DIY Solar Pump

Assembly and Installation
Congratulations on your DIY solar pump and to joint participation in shaping our future.

Pumpmakers is not just a vision – Pumpmakers is the route to realising a vision:

„Water and work“ even for remote areas of this world.

It all began in 2009.

Countless numbers of people waiting in front of a wind turbine for water – in vain, not enough wind.

A few kilometres further on, the same situation. One of the many hand pumps – faulty due to the maintenance that is constantly necessary.

A well with a generator-operated pump in the centre of the village – not working; running costs unaffordable.

THESE are the most frequently used water pump systems in the world.

Let’s change the future together sustainably with the DIY solar pump!

Diëtmär Stück
Managing Director PM Pumpmakers GmbH
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Basic explanation of the system

The DIY solar pump stands out because it is not dependent on consumable and therefore cost-based energy.

It was designed to provide a cheap option which is not dependent on any power supply for pumping water from drilled and dug wells.

It can also be used to replace existing pump systems, such as hand pumps, windmills or generator-driven submersible pumps.

The drive of the pump is located on the surface and is powered by means of electricity from solar panels.

The motor has a gear mechanism and drives a crankshaft via which an up and down motion takes place.

As a result of this up and down motion, the water is pumped to the surface by means of a pump piston which is located in the well.

The water escapes at the wellhead freely and without pressure and is collected in a tank.

The water tank may have several water outlets installed for a wide variety of uses, such as drinking water, irrigation, ponds and a water supply for nearby houses.

In addition, the water tank has an overflow from which the water escapes when the tank is full. The water from this overflow can in turn be collected in a pond for further use.
Safety precautions for the DIY solar pump

THE FOLLOWING APPLIES TO THE „DIY SOLAR PUMP“:

1 GENERAL INFORMATION

It is imperative to take these safety precautions for safe operation. Pay attention to the following warning signs:

- General hazard
- Risk of slipping
- Risk of crushing - hand area
- Risk of fire
- Risk of being rolled over / risk of crushing
- Electrical hazards
- Risk of whole body being trapped
- Special notes
- Do not climb on or up the mast
- Inspection Cleaning
- Do not enter the pump field
- Do not stand beneath overhead loads
- Risk of falling

2 BASIC SAFETY REGULATIONS

The danger zone during installation and during operation is defined as a potential accident radius equal to the height of the system. Those in charge must ensure and monitor overall safety at all times. This applies to the entire pump field and also during cleaning, maintenance and inspection of the plant.

Climbing on or up the mast is prohibited. Wilful damage to the overall system is prohibited. Only authorised persons and authorised and trained staff are permitted to work on the system. The person in charge will therefore hold offenders legally accountable. No liability is accepted for wilful damage and incorrect installation. Ensure that the DIY solar pump is in good mechanical condition.

Check the DIY solar pump for wear or damage. Climbing during installation poses a risk of falling at any time.

3 ACCESS PROHIBITED

Only trained and authorised staff are permitted to enter the pump field.
4 REGULAR OPERATION

Regular operation approved without exception by the manufacturer, within the meaning of the CE-KBV and the system, complies with the functions described in these operating instructions, including specified assembly and disassembly always in a correctly executed manner at the operating site and only in compliance with the approved temperatures. Any inappropriate use not described here is prohibited, will cause possible damage to the equipment and releases the manufacturer/distributor of all liability.

Any inappropriate use and operation other than the prescribed use in the disassembled and assembled state is prohibited and, in addition to damage to the systems, may result in danger to people and the restriction of safety. The „DIY solar pump“ must only be operated at temperatures between -40 °C and +60 °C.

5 BEARING ARRANGEMENT

During the cold season, a water drain must be constructed in the subsoil 1m from ground level to the water from freezing on days when the pumping station is not delivering any water. This can be constructed by means of a small hole for example. Please note that this reduces the flow rate. Any parts to be stored must be kept dry and covered and must be protected against damage.

6 SETTING UP

6.1 Installation safety precautions

Only carry out installation of and all activities on the „DIY solar pump“ during all work stages with appropriately standardised safety devices and with no people within the danger zone.

See country-specific regulations corresponding to Employers’ Liability Association (VBG - Verband der Berufsgenossenschaften, Germany) and Austrian Workers Compensation Board (AUVA - Allgemeine Unfallversicherungsanstalt) or Labour Inspectorate (AI - Arbeitsinspektorat, Austria).

Attention risk of slipping, crushing hazards for people and equipment!

Climbing on and up the mast only with safety equipment and safety and cable brake systems.

The commissioned foreman of the installation team shall be responsible for safety.

Pay attention to the risk of slipping and wear sturdy footwear due to the wet environment. Do not carry out the installation with bare feet!

Take care and bear the weight of the system in mind during installation.

Proceed strictly according to the operating instructions and use only the tools provided during installation.

There is always a risk of falling when climbing during installation.

6.2 Construction using crane

It is preferable to set up a crane, with all appropriate safety precautions on site, to prevent the DIY pump from falling over. The MVSO 2010 safety regulations, the requirements of the AUVA and the AI (Labour Inspectorate) shall be complied with in Austria.

Equivalent requirements of the Employers’ Liability Association apply in Germany (VBG - Verband der Berufsgenossenschaften).

The erectors themselves are responsible for safety, unless the erection is carried out by the erector’s service technicians themselves.

The following always applies: Self-protection by self-belaying.

1 MVSO 2010 ... Machinery Safety Order 2010 (Maschinensicherheitsverordnung 2010)
6.3 Manual construction

Manual erection after assembly poses special risks as special precautions against slipping and falling over of the lattice tower have to be specified here and there.

In particular, special precautions must be taken to prevent tipping if the lattice feet slip sideways. See installing the concrete foundation and bolting.

It must be secured against falling over. Special ratchet-operated securing systems and supporting beams must be used.

Do not stand beneath overhead loads.

Risk of falling!

7 CLEANING

Use only specified agents and methods for cleaning.
The „DIY solar pump“ is splash-protected; do not immerse it directly in liquids.
Send any equipment that has fallen into the water to the service team without delay!

Ensure before moving the „DIY solar pump“ that there are no people or objects in the danger zone around the „DIY solar pump“.

The same safety precautions apply when cleaning as during construction and maintenance.

Attention risk of slipping, crushing hazards for people and equipment!

Climbing on and up the mast only with safety equipment and safety and cable brake systems.
Never reach into the DIY solar pump or moving parts while the system is operating.
Clean the drive with a dry cloth if necessary.
It is imperative to clean the „DIY Solar Pump“ of any ice and snow.

8 OTHER WARNING SIGNS

9 CE DECLARATION OF CONFORMITY

The „DIY Solar Pump“ is CE certified and the CE Declaration of Conformity can be supplied on request.
Tools for assembly & installation

- Hammer
- Protective gloves
- Socket wrench set
- Combination open-ended/box-ended wrenches
- Screwdrivers
- Allen key set
- Strap wrench
- Water pump wrench
- Cartridge applicator gun
- Cutter
- Hacksaw frame
- Hacksaw blades
- Combination pliers
- Spring-tape measure
- Spirit level
- Tool box
- Cordless drill/driver
- Drill cassette
- Hole saw shaft
- Hole saws 41, 48, 60 mm
- Ladder
1a. The drive unit
1a. The drive unit

1a.1 Assembling the drive shaft

1.) Shaft
2.) Key
3.) Flange
4.) Spacer shaft 24 mm
5.) Bearing bracket
6.) Spacer shaft 74 mm
7.) Hexagon bolts with washers and nuts
1a. The drive unit

1a.1 Assembling the drive shaft

c

d

e

f

g

h
1a. The drive unit

1a.1 Assembling the drive shaft
1a.2 Securing the drive wheel

1.) Drive wheel  
2.) Hexagon bolt with washer  
3.) Hexagon bolts with washers and nuts
1a.3 Installing the electrical box

1.) Cover
2.) Cable distributor positive
3.) Cable distributor negative
4.) Fillister-head bolts with washers and nuts
5.) On-off switch
6.) Cable distributor 10 mm and 5 mm
1a. The drive unit

1a.3 Installing the electrical box

(a) [Image of the electrical box]

(b) [Image of hands holding a tool]

(c) [Image of someone installing a bolt]
1a. The drive unit

1a.4 Installing the electrical unit

1.) Negative connector
2.) Positive connector
3.) Lock nuts
4.) Self-sealing grommet
1a.4 Installing the electrical unit
1a.4 Installing the electrical unit
1a. The drive unit

1a.4 Installing the electrical unit
1a.5 Functional Test
1a. The drive unit

1a.6 Attaching the connecting rod

1.) Bearing housing with drive belt
2.) Crankshaft
3.) Countersunk bolts with washers and nuts
4.) Countersunk bolt
1a.6 Attaching the connecting rod
1a. The drive unit

1a.7 Attaching the lightning rod and cover

1.) Hexagonal bolt with washers and nut

(a) (b)
1a.7 Attaching the lightning rod and cover
1b. The tower structure
1b. The tower structure

1.) Drive unit
2.) Struts 1
3.) Cross struts 1
4.) Central struts
5.) Struts 2
6.) Cross struts 2
7.) Struts 3
8.) Cross struts 3
9.) Solar panel struts
10.) Bracket
1b. The tower structure

1.) Nuts
2.) Washers
3.) Bolts
1b. The tower structure

1b.1 Installing the outer struts and cross struts 1
1b. The tower structure

1b.2 Installing the outer struts 2
1b.3 Installing the centre struts
1b.4 Installing the cross struts 2
1b.5 Installing the outer struts and cross struts 3
1b. The tower structure

1b.5 Installing the outer struts and cross struts 3
1b. The tower structure

1b.6 Raising the pump tower
2. The pump pipes
2. The pump pipes

2.1 Installing the pump pipes

1.) Pipes  
2.) Teflon tape  
3.) Pipe clamping clip  
4.) Lifting cap  
5.) Wrenches  
6.) Cylinder wrenches

2.2 Measuring the well depth and water level
2.3 Creating the installation plan

5.) Full pipe 2 m - up to the surface
4.) Adapter 1 piece
3.) Full pipe 1 m – at least 1 piece (depending on well depth and water level)
2.) Filter pipe 1 m – at least 1 piece (depending on well depth and water level)
1.) Bottom cap for pipe 0.10 to 1 m – 1 piece (depending on well depth and water level)
2. The pump pipes

2.3 Creating the installation plan

<table>
<thead>
<tr>
<th>Installation date:</th>
<th>Number of counterweights:</th>
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<tbody>
<tr>
<td>Pumping test carried out in advance?</td>
<td>YES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>User:</th>
<th>GPS data:</th>
<th>Well diameter:</th>
<th>Well depth:</th>
<th>At-rest water level:</th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td>First name:</td>
<td></td>
<td>mm</td>
<td>m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Last name:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Company / organisation:</th>
</tr>
</thead>
</table>

- Filter pipes:___________m (1.00 – 3.00 m)
- Full pipes:___________m
- Full pipe:___________m (1.00 – 3.00 m)
- Sump pipe with bottom cap:___________m (0.50 – 1.00 m)
- Well depth:___________m
- At-rest water level:___________m measured from ground level
- Minimum water level:___________m measured from ground level (during the pumping test)
- Drinking water for ________ people
- Irrigation for ________ m²
- Pond with ________ m³
- Lowered water level:___________m
- Pumped water volume:___________m
- Drinking water for ________ people
- Irrigation for ________ m²
- Pond with ________ m³
2.4 Thread sealing and attachment of clamping clip

(a) 
(b) 
(c) 
(d)
2.5 Installing the sump pipe with bottom cap
2.6 Installing the filter pipes
2.7 Installing the pump piston adapter and full pipes
3. The pump piston
3. The pump piston

3.1 Installing the piston pump
3. The pump piston
4. The guide rod
4. The guide rod

4.1 Installing the guide rod

1.) Wrenches
2.) Lifting rod
3.) Cross strut 1 for guide bracket
4.) Cross strut 2 for guide bracket
5.) Guide bracket
6.) Guide
7.) Ratchet wrench
8.) Bolts with washer and nut
4. The guide rod

4.1 Installing the guide rod

a. [Image of installing guide rod]

b. [Image of guide rod detail]

c. [Image of guide rod in action]

d. [Image of guide rod with wrench]

e. [Image of guide rod close-up]

f. [Image of guide rod installation completion]
4. The guide rod

4.1 Installing the guide rod
4.2 Putting the belt in a vertical position and attaching the cross struts
4.3 Connecting the pump cable with lifting rod

(a) [Image]

(b) [Image]

(c) [Image]

(d) [Image] 17cm 6.5"

(e) [Image]
4.4 Adjusting the pump tower

a. Workers preparing for adjustments.
b. Measurement of the pump tower.
c. Detailed view of the adjustments being made.
d. Using tools to adjust the pump tower.
e. Workers ensuring stability during adjustments.
f. Final checks for levelness.
5. The wellhead
5. The wellhead

5.1 Installing the wellhead

1.) Wellhead top section
2.) Sealing ring
3.) Bolts with washer and nut
4.) Wellhead bottom section + outlet
5.) Screw connection with internal thread
6.) Double nipple
7.) Teflon tape
8.) Core drill with adapter
9.) Silicone
5.2 Measuring and cutting the pump tubes to size

(a) [Image showing a person measuring a pump tube with a tape measure]
(b) [Image showing a close-up of a pump tube with a marking]
(c) [Image of a person holding a blue pump tube]
(d) [Image of two people working on a pump tube]
(e) [Image showing a tape measure with measurements marked]
(f) [Image of a person attaching a clamp to a pump tube]
5.3 Attaching the wellhead
5.3 Attaching the wellhead
5. The wellhead

5.3 Attaching the wellhead

- **Step o**: Holding the wellhead firmly.
- **Step p**: Aligning the connection parts.
- **Step q**: Using a wrench to secure the connection.
- **Step r**: Final紧ening with a wrench.
5. The wellhead

5.5 Connecting the pump cable and lifting rod
5.5 Connecting the pump cable and lifting rod

g

h

i

j

k

l
5.5 Connecting the pump cable and lifting rod
5. The wellhead

5.6 Securing the well cover

1.) Well cover
2.) Cylinder head bolts
5.6 Securing the well cover

(a) 
(b) 
(c)
5.7 Attaching the counterweights

1.) Counterweight
2.) Countersunk bolts with washer and nut
5.7 Attaching the counterweights

<table>
<thead>
<tr>
<th>Water delivery head</th>
<th>Counterweights</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 m</td>
<td>33 feet</td>
</tr>
<tr>
<td>20 m</td>
<td>66 feet</td>
</tr>
<tr>
<td>30 m</td>
<td>100 feet</td>
</tr>
<tr>
<td>40 m</td>
<td>130 feet</td>
</tr>
<tr>
<td>50 m</td>
<td>165 feet</td>
</tr>
<tr>
<td>60 m</td>
<td>200 feet</td>
</tr>
<tr>
<td>70 m</td>
<td>230 feet</td>
</tr>
<tr>
<td>80 m</td>
<td>260 feet</td>
</tr>
</tbody>
</table>
6. The solar panels
6.1 Installing the solar panels

1.) Solar panels
2.) Struts
3.) Bolts with washer and nut
6. The solar panels

6.1 Installing the solar panels
6. The solar panels

6.2 Attaching the solar panel struts and mounting on the tower
6. The solar panels

6.2 Attaching the solar panel struts and mounting on the tower

![Image g]

![Image h]

![Image i]

![Image j]

![Image k]
6.3 Connecting the solar panels and attaching the signage
6.4 Functional test
7. The water extraction point
7.1 Installing the water extraction point

1.) Hose 1, 1/2 and 2 inches
2.) 90° elbow with 2-inch female thread
3.) Tank union 1, 1/2 and 2 inches
4.) Core drill bits set
5.) Screw connection with 2-inch internal thread
6.) Ball valve of PVC
7.) Teflon tape
7.1 Installing the water extraction point

c

d

e

f

g

h
7.1 Installing the water extraction point

7. The water extraction point
7.1 Installing the water extraction point
7. The water extraction point

7.1 Installing the water extraction point
7. The water extraction point

7.2 Installing the overflow

a

b

c
d

e

f
7. The water extraction point

7.3 Installing the water outlets

(a) Attaching the outlet nut
(b) Exposed outlet nuts
(c) Using a wrench to tighten
(d) Secured outlet nuts
(e) Assembling the hose connection
(f) Water flowing from the outlets
8. Lightning rod and foundation
8. Lightning rod and foundation

8.1 Installing the lightning rod and creating the foundation

1.) Rod
2.) Connection clamp
3.) Compression cable lug
4.) Cable
8. Lightning rod and foundation

8.1 Installing the lightning rod and creating the foundation

c

d

e

f

g

h

8.1 Installing the lightning rod and creating the foundation
8. Lightning rod and foundation

8.2 Creating the formwork and placing the concrete
9. The hand pump (optional)
9. The hand pump (optional)

9.1 Installing the optional hand pump

1.) Bearing bracket
2.) Shaft of hand pump
3.) Bolts with washer and nut
4.) Bearing pedestal
5.) Carabiners
6.) Cable thimbles
7.) U-bracket with pulley, countersunk bolt, washer and nut
8.) Pulley with axle, washer and nut
9.) Lifting eyebolt
10.) Eyebolt
11.) Cylinder head bolt
12.) Bracket
13.) Cable clamps
14.) Cable
9. The hand pump (optional)

9.2 Mounting the pulleys on the tower

a

b

c
d

e
f
9.2 Mounting the pulleys on the tower
9.2 Mounting the pulleys on the tower
9. The hand pump (optional)

9.2 Mounting the pulleys on the tower
9.3 Assembling and concreting in the lifting unit
9. The hand pump (optional)

9.3 Assembling and concreting in the lifting unit

Images:

- Image g: Person digging a hole in the ground with a shovel.
- Image h: Person using a hand pump in the hole.
- Image i: A lifting unit partially assembled with parts visible.
- Image j: Close-up of the lifting unit showing the lever mechanism.
- Image k: Close-up of a metal component with a bolt and nut.
- Image l: Hands using a wrench to tighten a screw on a metal beam.
9.3 Assembling and concreting in the lifting unit
9.3 Assembling and concreting in the lifting unit
10. The irrigation system (optional)
10. The irrigation system (optional)

10.1 Installing the irrigation system

1.) Hose
2.) Adapter
3.) Soaker hose
4.) Hose 1"
5.) Closure
6.) Water tap
10. The irrigation system (optional)

10.1 Installing the irrigation system
10.1 Installing the irrigation system
10. The irrigation system (optional)

10.1 Installing the irrigation system
10.1 Installing the irrigation system
10.1 Installing the irrigation system
Provide water & work