

تقرير تأهيل البئر الجوفي في كفر جمال  
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**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: Kufr Jammal\_ Tulkarem 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 (m<sup>3</sup>/hr)

Highest dynamic pressure reading (bar): 4.5

Pump capacity at highest pressure: 40 (m<sup>3</sup>/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 Summary:** Low discharge capacity and old pumping equipments and low efficiency.

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

Item	Description	Qty	Cost (\$)
<p><b>Electrical and Mechanical Works: (all materials specifications and works are according to annex below).</b></p> <p>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.</p> <p>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 contractor 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, power supply and drop voltage, 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 well's 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 annex below, international standards and PWA and general (PSI) pumping standards.</p>			
1	<p><b>Vertical turbine:</b> supply and install vertical turbine (Closed impellers manufactured from bronze and cast iron bowls) with capacity <b>80</b> cubic meter per hour at total dynamic head <b>200</b> meter with <b>1500</b> rpm. Shut off head not less than <b>280</b> m, Turbine overall efficiency at the working point is not less than <b>73%</b>. The maximum turbine size 10 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</p>	1	22000

	pumping equipments.		
2	<b>Supply and Install Vertical hollow shaft motor</b> duty inverter 50/60 hz (1500/1800 rpm) and turndown 10:1 with premium efficiency and extra high thrust and overload protection multiple thermistors an RTD (PTC100) temperature protection relays. Motor size not less than <b>125 hp</b> . 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%. And high thrust as 1.5 at full load	1	15000
3	<b>Electric panel: Supply and Install</b> suitable electric panel suitable for water pumping ( <b>80 m<sup>3</sup>/20 bars</b> ) three cabinets IP 65 with inverter <b>125</b> hp compatible with the motor and equipped with inverter Main breaker bypass 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, earthing, 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	<b>Supply and Install Pumping pipes (partial replacement):</b> seamless standard sizes sch40 length <b>66</b> meter of diameter 5 inches threaded and epoxy painted from inside and outside or equivalent as galvanized pipe including coupling not less 8 teeth per inch over 13 cm coupling	66 meter /135\$	8910
5	<b>Supply and Install Retainers and bearings and rubber joints complete set</b> suitable for the existing <b>5"</b> pumping pipes and new shafts	54 piece /100\$	5400
6	<b>Supply and Install Shafts as carbon steel 1040/1045 or equivalent as 304/306 stainless steel.</b> Diameter <b>38</b> mm and including all required fastenings and connections	162 m/110\$	17490
7	<b>Supply and Install Access pipes and all connections</b> to	165	1650

	monitor water level using pvc pipes sch 80 /1.25 inches or equivalent (not less than 25 mm internal diameter) used for hydrostatic water level measurements	m/10\$	
8	<b>Supply and Install Pressure gauges</b> 16 or 25 bar with oil liquid Rotal ASME, B40. With all accessories including coupling and ½ inch ball valve.	1 piece /75 \$	75
9	<b>Supply and Install Flow Switch</b> (one piece suitable for 6" pipes PN 16 bar)	1/100 piece	100
10	<b>Supply and Install Pressure Switches:</b> 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.	2pieces 100 \$	200
11	<b>Supply and Install Digital Pressure Measuring Sensor (range 0-20bar).</b> The design to 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.	1	100
12	<b>Supply and Install Steel pipes:</b> replace existing pipes and fitting to install new pipes and fittings 6 inch diameter and thickness 3.96 mm. the price include painting the pipes two faces (primer and oil ant oxidant)	6 m/50	300
13	<b>Old Pump lifting and installation new pump and old pipes.</b> 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	3000
14	<b>Supply and Install Gate valve:</b> 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	<b>Supply and Install Supply and Install Compound air valve:</b> Supply and assemble 2" compound air valve complete, 16 bar. The price includes excavation, cutting, welding, adding screws,	1Piece /400 \$	400

	bolts and accessories that are needed to assemble the valve. The Price also include supplying and installing 2" coupling, nipple and 2" ball valve. ,		
16	<b>Supply and Install Dresser-Universal Coupling:</b> 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
17	<b>Supply and Install Elbows, T or Saddle or Elbows:</b> 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
18	<p><b>Supply, install a screen digital hydrostatic level meter</b> (submersible digital level sensor) with the following characteristics:</p> <ul style="list-style-type: none"> <li>• Maximum diameter 19.0 mm</li> <li>• Water Level Measurement: 40m (max.)</li> <li>• Excitation: 9 to 30 Vdc, reverse polarity protected</li> <li>• Output: 4 to 20 mA DC, 2 wire, short circuit protected</li> <li>• Input Current: 20 mA max</li> <li>• Accuracy: 0.50% FS BFSL (includes linearity, hysteresis and repeatability)</li> <li>• Response Time: 2 ms</li> <li>• Operating Temperature: -10 to 60°C</li> <li>• Proof Pressure: 150%</li> <li>• Burst Pressure: 200%</li> <li>• Wetted Parts: 316 stainless steel</li> <li>• Electrical Connections: Submersible cable terminating in digital leads</li> </ul> <p>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 and cables 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</p>	1Piece /2000 \$	2000
Total Cost			<b>89925</b>

## **Annex –Technical Specifications**

### **Quality Assurance**

- A. 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.
- B. 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.
- C. 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/ vacuum, 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 ( $H_T$ ) 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 m<sup>3</sup>/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 thermostors, 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 mm<sup>2</sup> foundation line 3

earth electrodes ( $D > 19 \text{ mm}$ ,  $L = 1.5\text{m}$ ) and any other necessary material or components to achieve an earthing resistance of  $R_{\text{Earth}} < 1.5 \text{ Ohm}$  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 /or 32mm PVC sleeve pipe), 4-20 mA with all necessary components for proper operation and the cable (with enough length>180m or as specified ) 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 40°C, 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  $\pm 1.5\%$  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:

- A. 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.
- B. Check valves shall have bronze seat and body rings, extended bronze hinge pins and bronze nuts on the bolts of bolted covers.
- C. 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:

- A. Valves shall be outside screw and yoke type with rising stem.
- B. Face to face metal valves dimension shall conform to ISO 5752 or EN 558-1,2.
- C. 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.
- D. 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.
- E. Stuffing box follower bolts shall be of steel and the nuts shall be of bronze.
- F. The design of the valves shall permit packing the valves without undue leakage while they are wide open and in service.
- G. 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 design to 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 be in accordance with these technical specifications, drawings and engineers directions.

**Air Release/ Air 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 designed with 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 (1040/1045) or stainless steel 304/316 rods are used to transmit rotational torque from the motor and down to the pump bowels. It's

manufactured according to ASTM A29, A510. It is composed of minimum corrosion resistant 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 7/8 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

**Carbon steel line shafts: According to ASTM A510**

**Irrigation Steel Pipes Welded Black Steel Pipes, ASTM A53 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 (Grades A)