**جدول الكميات لمشروع تأهيل بئر حبله**

**Electro mechanical works for groundwater well no. 14-17/008A in Hableh**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Item** | | **Description** | **Unit** | **Unit Price /$US** | **Qty.** | **Total**  **/$US** |
| **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. The contractor should verify the design equipments by conducting field visits to the well and must be before ordering any equipment or materials as follows: the contactor must check and verify and match between the reality and the design quantities 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, pump diameter, columns 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 of information we got for this well. 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 instructions of the supervisor engineer. | | | | | | |
| 1 | **Supply and install a** multi stage submersible pumping Turbine complete (pump, screen, shaft bowels, stages, connection head to the 5” pipes and, all related accessories all as specified in the technical specifications attached with the tender). The price includes any other works to achieve the required head and quantity and efficiency all according to the Annex below.  Current well hole is **varies with crookedness at depth 15 m below surface** and total well depth is **90** meters; and the existing pump diameter is **8"**. The existing pumping pipes diameter is **5**"; and the total length inside the well is approx. **66** meters, and dynamic drawdown is not known exactly (noticed air pockets in water during summer). Static water level is around **60** meters below surface. The contractor offers submersible turbine properties has to fit as follows:   * Liquid water is suitable for domestic and agriculture uses; which is **potable water**. * Design capacity (m3/h): **70** * Design anticipated total head (TDH) (m): Anticipated turbine discharge at TDH at **165 m** * Maximum pump column and discharge head assembly head losses (m): 3 * Shut-off head limits (m):minimum **200 m** * Turbine overall efficiency at the intended point is not less than 75% * Minimum bowl efficiency at run out capacity (80 %) * NPSHA at maximum run out capacity (m): 8 * NPSHA at maximum anticipated TDH (m): 5 * Motor and pump operating speed (rpm): 2,900 * Non-overloaded motor. * Max. Pump and motor diameter (in): **8”** * Stainless steel column, stainless steel screen filter * Column pipe and discharge head diameter (in): **5”** * Stainless steel **Original** (not local) Shroud on the motor to direct the water inlet to the pump as to pass from underneath the motor to the pump. * Closed impellers manufactured from bronze and cast iron bowels. * The well pump shall be capable to run on/ off every few minutes with technical warnings. * The electrical motor must be supplied with RTD (PT 100) temperature protection. The type of motor connection must be suitable to present the motor temperature digitally on control panel. The price include all wiring, PT cables and connections and works required to connect the motor inside the well and the main control panel with relay and off-alarm and digital display screen. The pump shutdown when motor temperature exceeds 60 centigrade. * Contractor has to connect the motor and control panel upon his responsibility. The connection using the whole length of flat cables shielded with galvanized sheets to prevent cable scratches with well walls and to carry the cable insulation resistance with megger. * The motor shall be designed and built for 24-hours continuous service at any and all points within the required range of operation without overheating, cavitations excessive vibration and strain. * Motor turbine has to be new and furnished with a stainless steel name plate with data of the serial no., speed, Kw, input voltage, full load, Hz, power etc.) and motor must be 1.25 larger than Pump brake horse power or 1.15 larger than the total Input Horsepower to the Electrical Motor. The motor size should not be less than 60 hp or according to the manufacturer recommendations * The motor shall be furnished with a removable water block lead assembly to prevent ingress of water and a sand slinger shall be installed where the shaft inters the stator. * The motor shall be filled at the factory with a treated glycol water internal lubricating solution for a maximum reliability and long life. * All works from supplying, installing connecting running and testing are under the contractor's expenses. * All works must be according to the Palestinian standards and engineer’s instructions and the specification and drawings. * The price also includes any missing works not mentioned to execute this work. * The contractor must submit the motor specifications, certificate of origin, catalogues and on site testing report which shows that the motor is matching with the manufacturer specifications. * The well pump shall be capable to run at shutoff head for a few minutes without mechanical problems. * The motor and turbine must fit with each other according to manufacturers’ instructions. * The turbine torque design should be duty inverter at speed range the design torque values between 1:10 * The price includes supplying and installing all required non return valve (**built in**) flanges, coupling, reducers, bolts, spacers, sleeves, nuts, etc. to connect between the turbine outlet, turbine column and the rising pipes and shafts accordingly. If necessary, the price also includes casting concrete foundation and I steel sections to hold the turbine. The price includes all repair works and damages as a result of old turbine disjoin or new turbine installation.   The contractor shall do in site testing the turbine in accordance with the performance curve and submitting the test report. Before installing any new materials, the contractor must get the initial records for existing conditions of the well including: the well pumping capacity in m3/hr, water level inside the (dynamic and static). Therefore, the contractor must prepare suitable water meter and water level meter to carry on these measures. Therefore, the price of the turbine includes the costs of all these tests. | | Lump Sum | 12000 | 1 | 12000 |
| 2 | **Supply and install submersible electric** cable with the following specifications:  The cable is flat with a light blue outer sheath -, drinkable conductors for permanent submersion in potable water, to respective depths and up –to 600 meters. It is water resistance tested to the European standard EN 505825-2-21 (AD8 condition complete submersion in water) and meets the requirements of BS 6920, and IEC 60228 covering the suitability of non-metallic materials and products for use in contact with water. The EPR (Ethylene Propylene Rubber) insulation and Elastomeric Cross-linked outer sheath should provide a robust and water-tight barrier.  The voltage rating is 0.6/1kV and a temperature rating of -25oC to +90oC. It is suitable for use in water of a maximum temperature of 80oC  the conductor main construction properties are as follows:   * Class 5 (Flexible Conductor) fine stranded tinned pure Copper * Voltage rating: (0.6/1kv) 600 V between the conductor and earth, and 1000 V rms between adjacent conductors. * Inner Insulation: EPR (Ethylene Propylene Rubber) * Outer sheath/ Jacket: Elastomeric Cross-linked compound including filler materials   Conductors sizes 3x50 (1FL, 3GI3 quality insulation)+1x25 mm2 . The junction box (Water Proof) and main connection as shown in the Annex. The cable is fixed to the pipes by stainless steel clamps each 2 m with soft rubber underneath and pvc ties each meter. The price includes the costs to carry the cable insulation resistance with megger and connect to control panel. | | M.L | 50 | 80 | 4000 |
| 3 | **Maintenance of the existing Main Electrical Control Panel Unit** which includes:   * Check and maintain the control panel to be suitable for pumping 70 **m3 @ 16.5** bars. * check and maintain the existing main hour meter and fusses- Main breaker as Siemens, contactor, capacitor(s) bank, main cables inlet/outlet.), the control panel water proof It shall be IP56 protected. All main cables and wiring must be closed with special plastic cover and protected against human electric shock. * Check and maintain all the control circuits, and including main and secondary contactor, breakers for the high voltage cabinet or the low voltage. The control panel must be stable and fixed to the wall and no opening(closed cabinet). The contractor should submit as built drawing including soft and hard copy.   The labeled nameplates should be mounted at the front of the main board behind the doors and above every switch and group of lamps. Control electric lamps 24v must be fixed to control all operation system, the starter shall be used to start, run, stop , protect and control manually and automatically by using the general required installation of the following equipments completely. The price for this item includes:   * The power circuit must consist of the following: main circuit breaker MCCB 3\*100A, 25KA adjustable for the company and for generator (MOLLER) two pieces. * Check and maintain the bus bar 200A/0.4KV (3 phases and neutral and earth) * Check and maintain complete 4p \* 20KA surge arrestors of replaceable type. With box fuse 3\*63. * **Supply and install** **new** digital screen inverter suitable for submersible pumps with minimum harmonics. Its size 60-70 hp see the annex. Solid state frequency converter as ABB type (see with bypass contactor 60 hp as MOELLER type equipped with over /under load, over temperature and all control system needed with all protections rated at suitable power that matches the pump motor with (0.8-1.2) over load range.   **Check and maintain the existing capacitor Banks**: Standby capacitor banks with discharge resistors compensating reactor dry type 400v 50 Hz to reach power factor 0.97 Ducati. Three phase capacitor with resistors 10 KVAR Ducati type.   * Check maintain the existing digital multi meter which is able to read directly from a screen (V, Hz, KW, A, PF). * Check and maintain or supply install if needed the No voltage phase sequence and phase failure devices and relays of best quality as MOELLER. * Check and maintain On-off push button set and emergency off button. * Check and maintain emergency, Reset push buttons red color 22 mm. * Check and maintain Overload relay unit rated at 1-1.5 of motor full load including digital motor screen protection control board. * Check and maintain or supply and install if needed a temperature relay unit rated at the motor thermal sensor, including digital motor screen protection control board with all cables and connections from surface to submersible motor. * Check and maintain the existing wireless connection to start and shutdown the pump. * Check and maintain suitable earth leakage relay class A (AC and Dc trip). Contactor with discharge 25KVAR Moeller type. * Check and maintain relays and timers 24 V for no flow switch and high-pressure, low-pressure sensors. * Check and maintain 24V/ 50Hz indication lamps installed in front of the control cabinet.. * Check and maintain 3 position selector switch A-O-M. * Check and maintain 220-2 \* 12V (AC) transformer 100VA. * the price includes all cables to be used for control purposes shall have the following cross section: * (3\*50 mm2 + 25 mm2) for the internal connections inside main board and the contractor has to check and order the exact required length. * All terminals shall be carefully protected to assure electrical insulation. * Switches, measuring instruments, and warning lights shall be installed in the front side of the panel. * The control panel must be equipped with control circuit for the probe water sensor . the price includes all cables and connections from surface to submersible motor including probe. The pump shutdown when water level below the probe. * Temperature control as digital screen * The alarm must be muted without general reset and there should a special button in the front door to stop it alone. * Circuits must consist of the all necessary materials to operate and protect the system automatically and manually, the wiring color system, numbering all the components. The price includes the design of the whole system of control the contractor is intending to carry. The contractor should also submit at the end of work a s built drawing.   The control panel deign should include:   * Transformer 230/24V 150VA * Water level relay HK type. * 220V AC /80 Watt with 2 fans in each compartment, one for taking in air and the other for taking out the air with grid ( for the panel) complete with thermostat protection. * SIREN (alarm system)   Alarm system 24V for :   1. High pressure outlet 2. Low pressure outlet if necessary 3. No flow (non return valve) 4. Start fault (No voltage, loss of phase/s, over voltage 5. Low water level 6. High motor temperature above 60 Co  * The price includes all works, as excavation works for installing pressure switches, flow switch and level sensor and all the electrical parts with suitable conduits and metal ducts to complete the works. * **Check and maintain Earthling unit to match** : complete earth unit with earth equalizer compressing C40 box copper B.B. 25 mm2, with minimum two concrete manholes as foundation lines , two earth electrodes, D>19m, L=1.5m and any other missing materials to earth the pumping station . The price includes testing earth unit so as to fulfill the standard requirements (resistance less than 1.5-2 ohm). The across different fittings in the piping system. | | L.S | 5000 | 1 | 5000 |
| 4 | **Pump lifting and reinstallation**: All works related to disjoin the existing discharge head, pumping pipes turbine, shafts, retainers, access pipes, …etc and reinstall the pumping pipes, submersible turbine, access pipes, cables, and all related accessories. The price involves checking and operating the pump after finishing project works and insure no vibration or unusual sound, according to the instructions of the supervisor engineer. The price includes all machine and labor works related to well's dismantling and installation. | | Lump sum | 2000 | 1 | 2000 |
| **Total costs of all materials and works** | | |  | | | **23000** |

**Costs Summary**

|  |  |
| --- | --- |
| **Description** | **Total amount /$US** |
| **All Mechanical and Electrical works for the groundwater well. 14-17/008A** |  |
| **Total in words (includes) –$US** | |

**Company / Contractor Name: --------------------------------------------**

**Address: -----------------------------------------------------------------**

**Telephone: -------------------------------------- Fax: ---------------------**

**Signature and Stamp: --------------------------------**

**Date: -----------------------------**

**General Information well 14-17/008A**

Location: Hableh , Qalqilya Area

Coordinaste: E= 148070 N= 175474, Z= 70 a.m.s.l

ID Number: 14-17/008A

Total Depth: 90 meters

Static Water Level: 60 meters below surface

Pump Setting: 66 below surface

Diameter of Drilling: VARIES

Existing Pumping pipes diameter: 5”

Existing Pumping Capacity: 50 m3/hr

Irrigated Area: 300 Dunums

Number of farmers: 80

Average working hours per day in summer: 12

Average working hours per day in winter: 2

**Annex:**

**Mechanical and Electrical Works:**

**General Specifications**: The contractor should attach in his offer type of turbine and details information on it if either imported as foreign turbine. He should include the manufacturer brand name, performance and testing curves (and due point), full specifications of manufacturing materials and dimensions of the stages, bowels, main shaft, retainers, stabilizers, lockers, etc. . The contractor must submit the turbine original performance/testing curve from the company or from an approved turbines test lab. Before installing any new materials, the contractor must get the initial records for existing conditions of the well including: the well pumping capacity in m3/hr, water level inside the (dynamic and static). These tests must be reported before start any import and supply orders. Therefore, the contractor must prepare suitable water meter and water level meter to carry on these measures. The contractor will not be paid any money for taking these records and their cost will be considered as undeclared/indirect costs that are already included in the turbine price. . The installation process includes all works such as excavation in all kinds of rocks and soils, welding, shaping, cleaning the site of work and painting.

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 materials have to be new and not renewed in accordance with the specified specifications. The contractor should verify before ordering any equipment or materials, all dimensions mentioned in the following specifications including the well's hole diameter, pump diameter, columns diameter, discharge head inlet and outlet. The sizes mentioned in this contract are the best estimate of information we got for this well. The contractor should be responsible technically and financially to supply the suitable materials.

**Electric Cable Connection**

**Splicing of electric cable should be done by a qualified person.**

* Use correct electric cable designed for submersible well pumps.
* Peel the coating at the end of the cable and lead line of the motor about 40 mm to expose the copper wire.
* Connect the bare wire about 20 mm long using a crimp link of the appropriate size. Each individual wire should be crimped and insulated individually. Use the waterproof adhesive tape for 3 to 5 layers to wrap the individual connections. The wires should then be bundled together and insulated again using adhesive tape again for 3 to 5 layers ensuring that it is totally waterproof.
* The waterproof adhesive tape should be elongated by pulling in 200% before wrapping it round the wire in spiral advantage method with half of the tape in each round being over-lapped. The shrinkage of the tape will fasten and waterproof the connected cable end better.
* The bare copper wire and adhesive tape should be kept clean.

**Submersible Turbine Pump and Settings**

* Furnish all labor, materials, equipment and incidentals required, install, complete and ready for operation and field test, submersible turbine pump and motor including all details in respect to the setting in the well.
* All necessary and desirable accessory equipment and auxiliaries whether specifically mentioned in this specification or not shall be furnished and installed as required for an installation incorporating the highest standards for this type of service. Also included shall be supervisory services during installation and field testing of each unit and instructing the regular operating personnel in the proper care, operation and maintenance of the equipment.

**Related Work**

* Instrumentation and control work, except as specified herein are included Instrumentation and controls provided in this section shall adhere to Instrumentation and control specifications
* Mechanical work and appurtenances are included
* Electrical work, except as specified herein, is included

**Submittals**

Submit shop drawings and product data. Submittals shall include the following:

1. Certified dimensional drawings of each item of equipment and auxiliary apparatus to be furnished including: pump supports and anchor bolt plans and details.
2. Schematic electrical wiring diagram and other data as required for complete pump installation.
3. Literature and drawings describing the equipment in sufficient detail. including materials of construction, to indicate full conformance with the detail specifications.
4. Total weight of pumping unit as well as weights of individual components

**Design Data**

* Manufacturer's certified rating curves, to satisfy the specified design conditions including operating speed , showing pump characteristics of discharge, anticipated field head, brake horsepower, bowl efficiency and guaranteed net positive suction head required (NPSHR). Curves shall show the full recommended range of performance and include shut-off head. This information shall be prepared specifically for the pump proposed. Catalog sheets showing a family of curves will not be acceptable.
* Calculations for velocity of flow past the motor based on motor proposed and designated well casing shall be submitted. Should such calculations show a velocity below that required by the motor manufacturer for adequate motor cooling a design of an enclosing flow inducer (suction sleeve/shroud) shall be submitted for approval. In any case of the results of calculations the contractor should install a shroud around the motor according to the standards of shrouds installation. Therefore, the contractor should make this step before he submits his offer to import the suitable submersible pump. These decisions will be considered according to the results of the step draw down test.

**Test Reports Include:**

1. Copies of all test data as described above

2. Tabulated data for the drive motors including rated horsepower, full load rpm, power factor and efficiency curves at ½ , 3/4 and full load, service factor and (Kw) input. including when the pump is at its design point. Submit a certified statement from the motor manufacturer that the motors are capable of continuous operation on the power supply without affecting their design life for bearings or windings

3. A schedule of the date of shop testing and delivery of the equipment to the job site

4. Description of pump factory test procedures and equipment

**Operation and Maintenance Data**

The maintenance instructions shall include troubleshooting data and full preventative maintenance schedules and complete spare parts lists with ordering information

Complete operating and maintenance instructions shall be furnished for all equipment included under this section.

**Reference Standards**

1. Design, manufacturing and assembly of elements of the equipment specified herein shall be in accordance with PWA and EU standards.

**Quality Assurance**

* To assure unity of responsibility, the motors shall be furnished and coordinated by the pump manufacturer. The Contractor and manufacturer shall assume responsibility for the satisfactory installation and operation of the entire pumping system including pump, motor, surface discharge head and controls, as specified herein.
* The equipment specified herein is intended to be standard pumping equipment of proven ability as manufactured by concerns having extensive experience in the production of such equipment. Units specified herein shall be furnished by a single manufacturer. The equipment furnished shall be designed, constructed and installed to operate satisfactorily when installed as shown on the contractor submittals.
* Pumps shall be manufactured in accordance with the standards specified herein.
* The Contractor shall be fully responsible for the design, arrangement and operation of all connected rotating components, to ensure operation meets all specified conditions.
* The Contractor shall be fully responsible for all elements of the pump installation and pump setting so that the installation meets the requirements as shown on the contractor submittals and as specified herein including depth of setting, discharge column pipe, column check valve, installation of water level instrumentation and surface discharge head assembly.

**System Description**

* The submersible pump, to be installed under this section, is a replacement vertical pump to be set in an existing water supply well.

**Delivery, Storage and Handling**

* All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed and the unit and equipment are ready for operation.
* All equipment and parts must be properly protected against any damage during shipment. Store the equipment in accordance with manufacturer's recommendations
* Factory assembled parts and components shall not be dismantled for shipment unless permission is received in writing from the Engineer.
* The finished surfaces of all exposed flanges shall be protected by wooden or equivalent blank thongs, strongly built and securely bolted thereto.
* Finished iron or steel surfaces not painted shall be properly protected to prevent rust and corrosion.
* No shipment shall be made until all required submittals have been approved by the Engineer and shipment approved by the Engineer in writing.

**Maintenance**

* Provide a list of recommended spare parts for 1 year operation of the pump, together with the current price of each item.

**Warranty**

* The equipment shall be warranted for a period of one year from date of substantial completion as defined under the General Conditions, to be free from defects in workmanship, design or material. If the equipment should fail during the warranty period due to a defective part(s), it shall be replaced and the unit(s) restored to service at no additional cost to the Owner.

**Pumping Unit Accessories**

* Water Level Monitoring Access Pipe
* Furnish steel sleeve welded to the surface discharge plate to accept the access pipe for water level measuring equipment and RTD's. The sleeve shall extend through the access plate and be flush with the bottom surface of the plate. The sleeve shall extend 150 mm above the upper surface of the plate and be sized to provide a 9 mm space around the pipe within the sleeve.
* Furnish a 25 mm internal diam sch80 (1.25 inch), 5 mm (0.200 in) wall thickness water level monitoring access pipes. Each pipe shall extend into the well to a depth equal to within 2 m of the installed depth of the top of the pump bowl assembly.
* The 32 mm (1.25 in) PVC pipe shall be slotted Schedule 80 flush coupled and threaded
* The access pipes shall each have a PVC cap mounted at the top of the PVC pipe. The cap shall be slipped onto the top of the access pipe to permit removal when the instrument is pulled for inspection or service. Do not attach the cap to the pipe with solvent. Cut a slot in the cap to the instrument size and seal around the cable and the slot with silicone rubber sealant to prevent debris from entering the access pipes.

1. Low Level Shut-Off

* Wire a data logger with a suspended sensor and solid-state relay for low level shut-off and alarm to be installed under this section, shall be as furnished and as specified in the control panel specifications.

**Products**

* The pumping units shall all be supplied by one manufacturer and shall be complete including pumps, motors, submersible power cable and motor RTDs.
* The pumps, motors, and devices shall be designed and built for 24-hour continuous service at any and all points within the required range of operation, without overheating, without cavitations, and without excessive vibration or strain. All parts shall be so designed and proportioned as to have liberal strength, stability and stiffness and to be especially constructed to meet the Specifications.
* Pump support and surface discharge is to be as shown in the BOQ. Each major piece of equipment shall be furnished with a stainless steel nameplate (with embossed data) securely mounted to the body of the equipment. As a minimum, the nameplate for the pumps shall include the manufacturer's name and model number, serial number, rated flow capacity, head, speed and all other pertinent data. As a minimum, nameplates for motors shall include the manufacturer's name and model number, serial number, KW/horsepower, speed, input voltage, full load amperes, Hz and power and service factors and insulation code.

**Conditions of Operation**.

The pump shall be designed for the conditions of service tabulated as follows and shall operate within the system head curves as appended. The pump shall have a rising head capacity curve for stable pump operation from the minimum head operating point to the shut-off head.

1. Depth of turbine 66 m below surface
2. Pumping pipes (existing) 5”
3. Static water level around 60 m below surface
4. Dynamic water level during pumping (to be determined during the pumping testy/Step Draw Down Test SDDT)
5. Pumping capacity 70 m³/h (according to the results of the SDDT)
6. Hole diameter varies with crookedness

**Column Check Valve**

The pump column shall be equipped with a stainless steel poppet check valve non-spring return located one column pipe joint above pump discharge

The check valve diameter shall be x-in and constructed of Type 316 stainless steel with disc and bushings of the same material. Fasteners shall be Type 316 stainless steel. The pressure rating of the valve shall be 1.5 times shutoff head (such as to accommodate the maximum pressure of the pump's total dynamic head through its entire performance curve from shut off run out).

**Design Data**

1. Manufacturer's certified rating curves, to satisfy the specified design conditions including operating speed , showing pump characteristics of discharge, anticipated field head, brake horsepower, bowl efficiency and guaranteed net positive suction head required (NPSHR). Curves shall show the full recommended range of performance and include shut-off head. This information shall be prepared specifically for the pump proposed. Catalog sheets showing a family of curves will not be acceptable.
2. Calculations for velocity of flow past the motor based on motor proposed and designated well casing shall be submitted. Should such calculations show a velocity below that required by the motor manufacturer for adequate motor cooling a design of an enclosing flow inducer (suction sleeve/shroud) shall be submitted for approval

**Field Testing**

1. After the pump has been completely installed, a test of the equipment shall be conducted by the Contractor under the direction of the Engineer to prove compliance with the requirements set forth for the pump design. An efficiency test of the pump shall also be conducted and the Contractor shall furnish all instruments, meters, gauges and incidentals which may be required for the test.
2. Pump capacity and pump discharge head shall be recorded at a minimum of 5 capacity points along the curve. One of the capacity points shall be within plus or minus 2 percent of the design capacity as shown on the approved shop drawing submittal of a pump curve. The pump at all times shall be operated at plus or minus 5 percent of the design speed
3. Upon recording pump discharge and pressure at 5 capacity points, the pump shall be shut down and the water level recovered within I-in of static levels. At this time, the pump shall be operated within plus or minus 2 percent of the design capacity for a period of I hour. Measurements of pump capacity, discharge head. horsepower input and motor speed shall be made.
4. Pump performance shall be computed from field pump test data. After accounting for field test accuracy, the well pump shall be expected to operate within 5 percent of the approved head capacity curve and not more than 2 percent from the approved efficiency) curve. Correct an) condition to obtain performance equal to these field operating conditions

**Solid state frequency inverter**

* Wide Voltage Range: 320 ~ 480V
* Input Frequency Range: 40 ~ 65Hz
* Output Voltage Range: 0 ~ rated input voltage
* Output Frequency Range: 0 ~ 500Hz
* Overload Capacity: 60s with 150% of rated current, 2s with 180% of rated current
* From 0.75 ~ 7.5KW Plastic house; 11 ~ 630KW is metal house
* Control Mode: High Quality V/F Control
* Speed Accuracy: V/F + 0.5% of maximum speed
* 20 channels for frequency setting
* Analog signal: 0 ~ 10V,-10V ~ 10V,0 ~ 20mA.
* Pulse setting input: 0~50 KHz.
* Built-in RS485 communication port
* Solid state programmable screen and PLC configurations
* All model are integrated IGBT
* The malfunction ratio is 0.8% within 24 months warranty