

TECHNICAL SPECIFICATIONS

Solar-Powered Submersible Water Pumping System Habel Al-Sweeda Water project.

Project Location: Habel Al-Sweeda Area, Al-Mosaimeer District, Lahj Governorate (13°23'29.2"N 44°38'20.0"E).

◆ 1. Scope of Work

The contractor shall supply, install, test, and commission a complete solar-powered submersible pumping system to abstract groundwater and deliver 42 m³/day to an elevated storage tank through a 1300 m pipeline.

The system should be fully operational, autonomous, and designed for high-temperature environments ($\geq 50^{\circ}\text{C}$).

◆ 2. System Design Requirements

Parameter	Requirement
Required discharge	42 m ³ /day
Operating hours	5–6 hours/day
Design flow	6–8 m ³ /hr
Total Dynamic Head (TDH)	100 m
Well depth	39 m
Static water level	22 m
Pipeline length	1300 m
Ambient temperature	Up to 50 °C

◆ 3. Solar Submersible Pump

3.1 General Requirements

- Pump shall be DC/AC solar submersible type

- Suitable for continuous operation under solar radiation
 - Minimum efficiency $\geq 50\%$
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3.2 Performance Requirements

- Flow rate: $\geq 7 \text{ m}^3/\text{hr}$
 - Head: $\geq 100 \text{ m}$
 - Operating voltage: Compatible with solar array
 - Pump curve must demonstrate required duty point
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3.3 Materials

- Pump body: **Stainless steel (AISI 304 or better)**
 - Impellers: Stainless steel or high-resistance polymer
 - Motor: Brushless DC, water-filled
 - Protection class: **IP68**
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3.4 Protections

- Dry-run protection
 - Overload protection
 - Under/over-voltage protection
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◆ 4. Pump Controller

- Type: **MPPT (Maximum Power Point Tracking)**
- Efficiency: $\geq 95\%$
- Integrated protections:
 - Reverse polarity
 - Short circuit
 - Over-temperature
- Enclosure: **IP65 minimum**

◆ 5. Solar PV Modules

5.1 General

- Type: **Monocrystalline**

5.2 Standards

- IEC 61215 / IEC 61730 certified
- High temperature resistance

5.3 Mechanical

- Aluminum frame (corrosion resistant)
- Tempered glass (≥ 3.2 mm)

◆ 6. Mounting Structure

- Material: **Hot-dip galvanized steel**
- Wind resistance ≥ 120 km/h
- Fixed tilt angle optimized for site ($\sim 15\text{--}20^\circ$)
- Anchor bolts with reinforced concrete base

◆ 7. Electrical Works

7.1 Cables

- Solar DC cables: UV resistant
- Copper conductor
- Suitable for high temperatures ($\geq 70^\circ\text{C}$)

7.2 Protection System

- DC isolator switch
- Surge Protection Device (SPD)

- Earthing system:
 - Copper rod (≥ 2 m)
 - Earth resistance ≤ 5 ohm
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◆ 8. Rising Main (Inside Well)

- Pipe: **HDPE PN16**
 - Diameter: ≥ 2 inch
 - Accessories:
 - Non-return valve (NRV)
 - Gate valve
 - All fittings pressure-rated
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◆ 9. Transmission Pipeline

- Material: **HDPE PN10 or higher**
 - Diameter: **2 inch minimum (recommended ≥ 2.5 inch)**
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Accessories:

- Air release valves at high points
 - Concrete thrust blocks at bends
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◆ 10. Installation Requirements

- Pump shall be installed $\geq 5\text{--}10$ m below dynamic water level
 - Proper cable fixing every 3 m
 - Alignment of solar panels must avoid shading
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◆ 11. Testing & Commissioning

The contractor shall perform:

11.1 Pump Testing

- Measure discharge (m³/hr)
 - Measure dynamic head
 - Verify performance against design
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11.2 Solar Testing

- Voltage and current output
 - Controller performance
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11.3 Trial Operation

- Minimum **3 consecutive days**
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◆ 12. Warranty

- The assign contractor will provide retention guarantee for a period of no less than six months from completion of the project, the guarantee will equal to 10% of the project amount.
 - Pump: **Minimum 1 year**
 - Solar panels: **Minimum 10 years**
 - Controller: **Minimum 1 year**
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◆ 13. Measurement & Payment

- Payment shall be **lump sum** for complete system
 - Includes supply, installation, testing, and commissioning
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◆ 14. Acceptance Criteria

System will be accepted only if:

- Delivers **≥ 42 m³/day**
- No system faults during testing period

