be rated for PN 16 working pressure.

Part Name		Material
body wedge and bonnet (10-25 bar)		Minimum ductile cast iron EN 1563- EN-JS1030- EN-GJS-400-15 (GGG 40) , or equivalent
		Minimum ductile cast iron- EN 1563- EN-JS1050 -EN-GJS-500-7 (GGG 50) , or equivalent
body wedge and bonnet (40 bar)		same body material as PN 16-25 could be used or "cast steel"
seat	Resilient seat	Wedge full lining with EPDM for water system for pressure less 16 bars. According to EN 1171.
	Metal seated	Non resilient seat (metal seat and wedge ring utilize welded of stainless steel for water system and resistant zinc free bronze for waste water system).
Valve stem(shaft)		shall be stainless steel from the following grades : SS 420 (x20Cr13) (for potable water) With 13% chromium according to EN10088-3 (ASTM –A352 CAGNM cold rolled thread). Outside screw stem and stem nut made of hard bronze with double o- ring sealing type for Non –rising stem.
Thread nut		Brass, bronze, SS304, SS316. (SS-EN1982,SS-EN 12168, EN 10088-3)
Body Bolts		shall be electro-zinc plated steel with hex heads and hex nuts in accordance with, A2 SS-EN 10088-3

11.3.1 Rotation of Opening

All valves shall open by turning to the left or counter clockwise, when viewed from the stem.

11.3.2 Coating

All internal ferrous metal surfaces shall be fully coated, blue color, holiday free, to a minimum thickness 250 microns epoxy coating. Side coating shall be non-toxic, impart no taste to water, and shall be coated in accordance with EN standards. The color is Blue and the grade code is RAL 5005 or RAL 5015, any other grade must be subjected to Miyahuna approval on time of tender.

11.4 BUTTERFLY VALVES

11.4.1 General

- I. Butterfly valves may be used on water mains 8 inches and larger.

2. butterfly valves shall be of the tight closing, metal seat type with recess-mounted and securely fastened to the valve body or attached to the valve disc. Directions of flow shall be satisfactory for applications involving valve operation after long periods of inactivity.
3. Valve discs shall rotate 90 degrees from the full open position to the tight shut position.
4. Double eccentric design

11.4.2 Material

Part Name	Material
Body and cover	Ductile cast iron EN 1563- EN-JS1030- EN-GJS-400-1
Sealing disk lever	Ductile cast iron EN 1563- EN-JS1030- EN-GJS-400-15 (GGG 40)
Shaft	Min X20Cr13(1.4201), SS304,SS316.according to (EN 10088-3)
Thread nut	Brass, bronze, SS304, SS316. (SS-EN1982,SS-EN 12168, EN 10088-3)
Bolts	Shall be electro-zinc plated steel with hex heads and hex nuts in accordance with, A2 SS-EN 10088-3

11.4.3 Design

1. Face to face to EN 558-1, basic series 14.
2. Flanged accordance to EN 1902-2.
3. Flanged connection to DIN 2501.
4. Soft sealing.
5. Glands shall be O-ring.
6. Valves shall be suitable for installation in either horizontal or vertical position.

11.4.4 Coatings

All internal ferrous metal surfaces shall be fully coated, blue color, holiday free, to a minimum thickness 250 microns with a two part thermosetting epoxy coating. Said coating shall be non-toxic, impart no taste to water, and shall be coated in accordance with EN standards. The color grade is RAL 5005.

11.5 ELECTRICALLY ACTUATED ISOLATING VALVES

Isolating valves shall be according to EN 593, and shall be suitable for a nominal working pressure of 16, 25, 40, 50 bars according to the final design performed by the contractor.

Body and disk shall be of ductile iron EN-GJS-400-18 / EN-JS 1030 acc. to EN 1563 (GGG 400 - DIN 1693) and shall be inside and outside fusion bonded epoxy powder coated with a minimum coating thickness of 250µm according to EN 14901. Buried valves shall be inside

and outside epoxy powder coated complying in general with DIN 30677 Part 2, coating thickness shall be minimum 250µm, freedom from imperfections shall be tested by high-voltage method.

Valves shall be cast iron and shall be designed and manufactured in accordance with EN 593 and EN 1074-2.

Stems shall be made of Stainless Steel (St 1.4021 / X20Cr13) in accordance to EN 10088 - 3

Body seat, shall be made of stainless steel 304 (minimum 1.4021) (or 316 (minimum 1.4462)) or body seat wear nickel welded overlay, micro finished. Shaft and Internal bolts and pins shall be made of A2 stainless steel quality minimum or stainless steel 304 (minimum 1.4021)

Endless profile sealing ring and O-rings shall be of EPDM suitable and approved for potable water.

Sealing ring can be replaced without dismantling the valve.

Isolating valves shall be equipped, if not otherwise requested in the bill of quantity, with gear box and hand wheel.

Hand wheel spindles shall be vertical. Where the valve spindle is vertical but offset from the nearest suitable operating position, the offset shall be accommodated by either an enclosed gearbox or by an intermediate shaft with 2 universal joints. Where the valve spindle is not vertical, either an enclosed gearbox or an intermediate shaft with constant velocity joints shall be provided.

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

Where required Isolating valves shall be operated by means of electrically driven actuators with integral reversing starters

Actuators shall be suitable for use with a nominal 415 volt 3 phase 50 Hz power supply and shall incorporate a motor integral reversing contactor starter local control facilities and terminals for remote control and indication connections.

The actuator shall be capable of opening or closing the valve or penstock against an unbalanced head equal to the maximum working pressure.

The safety margin of motor power available for sealing and unsealing the valve or penstock shall be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal. The operating speed shall give valve opening and closing at approximately 300mm per minute.

The actuator shall be capable of functioning at ambient temperature ranging from -5° to 55°C for twice the valve stroking time at an average load of at least 33% of maximum valve

torque. Where actuators are required for modulating purposes continuously rated motors shall be provided.

Overload protection shall be provided by a direct sensing thermostat embedded in the motor windings.

The gearbox shall be of the total enclosed oil bath lubricated or grease filled type suitable for operation at any angle and provided with appropriate filling and drain plugs. The drive shall incorporate a lost motion hammer blow feature. The output shaft shall be hollow to accept a rising stem and incorporate thrust bearings of the ball or roller type. The design shall permit the gear case to be opened for inspection or disassembled without releasing the stem thrust or taking the valve out of service.

All operating spindles, gears and headstocks shall be provided with adequate points for lubrication.

A hand wheel shall be provided for manual operation engaged when the motor is de-clutched by a lever which shall be padlock able in either position. The drive shall be restored to power automatically by starting the motor. The hand wheel drive must be mechanically independent of the motor drive, and any gearing should be such as to permit emergency manual operation in a reasonable time. Clockwise operation of the hand wheel shall give closing movement of the valve or penstock. The effort required for manual operation shall not exceed 250N.

Hand wheels shall be clearly marked with the words "OPEN" and "CLOSE" and arrows in the appropriate directions. The rims of hand wheels shall have a smooth finish.

The actuator shall be fitted with a drive bushing which is easily detachable for machining to suit the valve stem or gearbox input shaft. Bushings shall be fitted in the base of the actuator to enable standard length valve stems to be used.

Transparent PVC covers shall be fitted to protect the threads of rising spindles.

Actuators shall be provided with open and close torque and/or position limit switches as required by the type of valve or penstock plus two additional limit switches at each end of travel for remote indication and interlocking. A mechanical latch shall be provided to prevent the open torque switch tripping while the initial unsealing hammer blow is applied. Two additional sets of limit switches consisting of 3 switches per set shall be provided. Each set shall be independently adjustable to any valve or penstock position. Switch contact ratings on inductive circuits shall be 5 amp. AC up to 440V, 50 watts DC up to 250 volts.

An illuminated mechanical dial indicator shall be provided to show continuous movement valve position, and the actuator shall incorporate a sealed potentiometer of at least 3 watts rating for continuous remote position transmission.

The reversing contactor starter and local controls shall be integral with the valve actuator housed to prevent breathing and condensation build-up. The starter shall be suitable for 60

starts per hour and shall comprise mechanically and electrically interlocked reversing contactors of approximate rating to the motor size with coils fed from a 120 volt control transformer of 40VA minimum rating. The common connection of the contactor coils at the transformer shall be grounded so that the contactors drop out on the event of leakage to earth. The primary winding shall be separated from the secondary by a grounded screen and shall be protected by two easily replaceable cartridge fuses. Secondary windings shall also be protected by cartridge fuses.

Local controls shall comprise push-button switch for Open, Close and Stop, and a Local/Off/Remote selector switch padlock able in any one of three positions:

- (a) Local control only.
- (b) Off/No electrical operation.
- (c) Remote Control with local stop.

It shall be impossible to operate both open and close pushbuttons simultaneously. Stop pushbuttons shall be mushroom headed "Stay-put" type.

Each actuator shall incorporate the following:

- (a) Easily replaceable phase discriminator to prevent starting with an incorrect phase rotation or dead phase.
- (b) Plug-in interposing relays with dust covers for Open/Close/Stop control from a specified remote DC supply.
- (c) Plug-in instantaneous reversal monitor relay with normally open contacts and having its coil energised from the control transformer only when the Local/Off/Remote switch is in the remote position to show that the actuator is electrically operable by remote control.

Internal wiring shall be of a tropical grade PVC insulated stranded cable of 5 amp. Minimum rating for control circuits and appropriate size for the motor 3 phase power. Each wire shall be clearly number identified at each end. The terminal compartment shall include a moulded "transfer back" terminal block of the stud type the 3 phase power terminals being segregated by a separate insulating cover. The terminal compartment shall include a double O-ring seal to provide a watertight barrier to the electrical enclosure so that electrical components are protected from moisture ingress while the terminal cover is removed.

The actuator enclosure shall be watertight to NEMA 6, IEC 144-IP67 and where specified shall be explosion-proof to Division I, Class II and II, BS 229 or other approved equivalent standard.

The actuator starters shall be integrally housed with the actuator in robustly constructed totally enclosed weatherproof housings. The motor starters shall be capable of starting the motors under the most severe conditions.

The starter housing shall be fitted with internal heaters so as to provide protection against damage due to condensation. Heaters shall be suitable for single phase operation. The heaters shall be switched "on" when the actuator is stopped and shall be switched "off" when the actuator is running.

Contractor shall conduct all works for the operation management of DZ 24 in accordance drawings number CY01 to CY04 Including all required hardware, remote sensors, GSM cards, connection to existing SCADA ... etc, where the client will be able to control the operation of these DMAs through the existing SCADA.

11.6 AIR VALVES

11.6.1 Single Air Release Valve

Air Valves shall be single automatic air valves, PN 16, operation pressure PN 0.1 – 6 bars and 1-16 bars, with body/bonnet of special plastics or Ductile Iron according to EN-GJS-400-18 / EN-JS 1030, or equivalent, according to EN 1563 (GGG400 - DIN 1693).

11.6.2 Air and Vacuum Valve

The air and vacuum valve shall be able to automatically exhaust large quantities of air during filling of a pipeline. The valve shall automatically close when water fills the valve and remain closed while the system is pressurized but open automatically to admit air during draining or a negative pressure condition. Safe operation even under high-volume, high-speed venting up to sonic speed;

The valve shall be with a venting orifice no smaller than the nominal valve size.

The float ball shall be spherical and made of stainless steel grade 316.

All Internal parts shall be made of stainless steel grade 316.

Shall be of the triple function type with a flanged inlet to EN 1092-2 PN 16 (or 10) (DIN 28605 / DIN 2501/BS 4504) and shall be suitable and approved for the use with potable water at a nominal working pressure from 1 to 16 bar.

Body and cover shall be of ductile iron EN-GJS-400-18 acc. to EN 1563 (GGG 400 - DIN 1693) and shall be inside and outside epoxy powder coated complying in general with DIN 30677 part 2, coating thickness shall be minimum 250µm, freedom from imperfections shall be tested by high-voltage method.

Orifice and float balls shall be of corrosion free material (stainless steel or plastic), all seals shall be of EPDM or NBR suitable and approved for potable water.

11.6.3 Automatic Air Valve, Single-Chamber Type

The Automatic Air Valve shall combine the operating features of both an air and vacuum valve and an air release valve in one house. The air and vacuum valve portion shall automatically exhaust large quantities of air during the filling of the pipeline and automatically allow air to re-enter the pipeline when the internal pressure of the pipeline approaches a negative value due to column separation, draining of the pipeline, or other emergency. The air release valve portion shall automatically release small amounts of air from the pipeline while it is under pressure. Safe operation even under high-volume, high-speed venting up to sonic speed;

The valve shall be with a venting orifice no smaller than the nominal valve size.

The float ball shall be spherical and made of stainless steel grade 316.

All Internal parts shall be made of stainless steel grade 316.

The seat shall be replaceable and made from Buna-N rubber or other suitable elastomer compounds suitable and approved for potable water.

- Single-chamber valve directly operated by the medium;
- Two-orifices venting system with 3 functions (supply and release of air as well as automatic venting during operation);
- Safe operation even under high-volume, high-speed venting up to sonic speed;

With test and purge connection;

- Body and cap made of ductile cast iron EN-JS 1030 (GGG-40);
- Inner parts made of stainless steel grade 316 (DN 50 float made of plastic);
- Seal made of EPDM.
- Equipped with inspection valve.

Corrosion Protection:

Inside and outside with epoxy coating to GSK standards for heavy-duty corrosion protection to DIN 30 677-2, coating thickness >250 µm, colour: RAL 5005 blue

11.7 PRESSURE REDUCTION VALVE (PRV)

11.7.1 Design

- The main valve shall be pilot-controlled, hydraulically operated, differential piston actuated and full ported.
- The control valve shall be “self-contained” and incorporate a system of pilot controls, factory assembled to and tested with the main valve. The valve shall be operated by line pressure and utilize the pilot system to open, close or throttle the differential piston main valve to perform the specified function.

11.7.2 Construction

- The main valve body shall be globe style, constructed of high-strength cast iron.

- The valve shall be “full-ported” so that when fully open the flow area through the valve is no less than the area of its nominal pipe size. Globe body valves shall have an integral bottom pad or feet to permit support directly beneath the body.
- The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area and the area on the upper surface is greater than that of the underside. There shall be no diaphragms or springs in the main valve.
- The valve piston shall be fully guided on its outside diameter and all guiding and sealing surfaces shall be bronze. To minimize the consequences of throttling, throttling shall be by long, stationary vee-ports located downstream of the seat and not by the seat itself.
- The valve shall be fully capable of operating in any position without the need of springs and shall not incorporate stems, stem guides or spokes in the waterway. A visual position indicator shall be provided.
- The main valve shall be serviceable in the line through a single flanged top cover that provides easy access to all internal components.
- The valve shall be inside and outside epoxy powder coated with a minimum thickness of 250 µm and shall be suitable and approved for the use with potable water.

11.7.3 Pilot System

- The valve shall be operated by a system of pilot controls necessary to perform the specified function.
- The pilot system shall be factory pre-piped, installed on the main valve and tested as an assembly.
- In addition to the necessary pressure regulating pilots, the system shall incorporate a wye-strainer and opening and closing speed control valves.
- Sufficient isolating valves and pipe unions shall be provided to facilitate removal and maintenance of the pilot system without disturbing the main valve.
- Pilots, controls, piping and fittings shall be corrosion resistant copper, bronze or brass.

11.7.4 Controller

I – Installation and Commissioning

All PRV Control Systems must be quick easy and simple to install.

1. PRV Control System should be able to be installed, commissioned and maintained by a technician with experience of PRV servicing and following appropriate training.
2. It is required that the PRV Control System can be rapidly serviced with replacement components, these replacement components should be programmed with a duplicate configuration remotely via the Host Software Suite or locally using a field programming device.

Following installation and configuration the PRV Control System should initially operate in fixed PRV outlet pressure mode; this “learning” mode will enable data to be gathered to

calculate accurate flow and pressure models, before introduction into the control regime.

II – Control Models

The PRV Control Systems must provide accurate and reliable control in a number of different control modes.

1. PRV Control System should be able to modulate the PRV control and maintain the required network pressure target without the requirement for a flow signal input.
2. PRV Control System should provide control of network pressure against flow, time, and a combination of flow/time or from direct feedback from CP data.
3. The system must use adaptive algorithms, which automatically respond to changing network characteristics and proportionally modify control models in order to maintain required levels of service but optimising potential opportunities to reduce pressure.
4. Each individual PRV Control System must be able to accept inputs from up to 3 critical point loggers, the system must automatically select between CP's depending upon prevailing network conditions.
5. PRV Control System control modes must be automatically updated in response to changing network characteristics, for different times of day, days per week, weekdays, weekends or everyday. System Control Models shall be automatically updated in response to changing network characteristics as fresh data is received from the system components, these updates should take affect immediately as the data is received and there should be no delay in updating and applying the modified control models.

III – PRV Control

PRV Control Systems must operate as to smoothly and efficiently adjust the Pressure Reducing Valve without causing pressure surges.

1. It should be possible for the PRV Control System to finely adjust the PRV outlet pressure to a resolution of 0.1m and with a frequency of 1500 operations per day, ensuring smooth and efficient adjustment of the outlet pressure to reduce the possibility of inducing pressure surges.
2. The PRV Control System should automatically control the speed of valve response to the given target pressure to provide rapid response to network changes whilst minimising the possibility of inducing pressure surges and reducing burst frequency.
3. In fault conditions the PRV Control System should be able to directly fully open or close the valve in response to extreme or emergency situations.

4. A pressure failsafe setting needs to be configured in the PRV Control System so output pressure never falls below an acceptable level. Mechanical fail-safes must be installed to ensure sufficient network pressure even in extreme failure conditions

IV – Network Data/Logging

All PRV Control Systems components must have internal data logging.

1. The PRV Control System must incorporate advanced bi-directional communications via integrated telemetry.
2. PRV Control System record data from PRV inlet pressure, PRV outlet pressure, Flow and Temperature.
3. Logging and Dial-in frequency must be remotely configurable from the Host Software Suite.
4. Each logging components should have the ability of fast logging to 1 second, this is to enable accurate minimum night flows to be calculated/investigation of network events and should be in addition to the normal logging channel.
5. A dedicated telemetry data logger shall be installed at the Critical Point (point of lowest pressure in the pressure zone). This data logger must record pressure and have the ability to transmit data to the Host every 15 minutes.
6. Data from all logged parameters must be accessible through a web interface from any web-enabled device.
7. Pressure Transducer should have an accuracy of 0.1% and a repeatability of 0.1%, full scale.
8. Flow input needs to have options to accept both pulse inputs. Flow logging needs to have count and event modes.

V – Alarms

All PRV Control Systems components should have sophisticated alarm routines to provide early warning of network events.

1. Alarms must be remotely configurable via the Host Software Suite or locally using the field programming device
2. All alarms should be able to be configured to send to the Host Software Suite and to individual hand phone numbers via SMS.
3. Alarms should be able to be configured as; Rate of Change, Profile, Minimum Night Flow, Threshold, communication failure and power failure. PRV Control System should be able to accelerate the rate of data dial-in upon alarm. Dial-in rate is increased if an alarm situation is triggered.

4. Low battery alarms must be generated by all components to allow for predictive maintenance. This alarm should be triggered more than a month before battery depletion. Battery voltage shall be transmitted to the Host Software Suite as part of the data message.

VI – Communications

All PRV Control Systems components should have two-way communications.

1. All configuration parameters, including exact regulated pressure, shall be programmed remotely via the Host Software Suite.
2. Communications should be available via(4G/ 3G/ GPRS) and SMS.
3. Each logging components should be able to be configured to send data to the host down to a frequency of 15 minutes.
4. PRV outlet target pressure should be remotely adjustable from any web-enabled device through User name and Password..
5. Alarms, Logged Data shall be sent to the Host Software Suite to a minimum frequency of every 15 minutes.
6. It will be possible to upgrade the Firmware for all components.
7. PRV controller should be able to be configured remotely from the Host Software Suite or locally via field programming device.
8. Instantaneous remote communications needs to be available for all components to enable immediate control of the PRV Control System.
9. PRV Control System should be able to operate autonomously and not be susceptible to loss or impaired control due to temporary or permanent failures to the communication network.PRV Control System shall continue to control according to the latest flow and time related pressure models indefinitely in the event of communications failure.

VII – Host Software Suite

A Host Software Suite is required to manage the PRV Control System

1. The Host Software Suite needs to be web-based with access available to any web-enabled device.
2. Host Software Suite shall be able to be installed on a suitable PC installed and managed locally, independent and isolated from access via any third party. This PC will be owned and managed by the Client.
3. Host Software Suite will offer Control, Monitoring, Database Management and Display functions.
4. Individual access to Control functions will be granted by the system administrator. The Host Software Suite will allow the administrator to grant individual users

different levels of system access. Pressures to a resolution of 0.1m must be able to be displayed by the Host Software Suite.

5. The Host Software Suite shall be able and configured to connect with any SCADA system via standard protocol.

VIII – Host Software Suite PC

The operator workstation will include a central computer together with associated hard disk storage devices and communication interfaces to provide full system facilities.

The speed of operation of the computer will be such that any alarm, control, display, or data is displayed to the operator or auctioned within 5 seconds of its request or occurrence.

The Operator Workstation PC will have, at minimum, the following requirements:

- a. Processor: 12th Gen Intel® Core™ i7 Processors
- b. Operating System: Microsoft Windows® 10 Professional.
- c. Memory: 4 DIMM slots (2 in USFF chassis): Non-ECC dual-channel 1333 MHz DDR3 SDRAM up to 16 GB.
- e. Hard Drive: 9 cm (3.5") up to 2TB - 7200 RPM SATA 3, 3.0GB/s.
- f. Network Adapter: Integrated 10/100/1000 Ethernet adapter.
- g. I/O Ports: 10 USB 2.0 ports, 4 front, 6 rear (+ 2 internal flex bay), 2 RJ-45; (stereo/microphone); 2 line-out (headphone/speaker).
- h. Video Adapter: 1GB.
- i. Case: Tower mounting case with minimum of two (2) internal 3.5", one (1) external 3.5", two (2) drive bays, 305 watt or greater capacity UL rated redundant hot swap power supplies, 3 internal cooling fans and external keyboard lock.
- j. External storage memory drive: at least one DVD-ROM/CD-RW combo drive.
- k. Sound card for the annunciation of audible WAV file tones or pre-recorded messages at the integral VDU stereo speakers.
- l. The PC shall be provided with latest version of the Microsoft Office.

XI – Power Requirements

Both the PRV Control System and the Critical Point Logger require independent power supplies

- I. All components shall be battery operated and shall have an expected lifetime under normal operation of 5 years.

Note : Meters and critical point loggers shall be battery operated.

X – Physical

Both the PRV Control System and the Critical Point Logger require to robust and suitable for installation in underground chambers.

1. Operating temperature should be from -5 to +50 degC
2. Ingress protection is to IP68, fully submersible. PRV Control System should operate when totally submersed without the requirement of a breather.

11.8 DATA LOGGERS F/P WITH GSM MODULE

The GSM and GPRS networks will be used to transfer recorded data, meter readings and alarm messages to a host computer or to the Internet, housed in a rugged, waterproof enclosure, suitable for installation in underground chambers.

Fully integrated SMS/Cellular Data Logger fit to local frequency.

Each channel independently selected for digital or analogue inputs
one channels may be dedicated for high resolution inputs / flash powering external 4-20mA loops (factory configured)

Self powered for > 5 years

Nationwide wireless coverage

On-demand data retrieval option

15 minute, 30 minute, 60 minute, daily data transmission using frequent data mode

"Data on the web" option

Threshold and profile alarms

Light and handy display and programming unit, specially designed for work in the field.

Advanced technology for safe, efficient and economical monitoring of piping networks.

Universally usable

Professional software solutions

Universal data communication –SMS / 3G/4G

User specific customized software

Technical data:

Measurements and registrations

parameters of water net :

pressure 0 - 16 bar

temperature -25 C - +70 C ±2 C

2 digital inputs

capacity of own battery

Transmission measured data by Cellular network (optional)

Process of transmission, registration, display made on line measurement process is not stopped

Internal RTC

Time of sampling : 1 sec to 31 days, with accuracy 1 sec

Data storage - 15360 records organized in circle buffer in Memory

Intelligent controller software can make tasks programmed by user PC software for presentation of data

Power :

Work - 5 years with measures 4 times by hour

With Modem – NO added external battery Processor unit

Processor unit

Hardware

RS232 / Adapter fit.

socket for analog and digital inputs

socket for external power

antenna

Mode of work RS232

Transmission : 57600 bps, 8n1

Configuration capabilities

Remote change of parameters : calibration, timing of sampling

Secondary channel

Automatically communicates with Data Gate or existing FTP site to receive data. Supports all Data Logger slcon driven communications Enables easy data storage on the host PC

Multiple graphical view options for advanced data analysis. Data export feature, Easy to use and highly convenient.

Cost effective – can be used to identify exceptional water usage in targeted areas quickly and efficiently.

Alarms enable prompt action to be taken to resolve problems.

Secure - password protected access to read only data ensures that data remains secure and protected.

CSV download option enables data to be easily exported into a spreadsheet or other document for analysis.

Meter reading statistics displayed as Mean, Min, Max, and Volume etc...

Mouse over functionality enables graph data to be clearly pinpointed.

Google Map function pinpoints logger position to enable easy identification and location.

Fleet reporting option enables loggers requiring investigation to be identified quickly.

User Manual:

Together with the set of the delivered Goods the Supplier shall furnish 1 paper copy of the User Manual in English and 1 electronic copy of the same Manual on

11.9 ELECTROMAGNETICFLOW METERS

- Flow meters must be certificated as MID – Measurement Instrument Directive, according to European Directive 2004/22/CE, MI-001, for cold drinkable water measurement according to MI-001, or equivalent.
- Flow meters must be compliant to OIML R-49: 1-2006, or equivalent.
- Flow meters or components in contact with drinkable water must have a Sanitary Compliance Certificate, from a European Origin. (e.g. – ACS France), or equivalent.
- The Manufacturer has to be certified an ISO 9001: 2008 quality certificate and present proof of certificate.
- The Manufacturer has to be certified an ISO 14001: 2004 quality certificate and present proof of certificate.

11.9.1 In Line Type

Construction

- The flow meter shall comprise of 2 parts: the flow sensor and the converter.

- The flow meter shall be delivered either in compact configuration where the converter is mounted on the flow sensor with no cable connecting between them or remote version with cable connecting between them depending on the configuration required.
- For remote version, the cable connecting between the flow sensor and converter shall be double shielded twin-core type or higher with a length from 5m to 20m maximum.
- The flow meter shall be battery powered.
- Water temperature range of flow meter shall be between -5 C to 50 C.
- Ambient temperature range of flow meter shall be between -10 C to 55 C.
- The flow meter shall be compatible with any Automatic Meter Reading system measuring instantaneous flow rate by time measuring between 2 pulses.
- For compact version, the flow sensor and converter of the flow meter shall be IP68 hermetically sealed against water ingress or condensation including the connector for Automatic Meter Reading systems. For the remote version, the flow sensor shall be IP68 and suitable for buried installation, and the converter shall be at least IP68 and suitable for wall mounting.
- The lining of flow sensor shall be constructed of PTFE.
- The flow sensor electrodes shall be made of suitable nickel alloys for durability in abrasive water.
- The flow sensor shall be of no internal moving parts.
- The flow sensor shall be of cone shaped design to ensure reliability in metrological accuracy.
- The flow sensor shall be at least PN16.
- The flow sensor shall be configured to be installed in any orientation without affecting the accuracy of the meter.
- The flow meter status information, such as flow direction and empty pipe detection must be available and displayed on the converter display.
- The flow meter pressure loss shall not be more than 0.006 bar at 2 m/s and 0.1 bar at 4 m/s.
- The electrical conductivity of the medium measured shall be not less than 20 uS/cm (drinking water, raw water, and irrigation water).

Principle of Operation

- The principle of operation shall be in accordance with Faraday's Law of Induction.
- The flow meter shall be capable of measuring flow rate and volume total in both directions, with two independent totalizers for network management purposes.
- The accuracy shall be better than Class I of OIML R-49:1-2006.
- A calibration certificate for each delivered flow meter shall be provided.
- The flow meter installation shall not require more than 5D of straight length upstream and more than 2D downstream of the meter to secure its accuracy.
- The flow meter shall offer lifetime stable zero so that routine zeroing is not required.
- The flow meter shall indicate empty pipe detection when no water is present.

Physical Requirements

The flow meter shall be built as follow:

Sizes	From DN25 to DN800
Medium Compatibility	Compatible with raw, ground & surface water, potable water & irrigation water. Electrical conductivity $\geq 20 \mu\text{S/cm}$ -5°C to $+55^{\circ}\text{C}$
Sensor Housing	Sheet polyurethane coated
Electrodes	Stainless steel
Flange	Steel
Environment	IP68 to 2m submergence in water
Connections	DIN, ASME

Communication Output Specifications

The meter should have at least one or two pulse output (passive) and one or two status output (passive):

- Pulse output:

2 Active pulse outputs

$f \leq 500 \text{ Hz}$; $I \leq 10 \text{ mA}$; $U: 2.7\text{...}24 \text{ VDC}$ ($P \leq 100 \text{ mW}$)

Volume / pulse is programmable

Pulse width is selectable: 1 ms, 5 ms, 50 ms, 100 ms

- Status output:

2 Active status outputs

$I \leq 10 \text{ mA}$; $U: 2.7\text{...}24 \text{ VDC}$ ($P \leq 100 \text{ mW}$)

Function [selectable]: self checking, battery pre warning, battery final warning, counter overrun.

11.10 WASHOUTS

The types of Washout specified for this Contract, whether in concrete chambers or buried type, are as shown on the drawings. All Washouts shall be constructed as indicated on the drawings or as instructed by the Engineer.

If the flow cannot be discharged by gravity, flooded-manholes can also be constructed opposite the concrete wash-out chambers within the road corridor. Additional excavation and backfilling works shall be included in the unit rates of the washout.

The lengths of washout discharge lines may vary according to the location requirements on site and shall be agreed with the Engineer's Representative prior to installation. Discharge lines shall be paid for as per unit rates of pipelines included in the Bills of Quantities.

At place shown on the drawings or directed by the engineer, wash-outs shall be installed as follows:

- a. For ductile iron main pipeline, the Contractor shall install a suitable flanged tee (T) to install the flanged washout valve. The branch shall be ½ of diameter of the main pipe diameter.
- b. The washout shall have gate valve installed directly at the branch from the main pipe with all fittings and accessories as per drawings.
- c. The wash-out pipes shall be extended to such a length and reach discharge area as is required for every particular site condition as not to flood the trenches or cause any damage to the surrounding area. In case no Wadi is available a flooded-manhole shall be constructed at the nearest road.

The unit rate washout pipe work shall include for the outlet structure and riprap, as shown on the standard drawings, unless noted otherwise.

11.11 PRESSURE GAUGES

Pressure gauges shall be installed at all pressure reducing valves upstream and downstream of the valve and at selected strategic points in the distribution system for monitoring pressure fluctuation. They shall be of the bourdon tube type with sensor (for positive and negative pressures). All moving parts shall be of stainless. The dial face diameter shall be 160 mm and the accuracy class 1.6. The gauge must be suitable for a pressure range up to 16 bars.

The installation of the gauge shall be complete and shall include the connecting fittings to the main pipe, the gauge inlet pipe with 3 way cock and screwed joints.

11.12 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, dismantling joints shall be provided in general by restrained dismantling pieces (short version) or flanged adaptors as indicated on drawings or as directed by the Engineer.

Body and glands of steel welded dismantling pieces shall be capable of standing a working pressure of 16, 25 and 40 bars (according to the final design performed by the contractor and approved by the engineer) with bolts and nuts of stainless steel. The surface protection shall be epoxy powder coating. Rubber sealing rings made of Perbunan material, nitrile rubber or equivalent quality shall be used and shall be suitable and approved for the use with potable water.

11.13 SPARE FLANGES, FLANGE ADAPTORS, COUPLINGS, RESTRAINER CLAMPS

All spare flanges, flange adaptors and couplings shall be made of ductile iron GGG or GG shall comply with DIN equivalent ISO Norm and EN-GJS-400-18 / EN 1563. Flanges shall conform to the dimensions and drillings of the DIN 2501 / EN 1092-2 - PN 16.

All flanges and couplings shall be epoxy powder coated according to ISO14901 or to DIN 30677 Part 2, coating thickness shall be minimum 250µm, freedom from imperfections shall

be tested by high-voltage method and shall be suitable and approved for the use with potable water.

Seals shall be made of EPDM or NBR suitable and approved for potable water.

Restrained Flanges shall have a grip ring of steel for DI and ST pipes and a grip ring of Ms 58 (CuZn36Pb3) for uPVC pipes.

Wide range coupling or flange adaptors for Asbestos Cement / DI connections as indicated on the Drawings and in the Bill of Quantities.

Couplings shall be made of Steel, epoxy powder coated, with sealing rubber rings and lock-head bolts.

For connection of the existing to the new pipeline system, flexible couplings shall be installed as indicated on the drawings or as directed by the Engineer.

11.14 PROGRAMMABLE LOGIC CONTROLLER (PLC) / REMOTE TELEMETRY UNIT (RTU)

11.14.1 General:

The Remote controller shall be intelligent, modular unit, capable of both data acquisition and local data processing. It shall monitor and control local equipment in a standalone mode as well as being an intelligent node in a distributed system. It shall be based on multiprocessor architecture, in which a co-processor is used for handling on-board input/output channels. To facilitate initial installation, maintenance and future expansion, all external input/output modules shall connect to the basic controller using a high-speed bus.

The SCADA controller shall be configured with a modern Windows application and programmed with open standard IEC 61131-3 programming languages. Programs shall be developed and downloaded either directly to the controller using USB, Ethernet and remotely through the communication network media such as phone lines, dedicated lines, mobile IP systems or wireless radios.

The controller must be supplied with the number and type of input/output modules and communication ports as indicated elsewhere in the specifications. Expansion shall be by plugging in additional input/output modules to the I/O bus.

11.14.2 QUALITY CRITERIA :

Equipment installed within the framework of this remote processing project will have to meet specifically the following criteria:

- Very high reliability to guarantee a maximal availability of the remote processing, even on very exposed sites.
- Important sustainability of the proposed solutions for easy and cost-efficient future extensions.

- Great ease-of-use to minimize implementation times and so that unspecialized staff could be able to master it.

11.14.3 Environment:

- The controller shall operate over an ambient temperature range of -10°C to 70°C with a relative humidity 5% to 95%, non-condensing.
- The controller shall operate from nominal power supplies 12-26 VDC, but shall tolerate a wider range than this.

11.14.4 MATERIAL :

RELIABILITY AND MODULARITY :

To guarantee equipment reliability, the proposed RTU must be conceived with high protection EMC (Electromagnetic Compatibility) components, to comply with the level 4 of the following standards:

- **IEC EN 61000-4-4:** Testing and measurement techniques - Electrical fast transient/burst immunity test.
- **IEC EN 61000-4-5:** Testing and measurement techniques - Surge immunity test.
 - Each RTU shall have modular architecture:
- The RTU configuration fit at best with the needs of the facility.
- Also for implementation of future extensions at lesser cost.

11.14.5 ELECTRONIC CARDS :

The non-exhaustive list of cards below can constitute a RTU depending on the needs for the site to be equipped:

- Inputs/Outputs Cards:
 - Digital Input Card.
 - Analogic Input Card.
 - Digital Output Card + Watchdog.
 - Analogic Output Card
- Cards of Communication:

- GSM Modem.
- Card for connections Ethernet.
- Serial Interfaces RS232 / RS485.

To facilitate the cabling, all the cards must be equipped with disconnectable terminal blocks. Cards for Analogic Inputs acquisition should be able to feed directly the 4-20 mA sensors, without any external power supply. This power supply must be protected from the short circuits. Cards for Digital Inputs acquisition should be "in dry contact" : they should be opto-isolated and the power supply of the contacts should be done via a power supply isolated from the equipment.

11.14.6 FEATURES :

The RTU proposed will have to ensure the following functions:

- Acquisition of inputs - outputs
 - Digital status (on/off, defaults ...).
 - Measures (level, pressure ...).
 - Counting (Flow, time of functioning ...).
 - Command (opening/closing ...).
 - Regulations (Instruction of Flow ...).

The acquisition of inputs-output will be made either by means of inputs-outputs cards integrated in the RTU or via external inputs-outputs cards.

- Treatment of the information acquired
 - Measures (level, pressure ...).
 - Warning levels.
 - Temporizations of the alarms.
 - Calculation of balance sheets.
 - Complete module for information and events archiving
- Alarm transfer

Alarms must be transmitted by GSM as vocal messages, SMS or Emails towards on-call agents or control centre. The authorized people should be able to consult remotely and at any time the information of the installation via the voice server or by SMS, so authorizing a great freedom of movement.

- Communication with other equipment

The RTU should be able to communicate with other equipment via a standard protocol such as:

- DNP3 protocol (IEEE 1815-2012 , and IEC 60870-6)
- Hart protocol
- Ethernet PowerLink
- Modbus
- Ethernet TCP/IP

- TCP/IP communications shall be supported over Ethernet, asynchronous serial PPP, IxRTT and 4G cellular IP networks.

- Interface -Operation:

The RTU should be totally accessible locally and remotely via a simple Internet browser on PC.

- Interface Configuration

The configuration tool should work on a standard PC and be based on graphical interfaces easy to treat.

- Automatism

The RTU should have specific functions to do combinations between digital inputs easily, or to make elementary automatism. On the other hand, to address the needs for more advanced automatisms (regulation, permutation / pumps management...) the RTU should have a standard automation language (according to the standard IEC 61131-3) and function library ready for use.

11.14.7 RTU Enclosures

The enclosure shall be heavy duty; reinforced steel, freestanding cabinet which requires access only from the front (hinged front panels).

A. Index of Protection

Shall be protected to BS EN 60529 as follows:

- IP42 Indoors, clean locations
- IP54 Indoors, dirty locations
- IP67 Outdoors
- IP68 to depth 5 meters where flooding may occur

The degree of protection shall not be degraded during calibration and it shall only be necessary to open the enclosure for the purpose of maintenance, fault finding or repair. The degree of protection for all internal components shall not be less than IP2X.

B. Materials

Equipment housings and enclosures shall be constructed from materials which are resistant to the effects of weather (outdoor applications) and from exposure to process or sample media in solid, fluid or gaseous form.

C. Security

Covers or doors shall be locked (requiring a special tool or key to open) to prevent access to the enclosure and fitted with suitable "Danger Live" labels to be protected against unauthorized intervention which may affect the performance of system.

D. Electrical Termination

Incoming and outgoing cables shall be identified and shall pass through glands fitted to a properly designed gland plate and spaced so as to allow access to both sides of the glands, without the use of special tools. All connections shall be properly identified both on the terminal and conductor by indelible means. Sleeve type ferrules shall be used; open type clip-on ferrules are not acceptable. Where possible, separate terminal rails shall be provided for incoming and outgoing terminals.

E. Terminations for PLCs

These requirements are applicable to Programmable Logic Controller (PLC) or other housings containing various instruments, relays, lamps, switches, pushbuttons or other control and indication components, to marshalling cubicles also to control or data acquisition equipment forming part of the system. Such Local Control Panels may be wall mounted or free standing cabinets

- Terminal blocks shall be arranged such that both terminals and wiring ends are readily accessible and have separate terminals provided for incoming and outgoing wires.
- Each terminal shall be labeled to correspond with the diagram of connections and the terminal identification label shall be attached to the fixed portion of the terminal blocks only.
- Terminals which may be “live” when the equipment is isolated from the main supply shall be adequately shielded from accidental contact and be clearly identified and inscribed accordingly.
- Terminal blocks shall have separate terminals for internal and external connections. External connections shall always be connected to the same side of the terminal blocks.
- Control terminals shall be Phoenix Contact DIN rail mounting of spring-cage connection Clip line ST 2.5 as minimum or similar manufacture and rated for continuous current operation. Control terminal rails shall be provided with 5 spare terminals for future use, within each starter cubicle, and 20% spare terminals within marshalling sections.
- Terminals connected to remote alarms, indication, electrodes and instruments shall be spring cage Knife disconnect terminal for testing (e.g. Cline ST2.5-MT or similar).
- PLC shall be provided with a panel mounted lighting fixture operated through a dedicated door-limit-switch.]
- An anti condensation heater shall be installed in each vertical section, the heater shall be operated by a common panel-thermostat.

11.15 COMMISSIONING OF PRESSURE MANAGEMENT SYSTEM

Immediately prior to formal Taking Over but after completion of the installation to all sites there shall follow a comprehensive period of Tests on Completion where all hardware and software supplied shall prove its full functionality the final.

Test on Completion shall be a full **reliability test** for a period of 30 consecutive days operation with no significant fault occurring. The Employer, the Employer's operational staff and the Contractor will monitor this period of testing.

In the event of major system failures, (i.e. failure requiring hardware replacement or software configuration, control software or communications network) the 30-day period will be aborted and, following correction, the period restarted at day 1.

Following correction of the problem, a new 30 day shall begin.

- (a) Failure to repair a hardware or software problem within 120 consecutive hours from the time of notification of a system failure.
- (b) Recurrent hardware or software problems: if the same type of problem occurs three times or more.
- (c) Software problem causing a processor to halt execution.

The Contractor shall provide response to the Employer's notification of a defect or system problem within 2 working days and after resolution of the problem shall provide a full written report within 2 working days.

In case of faults, the Contractor shall pay all costs for replacement, i.e. delivery, installation and start-up. If it should be necessary for the Contractor to change the technical solution, any costs will be to his account, including any increase in costs for electricity, maintenance and consumption of spare parts for the following two years.

Tests on Completion

The Contractor shall provide full Site Acceptance Tests approved by the Engineer upon completion of the installation.

Any special test equipment relevant to the Contractor supplied equipment shall become the property of the Employer upon completion.

