

ACT! ON
FOR
Technical Specifications
HUMANITY
YEMEN

Site Visit:

Bidders are instructed to visit to the site and physically verify the damages and required quantity and quote the price accordingly.

Construction Materials:

All the construction materials must have standard manufacturing certificate. AFH will not accept unknown products or any materials or accessories without manufacturing standards. AFH appointed engineer will review the materials case by case and approve.

Sample approvals:

All the construction materials must be approved by AFH appointed engineer before contractor bring it to the construction site. The contractor must discuss with the engineer, list of all the materials, which samples/catalogues are to be inspected by the engineer before bringing to the construction site. The contractor must get a written approval for the materials. AFH will not be responsible for any part of construction executed by the contractor without construction material approval.

Pumping system components:

The solar water pumping system consists of the following:

- Array solar cells, including panels, connections, cables, type DC, all for accessories.
- The conversion and tracking device for the maximum capacity of the panels with a system (MPPT), which can be fed from two sources (AC / DC), to ensure the operation of the pump from a source of electricity and solar energy.
- Submersible pump with motor, submersible and regular cables and sensors necessary for protection and to be suitable for work using solar energy and electric energy.
- Control and protection system.
- Installation pipes and their accessories for cable extensions for raising water from the well.
- Electrical cables and accessories.
- Other accessories that complement the installation.

Solar panel Array:

Photovoltaic cells (PV) made of pure crystal have high sensitivity to light with a conversion efficiency of at least 21% They convert solar light energy directly into electrical energy. The following panels are required:

- To be single or polycrystalline silicon panels (Polycrystalline or Monocrystalline).
- It must be of (Class A).
- That the board can withstand a voltage of 1500 volts.
- The voltage drop should not exceed - 0.34% for each temperature increase in degrees Celsius.
- The power drop should not be more than - 0.38% for each temperature increase in degrees Celsius.
- It can bear a temperature of -40 to + 80C.
- The dictation factor should not be less than 75% of the Fill Factor
- That the serial number of the plate under the glass
- Assembly lines (bus bar) must be at least 12 lines per cell to ensure efficiency > The panels must bear a mechanical pressure of not less than 5400 Pa.
- The applicant must attach data that guarantee the performance of the panels for 25 years, so that the percentage of performance decrease is not less than 80% after 25 years, and ten years for any technical defect.
- To be in conformity with international specifications IEC61215, IEC 61730.
- That the number of panels in a row be compatible with the input of the inverter used, considering the drop in the operating voltage at high temperature, so that it is within the specified frame of the MPPT inverter.
- The number of panels groups in parallel corresponds to the output of the ampere in it with the power of the pump, considering that the radiation is between 1000-800 W / m² and thus the number of rows of panels gives the total current when the radiation drops to 800 W / m² the brightness time in the winter period so that the pump operates at full capacity. The average solar energy for the worst months is taken into account in the overall energy amount. The body and frame of the panels withstand the specified wind speed in the specified operating conditions of 150 km per hour and withstand the specified humidity.
- The voltage drop of the panels does not exceed 3% of their total voltage when connecting them with the switching device.

- The panels must be equipped with protection diodes that bear the voltage and the total current for each row, to prevent the reverse current when partial shading of some panels occurs.
- It considers the total capacity of the panels, the effect of the heat factor on the capacity of the panels and the effect of the decrease in radiation during the brightness time in the seasons of the year so that the remaining power is sufficient to operate the pump at full capacity.
- The percentage of drop in plate capacity and the maximum power voltage meet (Class A) specifications so that it is at the minimum level for first class panels. Considering the effect of the large obstacles that reduce the brightness hours of some sites and thus the effect of orientation of the panels with a slight angular deviation (east or west) from the geographical south and the effect of this on the number and capacity of the panels used for these sites.
- It must be indicated in the back panel data (panel data sheet solar) for each data sheet on the materials and standards applied and specifications for the board and certificates of authentication and product quality, efficiency and performance indicators recorded when examining the board laboratory STC at radiation 1000W / m², 25C.

Inverter device:

- The inverter power should be = (submersible motor power x 1.5)
- The maximum power MPPT tracker of the panels shall consider the large change in the change of the maximum operating point of the panels with the influence of the temperature factor and the change of radiation, and it gives a constant output voltage.
- It should be of a variable frequency compatible with the frequency range of the pump.
- A degree of protection of not less than IP-54 and provided with a protective casing to be installed in it.
- It can withstand the maximum peak voltage of the panels.
- The voltage change range is sufficient to accommodate the large dimension in the peak voltage and the open peak voltage, so that the drop in the panel output due to the rise in the temperature of the panels is considered from 20 ° C to 70 ° C- the inverter required in **the converting and tracing device for the maximum capacity of the panels:**
- The inverter must be operated with a DC system (solar energy) at times of the day and with an AC system (generator power or generator power) at night and not

through the traditional control dashboard, to ensure that all the protections equipped with the inverter are running during operation at night.

- There must be a mechanism to prevent the entry of two sources of energy to ensure any interference between public electricity and solar energy (Revers Power Protection) AC&DC.
- It works on a DC system voltage of no less than 440V.
- It works on the internal voltage system 240-400 VDC MPPT.
- It works on an external voltage system of 220-240 VAC.
- Frequency from 0-60 Hz. Inverter efficiency is not less than 98%.. Separation when dry rotation without external electrode cable. Overload. High current. - Protection against reversing vases. Loss of a winner. High voltages. Low voltages. - electrical contact. Loss of isolation.

To have the feature of monitoring and displaying readings of operating status, the most important of which are:

- He must have the feature of storing chronic data by day and hour.
- Measuring the energy consumed during operation kw and measuring the cumulative energy during any kwh period.
- Display to measure the intensity of current. - DC input voltage display. - AC output voltage display of the motor. - Display of operating hours of the pump.
- Display the inverter temperature. - Display engine frequency. - Rotation speed display of the engine.

Earthing of the solar system (panels, inverter and all parts of the system):

Grounding protection box contains:

- Sensors for lightning strikes with high response.
- Fuses for groups to separate from any electrical shortage caused by the panels.

Make all parts of the system grounding so that the ground resistance is not more than 3 ohms.

- The system must contain protection against water level drop, high temperature, high voltage, high current, loss of a vase, short circuit, etc.
- It is necessary to protect the panels system from partial shading of some panels by means of two types of protection diodes, panel protection and bypass and blocking protection respectively. For grounding electrodes (1*14mm diameter, length 1.2 m) copper. 45*45cm copper plate diameter.
- A hole for grounding 1 m x 1 m.
- Yellow PVC (insulated) ground cable 1c x 16 mm².
- All cables going into the bus bars must run inside plastic pipes.
- All cable ends must be connected to cable lugs.
- AC grounding should be separated from DC grounding.
- Consideration must be given to the grounding of the lightning protection system.

Submersible pump and motor:

- The submersible pump and electric motor are made of SS AISI 304, AISI 316 or bronze stainless steel, Italian made or equivalent.
- That the external diameter of the pump with the electric cable be less than the inner diameter of the well pipes so that the pump can be installed easily and smoothly.
- Be careful when installing the pump in the well so that it is far from the well filter (perforated tubes).
- A plastic protective cover is provided to prevent dust and sand from entering the pump by covering the draft filter and the submersible motor, and it remains open from the socket of the submersible motor to provide adequate cooling for the engine.
- The submersible motor must be rewound. The pump shall be made of steel or bronze to ensure long service life and the highest resistance against rust according to the special technical specifications.

- The pump should be suitable for pumping with the least number of solar cells.
- The pump and its motor must be of the type suitable for variable speed operation (1800-3000 d / d).
- The pump and its motor must be of the type suitable for operating at variable frequency (30 Hz- 60 Hz), operating in a frequency frame compatible with the operational solar radiation range between (1100-200) W / m².
- The electrical system is three-phase (3 phase) and the voltages are 380-415 volts, and match the frequency range and speed mentioned above.
- The pump operates with a edge radiation of a maximum of 250watts / m² when operating and a radiation of 200 watt / m² when stopped. The pump efficiency is not less than 75% and the efficiency of the submersible motor is not less than 85%.
- The housing for the pump and fans is made of AISI 304 stainless steel and the drive shaft is made of stainless steel AISI 316.
- Dewatering motor is AISI 304 stainless steel and AISI 316 stainless steel shaft.
- The degree of insulation of the PE2 + PA submersible motor windings withstands a temperature not less than 50 ° C. The degree of protection of the submersible motor is IP 68 and the water temperature is 50 ° C.
- The number of engine start-ups is not less than ten times per hour. Required protections: dry circulation, overloading, overheating, low water level, high and low voltage, high and low current, short circuit.
- The connection between the motor and the pump is in accordance with (NEMA standard).
- The length of the cable connecting the pump should be increased by 5 meters to facilitate the deepening of the pump in the future.

Cable of Submersible Installation Pipes:

- The supplier shall provide the appropriate piping specifications.
- Electrical cables and accessories 3 x 16 mm² submersible pump and motor feeder cable type: copper braided, waterproof, flexible and double insulated in accordance with European specifications (H07) and test result for voltages from 1000- 1100 V.
- The cable for protection against falling water level, with a diameter of 2 x 1.5 mm², with an electrode.
- The length of the sensor cable is the same as that of the electric cable.

Connection Cables from Solar Panel to Combiner Box:

PVC Insulated Cu copper cable, 2 x6 mm² for solar energy. The connection cable from sub-assembly boxes to main DC combiner box. The connection cable between main DC combiner box and the inverter of copper, the cross-section area of not less than 2 x25 mm², the double of the insulation, and that all the connecting cables between the solar panels, the operating system and the protection system must be DC cables must be according to the TUV & UL standard system, especially for use in solar energy systems, and they must bear a voltage of no less than 1500 volts DC.

All cables must be made of copper material and equipped with double insulation, correct for the amount of voltage drop should not exceed 3%.

- Conductor for installation of cables type MC4 first class wicker of copper. The cable entry holes in the box must be from the bottom. The cable entry holes in the box must be sealed to prevent dust and moisture from entering. All strings shall have double protection fuses on the plate side and on the inverter side.
- The box must be equipped with high voltage protection.
- The box must be protected from high short currents.
- The box must be supplied with DC MCB for each MPPT from the inverter input side.
- The cable entrances to the box must be through the **Jee land** cable.
- The ends of the cables must be connected by copper or aluminum wire.
- DC cables must be in accordance with TUV & UL standard system especially for use in solar energy systems.
- The cables must be directly laid in the ground with holes of at least 60 cm depth from the bases to the collection box, from the main assembly box to the reflector,

and from the bottom of the bases to the panel's groups.

Solar Mounting Structure:

1. The structure system of the panel racks shall be designed from steel or galvanized stainless steel with three layers of rust-resistant paint for moisture, sun and water in the long term for the main columns and beams and for the sub-pillars and beams of the solar panels racks network according to the drawings and instructions of the supervising engineer.
2. The beams, the frames on which the boards and inclined anchors are fixed, of empty square iron (hardness and thickness), according to the submitted drawings.
3. The corners of the outer frame on which the panels are fixed, the size and thickness according to the drawings provided, provided that each panel is fixed with nails from the bottom and from the sides to reduce the effect of the wind on it according to the drawings presented.
4. The height of all the bases in the yard should be on one level and the bases on the roofs of the buildings on one level, taking into account the levels on the roofs of the buildings.
5. Withstands winds of up to 150 km / h, so that the concrete footings that are installed for the carriers are suitable and evaluate the forces of lifting upwards due to the whirlpools.
6. It should be taken into account that there is a distance of not less than 2 cm between each panel and another in order to dissipate the wind pressure on the panels from bottom to top, and between each row of panels and the other row a distance of not less than 2 cm.
7. The solar panel racks shall be installed in the form of an interconnected network as in the drawings, divided into several groups, each group carrying two rows of solar panels and the number of panels in each platform according to the drawings provided.
8. The necessary distance between groups must be achieved to prevent shadowing between parallel axes and according to the tracking system.
9. The supplier must take into consideration the variance in the height of the groups of solar panels, if any.
10. Drilling in any type of soil (rocky - sandy etc.) for all bases for the purpose of fixing the installed bases for the metal structure holding the panels according to the drawings and directions of the supervising engineer.
11. It should be taken into consideration the installation of metal structures

carrying solar panels on the roofs of buildings according to the drawings and instructions of the supervising engineer.

12. Reinforced concrete mass, with a cement weight is 350 kg per cubic meter, for the foundations to install the panels platforms according to the plans and directions of the supervising engineer.

Reinforced Concrete:

Repairing or implementing any parts of the reinforced concrete: the rate is including all relevant materials, such as reinforcement, special bonding chemicals, scaffolding, concrete, skill and unskilled work and any other requirement.

Electrical accessories:

All the electrical accessories such as cables, bulbs, bulbs cases, power outlets, fans and any other items must have manufacturing standard. The contractor has to submit the sample and get prior approval from AFH appointed engineer prior installation in the building.

Electrical Works:

All the electrical works must be to the acceptable standard. The rate is including the electrical materials, necessary connection cables, necessary conduit/casing and accessories, dismantling, assembling and commissioning to the working condition.

Carpentry Work:

Timber must be seasoned and free from damages and warping. Contractor have submit the sample and get prior approval from the engineer.

Plumping Work:

All the bathroom fittings samples must be submitted to engineer and get prior approval.

All the bathroom fittings must have manufacturing approval and standard certificate.

Arrangement, Safety, and Temporary works.

The contractor has to consider the Site and responsible for any arrangement that may require during the implementation such as safety; coordination, temporary facilities, etc.

Project Plan

Bidder to provide full plan of the project within the proposal. This includes and not limited to the following:

- a. Detail time schedule.

- b. Proposed a qualified project team with CVs within the proposal;
- c. Brand and detailed specification of supplied materials.

Implementation planning and reporting

Contractor is responsible for planning and scheduling, and to submit daily, weekly and monthly reports and as required by the Supervisor Engineer;

Final Dossier

Contractor to submit a hard and soft copy for the full package. This includes (not limited to) As-built drawings and Quality Control Documents such as approvals, catalogs, and guarantees of supplies.



Material

Rebar of Reinforcement concrete

It must be of good iron from approved factories, a Turkish type or its equivalent, with a hardness of not less than 3500 kg/cm², and able to be flexed and operated.

The sand

It must be gradual in size, clean, coarse, free from salts, shells and organic materials, and a sample must be submitted for approval before importing. The sand should be washed with fresh water if necessary to remove what may be stuck to it of foreign substances and salts. In general, the sand should not contain more than From 3% by weight of clay or foreign matter.

Aggregate

The aggregate must be clean and free of clay, organic matter or any other impurities, and its granules are sized and angled and not flat. The aggregate must be shaken before use and washed with water to remove the substances that are stuck to it. It conforms to the British Standard Specifications No. 882 BS and in general it must be graded (1/8, 1/4, 1/2, 3/4 inch). It should also be noted that the aggregate is roasted on clean solid surfaces, to avoid the accumulation of water, dust and debris under it.

Cement

Manufacture of Portland cement shall be in conformity with Standard Specifications 12 BS or ASTM -C 145 and of a brand approved by the Engineer prior to supply, and shall be of one quality for the unit form, and the cement shall be uniformly roasted so that it is guaranteed to prevent rain and moisture, and so that it can be Withdrawing each batch for use according to the order of receipts for the store.

Water

The water used in the required work must be clean and free of all salts and impurities, and so that it is fit for drinking. Water that is not suitable for drinking can be used after being tested to ensure that it gives the required results.

Various tests of materials

All tests for materials used in concrete are carried out in a laboratory approved by the project.

The contractor shall not start work on any concrete that is part of the permanent structure without obtaining the approval of the laboratory in the results of the tests.

The contractor, after the approval of the engineer and under his supervision,

sends a sample of cement, to be taken from close quantities of 12 bags and mixed to weigh 50 kg, and this is repeated for each new consignment, and it is taken from the crater to be examined with a cube size of 30 x 30 x 30 cm, in a way that the sample is completely representative of the slurry For sand, the same volume is also taken, Concrete shall be executed according to the dimensions indicated in the drawings or according to the engineer's written instructions during the course of work. The effort to withstand the test cubes shall not be less than what is specified in the bills of quantities or special specifications. The contractor shall adjust the water percentage, the time of mixing the mixture and the duration of placing the mixture in its place.

Matching samples

All materials received for the work site shall conform to the approved samples, and if the contractor wants to replace one material with another, he must submit samples of the new material to be tested at his expense, and he must obtain approval from the engineer in advance.

Cube test

The Contractor shall provide cubes for testing from time to time, according to the work requirements and as follows:

Test samples are taken from 15 x 15 x 15 cm cubes of the same newly mixed concrete used in the casting process for the required parts. A special method of mixing will not be allowed when sampling;

The concrete shall be filled in the cube in layers not exceeding 5 cm in thickness, and each layer must be well compacted with no less than thirty-five strokes with a flat-faced gas skewer 625 cm²;

The cubes are prepared in the molds by covering them with wet burlap or by any other permissible means for approximately 24 hours. After that, the cubes are transferred from the molds and immersed in water or wet sand or both, and sent to the laboratory for safekeeping until the test date. Three cubes shall be prepared for each test so that one of the cubes is tested after seven days and the second after twenty-eight days. As for the third cube, it shall be kept for any additional testing as determined by the engineer or as required by the working conditions, and the results of the resistance shall not be less than what is specified. On drawings or special specifications.

If the result of the tests after seven days and after twenty-eight days is satisfactory (-10%), then the concrete that they represented is accepted. He must remove and re-pour the parts subject to the sample at his expense without waiting for the result of the twenty-eight days

If the test results are not satisfactory, all sampled concrete work shall be removed and re-cast at the Contractor's expense.

Painting Work

The Contractor shall provide catalogs and data of paint and color for prior approval before supplying. The value of the paint items includes the supply and implementation of all works such as surface cleaning, cleaning materials or peeling as needed, as well as paint, filling, paste and sanding materials, including skilled and unskilled labor. No sample of the prohibited paints will be accepted because they contain toxic substances such as lead or other harmful substances.

All paint works work with ready-made paints, approved and locked in their boxes, and no materials may be added to them unless otherwise stated in the special specifications, or according to the instructions of the producing company, provided that this is done with the approval and presence of the supervising engineer.

If it is necessary to obtain a special color, the mixture shall be of the same brand and the same containers. The contractor shall provide samples of the paints to be used for the engineer's approval.

The contractor shall not start painting before obtaining the engineer's approval, in order to ensure the drying of the coating layer, in addition to other reasons

Pipes and accessories

Types of pipes for water supply

Cold water supply pipes are used with their accessories made of galvanized iron or UPVC, HDPE and conforming to British Standards or German Standards (DIN-8075, DIN-8077, DIN-8078, DIN-8062, DIN-8061) carved on it with the country of origin and tested. It is based on a water test pressure twice the capacity of the operating pressure of the pipe. The test depends on the type of pipe and the pressure required to be tested and the catalogs are attached.

Galvanized iron pipe

It supplies medium pressure galvanized iron pipes according to British specifications under No. BS-1387 and threaded according to British specifications No. BS-21 to work at an operating pressure of no less than 50 kg / cm² with all its pieces of heavy-duty galvanized iron and conform to British specifications No. BS-1470 And threaded according to British specifications No. BS-21, to work at an operating pressure of 25 kg / cm², with a socket connection from the well to the tank. The item includes a tension work for every 60 m, with threads and putty for installation and painting the pipes with anti-rust paint. Installation methods.

1. All pipes and fittings shall be supplied in accordance with British Standard Specifications, or its equivalent.
2. Galvanized iron pipes shall be with screw heads and rails, with Taking into account the installation of the union tightness every ten tubes (pipes), elbows and all accessories.
3. A test valve (non-return valve) shall be installed and withstands a water pressure of 500 meters, or as specified by the special specifications.
4. Install valves, nibs, tripods, inverters and all other accessories; As well as triple or quadruple branches. It must withstand a water pressure of no less than 20 kg/cm².
5. The valves shall be placed in a suitable metal box, or in the inspection room, as indicated in the drawings.
6. The tubes (pipes) and their fittings are tightly connected to the end of the threads, with the use of putty and special threads. 7- The inspection of the lines must pass the results specified in the specifications after testing them, and the contractor is solely responsible for the safety of the line and the repair of any defects that appear after the test until the expiry of the period of responsibility for defects (warranty).
7. The pipes shall be protected with reinforced concrete, when the lines pass by roads, valleys or excavations, and their cost shall be borne within the item supplying and installing the pipes.
8. Supports for pipelines are made of light reinforced concrete, and the drawings and specifications specify the method and method of installation, the cost of which is borne by the item supplying and installing pipes.
9. When the pipeline passes the walls of the agricultural lands, the necessary parts are removed temporarily and reconstructed in the same way as before, after installing and placing the pipes (pipes).
10. The contractor shall use the hydraulic bending (bending) when necessary, in the case of using bends for the pipes, and they are implemented well so that the work is given good workmanship.
11. It should be avoided as much as possible when laying pipelines (pipes) next to sewers and sewage pipes. and if necessary, to cross or pass the pipeline(s) next to, over or under sewer or brine and sewage pipe(s); It must be given the necessary care for that, such as working for drinking water pipes the necessary impermeability, such as pouring concrete on them or protecting them with materials that lead to a good concealment.

The test

The supervising engineer conducts an inspection of samples from the pipes with random samples consisting of a complete pipe of 1 m length of each diameter before supplying to approve the sample and another examination after supply for conformity. The sample is cut from a random place in the pipe to conduct the necessary tests based on the instructions of the supervising engineer and the contractor Assuming full responsibility in case the examination does not match the sample before supplying (returning the quantity and delay in implementation).

Hydraulic test

1. The contractor must bring all the necessary supplies for the test, and the engineer shall give the details of the test method before conducting it for approval and approval.
2. The pressure gauge must be from modern industries approved to conduct tests according to British specifications, free from faults, and attached with it a calibration certificate from a third party that does not exceed six months and has a scale inserted at least 200 mm, and the approved pressure test shall be 75% of the reading of the device.
3. The contractor must make sure, while pumping water into the pipes, that the air has been emptied through the air trap located at the top of the line.
4. The pressure should increase gradually, and the final pressure of the device should be 1.5 times the operating pressure.
5. Leakage shall not be more than 11 mm of pipe diameter per kilometer every 24 hours for each vertical height of 30 meters. It should be measured every 4 hours and the period can be increased if necessary.

Pipe cleaning and disinfection

1. Cleaning of the network and lines is carried out in general, by opening the connection tension, in the low areas, or through the washing valves for the purpose of removing dust and dirt.
2. Disinfection is carried out by adding chlorine to the pipes, while pumping water in them, for the purpose of the hydraulic test, and the dose is 50 milligrams per liter of chlorine. The dose of chlorine should remain in the pipeline (pipes) for 24 hours and the period can be increased if necessary that.

3. The remaining amount of chlorine is tested on the other side, after the end of the specified period for chlorine remaining from the pipeline (pipes).
4. The remaining amount of chlorine for injection should not be less than 10ml/L.

Valves, gauges and all other accessories of original and new types.

Valves

1. Steel Gate Valves
2. Gate valves shall be manufactured to withstand high pressures from 16 to 100 bar, and shall comply with BS 5157 British Standard Specifications and thermal pressure.
3. The gate's ratchet shall be solid, and manufactured from the materials specified in the special specifications.
4. The operation shall be manually by means of a wheel.
5. The stopcock shall be provided with a tool at the bottom for draining.
6. Cast Iron Gate Valves
7. These valves shall be manufactured according to the British Standard Specifications BS 5151 or its equivalent.

These valves are manufactured to withstand pressures of 10, 16, 25 bar.

Cast Iron Double Disk Gate Valves

- These valves shall be manufactured according to the British Standard Specifications BS 5150 or its equivalent.
- These valves are manufactured to withstand pressures from 2.5 to 25 bar.

Copper Alloy Gate Valves

- These valves shall be manufactured according to British Standard Specifications BS 5154 or its equivalent.
- These valves are manufactured to withstand pressures from 16 to 40 bar.

Cast Iron Globe Valves

- These valves shall be manufactured according to British Standard Specifications BS 5152 or its equivalent.
- These valves are manufactured to withstand pressures of 10, 16, 25 bar.

Copper Alloy Globe Valves

1. These valves shall be manufactured according to British Standard Specifications BS 5152 or its equivalent.
2. These valves are manufactured to withstand pressures from 16 to 40 bar.

Flanged Steel Globe Valves

1. These valves shall be manufactured according to the British Standard Specifications BS 5160 or its equivalent.
2. These valves are manufactured to withstand pressures from 16 to 40 bar.

Check Valves

1. The valve body is made of ductile iron and the internal parts are made of stainless steel.
2. Check valves shall be manufactured to withstand high pressures of more than 24 bar, in accordance with British Standard BS1560; And the heat pressure matches 1560 BS.
3. Water flows in one direction.
4. It is designed to close quickly when the pump stops and does not allow water to return in the reverse direction.
5. The cock must be equipped with a tool at the bottom for draining and a tool for balancing.
6. The operation is automatic.

Steel Flanged Check Valves

1. These valves shall be manufactured according to British Standard Specifications BS 5160 - BS 5153 or its equivalent.
2. These valves are manufactured to withstand pressures from 16 to 40 bar.

Air Valves

1. Air valves are used to deal with the following cases:
2. Discharging the air during filling the pipeline (pipes) with water through a hole with a rubber ball that drops when the pipes (pipes) are not filled with water and allows water to escape and when it is filled with water it closes automatically.

3. Allowing air to enter while emptying the pipes.
4. Discharge the air collected at the highest sites along the line when operating
5. The rate of air discharge through wide openings proportional to the volume of air to be drained.
6. The stopcock contains nets in the places of air entry and exit to trap sand and not allow it to enter.
7. Valves shall not contain materials containing more than 5% zinc and shall be in accordance with BS 5163 specifications.
8. The internal parts are made of aluminum alloy, bronze, nickel and copper.

Pressure Reducing Valves.

1. The pressure relief valve is used to reduce the pressure on the network, and not to exceed the permissible limit, in order to address the problems caused by the high pressure in the network on the amount of water consumed, as well as the increase in the percentage of losses due to leaks and the large number of cracks and fractures in parts of the network, with increasing pressures over time for the project.
2. Pressure relief valves shall be installed at high pressure points, and this point shall be Up Steam at the entrance, and the pressure shall be relieved from the valve at the exit (Down Steam) according to the specified specifications.
3. The valve body shall be made of solid iron or bronze, serrated on both sides.

Pressure Regulator Valves

Pressure regulating valves are used in city networks, and they work to regulate pressures at a certain level and regulate it in all parts of the network.

Pressure Control Valves

The pressure control valve is used in the networks of mountainous areas to control the pressures at specific levels in order to ensure that water reaches the high areas, and that the water does not flow into the sloping areas, and the high areas remain without water until the low areas are sufficient and then the water reaches the high areas.

Operation keys

It is a combined pickup rod and lever type wrench with a vertical shaft of 1.50 m in length and a horizontal bar of 0.50 m in length. These switches are provided in a ratio of one key for every 5 valves.

The elongation shaft for gate valves is made of steel for gate valves to diameters less than 300 mm, and the shaft has a manual T-shaped key, and its protection tubes are made of cast iron.

Surface boxes (SURFACE BOXES) are made of cast iron and the letter W is cast on the rings of flexible steel or wrought iron and the cover of the box is written on the cover, the word water is in Arabic and English and has 3 types:

- A. Heavy class type (A) for paved roads, wheel loads up to 11.50 tons
- B. Medium grade type (M), where heavy machinery up to 7.50 tons are exceptional
- C. Light grade (L), where wheeled vehicles of up to 2.50 tons do not enter it, and there is a protrusion on the axis of the cavity so that a T-shaped key can be inserted.

In order to facilitate the process of opening the cover.

Water Meters.

1. The meters shall be of the turbo type and according to the standard specifications of BS 5728 and ISO 4064.
2. It shall conform to the requirements of the weather conditions in the region.
3. The meter contains a sealed magnetic readout register, which can be read from the top and contains 7 digits for the total readings and a central hour hand that reads up to 100 liters.
4. The meter works with a temperature of up to 50°C and bears a pressure of not less than 40 bar, as determined by the schedule of quantities.