**Tender Document - Type Design.**

**Solar Energy based Dual Pump Piped Water Supply Scheme.**

**Technical Specifications of 1 H.P Solar Photovoltaic (SPV) DC and AC Submersible Pumps for Bore well (900 W Pump) suitable for the Bore well/Tube well of dia.115 mm and Distribution System as shown in sheet - 1.**

**Part A:**

**1 H.P Solar Photovoltaic DC and AC Submersible pump System Suitable for Bore well.**

**1) 1 H.P Solar Photovoltaic DC PUMPS:**

Solar Energy Based DC Submersible Pump Set should deliver 4500 to 6000 Liters of water per day at 90 metre head at 5- 6 kWh / Sq. m. / day solar irradiation incident as below :

- Installation of SPV system in Existing Bore well/Tube well in addition to existing Hand Pump for making it Dual Pump System (Sheet No 2), using Special Water Chamber ( Sheet No 3.)

- **System should be provided with:**

✓ Solar Energy Based DC Submersible Pump Set with cable wire 3 Core 2.5 mm $^{2,}$ Control Panel and protections with Rain Preventive Box.
✓ Solar Photovoltaic Panels with manual Tracking System (sheet-4) including foundation work (sheet 5) and fencing (sheet 6.)
✓ **Storage batteries will not constitute a part of this solar photovoltaic water pumping system.**

- **Solar energy based Submersible Pump Set:**

✓ Motor of the pump set should be Permanent Magnet DC Brush less type.(PMDC)
✓ Pump should be positive displacement type with Helical Rotors.
✓ Outer dia of the pump set should not be more than 96 mm.
✓ Out let of the pump should be 32 mm.
✓ **Wire to water efficiency should not be less than 50%.**

Detail technical specifications are as below:

**I ) Motor:**

Solar photovoltaic water pump should consist of a PMDC / BLDC submersible motor pump set, electronics if any, interconnect cable of 3 core, 2.5 mm$^2$ and MCB as below:

- 1 H.P - 900 W Submersible Motor.
- Rated speed 500-3600 rpm
- Maximum current input for solar drive 9.5 amps.

**II) Submersible pump:**

- ✓ Submersible pump should be positive displacement type with Helical Rotors,
- ✓ Outer dia of the pump set should not be more than 96 mm.
- ✓ Total head: 90 metre.
- ✓ Daily discharge: 5000 Liters at array of 5 – 6 kWh / m Sq. per day.
- ✓ Option for operating head from 15-90 m.
- ✓ Discharge range from 4500-6000 Liters per day.
- ✓ Light weight stainless steel pump and body.
- ✓ Suitable for 100 mm and above dia. Bore wells.
- ✓ Outlet size 32mm
- ✓ The overall efficiency of the motor pump set at 10 meter total head should be at least 40% and the efficiency of the submersible motor pump set should not be less than 50%.

**III) Cable:**

3 core flat 2.5 $mm^2$ Cable should be IS: 654 marked, sufficient to connect photovoltaic panels should be to the motor of submersible should be provided.

**IV) Solar Photovoltaic Panels:**

The SPV water-pumping system should be operated with a PV array measured under standard test conditions. Sufficient number of modules in series and parallel will be used to obtain the required PV array current, voltage and power output. The power output of individual PV modules used in the PV array, under STC, should be a minimum of 75 Watts, with adequate provision for measurement tolerances. Use of PV modules with higher power output (preferably 225 Wp and more) is encouraged to avoid associated power losses and ease of installation & maintenance. The PV module shall contain mono / multi crystalline Silicon solar cells. The PV module shall be as per IEC 61215 (revised) specifications or equivalent National or international standards.

1. Mono/Multi-crystalline Solar Panels.
2. Solar Panels should be installed on a steel column of 3 m high made up of Galvanized MS Square tube of 100X100X4.8 mm, with manually tracking arrangement.
3. **Solar Panels should not be mounted above HDPE tank to avoid hazards in regular cleaning of panels and maintenance.**
4. Adequate anti-theft fittings need to be provided for each panel.

**V) MOUNTING STRUCTURES & TRACKING SYSTEM:**

- To enhance the performance of Solar pumps it is desirable to use a Manual tracking system as shown in sheet- 4.
- The PV modules will be mounted on Galvanized metallic structures of adequate strength and appropriate design, which can withstand load of modules and high wind velocities up to 200 km per hour.
- Height of the panels from ground level should not be less than 3 metre. as per Design and drawing of the system.
- Protection to the system should be provided by the strong enough fencing and gate.

**VI) PROTECTIONS:**

Adequate protections should be incorporated against dry operation of motor pump set, protection against lightning, hails & storms. Full protection against open circuit, accidental short circuit and reverse polarity should be provided. Float system should be provided to avoid over flow from the storage tank (if any).

**VII) OTHER FEATURES:**

i) A good reliable MCB is to be provided with the motor pump set. Sufficient size & length of cable should be provided for inter-connection between the PV array and the motor pump set.
ii) The following details should be marked indelibly on the motor pump set and the photovoltaic modules:
(a) Name of the Manufacturer or Distinctive Logo.
(b) Model Number.
(c) Serial Number.
iii) An Operation, Instruction and Maintenance Manual, in English and the local language, should be provided with the solar PV pumping system.
The following minimum details must be provided in the Manual:
(a) About Photovoltaic
(b) About solar pump
(c) About PV module
(d) About motor pump set
(e) Clear instructions about mounting of PV module.
(f) About electronics used in AC motor pump sets, if any
(g) DO sand Don'ts,
(i) Clear instructions on regular maintenance and trouble shooting of the pumping system,
(j) Name & address of the person or Center to be contacted in case of failure or complaint.
iv) Components and parts used in the solar pumping system including the metallic structures should conform to the BIS specifications, wherever such specifications are available and applicable.
v) The PV module (s) will be warranted for a minimum period of 10 years from the date of supply and the complete Solar pumping system will be warranted for a minimum period of two years from the date of installation.
The Warranty Card to be supplied by the manufacturers with the system must contain the serial numbers of PV modules, motor pump set, electronics if any and the relevant dates about validity of warranty. The full name and address of contact person(s) for after sales service and warranty obligations must also be stated on the warranty card. A copy of warranty card will be provided to MEDA. The manufacturer can also provide additional information about the system and conditions of warranty as necessary. To ensure compliance of MNRE specifications, copies of data sheets of the PV modules, motor pump set, system design calculations, installation and O&M manuals and blank warranty cards, pass book for maintaining maintenance records etc. will be supplied by the manufacturers to User / MEDA. A copy of the drawing of the support structure will also be provided to User / MEDA.

**VII) WARRANTY (Defect liability Period) and Comprehensive Maintenance Contract (CMC) :-**

1. Complete system would be under warranty for a period of one year from the date of commissioning against any defects.

2. SPV Modules will contain warranty of 10 year for 90 % peak output 25 years for 80 % peak output from the date of commissioning of system.

**Comprehensive Maintenance Contract (CMC)**

Duration of CMC – 5 years excluding warranty period of 1 year.

Quarterly monitoring and performance report duly certified by authorized person is required to submit during Warranty and CMC period.

*** As the Solar Pumps being Installed for Drinking water solutions hence the guidelines issued by Ministry of Drinking Water & Sanitation, Govt. of India vide no. W-11044/02/2012-Water Dated: 17.09.2012 will be applicable.** (The circular is available in the link below: - http://www.mdws.gov.in/hindi/sites/upload_files/ddwshindi/files/pdf/Solar_energy_based_dual.pdf)

## 2) 1 H.P Solar Photovoltaic AC PUMPS:

Solar Energy Based DC Submersible Pump Set should deliver 4500 to 6000 Liters of water per day at 90 metre head at 5- 6 kWh / Sq. m. / day solar irradiation incident as below :

- Installation of SPV system in Existing Bore well/Tube well in addition to existing Hand Pump for making it Dual Pump System (Sheet No 2), using Special Water Chamber ( Sheet No 3.)

- **System should be provided with:**

✓ Solar Energy Based AC Submersible Pump Set with cable wire 3 Core 2.5 mm $^{2,}$ Control Panel and protections with Rain Preventive Box.
✓ Solar Photovoltaic Panels with manual Tracking System (sheet-4) including foundation work (sheet 5) and fencing (sheet 6.)
✓ **Storage batteries will not constitute a part of this solar photovoltaic water pumping system.**

- **Solar energy based Submersible Pump Set:**

✓ Outer dia of the pump set should not be more than **96 mm.**
✓ Out let of the pump should be 32 mm.
✓ **Wire to water efficiency should not be less than 50%.**

Detail technical specifications are as below:

**I ) Motor:**

A Solar Photovoltaic water pumping system consists of AC motor, pump set, Converter, controller, electronics, interconnect cables, an MCB and a Solar PV array mounted on a suitable GI structure with a provision of single axis manual tracking. Storage batteries will not constitute a part of the SPV water pumping system.

- 1 H.P - 900 W Submersible Motor.
- Maximum input power to submersible pump 900 Wp
- Minimum required array for submersible pump to start 900 Wp

**II) Submersible pump:**

- ✓ Outer dia of the pump set should not be more than **96** mm.
- ✓ Total head: 90 metre.
- ✓ Daily discharge: 5000 Liters at array of 5 – 6 kWh / m Sq. per day.
- ✓ Option for operating head from 15-90 m.
- ✓ Discharge range from 4500-6000 Liters per day.
- ✓ Light weight stainless steel pump and body.
- ✓ Suitable for 100 mm and above dia. Bore wells.
- ✓ Outlet size 32mm
- ✓ The overall efficiency of the motor pump set at 10 meter total head should be at least 40% and the efficiency of the submersible motor pump set should not be less than 50%.

**III) Cable:**

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**IV) Solar Photovoltaic Panels:**

The SPV water-pumping system should be operated with a PV array measured under standard test conditions. Sufficient number of modules in series and parallel will be used to obtain the required PV array current, voltage and power output. The power output of individual PV modules used in the PV array, under STC, should be a minimum of 75 Watts, with adequate provision for measurement tolerances. Use of PV modules with higher power output (preferably 225 Wp and more) is encouraged to avoid associated power losses and ease of installation & maintenance. The PV module shall contain mono / multi crystalline Silicon solar cells. The PV module shall be as per IEC 61215 (revised) specifications or equivalent National or international standards.

5. Mono/Multi-crystalline Solar Panels.
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7. Adequate anti-theft fittings need to be provided for each panel.

**V) MOUNTING STRUCTURES & TRACKING SYSTEM:**

- To enhance the performance of Solar pumps it is desirable to use a Manual tracking system as shown in sheet – 4.
- The PV modules will be mounted on Galvanized metallic structures of adequate strength and appropriate design, which can withstand load of modules and high wind velocities up to 200 km per hour.
- Height of the panels from ground level should not be less than 3 metre. as per Design and drawing of the system.
- Protection to the system should be provided by the strong enough fencing and gate.

**VI) PROTECTIONS:**

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(c) About PV module
(d) About motor pump set
(e) Clear instructions about mounting of PV module.
(f) About electronics used in AC motor pump sets, if any
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(i) Clear instructions on regular maintenance and trouble shooting of the pumping system,
(j) Name & address of the person or Center to be contacted in case of failure or complaint.
iv) Components and parts used in the solar pumping system including the metallic structures should conform to the BIS specifications, wherever such specifications are available and applicable.
v) The PV module (s) will be warranted for a minimum period of 10 years from the date of supply and the complete Solar pumping system will be warranted for a minimum period of two years from the date of installation.
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**VIII) CONVERTER:** Suitable converter should be provided to convert DC supply from Photovoltaic panels to into AC to power required for AC motor,

**Part B:**

**VIII) Distribution including overhead tank as shown in sheet No 7.**

**a) Overhead Tank :**

- Galvanized Steel staging (3m high) suitable for 5,000 liters HDPE tank,
- HDPE Water Tank capacity -5,000 liters. - IS: 12701
- Auto Water Level Controller.
- Distribution pipe line.
- Galvanized Stand Post (4 taps)/House hold water supply distribution system.

1. Tenderer should provide design and certificate from certified structural engineer at the time of submitting the bid.
2. Structure should be strong enough(Main columns and base frame for Overhead Tank should be made out of minimum of 70mm x 70mmx4.8 mm square tube)
3. Concrete foundation should be of size 500x500x1500(depth) -4 nos.
4. Foundation bolt – M -16X700mm (length)-16 nos. 4 nos. for each concrete foundation.
5. The structure should be sized to hold 5,000 liters HDPE water tank.
6. The structure should be hot dip galvanized.
7. Height at which the tank in kept is 3 mtr.
8. All frames of the structure should be as per approved design.
9. Overhead Tank Structure should be erected on suitable solid foundation made of reinforced cement concrete as per the ground requirement.

**IX) . Galvanized Tap Stand :-**

1. Tap Stand should be hot dip galvanized with having platform of 2mtr x 2mtr with proper drainage up to 3 mtr.
2. Stand should consist of 4 nos. of 1/2 inch taps at height min. 800 mm.

**X ) Plumbing :-**

1. Underground **UPVC piping** essential for all connections within the periphery of 15 mtr. from the bore well to overhead tank and overhead tank to stand post should be provided by the supplier.
2. Plumbing outside the periphery of 15mtr. will be paid extra as per the approved rates.

**XI. Civil Work :-**

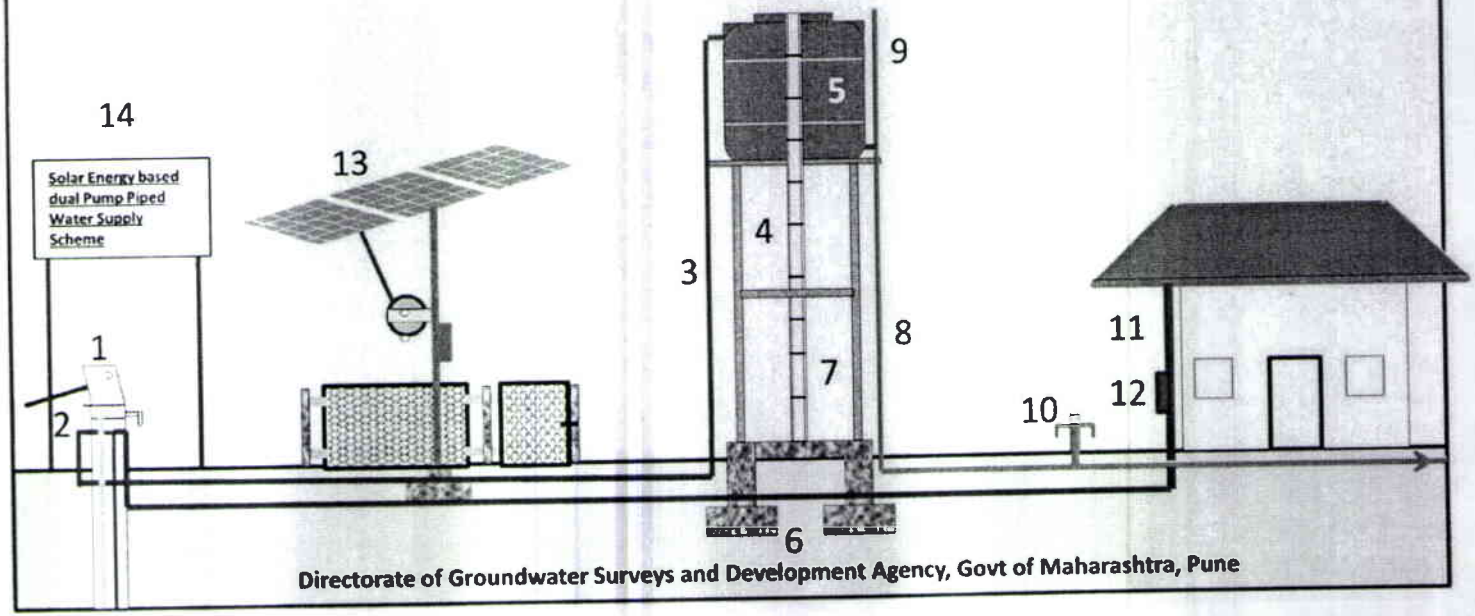
2. Civil work essential for erection of Overhead Tank Structure as per local site conditions and soil formation.
3. Civil work essential for erection and skirting of Stand Post – 2mtr x 2mtr.

# Sheet- 1

## Solar Energy based Dual Pump Piped Water Supply Scheme

### Legends

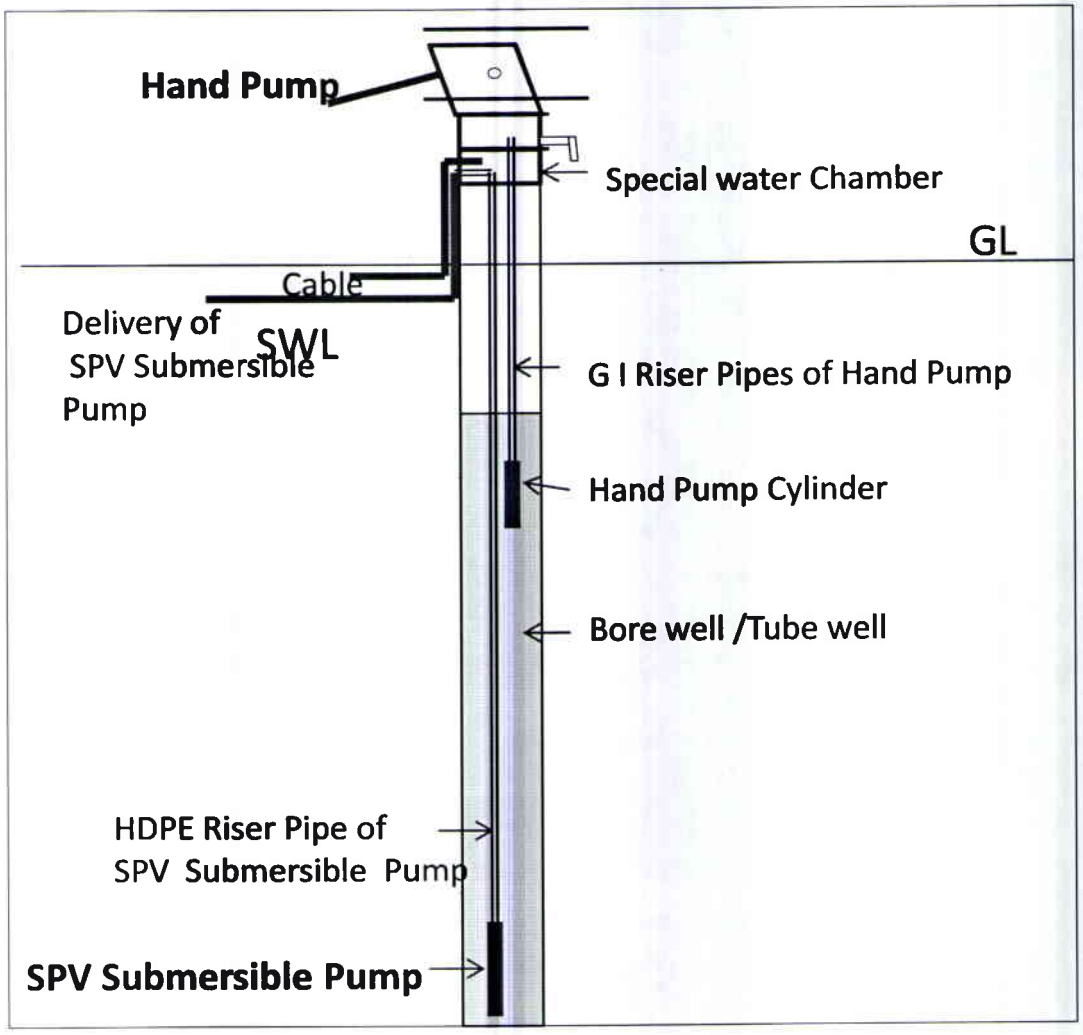
| | | | |
|---|---|---|---|
| 1 | Hand pump | 8 | Distribution Line |
| 2 | Special Water Chamber | 9 | Vent tube |
| 3 | Riser Pipe | 10 | Hose hold tap Connection |
| 4 | GI Steel Staging 3 m high | 11 | Rooftop Rain Water Harvesting Pipe |
| 5 | HDPE Tank 5000 Liters | 12 | Filter |
| 6 | RCC Foundation | 13 | Solar Photovoltaic Panels with manual tracking and fencing |
| 7 | Stair | 14 | Name plate |




Directorate of Groundwater Surveys and Development Agency, Govt of Maharashtra, Pune

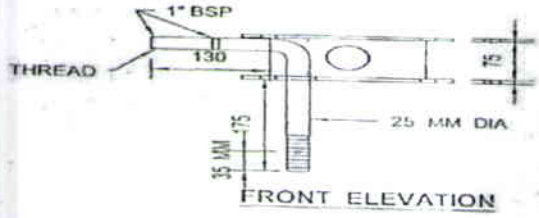
## Sheet -2

Schematic Drawing of Solar Energy based Dual Pump System.
Arrangement of two pumps in one Bore well

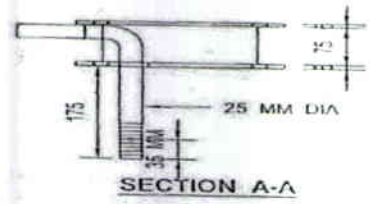


# Sheet -3

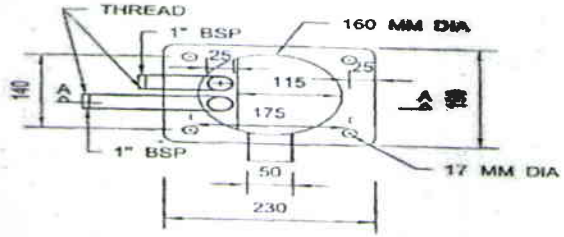
## Schematic Drawing of Special water Chamber




FRONT ELEVATION




SECTION A-A




TOP VIEW

DIRECTOR OF GROUNDWATER SURVEYS AND DEVELOPMENT
AGENCY PUNE
SCHEMATIC DRAWING
OF
SPECIAL WATER CHAMBER FOR DUAL PUMP SYSTEM.

NOTE

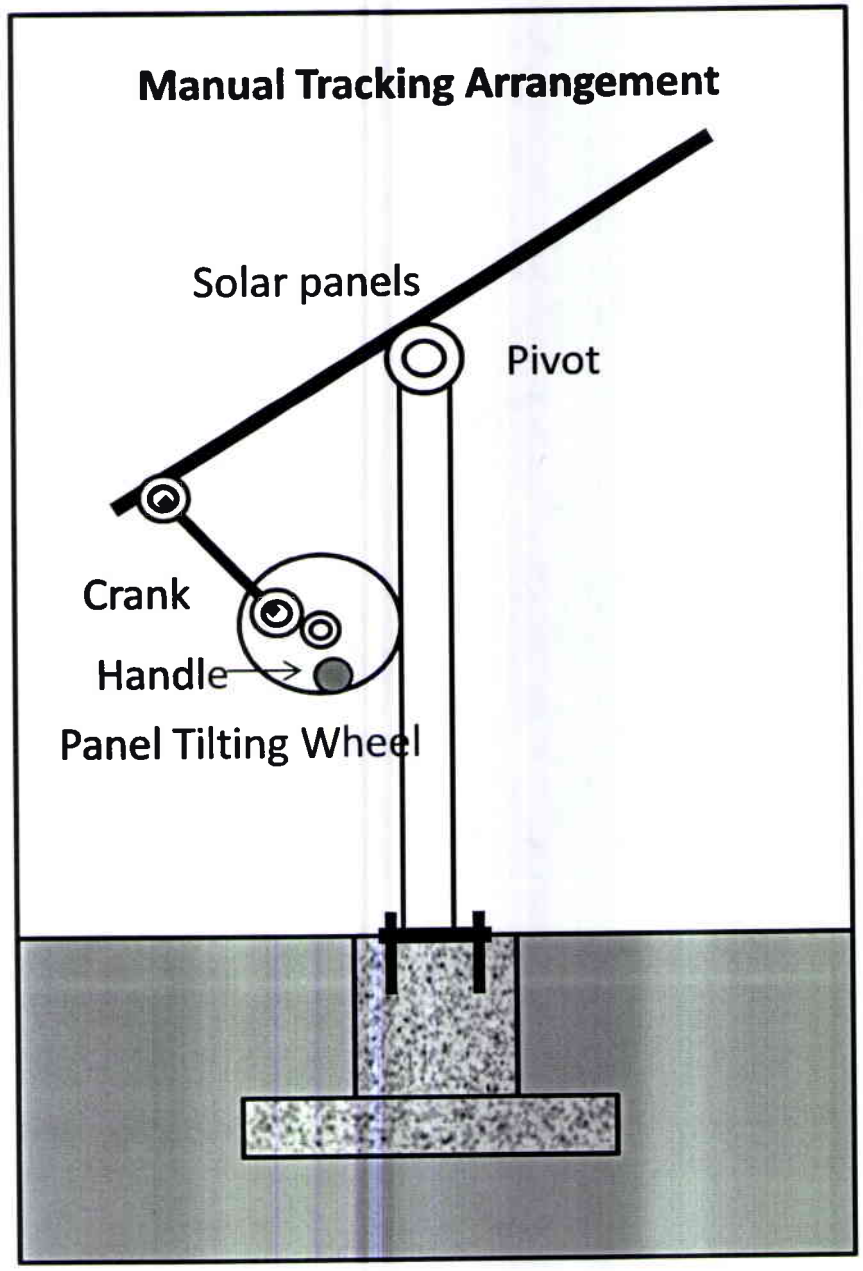
1) ALL DIMENSIONS ARE IN MM.
2) DRAWING NOT TO SCALE.

Prepared by
Dy.Engr.

Checked by
Sr.Drilling Engr.

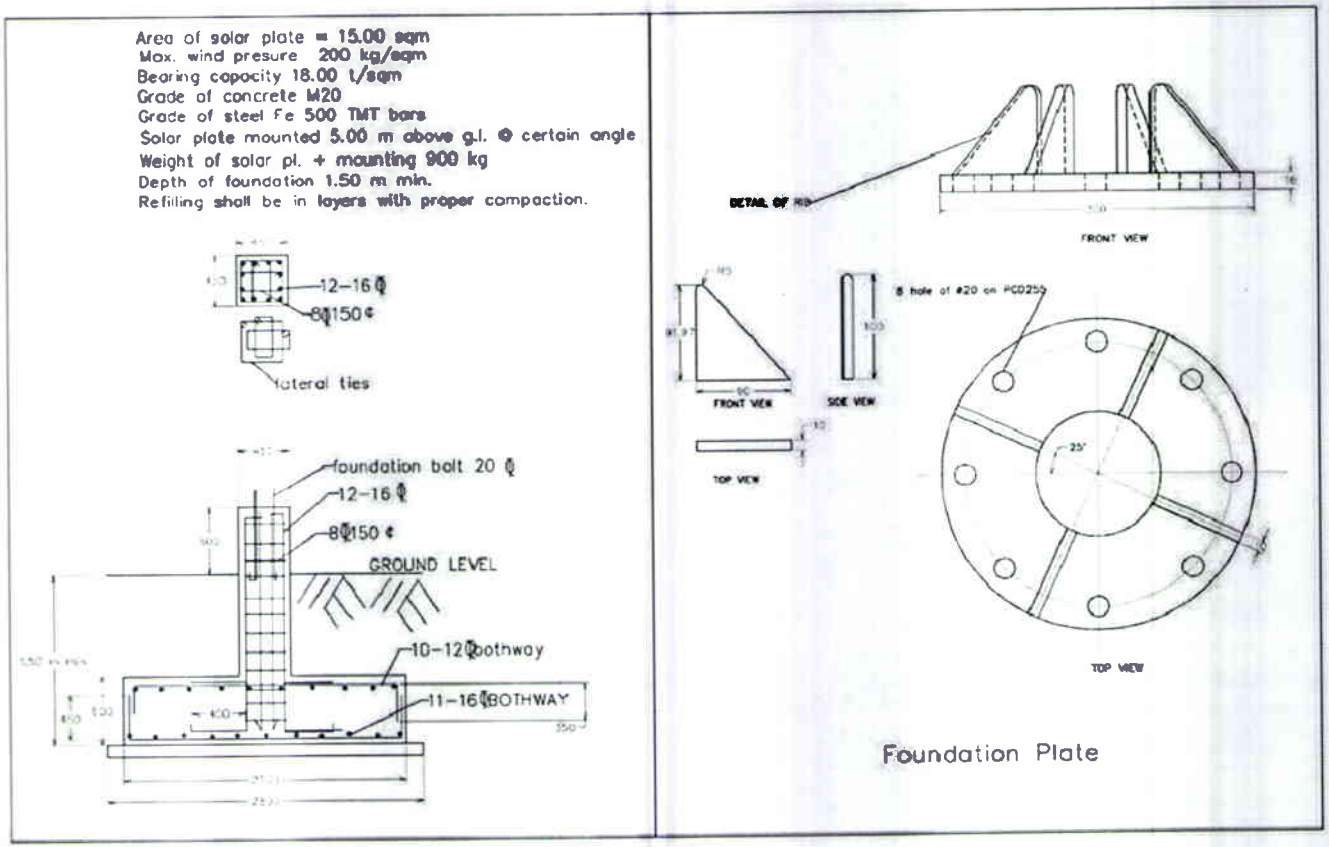
Approved by
Chief Drilling Engr.

**Sheet- 4**


Manual Tracking Arrangement
Solar panels
Pivot
Crank
Handle
Panel Tilting Wheel

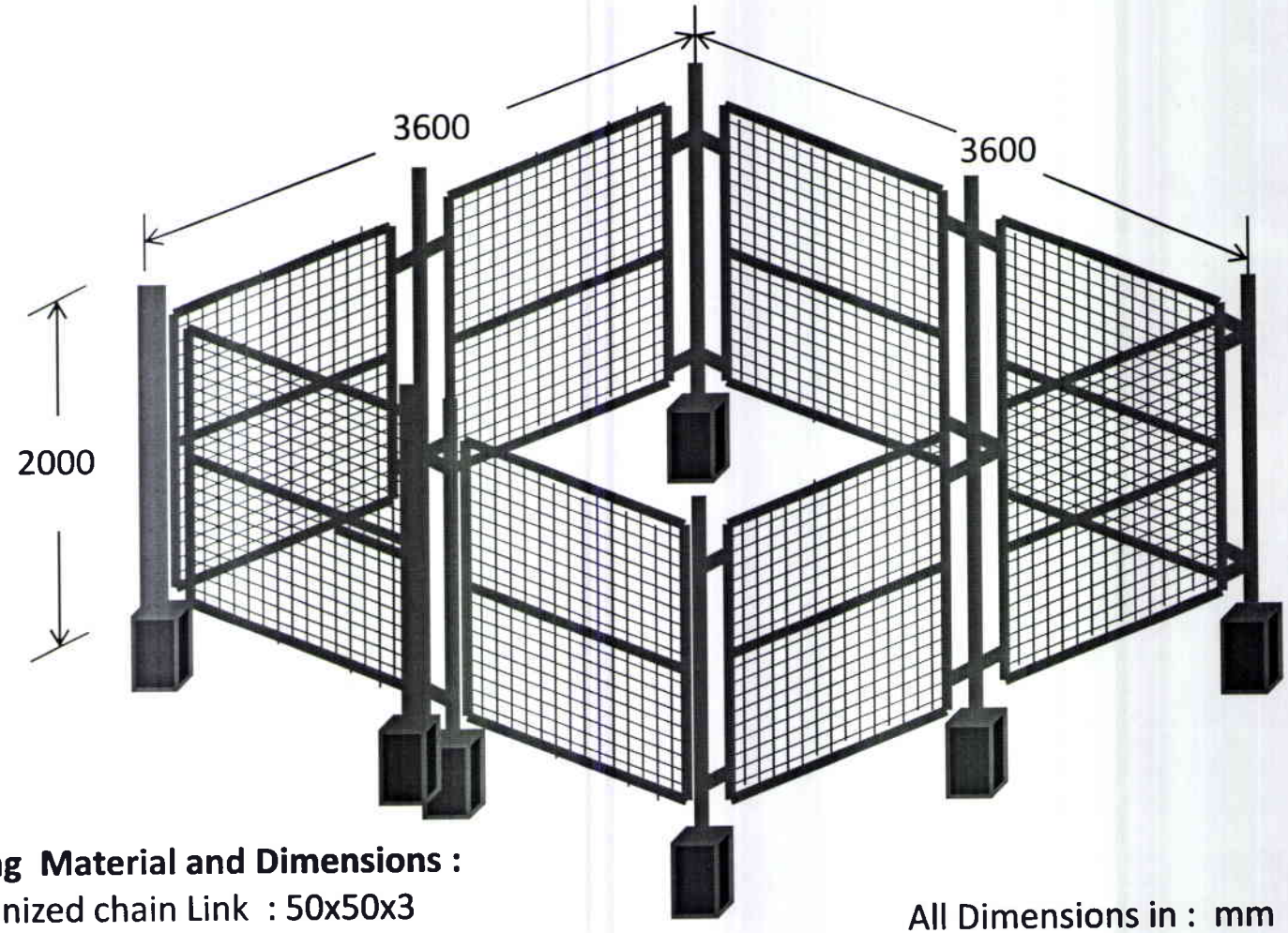
## Sheet - 5

# RCC foundation for Solar Photovoltaic Panel Tracking arrangement on single pole of 3 m height 100x 100x4.8 mm.



**Sheet No : 6**

**Fencing of Chain link for SPV Panels**




**Fencing Material and Dimensions :**

- Galvanized chain Link : 50x50x3
- Vertical C Channels : 75x40x5
- Chain Link Frame Angles : 40x40x5

All Dimensions in : mm

# Sheet-7

## Galvanized Steel Staging for 5000 Liters HDPE Tank