**تقرير تأهيل البئر الجوفي في كفر جمال**

**Rehabilitation of Groundwater Well 15-18/012**

**Basic information**

The listed information is gathered from local well's operator. Therefore it is advised to verify where necessary and double check with MoA wells' data registry files.

Well Id Number: 15-18/012

Well location: Falamya\_ Qalqilya District

Well coordinates: X= 154530 Y=. 181780 Z=163

Water quality: potable water and used for agriculture and domestic demands

Number of farmers :120

Total irrigated area dunum: 350 and for drinking purposes as wells

Average annual working hours (1900)

Well total depth (meter): 172

Drilling hole diameter (inch): 18/16 inch

Casing: no

Pump setting below surface (meter): 165

Diameter of pumping pipes (inch): 5

Well pump type and capacity at well site: closed pump 55 (m3/hr)

Highest dynamic pressure reading (bar): 6.5

Pump capacity at highest pressure: 40 (m3/hr)

Well crookedness: minor after re drilling the well in 2018

Electric Power: Available transformer and no voltage drop

Static water level below surface (m): 147

Dynamic: 148, no air noticed during summer

Well rehabilitation partially (pumping pipes since 1985), motor 2006..etc

Technical malfunction: old pumping equipments and low efficiency.

**Design Proposed Quantities Well 15-18/012 (work includes Supply and Install)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **Description** | **Qty** | **Cost ($)** |
| **Electrical and Mechanical Works:**  The contractor shall submit in his offer and supply maintenance manuals, catalogs, characteristic curves, testing certificates, shipping, lading documents and specifications of pumps, motor, fittings, mechanical and electrical control devices, cables, wiring and all accessories and ancillaries to complete the work. All to be new and not renewed in accordance with the specified specifications and annex below. Therefore, the unit price in this tender must fit with the technical specifications; moreover, any material submittal should match with these specifications even if accepted by the open session committee.  The contractor should verify these specifications and carry on the design based on such reference information including all equipment and materials in this tender. The contractor will conduct field visits to the well and must be before ordering any materials or equipment as follows: the contactor must check and verify and match between the reality and the design quantities (well dimensions, pumping pipes, electric and mechanical data) ,as mentioned in this tender. If he notices any difference or no matching, then he must inform the supervisor engineer and find together a suitable solution to such conditions. This include checking and fitting all dimensions mentioned in the tender as the well's hole diameter, well crookedness, pump diameter, electric connections, cables, pipes diameter, discharge head inlet and outlet. The contractor must check in particular that the size of the hole of the well is enough to install the pumping pipes, and the water level pipes together. The sizes mentioned in this contract are the best estimate and information we got for this well from Falamyeh well committee. The contractor should be responsible technically and financially to supply the suitable materials. All connections including the electrical and mechanical fittings should be according to the PWA and general (PSI) pumping standards. | | | |
| 1 | **Vertical turbine:** supply and install vertical turbine (closed impellers) with capacity **85** cubic meter per hour at total dynamic head **200** meter with **1500** rpm. Shut off head not less than **280** m, Turbine overall efficiency at the working point is not less than **73%**. The maximum turbine size 9.5 inches. It includes connections to discharge pipe and discharge head. This item includes all connections to pumping pipes and discharge head and all works to dismantle the existing pumping pipe and turbine and re install new pump and pumping equipments. | 1 | 21000 |
| 2 | **Vertical hollow shaft motor** duty inverter 50/60 hz (1500/1800 rpm) and turn down 10:1 with premium efficiency and extra high thrust and overload protection multiple thermestors as RTD (PTC100) temperature protection relays. Motor size not less than **125 hp**. Class F insulation, service factor 1.15, IP 55 as US motors double thrust bearing design, spike resistant wiring, and full load efficiency not less than 94%. | 1 | 15000 |
| 3 | **Electric panel**: suitable electric panel three cabinets ip 66 with inverter **125**  hp compatible with the motor and equipped with inverter Main breaker by pas contactor, changeover, capacitor banks, all protection sensors against high pressure low pressure, no flow, low voltage and spikes, surge arresters, low water level, high motor temperature and overload. It includes, power cables, control cables, cooling fans, alarm for all voltage or phase failures, breakers.. contactors, kilo watt hour meter, earthling, temperature display, relays and timers, multi meter, 24 volt transformer manual and automatic control and display hydrostatic water level circuit, air condition split unit 2 ton...etc  All devices and cables to match the load and motor size. | 1 | 12000 |
| 4 | **Pumping pipes**: seamless standard sizes sch40 length **162** meter of diameter 5 inches threaded and epoxy painted from inside and outside or equivalent galvanized pipes..including coupling not less 8 teeth per inch over 12 cm coupling | 162 m/150$ | 29160 |
| 5 | **Retainers and bearings and rubber joints complete set** suitable for the **6"** pumping pipes | 54 piece /90$ | 4860 |
| 6 | **Shafts as carbon steel 1040 or equivalent**. Diameter **38**  mm and including all required fastenings and connections | 162 m/110$ | 17820 |
| 7 | **Access pipes and all connections** to monitor water level using pvc pipes sch 80 /1.25 inches used for hydrostatic water level measurements | 165 m/8$ | 1320 |
| 8 | **Pressure gauges** 16 bar | 2 piece /75 $ | 150 |
| 9 | **Flow Switch (**one piece suitable for 6" pipes**) and pressure switches (PN** 16 bar 2 pieces for high and low pressure). | 1 | 100 |
| 10 | **Pressure relief valve 2 inch** for mechanical protection of high pressure include 2 inch wash out piping and ball valve; and water piping as 2 inch galvanized pipes, 2" ball valve a | 1 | 500 |
| 11 | **Discharge head:** 6"x6" including stuffing box | 1 piece | 1200 |
| 12 | **Steel pipes:** replace existing pipes and fitting to install new pipes and fittings 6 inch diameter and thickness 3.96 mm. the price include painting the pies two faces (primer and oil ant oxidant) | 12 m/40 | 480 |
| 13 | **Old Pump lifting and installation new pump and pipes.** All works related to prepare the site including all mechanical installations, the discharge head, pumping pipes, turbine, shafts, rubber joints, access pipes, retainers and all related accessories. The price involves checking and operating the pump after finishing all project works to insure no vibration or unusual sound. The price includes all machines and labor works related to well's installation. | 1 | 2500 |
| 14 | **Gate valve**: Supply and assemble gate valve, 6" complete, 16 bar. Price includes excavation, cutting, welding, adding screws, bolts and accessories that are needed to assemble the valve. | 2 Pieces /400 $ | 800 |
| 15 | **Non return valve**: Supply and assemble a non return valve, 6" complete, 16 bar of the swing type with counter weight. Price includes excavation, cutting, welding, adding screws, bolts and accessories that are needed to assemble the valve. | 1Piece /1000 $ | 1000 |
| 16 | **Compound air valve**: Supply and assemble 2" compound air valve complete, 16 bar. The price includes excavation, cutting, welding, adding screws, bolts and accessories that are needed to assemble the valve. The Price also include supplying and installing 2" coupling, nipple and 2" gate valve. , | 1Piece /400 $ | 400 |
| 17 | **Dresser-Universal Coupling:** Supply and assemble 6" dresser complete. Price includes ears 60 cm rods and screws, bolts, excavation, cutting, welding, and adding accessories that are needed to assemble the dresser with NP 16 bar, | 2 Pieces /200 $ | 400 |
| 18 | **Elbows, T or Saddle or Elbows:** Supply and install 6"/90 or 45 degree black steel elbows or T and Saddle for welding SCH 40 anywhere within the project area | 2 Pieces /50 $ | 100 |
| 19 | Supply and install a complete 6" **cast iron water mete**r according to ISO 4064 (class B) or equivalent. Capacity 200 m³/hr, 16 bar painted with epoxy coated from both inside and outside, the measuring unit should be removable type without removing the body Price includes excavation, cutting, welding, adding dresser, flanges, screws, bolts, gaskets and adding accessories that are needed to assemble the valve with the dresser. | 1 Piece /700 $ | 700 |
| 20 | Supply, install a screen **digital hydrostatic level** meter (submersible digital level sensor) with the following characteristics:   * Water Level Measurement: 40m (max.) * Excitation: 9 to 30 Vdc, reverse polarity protected * Output: 4 to 20 mA DC, 2 wire, short circuit protected * Input Current: 20 mA max * Accuracy: 0.50% FS BFSL (includes linearity, hysteresis and repeatability) * Response Time: 2 ms * Operating Temperature: -10 to 60°C * Proof Pressure: 150% * Burst Pressure: 200% * Wetted Parts: 316 stainless steel * Electrical Connections: Submersible cable terminating in digital leads   The price includes all works and materials, as cables, connections, sensor, digital screen that shows the remaining water depth above the sensor. The price includes all wiring necessary to connect the sensor inside the well’s hole to the MCB. In addition to that a process meter/controller, should be digital and programmable one, with flush mounted to be installed in the MCB 's door, step response 2 sec, 6A dual relay | 1Piece /2000 $ | 2000 |
|  |  |  | 111490 |

**Recommendation:**

This well is adjacent to the separation wall less than 30 meters. The agricultural area is located inside and outside the wall. It is expanding in the last few years and demand on water is increasing. Therefore, it is advised to install new pumping equipments that enable to meet the maximum (daily/monthly) and save power and maintenance costs.

**Quality Assurance**

1. The contractor shall offer new pumps and electric motors suitable for running the pumps from manufacturers specializing in the design and manufacturing of water pumps and electric motors in accordance with international standards for more than 20 years experience. These pumps and electric motors should have been successfully used in the West Bank.
2. All materials and components supplied to this project including pumps, motors, controls, sensors, switches, valves, meters, strainers, fittings, shafts and pipes should pass the quality assurance tests at the factories producing these materials and components in accordance with accepted international standards. The contractor shall supply certificates indicating that the materials supplied have passed such tests.
3. The Contractor shall prove that he has successfully implemented similar works specified in this section in at least 3 other projects.

**Submittals**

* Pump Submittals: Provide shop drawings, pump test results, performance curves, warranty and certificate approving installation for the pump.
* Pump motor submittal: Provide shop drawing, performance characteristics, warranty and certificate approving the installation and suitability of the electric motor for the continuous successful operation of the system.
* Operation and Maintenance Manuals: Provide 4 copies of the Operation and Maintenance manual; containing complete parts list, recommended maintenance schedules and procedures, and guide for operation.
* Contractors shall provide complete submittals for the pumping station and all installations that will be implemented at the well site, including the pipes, valves, fittings and electric control unit, for approval.

**Reference Standards**

In these reference standards, the Palestinian Standards when appropriate to the use shall prevail. However, when the Palestinian Standards do not cover a certain part or activity, the appropriate international standard will be used. Preference will be given to ISO otherwise the US (AWWA, ANSI, ASTM, API, ACI) or English standards will be used. The following is a list of standards related to the work proposed in this project:

* American Water Works Association AWWA C200: Steel water pipe\_6 IN. (150 mm) and larger
* American Water Works Association AWWA C207: Steel pipe flanges for waterworks services – sizes 4 in. through 144 in. (100 mm through 3600 mm)
* American Water Works Association AWWA C508: Swing-check valves for water works service, 2-in through 24 in. (50-mm through 600-mm)
* American Water Works Association AWWA C509: Resilient-Seated Gate valves for water supply services
* American Water Works Association AWWA C512: Air release, air/ vaccum, and combination air valves for waterworks service
* American Water Works Association AWWA C701: Cold-water meters-turbine type, for customer service
* ACIS 301-Standard Specification for Structural Concrete
* AC1 318-Building Code Requirements for Structural Concrete. ANSI/ASTM A36-Standard Specification for Carbon Structural Steel
* ANSI/ASTM A53-Standard Specification for Pipe, Steel, Black and Hot -Dipped, Zinc- Coated, Welded and Seamless
* ASTM D 751 Hydrostatic Burst Test, Section 33, Procedure A ISO 6002-1992: Bolted bonnet steel gate valves
* ISO 5781 Hydraulic fluid power - Pressure-reducing valves, sequence valves, unloading valves, throttle valves and check valves -- Mounting surfaces
* ISO 5752 Metal valves for use in flanged pipe systems -- Face-to-face and centre-to-face dimensions
* ISO 5171 Gas welding equipment. Pressure gauges used in welding, cutting and allied processes
* ISO 4126 Safety devices for protection against excessive pressure
* EN 1074-4 Valves for water supply - Fitness for purpose requirements and appropriate verification tests - Part 4: Air valves
* PSI 186-97: Steel pipes for general use.
* PWA, 2000: Planning and design guidelines “ pumping stations for water”
* PWA, 2003. Construction and installation of pipes in water supply and sewerage trenches.

**Vertical Pump:** Vertical Multi Stage Centrifugal Pump and all the accessories it needs to get a working system with design discharge (Q) at a total pumping (dynamic) head (HT ) as specified in the BoQ for each well . Efficiency of this pump should not be less than 73% at the design point.

**Pump Assembly:** Bowls-Cast Iron A48 Class 30/ DIN GG20, BS 1452 Grade 220, free from blowholes, sand holes and other faults, internally epoxy or porcelain coated, externally coated with backed epoxy. Impellers are of enclosed type and of Zinc Free Bronze unless specified otherwise in the Bill of Quantities. Bowl Bearings- High-lead Tin bronze B584 C937. Turbine Shaft Stainless steel- A582 type 416, with diameter as given in BoQ, Bowl Bolts-SS A276 Type316. Suction Strainer-SS A276 type 316. The recommended maximum outside diameters are defined in the BoQ, the Outside and internal pump diameters and all materials of pump elements and the diameter of the SS- shaft should be clearly identified in the catalogues presented and also in the offer. Out Diameter of pump should be appropriate to the diameter of the well casing, shut off head should be also clearly identified through the H-Q performance curves that should be submitted with the (Efficiency- Q) curves of all pumps.

The pump should be supplied with a pump nameplate easy to read and corrosion resistance containing complete pump information including: pump manufacturer's name, serial number, pump model number, number of stages, speed, total dynamic head and discharge in m3/hr or liters per second the middle design point, year manufactured, etc.

**Electric Motor:** Shall be a vertical hollow shaft 3 phase induction motor with enclosed fan cooling (squirrel cage) with maximum speed n= 1500 r.p.m. rated at an output power according to the BoQ, Supply voltage =380-440 Vrms, inverter duty 50/60Hz, turn down 10:1 Efficiency premium >94%, P.F>0.87. Thrust Load minimum=1.5xRated Load, water proof with high protection degree IP55 and insulation class F, including none –reverse ratchet with all protections needed, suitable to drive the above mentioned pump without over loading, with multiple thermal protection thermestors, space heater (max temp. at well site 46°C), drive shaft, couplings, flanges, nuts, bolts,...etc, and all necessary fittings and cables for installation of the pumping unit. Complete thermal protection unit, complete current overload unit service factor 1.15, double thrust bearing design, spike resistant wiring, and full load efficiency not less than 94%. Steady bushing if needed. It is designed as continuous duty cycle and direct on line start if needed. The maximum number of starts is as NEMA. Maximum altitude is 1000 m above sea level. The column shaft (connecting the pump) shall be directly connected to driver motor by means of an adjustable flanged spacer coupling, suitably sized to transmit the required driving torque and be easily accessible for adjustment, packing or mechanical seal replacement.

**Electric Power Control, Switch and Distribution Board**

The main power control switch and distribution board should be built in a dust tight, water proof IP65 steel sheet cabinet (2mm thick) rust free, factory made with front door and lock (gray thermally painted). The top of the three cabinets should be 180-220cm from finished floor and its base is protected by min 20cm cement block. All wiring, bus bars and marking terminal unit and electric company kWh meter are to be in this power cabinet. On/Off push button, emergency button, warning lamps, alarm, digital multi-meter for measuring Current, Voltages and Power. Cabinet dimensions have to be not less than 30% free space as specified in the BoQ (200 X 180 X 40 cm). The cabinet should include inverter starter (appropriate for the rated motor power and torque) with all protection relays timers, fuses, circuit breakers, bypass contactors and any other components necessary for protection of the 3 phase motor and the pump according to the attached technical drawings and the engineer’s instructions. All circuit breakers must be secured through thermal and magnetic combination action while over load release should be of thermal type with calibration adjustable between 0.8 and 1.5 of the motor full current. Relays, circuit breakers, contactors, timers and any other protection components should be of best quality as Merlin Gerlin, Moeller, ABB , Schneider or other approved equivalent type. Transformer 220/ 2x12Vrms should be included in the control cabinet.

The Cabinet shall be manufactured in approved Factory with at least five similar jobs of the same level

**In addition to the above, the cabinet should include at least the followings:**

**a) Over load protection spikes and loose connections** adjustable 0.8 – 1.5 Nominal motor current, short circuit capacity 4PX20 kA surge arrestors of replicable type.

**b) Protection relays** for: phase failure, phase sequence, short circuit and earth leakage.

**c) Digital multimeter** : Digital screens to be installed on the front door of the cabinet for presentation of the measuring variables : V, A, kW, Hz, PF , Water level above the pump in (m) and pressure in bar at the well ground surface level .

d) **Analogue Multimeters :** Analogue multimeters for measuring the three phase supply voltages and three phase supply currents of the induction motors are to be installed on the front panel of the control cabinet as specified in the BoQ.

**e) Warning lamps** for soft start fault, over load, No flow, High pressure, Low pressure and Low water level in the well and high temperature .

**f) Capacitor bank** with discharge resistors, reactors and contactor operating at 3phase 400V, 50 Hz to improve the power factor of the motor to achieve 0.95 lagging as specified in the. The capacitors have to be connected in DELTA-connection, the capacity of each capacitor have to be based on the supply voltage of 400V(rms-Value).

**g- Earthing unit**: Earth equalizer, Comprising C14 box, Copper B.B. 70 mm2 foundation line 3 earth electrodes (D> 19 mm, L = 1.5m) and any other necessary material or components to achieve an earthing resistance of REarth <1.5 Ohm for the whole pumping station. Earthing unit should be properly connected to the power/control cabinet of the booster pump and to other components according to the technical drawings.

**Accessories:**

**Water Level Sensor :** ( Out Diam.<19mm to fit in the 25 /or32mm PVC sleeve pipe), 4-

20 mA with all necessary components for proper operation and the cable (with enough length>180m or as specfied ) which includes the wires and thin pipe. The sensor will be connected via its cable with the electric board to measure continuously the water level above the pump. The measured value in m should be shown digitally on the front panel of the control cabinet in accordance with technical specifications and/or engineer's directions. This water level sensor have to be used also for protection of the motor against dry running by switching the motor OFF if the water level above the pump sinks to a definite adjustable limit.

**Pressure Switches:** A set of low and high pressure switches 0-30 bar to be connected with the control panel unit including all required cables and accessories in accordance with drawings and/or engineer’s directions.

**Flow Switch:** Electric flow switch (at least 16bar) suitable for the pipe to be installed in (6” or 4” steel pipes) powered by a 24 V source. Flow switches shall have no moving parts, include 316 Stainless Steel Sensor, suitable for water temperatures up to 40oC, and Pressures of 40 bars or more, Exotic Alloys for Corrosion Resistance including all cables and accessories to connect it to the control unit in accordance drawings and/or engineer’s directions.

**Water Flow Meter:** Turbine water flow meter (6” or 4” as specified in BoQ, cast iron body, at least 16 or 25 bars as BoQ) complete with flanges, gaskets, bolts and nuts all according to AWWA C207, AWWA C701, or appropriate ISO standards. The meter shall have an accuracy of ±1.5% or better, maximum pressure drop at maximum discharge 0.3 bar. Materials: meter housing (cast iron epoxy coated or cast bronze), rotor (thermoplastic or stainless steel), rotor bearing pivots (stainless steel type 316). The standard register is a straight-reading, permanently sealed magnetic drive register. The meter to include an automatic reading through 100 mA @ 24 V ac/dc reed switch, cable length 5 meters and an LCD to display meters reading in SI units.

**Strainers** (cast iron, at least 16/25 bars as BoQ). Strainers body will be made of cast iron. Strainer body will be coated with an epoxy powder minimum thickness 120 microns. Screen shall be made of stainless steel. For maintenance purposes, covers shall be provided to allow ample access to inspection, cleaning and servicing. A drain bend at the bottom of the body, fitted with a stopcock shall be incorporated. Head loss shall not be more than 0.1 bars, when clean, at the nominal flow rate of the control valve or water meter protected by the strainer box.

**One Way (check) Valves**, cast iron, swing type: Check valves shall be swing type and shall meet the material requirements of ISO 5781 or EN 1074-3. The valves shall be iron body, bronze mounted, single disc, 16/25 bars as BoQ working water pressure, nonshock, and hydrostatically tested at a minimum of 36 bars (525 psi). The check valve shall BE:

1. When there is no flow through the line the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway.
2. Check valves shall have bronze seat and body rings, extended bronze hinge pins and bronze nuts on the bolts of bolted covers.
3. Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and spring. Springs with various tensions shall be provided and springs approved by the Engineer shall be installed.

**Gate Valves:** (Resilient seated Rising Stem Gate Valves, metal seal, at least 16 bars) complete with flanges, gaskets, bolts and nuts according to AWWA C509, AWWA C207 standards and drawings. The Gate valve shall be of iron body, have flanged ends, and shall be bronze, solid wedge, non rising-stem-type gate valve. The valve shall be rated for 16/25 as BoQ-bar pressure and a minimum of 36 bars test pressure. The valve should have the following characteristics:

1. Valves shall be outside screw and yoke type with rising stem.
2. Face to face metal valves dimension shall conform to ISO 5752 or EN 558-1,2.
3. Bronze gate rings shall be fitted into grooves of dovetail or similar shape in the gates. For grooves or other shapes, the rings shall be firmly attached to the gates with bronze rivets.
4. Hand wheels shall turn counterclockwise to open the valves. Hand wheels shall be of ample size and shall have an arrow and the word OPEN cast thereon to indicate the direction of opening.
5. Stuffing box follower bolts shall be of steel and the nuts shall be of bronze.
6. The design of the valves shall permit packing the valves without undue leakage while they are wide open and in service.
7. O-ring stuffing boxes may be used.

**Analog Pressure Gages (range: 0- 20 bar):** Pressure gauges ( with Analog

Scale) shall be manufactured in accordance with ISO 5171 or EN 837-1,2,3 and shall

be furnished and installed in each pump suction and discharge nozzle and in accordance with the bill of quantities. Where gauge taps are not available in the pump’s suction or discharge nozzle, the necessary taps in the adjacent piping shall be made for installation of gauge connections. Each pressure gauge should be equipped with a stop valve of the same pressure rating.

**Digital Pressure Measuring Sensor (range 0-20bar).** The designto measure digitally the pressure in the discharge pipe near the well opening. The digital measurement in bar should be indicated at the front panel of the control cabinet. All work should in accordance with these technical specifications, drawings and engineers directions.

**Air Release/ Relief Valves:** Air relief valves shall be of the double orifice pattern with cast iron bodies, the inlet flange shall be fitted and drilled in accordance with EN 1074-4. The valves shall be adequately sized for the release of air from the pipeline without restriction of rate of filling or flow due to backpressure. Air shall be allowed to enter at a rate sufficient to prevent excessive reduction of pressure in the pipe during pipeline emptying. The “aerokenetic” type shall be provided, air valves with internal operating linkages shall be avoided. Valves shall be designed to prevent the operating elements being in contact with the pipeline liquid by approved means such as the provision of an auxiliary float and chamber sufficiently large to isolate the orifice valves and seats throughout the rated operational range. Air valves shall be fitted with a separate isolating sluice or gate valve and gearing shall be provided, where necessary, to facilitate operation. EN 1074-4. All air relief valves and associated isolating valves shall be works tested and capable of withstanding the same test pressure as the pipeline or vessel on which they operate. All materials used in the manufacture of the valve shall conform to EN 1074-4.

**Pressure Relief Valves:** It is designedwith adjustable setting to allow pressure relief when pressure exceeds an adjustable setting in accordance with ISO 4126. The pressure/surge relief valve shall be heavily constructed cast iron valve body, with integral end flanges and full unobstructed flow through area. The disc shall be cast iron having a replaceable resilient seat for tight shut-off. The Pivot shaft shall be stainless steel and be a single unit (not stubs), extending through the valve body with a weight and lever mounted on one or both ends. The pressure/surge relief valve shall be adjusted at the factory to hold closed against the normal operating system pressure. When the system pressure exceeds this setting, the surge relief Valve shall open immediately to relieve the pressure rise, but closes slowly at an adjustable rate as the system pressure returns to normal. A heavy-duty oil dashpot system and stainless steel oil reservoir shall be externally mounted on the valve to control the rate of closure, in such a manner, to positively prevent any slam. The closing rate shall be externally and infinitely adjustable thru a

color-coded flow control valve having a locking device to prevent tampering, once the close rate is set. Prior to shipment of the valves the manufacturer shall factory test the valves under the pressure and flow conditions specified above. The manufacturer shall submit to the Engineer with certified copies of the factory test results. Surge relief valves shall be in accordance with ISO 4126 and shall be installed on the plant water lines as BoQ.

The surge relief valve shall be heavily constructed cast iron valve body, with integral end flanges and full unobstructed flow through area. The disc shall be cast iron having a replaceable resilient seat for tight shut-off. The Pivot shaft shall be stainless steel and be a single unit (not stubs), extending through the valve body with a weight and lever mounted on one or both ends.

The surge relief valve shall be adjusted at the factory to hold closed against the normal operating system pressure. When the system pressure exceeds this setting, the surge relief Valve shall open immediately to relieve the pressure rise, but closes slowly at an adjustable rate as the system pressure returns to normal. A heavy-duty oil dashpot system and stainless steel oil reservoir shall be externally mounted on the valve to control the rate of closure, in such a manner, to positively prevent any slam. The closing rate shall be externally and infinitely adjustable thru a color-coded flow control valve having a locking device to prevent tampering, once the close rate is set. Prior to shipment of the valves the manufacturer shall factory test the valves under the pressure and flow conditions specified above. The manufacturer shall submit to the Engineer with certified copies of the factory test results. Surge relief valves shall be installed where indicated on the Drawings. Valves shall be rated 40 bars (600 psi) working pressure.

**Black Steel Pipes at least 3.96mm Thick** externally painted two faces or coated as BoQ with backed epoxy manufactured in accordance with PSI 186-97 and AWWA C-200 for connecting the riser column pipe through the well discharge head with the valves, switches, meters, strainer , gages and dressers in accordance with BoQ and drawings and engineer's directions. Price includes all jacks, accessories, material, welding, cutting and supports needed to connect and support the pipe in place and its connections. Black steel pipe should have been tested at a pressure of 55 bars or above.

**Seamless Steel Pipes**: ASTM A53 Gr. B Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Seamless cold drawn. Corrosion resistant Nickel–copper alloys length 3 meters per pipes threaded end coupling not less than 15 cm or as Specified in the BoQ. The pipes are Sch40 not less than 7.1 mm thickness. Tensile strength > 415 MPa

Pumping Shafts: the carbon steel rods are used to transmit rotational torque from the motor and down to the pump bowels. It’s manufactured according ASTM A29, A510 1040. It is composed of minimum corrosion resistant and alloys as iron medium carbon manganese-sulfur-phosphorus. Its tensile strength >620 MPa. Tested for toughness high strength and signs of misalignment.

**Flanged Dresser: 6” and 4”** complete for (16/25 bars) with two tie rods 60 cm long diameter of 5”/8 and 4 ears for each dresser in accordance with drawings and engineers. Material of dresser shall be high strength steel

**Wash Out**: the main wash out end is shown in drawings. The work shall be completed according to the contract condition and the engineer approval. The material needed including a heavy duty 3" flanged cast iron gate valve (16/25 bars, all piping and all accessories, fittings, piping and joints needed as shown in the drawings.

**Annexes: Pipes, Fittings Materials Specifications and Testing**

**Steel Fittings:**

S1: Check valves

1. Body: Cast Iron
2. Disc: Cast Iron
3. Cover: Cast Iron
4. Seat Holder Cast: Iron
5. Body Seat Ring: Bronze ASTM B62
6. Disc Seat Ring: Rubber (BUNA-N) ASTM D 2000 AA 7008
7. Hinge Pin: Stainless Steel
8. Plug: Malleable Iron
9. Cover: Bolt & Nut: Steel
10. Seat Holder Bolt: Stainless Steel
11. Cover Gasket: Rubber (BUNA-N)
12. Coating: fusion bonded epoxy inside and outside

S2: Gate valves none rising stem:

1. Body: Cast Iron
2. Bonnet: Cast Iron
3. Packing Box: Cast Iron
4. Disc Cast: Iron
5. Hand Wheel: Cast Iron
6. Body Seat Ring: Bronze
7. Disc Seat Ring: Bronze
8. Gland Cast: Iron
9. Stem Nut: Bronze
10. Stem Bronze
11. Bonnet Gasket: steel
12. Packing Box Gasket: steel
13. Bonnet Bolt & Nut: Steel
14. Gland Stud & Nut: Steel
15. Packing Box Stud & Nut: Steel
16. Top Nut: Steel
17. Washer: Steel
18. Packing: Graphite Fiber Commercial
19. Operating Nut: Cast Iron A 126 Class B
20. Coating: Electro statically applied epoxy inside and outside,

S3: Combination Air Valve

1. Body: PN21 Sphero Nodular ASTM-536 60-40-18
2. Rolling Seal: Rubber E.P.D.M
3. Clamping Stem: Reinforced Nylon
4. Float: Foamed Polypropylene
5. Base: Brass ASTM B-124
6. O-Ring: Buna-N
7. Cover : PN21 Cast iron ASTM A-48 CL-35B
8. Nozzle Seat: Bronze ASTM B-62 B-271 C83600
9. Nozzle Seal: Rubber E.P.D.M
10. O-Ring: Buna-N
11. Bolt and Nut: Galvanized Steel, Chromate Plated
12. Float: Stainless Steel 304L
13. Body: PN21 Cast iron ASTM A-48 CL-35B
14. Sleeve: Reinforced Nylon
15. Threaded Outlet: Brass
16. Coating: fusion bonded epoxy inside and outside

S4: Butterfly Valves: (GEAR)

1. Stem: Stainless steel
2. Body: Cast iron
3. Bushing: Brass
4. O ring: EPDM
5. Bushing (spacer): Polymeric
6. Disc: Stainless steel
7. Liner: EPDM
8. Washer: Bronze
9. Retaining ring: Spring steel
10. Plug: Plastic
11. Coating: Fusion bonded epoxy inside and outside

S5: Water meter specification and materials.

1. Working pressure 16 or 25 bars as required.
2. Max. temperature 60 C
3. Body: cast iron
4. Coating: epoxy
5. Connection: Flanged ends for 4” and above diameters or records 3” and less diameters

S6: Strainers Specifications:

1. Body: cast iron ASTM 126 class B
2. Cover: cast iron ASTM 126 class B
3. Screen: stainless steel
4. Gasket: Buna -N
5. Plug: steel
6. Bolts: steel
7. Coating: fusion bonded epoxy inside and outside

S7: Control Valves specifications (float valves and pressure reducing valves)

1. Connection: flanged
2. Water temperature up to 60 C
3. Working pressure 16 bars
4. Valve body and cover ductile iron (ASTM A-536)
5. Valve internals: stainless steel and bronze
6. Control trim: brass
7. Elastomers: Buna-N
8. Coating: fusion bonded epoxy

**S8a:** the price per meter length (for 160 mm, 100 mm, 50 mm steel pipes diameters) includes all of the following: all costs of transport, unload, spreading pipes (whatever the road conditions or even if no existing road) along the route of pipe lines; the price per meter length also includes supply and install all necessary fittings (as coupling, elbows) for connecting the pipes mentioned above including these fittings: coupling, saddles, elbows, caps, and reducers. This means no payments for these fittings which installed to connect these pipes. The pipeline will be always in the center of the route. The welding is done (connecting pipes and fittings).

The price per meter length includes supply and install T branches, and nipples for existing farms and future customers and as required by the supervisor engineer. Any pipes irregularities or damages must be repaired. Installation works are not limited to the main routes in the community, but new route lines are expected as well and without variation in the technical specification and quality of works and unit prices in the whole tender items. No additional prices for the unit price what so ever the site of work is rough as no existing roads or far from the dirt roads. The distribution and welding works must be carried out in all intended pipes routes without variation in unit prices.

**S8-b** Pipes installation including for road crossing for 160 mm.

The price per unit length for any PE pipe diameter in this tender includes all excavation and backfill costs as shown below. This includes all excavation works necessary for making pipes trenches across the whole road width (whatever is the road width). The width of trench should be not less than 40 cm or as specified by each item. The total trench depth should be not less than 60 cm plus the pipe diameter or as specified by each item. The backfill materials must include soft back fill as follows: fine silica sand 10 cm below the pipe bottom plus pipe diameter and 10 cm above the pipe top crown (total soft backfill thickness inside the trench equal 20 cm plus the pipe diameter). The final backfilling of the trenches are by using base course grade A and compaction achieving 95% relative compaction. The pipes installation includes all necessary works as exactions, cleaning the roads from excess of materials during works, reinstatement of roads, border stone walls, asphalt, concrete or any another constructions to its original situation as before the project. This includes any damage to any type of structure or road, or land. The price per unit length for any pipe diameter in this tender includes all necessary works as machine labor works to install the pipes on stable ground. No pipes installation or any part of the pipe above the ground. The route of the pipe must be straight as possible to avoid elbow and sharp changes in directions (no zigzag pathway). The route of pipes must be determined by the supervisor engineer and the project committee and according to the attached drawings; it should not to cross any land holdings without acceptance of the land owner. Any damage of pipes during construction must be repaired onsite by the contractor. The price of this item for all types of pipes and fittings includes hydrostatic pressure test as described in annex P2.

**S-9:** Farms connection water meter: 2” class complete with flanges, gaskets, bolts, nuts, coupling, strainer, 2” globe valve 10 Bar (W. P)- Epoxy coated. The installation works includes all costs of excavations, cutting, shaping, welding, and paintings. The price includes all works necessary to connect between steel pipes and the water meter. The price includes supply and install of galvanized steel box cover as specified in the tender specifications.

The price per meter length includes all of the following. Spreading along the route of pipe lines, welding two passes of the steel pipes including welding of readymade elbows (the unit price per meter length is valid for all the 6”, 4”,3” pipes and include all welding costs between each two pipes, or between pipes and elbows, or pipes and tees….etc. The price also includes the shaping and welding of elbows on site so as the pipe line will be always in the center of the route. The price include all welding of Tees, nipples and couplings for branches as 4”, 3”, 2″&1″, ¾” with plug for the future customers and as required by the supervisor engineer. Any pipes irregularities or damages must be repaired. Installation works are not limited to the routes specified in the attached drawing, but new route lines are expected as well and without variation in the technical specification and quality of works and unit prices in the whole tender items. No additional prices for the unit price what so ever the site of work is rough or far from the dirt roads. The distribution and welding works must be carried out in all intended pipes routes without variation in unit prices. Each Main pipe route line must be connected to the source well. The welding, cutting and shaping are including in the unit price (per meter length), and the welding costs include shaping and cutting without using elbows in case the outside angle is less than 22 degrees or the internal angle more than 168 degrees. The price of welding all types of elbows, tees, and other fittings are included in the unit price of the steel pipes and no payments for welding all these connections.

**S10**: Painting works include adding two faces (red oxide as priming paint and zinc oxide base oil paint for finish). The pipe surface must be painted with two coats from all sides, particularly lower part to the ground. Therefore, the pipe must hold on supports above the ground minimum 30 cms, and then released to ground down after the paint was dry. Prepare the surface and stir the paint before use or mix using a power agitator. Before applying paint, a thinner liquid has to be added to the pipes surface to clean away oil and grease, use a detergent to remove excess dirt and contaminants. Remove the metallic debris such as mill scale and rust using disc sanders, sandpaper or wire brushes which ensures an adhesive surface.

**S11**: Irrigation Steel Pipes Welded Black Steel Pipes, [ASTM A53](http://www.techstreet.com/cgi-bin/detail?product_id=911886) Or as API5L:

A53 Type F, which is longitudinally furnace butt welded or continuous welded (Grade A only), A53 Type E, which is longitudinally [electric resistance welded](http://en.wikipedia.org/wiki/Seam_welding) (Grades A)

**S12**: Road crossing for 6”, 4” and 3” pipes. The price per unit length for any pipe diameter in this tender includes all costs of excavation (80\*50 cm) and base course backfill 98% relative compaction and where along roads and road crossings as shown in the drawings. This includes all excavation works necessary for making pipes trenches across the whole road width (whatever is the road width). The width of trench should be not less than 50 cm plus the pipe diameter. The total trench depth should be not less than 70 cm plus the pipe diameter. The backfill materials must include soft back fill as follows: fine aggregates 2-3 mm diameters (symismya) below 10 cm below the pipe bottom plus pipe diameter and 10 cm above the pipe top crown (total soft backfill thickness inside the trench equal 20 cm plus the pipe diameter). The final backfill up to the original ground level must of compacted base course grade B.

**Testing General**

A. Standard: To BS EN 12484-5.

B. Notice (minimum): 1 day.

C. Condition of pipe work and equipment prior to testing: Correctly installed, secure and clean.

D. Pressure testing: Joints, fittings and components must be free from leaks and signs of physical distress when tested for at least 1 hour as follows:

1. Systems fed directly from the mains: Apply a test pressure equal to 1.5 times the maximum pressure to which the installation or relevant part is designed to be subjected in operation.

2. Systems fed from storage: Apply a test pressure equal to the pressure produced when the storage cistern is filled to its normal maximum operating level.

E. Other test procedures: As recommended by the manufacturer and required by the water undertaker.

F. Test results: Submit.

**Inspection Testing**

According to PS Standard: To BS 6700. All testing costs are included in the tender prices and additional costs for all testing in this contract as specified. The pipes testing includes cleaning all the pipes and network pipes and fitting with clean water.

**Pipe Line Pressure Test**

A. Testing will not be carried out against closed valves.

B. All charging should be carried out from the lowest point of the under test section and all testing equipment should be located at this point.

C. The pressure gauge will be located at the lowest point or adjustment must be made for the level of the pressure gauge relative to the pipes location.

D. Prior to testing care will be taken to ensure that all anchor blocks have attained adequate maturity and that any solvent welded joints included in the pipe system have developed full strength.

E. Correct support and anchorage of any above ground sections of the pipeline is also necessary.

F. Underground pipelines will be backfilled taking particular care to consolidate around lengths, which may have been deflected to negotiate curves.

G. All joints should be left exposed until testing is completed.

H. The main pipe will be charged slowly from the lowest point with any air cock in the open position. They will be closed in sequence from the lowest point only when water visibly free from aeration is being discharged through them. Satisfactorily charged, the main should be allowed to stand overnight to allow any residual air to rise out.

I. Re-venting is then necessary and any water deficiency should be made up.

L. Pressure testing can then begin by pumping slowly until the pressure reaches 9 bars. This pressure shall be kept for 24 hours.

M. A maximum water loss of 3 liters per 500 mm length per 25 mm nominal bore per 24 hours shall be considered acceptable.

**Field Work**

Field work and equipment shall include all works required to bring the system into service and to make sure that it is operating efficiently.

**As- Built Drawings**

The contractor should submit as built drawings for all works included in this contract for approval in the format as required by the Employer and approved by the Engineer.

**Welding**:

The welding machine should fit with the following specifications

* Generator Compatibility and Automatically checks generator suitability
* Weather proof and wide operating temperature Range:-10°Cto 50°C.
* Suitable for welding bars

**Construction Materials:**

**A1: Ready Mix Concrete**

a- Standard Specification for Ready-Mixed Concrete :ASTM C94/C94M-03

b- Testing Hardened Concrete Compressive strength: BS EN 12390-4

**A2: Steel Bars**

1. Standard Specification for reinforcement Steel Bars. ASTM 615/ Grade 60
2. Specification for mild steel. BS 1722-9

**A3: Cement Specifications**

Ordinary Grey Portland Cement Grade 42.5 Conforming To Standard Gb175-1999 Having Chemical Properties:

L.O.I. : Max 5.0

Mgo : Max 5.0

So3 : Max 3.5

Fineness : 0.08mm Sieve Max 10

Soundness : Sound Setting Time

Initial Set : Min 45 Minutes

Final Set : Max 10 Hours

Compressive Strength :

3 Days : 21 Mpa ,

28 Days : 42.5 Mpa

Bending Strength

3 Days : 4.0 Mpa,

28 Days : 6.5 Mpa

**A4- Aggregates**

* grading As C-144 ASTM
* durability As ASTM D3744-03
* particle shape and surface texture As ASTM D 5821-01
* abrasion and skid resistance As ASTM D7428-08
* unit weights and voids As ASTM C29/C29M-07
* absorption and surface moisture As ASTM C70-06
* Fine aggregates or sand as ASTM C778-06

**A5- Asphalt:**

### **ASTM D 449 Standard Specification for Asphalt Used in Waterproofing**

**-6 Base course materials:** it should be a result of hard crushed rocks as dolomite limestone free of organic and soil materials as follows:

* Gypsum materials 2% maximum
* Soil materials 6%
* Dry specific weight 2.1 ton/m3

**Base course Materials gradation by weight**

|  |  |  |
| --- | --- | --- |
| **Specifications Limits (%)** | | **Sieve no** |
| **Grade B** | **Grade A** |
| 100 | - | 2’’ |
| 70-100 | 100 | 1.5’’ |
| 55-82 | 75-100 | 1’’ |
| 50-80 | 60-90 | ¾’’ |
| 45-75 | 45-80 | ½’’ |
| 40-70 | 40-70 | 3/8’’ |
| 30-60 | 30-65 | 4 # |
| 20-50 | 20-40 | 10 # |
| 10-30 | 8-20 | 40 # |
| 5-12 | 5-10 | 200 # |

**Base Course Test:**

Before starting any base course supply to work site, the contractor should carry on the following tests and show that supply source or the quarry materials matches and pass these tests:

|  |  |
| --- | --- |
| Crushed percent by sodium sulphate | According to AASHTO –T104, maximum 10% |
| Percentage of loss by magnesium sulphate | According to AASHTO –T104, maximum 12% |
| Percentage of loss by abrasion test Los Anglos Machine | 5% |
| Absorption ratio after 24 hours of immersion in water | % 10 maximum |
| Abrasion percentage after 24 hours immersion in water | % 5 maximum |
| Plasticity index | (AASHTO T 90) maximum 6% |
| Sand Equivalent | %30 minimum |