Wednesday, 16 October 2013

Osiligi Obaya School
Solar pumping project

Parameter
Location: Kenya, Gilgil (1° South; 36° East) Static head: 150 m
Required daily output: 8.0 m³; Sizing for average month Motor cable: 160 m
Dirt loss: 5.0 % Pipeline: 160 m
Water temperature: 20 °C

Products
<table>
<thead>
<tr>
<th>Quantity</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS1800 HR-07H-1</td>
<td>1 pc. Submersible pump system including controller, motor and pump end</td>
</tr>
<tr>
<td>STP 180</td>
<td>8 pc. 1,440 Wp; 4 x 2 modules; 15 ° tilted</td>
</tr>
<tr>
<td>Motor cable</td>
<td>160 m 6 mm² 3-phase cable</td>
</tr>
<tr>
<td>Pipeline</td>
<td>160 m 40 mm (inner diameter) Pipeline</td>
</tr>
<tr>
<td>Accessories</td>
<td>1 set Well Probe, Float Switch</td>
</tr>
</tbody>
</table>

Daily output in average month

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Av.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.6</td>
<td>9.3</td>
<td>9.4</td>
<td>9.1</td>
<td>9.4</td>
<td>9.3</td>
<td>9.2</td>
<td>9.5</td>
<td>8.6</td>
<td>7.3</td>
<td>8.</td>
<td>8.9</td>
<td>8.9</td>
</tr>
</tbody>
</table>

Energy [kWh]
- Jan: 6.8 kWh
- Feb: 7.6 kWh
- Mar: 7.7 kWh
- Apr: 7.3 kWh
- May: 7.7 kWh
- Jun: 7.5 kWh
- Jul: 7.2 kWh
- Aug: 7.4 kWh
- Sep: 7.8 kWh
- Oct: 6.8 kWh
- Nov: 6.0 kWh
- Dec: 6.4 kWh
- Av.: 7.2 kWh

Irradiation [kWh/m²]
- Jan: 5.5 kWh/m²
- Feb: 6.2 kWh/m²
- Mar: 6.3 kWh/m²
- Apr: 5.8 kWh/m²
- May: 6.1 kWh/m²
- Jun: 5.9 kWh/m²
- Jul: 5.6 kWh/m²
- Aug: 5.8 kWh/m²
- Sep: 6.2 kWh/m²
- Oct: 5.4 kWh/m²
- Nov: 4.7 kWh/m²
- Dec: 5.0 kWh/m²
- Av.: 5.7 kWh/m²

Rainfall [mm]
- Jan: 1.7 mm
- Feb: 1.7 mm
- Mar: 2.7 mm
- Apr: 6.1 mm
- May: 5.2 mm
- Jun: 2.4 mm
- Jul: 2.6 mm
- Aug: 2.2 mm
- Sep: 3.1 mm
- Oct: 3.6 mm
- Nov: 2.2 mm
- Dec: 3.0 mm

Ambient temp. [°C]
- Jan: 19 °C
- Feb: 20 °C
- Mar: 20 °C
- Apr: 19 °C
- May: 19 °C
- Jun: 18 °C
- Jul: 18 °C
- Aug: 18 °C
- Sep: 19 °C
- Oct: 19 °C
- Nov: 18 °C
- Dec: 18 °C
- Av.: 19 °C

Hourly values

<table>
<thead>
<tr>
<th>6:00</th>
<th>7:00</th>
<th>8:00</th>
<th>9:00</th>
<th>10:00</th>
<th>11:00</th>
<th>12:00</th>
<th>13:00</th>
<th>14:00</th>
<th>15:00</th>
<th>16:00</th>
<th>17:00</th>
<th>18:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.0</td>
<td>0.47</td>
<td>0.95</td>
<td>1.2</td>
<td>1.3</td>
<td>1.3</td>
<td>1.2</td>
<td>1.2</td>
<td>0.9</td>
<td>0.42</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Energy [kWh]
- 6:00: 0 kWh
- 7:00: 0.22 kWh
- 8:00: 0.47 kWh
- 9:00: 0.69 kWh
- 10:00: 0.84 kWh
- 11:00: 0.93 kWh
- 12:00: 0.95 kWh
- 13:00: 0.91 kWh
- 14:00: 0.82 kWh
- 15:00: 0.67 kWh
- 16:00: 0.45 kWh
- 17:00: 0.21 kWh
- 18:00: 0 kWh

Irradiation [kWh/m²]
- 6:00: 0 kWh/m²
- 7:00: 0.16 kWh/m²
- 8:00: 0.35 kWh/m²
- 9:00: 0.53 kWh/m²
- 10:00: 0.67 kWh/m²
- 11:00: 0.75 kWh/m²
- 12:00: 0.78 kWh/m²
- 13:00: 0.75 kWh/m²
- 14:00: 0.67 kWh/m²
- 15:00: 0.53 kWh/m²
- 16:00: 0.35 kWh/m²
- 17:00: 0.16 kWh/m²
- 18:00: 0 kWh/m²

Ambient temp. [°C]
- 6:00: 14 °C
- 7:00: 14 °C
- 8:00: 15 °C
- 9:00: 17 °C
- 10:00: 19 °C
- 11:00: 21 °C
- 12:00: 23 °C
- 13:00: 24 °C
- 14:00: 24 °C
- 15:00: 24 °C
- 16:00: 23 °C
- 17:00: 23 °C
- 18:00: 23 °C
System characteristic

<table>
<thead>
<tr>
<th></th>
<th>Min.</th>
<th>800 W/m², 20 °C</th>
<th>Max./STC*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PV generator</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cell temperature</td>
<td>°C</td>
<td>46</td>
<td>25</td>
</tr>
<tr>
<td>Temperature loss</td>
<td>[%]</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Dirt loss</td>
<td>[%]</td>
<td>5.0</td>
<td>-</td>
</tr>
<tr>
<td>Pmax</td>
<td>[Wp]</td>
<td>984</td>
<td>1,440</td>
</tr>
<tr>
<td>Vmp</td>
<td>[V]</td>
<td>128</td>
<td>142</td>
</tr>
<tr>
<td>Imp</td>
<td>[A]</td>
<td>7.7</td>
<td>10</td>
</tr>
<tr>
<td>Voc</td>
<td>[V]</td>
<td>162</td>
<td>178</td>
</tr>
<tr>
<td>Isc</td>
<td>[A]</td>
<td>8.2</td>
<td>11</td>
</tr>
<tr>
<td>Pout</td>
<td>[W]</td>
<td>838</td>
<td>-</td>
</tr>
<tr>
<td>Vout</td>
<td>[V]</td>
<td>144</td>
<td>-</td>
</tr>
<tr>
<td>Iout</td>
<td>[A]</td>
<td>5.8</td>
<td>-</td>
</tr>
<tr>
<td><strong>Motor cable</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power loss</td>
<td>[%]</td>
<td>5.5</td>
<td>5.5</td>
</tr>
<tr>
<td><strong>Pump system</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor power</td>
<td>[W]</td>
<td>227</td>
<td>785</td>
</tr>
<tr>
<td>Motor voltage</td>
<td>[V EC]</td>
<td>34</td>
<td>113</td>
</tr>
<tr>
<td>Motor current</td>
<td>[A]</td>
<td>6.7</td>
<td>7.0</td>
</tr>
<tr>
<td>Motor speed</td>
<td>[rpm]</td>
<td>901</td>
<td>3,285</td>
</tr>
<tr>
<td>Flow rate</td>
<td>[m³/h]</td>
<td>0.009</td>
<td>1.3</td>
</tr>
<tr>
<td>Efficiency</td>
<td>[%]</td>
<td>1.3</td>
<td>62</td>
</tr>
<tr>
<td><strong>Pipeline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow speed</td>
<td>[m/s]</td>
<td>0.002</td>
<td>0.28</td>
</tr>
<tr>
<td>Friction loss</td>
<td>[m]</td>
<td>0</td>
<td>0.48</td>
</tr>
</tbody>
</table>

*STC: Standard test conditions for photovoltaic modules, 1000 W/m² solar irradiance, 25 °C cell temperature
Wiring diagram

Grounding should be done according to the instructions of the module manufacturer.

+ --- Controller

4 modules per string

2 strings in parallel

Wednesday, 16 October 2013
Osiligi Obaya School
Solar pumping project
### Layout

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>(Static head): Vertical height from the dynamic water level to the highest point of delivery.</td>
</tr>
<tr>
<td>T</td>
<td>(Tilt angle): Angle between the PV generator pane and the horizontal pane.</td>
</tr>
<tr>
<td>M</td>
<td>(Motor cable): The cable between controller and pump unit.</td>
</tr>
<tr>
<td>L</td>
<td>(Pipeline): Entire pipeline from the pump outlet to the point of delivery. Ellbows and armatures must be added as an equivalent length of pipeline.</td>
</tr>
<tr>
<td>B</td>
<td>(Drawdown): Lowering of water level depending on flow rate and recovery rate of the well.</td>
</tr>
<tr>
<td>D</td>
<td>(Pipeline inner diameter)</td>
</tr>
</tbody>
</table>

All specifications and information are given with good intent, errors are possible and products may be subject to change without notice.

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Wednesday, 16 October 2013

**Osiligi Obaya School**

Solar pumping project
**PS1800 HR-07H**

**Solar Submersible Pump System for 4" wells**

### System Overview

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head</td>
<td>max. 160 m</td>
</tr>
<tr>
<td>Flow rate</td>
<td>max. 1.4 m³/h</td>
</tr>
</tbody>
</table>

### Technical Data

#### Controller PS1800
- Control inputs for dry running protection, remote control etc.
- Protected against reverse polarity, overload and overtemperature
- Integrated MPPT (Maximum Power Point Tracking)
- Battery operation: Integrated low voltage disconnect

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>max. 1.8 kW</td>
</tr>
<tr>
<td>Input voltage</td>
<td>max. 200 V</td>
</tr>
<tr>
<td>Optimum Vmp*</td>
<td>&gt; 102 V</td>
</tr>
<tr>
<td>Nominal voltage (battery operation)</td>
<td>96 V</td>
</tr>
<tr>
<td>Motor current</td>
<td>max. 14 A</td>
</tr>
<tr>
<td>Efficiency</td>
<td>max. 98 %</td>
</tr>
<tr>
<td>Ambient temp.</td>
<td>-30...50 °C</td>
</tr>
<tr>
<td>Enclosure class</td>
<td>IP54</td>
</tr>
</tbody>
</table>

#### Motor ECDRIVE 1200-HR
- Maintenance-free brushless DC motor
- Water filled
- Premium materials, stainless steel: AISI 304/316
- No electronics in the motor

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated power</td>
<td>1.7 kW</td>
</tr>
<tr>
<td>Efficiency</td>
<td>max. 92 %</td>
</tr>
<tr>
<td>Motor speed</td>
<td>900...3,300 rpm</td>
</tr>
<tr>
<td>Insulation class</td>
<td>F</td>
</tr>
<tr>
<td>Enclosure class</td>
<td>IP68</td>
</tr>
<tr>
<td>Submersion</td>
<td>max. 250 m</td>
</tr>
</tbody>
</table>

#### Pump End PE HR-07H**
- Non-return valve
- Premium materials, stainless steel: AISI 304/316

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borehole diameter</td>
<td>min. 4.0 in</td>
</tr>
<tr>
<td>Water temperature</td>
<td>max. 50 °C</td>
</tr>
</tbody>
</table>

#### Standards
- 2006/42/EC, 2004/108/EC, 2006/95/EC
- IEC/EN 61702:1995, IEC/EN 62253 Ed.1

The logos shown reflect the approvals that have been granted for this product family. Products are ordered and supplied with the approvals specific to the market requirements.

*Vmp: MPP-voltage under Standard Test Conditions (STC): 1000 W/m² solar irradiance, 25 °C cell temperature

**Specify temperature range on order
PS1800 HR-07H
Solar Submersible Pump System for 4" wells

Pump Chart

Dimensions and Weights

Controller

- H = 396 mm
- H2 = 384 mm
- W1 = 178 mm
- W2 = 156 mm
- W3 = 118 mm
- D = 165 mm
- D1 = 150 mm

Pump Unit

- A = 771 mm
- B = 185 mm
- C = 586 mm
- D = 96 mm
- E = 147 mm
- S = 1.25 in

Net weight

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller</td>
<td>4.5 kg</td>
</tr>
<tr>
<td>Pump Unit</td>
<td>12 kg</td>
</tr>
<tr>
<td>Motor</td>
<td>7.0 kg</td>
</tr>
<tr>
<td>Pump End</td>
<td>4.5 kg</td>
</tr>
</tbody>
</table>

Vmp*: MPP-voltage under Standard Test Conditions (STC): 1000 W/m² solar irradiance, 25 °C cell temperature

**By cutting the rubber spacers the diameter can be adjusted between 6" and 4" wells.
Well Probe

Mechanically Activated Device for Dry Run Protection in Applications with LORENTZ Solar Pump Systems

The switch can be used to detect the water level within a well. When the water level in the well dropped below the level of the well probe, the LORENTZ Controller will stop the pump and indicates Source Low LED.

FEATURES

- Reliable dry run protection
- Simple to install
- Trouble free operation
- Corrosion-free
- Splicing kit included

TECHNICAL DATA

- Max. operating temperature 55 °C
- Enclosure class: IP68
  Submersion depth: max 50 m
- Cable length: 1.5m
- Wire size: 2x 0.75mm² or AWG 19, waterproofed
- Mounted in vertical position

STANDARDS

- Meets the requirements for CE

DIMENSION/WEIGHT

- Packaging dimensions: 260 x 170 x 40 mm
  10.3in x 6.7in x 1.6in
- Total weight: 0.1kg / 0.2lbs
Float Switch
Mechanically Activated Device for Water Level Detection in Applications with LORENTZ Solar Pump Systems

The switch can be used to detect the water level within a tank. When the water level in the tank reaches the maximum, the LORENTZ Controller will stop the pump and indicates Tank Full LED.

FEATURES

• Reliable water level detection
• Simple to install
• Trouble free operation
• Not sensitive to rotation
• Corrosion-free
• Three wires for normally open and normally closed application

TECHNICAL DATA

• Operating temperature: -10°C to 55°C
• Storage temperature: -10°C to 55°C
• Enclosure class: IP68
• Cable length: 3m, waterproof
• Wire size: 3x 1.0mm² or AWG 18

STANDARDS

• Meets the requirements for CE

DIMENSION/WEIGHT

• Packaging dimensions: 230 x 160 x 55 mm
  9.1in x 6.3in x 2.2in
• Total weight: 0.8kg / 1.8lbs