GOVERNMENT OF KHYBER PAKHTUNKHWA
IRRIGATION DEPARTMENT

Technical Bidding documents.
For Solar system in Kohat Irrigation Division Kohat.
For the following Projects.

For the Month of 22.03.2022.

	ADP#2359/180617Const: of Flood Protection Works, Irrigation Channels and Installation of Solar Tube wells in Khyber Pakhtunkhwa on need bases.
1	Supply & installation of solar pumping set for Irrigation Tubewell at Laghari Jadeed Walidad Koroona PK-86 District Karak. 6th time

Issued to……

Kohat Irrigation Division Kohat.

Appendix A to
Instructions to Bidders

NAME OF ELIGIBLE COUNTRIES

All countries of the World with whom Islamic Republic of Pakistan has commercial relations, in Construction Sector.

EVIDENCE OF BIDDER'S CAPABILITY

SYSTEM DESIGN FOR MANUAL TRACKING BASED SOLAR POWER PUMPING SETS

S No.	Name of Work	Discharge (I-GPH)	Head (Feet)	Setting (feet)	Water Horse Power (KW)	Pump efficiency	Motor Efficiency	Motor Input Power (watt)	Shaft Power (Watt)	Total PV Power (Watt)	PV Generator Peak Power (watts)				PV De-Rating Factor for Solar Panels as per Specification attached
											No of Strings in Parallel	No of Module/String in Series	Module Size	Total PV Generation	
	ADP#2359/180617Const: of Flood Protection Works, Irrigation Channels and Installation of Solar Tube wells in Khyber Pakhtunkhwa on need bases.														
1	Supply & installation of solar pumping set for Irrigation Tubewell at Laghari Jadeed Walidad Koroona PK-86 District Karak. 4th time	6000	400	350											

Application Form A – 1

General Information

All individual firms and each partner of a joint venture applying for qualification are requested to complete the information in this form. Nationality information is also to be provided for foreign owners or applicants who are forming part of the Joint Ventures as required under the PEC Bye-Laws as a Partnership/Joint Venture.

Where the Applicant proposes to use named subcontractors for critical components of the works or for work contents in excess of 10 percent of the value of the whole works, the following information should also be supplied for the specialist subcontractor(s).

1.	Name of Firm	
2.	Head Office Address	
3.	Telephone	Contact Person: Name: Title:
4.	Fax	
5.	Place of Incorporation/Registration	Year of Incorporation/Registration

NATIONALITY OF OWNERS		
	NAME	**NATIONALITY**
1.		
2.		
3.		
4.		
5.		

Application Form A – 2

General Experience Record

Name of Applicant or partner of a joint venture

All individual firms and all partners of a joint venture are requested to complete the information in this form. The information supplied should be the annual turnover of the Applicant (or each member of a joint venture), in terms of the amounts billed to clients for each year for work in progress or completed over the past five years.

Use a separate sheet for each partner of a joint venture.

Annual Turnover		
Year	**Turnover (in actual currency)**	**Equivalent Rupees in Millions**
1.		
2.		
3.		
4.		
5.		

Application Form A - 3

Joint Venture Summary

Names of all Partners of a Joint Venture
1. Lead Partner
2. Partner
3. Partner

Total value of annual turnover, in terms of work billed to clients,

Annual Turnover Data (Equivalent in Pak Rupees, Millions)						
Partner	**Form A-2 Page No.**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
1. Lead Partner						
2. Partner						
3. Partner						
Total:						

Application Form A – 4

Particular Experience Record

Name of Applicant or partner of a joint venture

On a separate page, using the format of Application Form A-5, each applicant or partner of a Joint Venture is required to list all contracts of a value equivalent to Pak ***Rupees 10 million*** *and above of a similar nature and complexity (Supply & Installation of Solar Based Pumping Machinery in any Public Work/NGOs) to the contract for which the Applicant wishes to qualify, undertaken during the last five years. The information is to be summarized, using Application Form A-5, for each contract completed or under execution by the Applicant or by each partner of a Joint Venture.*

Where the Applicant proposes to use named subcontractor(s) for critical components of the works or for work contents in excess of 10 percent of the value of the whole works, the information in the afore-mentioned forms should also be supplied for each specialist subcontractor.

Application Form A – 5
Details of Contracts of Similar Nature & Complexity

Name of Applicant or partner of a joint venture

Use a separate sheet for each contract.

1.	Name of Contract Country
2.	Name of Employer
3.	Employer Address.....
4.	Nature of works and special features relevant to the contract for which the Applicant wishes to pre-qualify ....
5.	Contract Role (Tick One) (a) Sole Contractor (b) Sub- Contractor (c) Partner in a Joint Venture
6.	Value of the total contract (in specified currencies) at completion, or at date of award for current contract Currency …….. Currency …….. Currency ……..
7.	Equivalent in Pak/Rs.
8.	Date of Award
9.	Date of Completion
10.	Contract Duration (Years and Months) _____Years _____Months
11.	Specified Requirements[1] ....

[1] *Insert any specific criteria required for particular operations, such as annual volume ofearthmoving, underground excavation, or placing concrete etc.*

Application Form A – 6

Summary Sheet: Current Contract Commitments/Works in Progress

Name of Applicant or partner of a joint venture

Applicants and each partner to an application should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which substantial Completion Certificate has yet to be issued.

Name of Contract	**Value of Outstanding work (Equivalent Pak Rs. Millions)**	**Estimated Completion Date**
1.		
2.		
3.		
4.		
5.		
6.		

Application Form A – 7

Personnel Capabilities

Name of Applicant

For specific positions essential to contract implementation, Applicants should provide the names of at least two candidates qualified to meet the specified requirements stated for each position. The data on their experience should be supplied on separate sheets using one Form for each candidate (Application Form A-8).

1.	Title of Position
	Name of Prime Candidate
	Name of Alternate Candidate
2.	Title of Position
	Name of Prime Candidate
	Name of Alternate Candidate
3.	Title of Position
	Name of Prime Candidate
	Name of Alternate Candidate
4.	Title of Position
	Name of Prime Candidate
	Name of Alternate Candidate

Application Form A – 8

Candidate Summary

Name of Applicant

Position		**Candidate** [Tick appropriate one] ☐ Prime ☐ Alternate
Candidate information	1. Name of Candidate	2. Date of Birth
	3. Professional Qualification	4. PEC Registration No.
Present employment	5. Name of employer	
	Address of employer	
	Telephone	Contact (manager/personnel officer)
	Fax	
	Job title of candidate	Years with present employer

Summarize professional experience over the last 10 years, in reverse chronological order. Indicate particular technical and managerial experience relevant to the Project.

Month/ Dates/Years		**Company/Project/Position/Relevant technical and management experience**
From	**To**	

Application Form A - 9
Equipment Capabilities

Name of Applicant

The Applicant shall provide adequate information to demonstrate clearly that he has the capability to meet the requirements for each and all items of equipment listed in the Evaluation Criteria 1.2 (v). A separate Form shall be prepared for each item of equipment listed or for alternative equipment proposed by the Applicant.

Item of Equipment		
Equipment information	1. Name of manufacturer	2. Model and power rating
	3. Capacity	4. Year of manufacture
Current status	5. Current location	
	6. Details of current commitments	
Source	7. Indicate source of the equipment ☐ Owned ☐ Rented ☐ Leased	

Omit the following information if it is owned by the Applicant or partner.

Owner	8. Name of owner	
	9. Address of owner	
	Telephone	Contact name and title
	Fax	
Agreement	Details of rental/lease specific to the Project	

Application Form A - 10
Financial Capability

Name of Applicant or Partner of a Joint Venture

Applicants, including each partner of a joint venture, should provide financial information to demonstrate that they meet the minimum requirements that the lead partner shall meet not less than 40 percent of all qualifying criteria and each of the partners shall meet not less than 25 percent of all the qualifying criteria given in Evaluation Criteria. All the above figures will be added together to arrive at JV's total capacity. Each applicant or partner of a joint venture must fill-in this form. If necessary, use separate sheets to provide complete banker information. A copy of the audited balance sheets should be attached.

Banker	Name of banker	
	Address of banker	
	Telephone	Contact name and title
	Fax	Telex

Summarize actual assets and liabilities in Pak Rupees (Equivalent at the current rate of exchange at the end of each year) for the previous five years, based upon known commitments, projected assets and liabilities in pak Rupees equivalent for the next two years.

Financial information in Pak Rs. or equivalent	**Actual: previous five year**					**Projected next two years**	
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. Total assets							
2. Current assets							
3. Total liabilities							
4. Current liabilities							
5. Profits before taxes							
6. Profits after taxes							

Specific proposed sources of financing to meet the cash flow of the Project, net of current commitments

Source of financing	**Amount (Pak Rs. or equivalent)**
1.	
2.	
3.	
4.	

Attach audited financial statements for the last five years (for individual applicant or each partner of joint venture).Firms owned by individuals, and partnerships, may submit their balance sheets certified by a registered accountant, and supported by copies of tax returns, if audits are not required by the laws of their countries of origin in case of foreign firms.

Application Form A - 11

Litigation History

Name of Applicant or Partner of a Joint Venture

Applicants, including each of the partners of a joint venture, should provide information on any history of litigation or arbitration resulting from contracts executed in the last five years or currently under execution. A separate sheet should be used for each partner of joint venture.

Year	Award FOR or AGAINST Applicant	Name of client, cause of litigation, and matter in dispute	Disputed amount (current value Pak Rs. or equivalent)

Check List

Yes	No	Check list
☐	☐	Valid PEC Certificate(s) in required category
☐	☐	Copy of valid dealer ship certificate
☐	☐	Application form (A-1), General Information
☐	☐	Application form (A-2), General Experience Record
☐	☐	Application form (A-3), Joint Venture Summary
☐	☐	Application form (A-4), Particular Experience (Record List of Solar based pumping machinery projects of similar nature and complexity completed in last five years and complexity in-hand.)
☐	☐	Application form (A-5), Detail of Contracts of Similar Nature and Complexity (Supply & Installation of Solar based pumping machinery)
☐	☐	Application form (A-6) Current Contract Commitments/Works in Progress
☐	☐	Application form (A-7), Personnel Capabilities
☐	☐	Application form (A-8) Candidate Summary (List of B.Sc. Engineers having relevant experience with their CVs and PEC Reg. No.& List of Associates Engineers (DAE) with their CVs having relevant experience)
☐	☐	Application form (A-9), Equipment capabilities
☐	☐	Application form (A-10), Financial Capability
☐	☐	Application form (A-11), Litigation History
☐	☐	Undertaking that all equipment listed in this document for qualification will be made available for the subject Project
☐	☐	Audited balance sheets for at least last three years and Bank statements
☐	☐	Undertaking that the Applicant has not been declared bankrupt
☐	☐	Original affidavit that the firm has not been black listed
☐	☐	Applicants legal status
☐	☐	Principal place of Business
☐	☐	Place of incorporation or registration
☐	☐	Certificate of registration with Income Tax & Sales Tax Department
☐	☐	Enlistment record with Government organizations and other agencies
☐	☐	Location of workshop facility, if any
☐	☐	Equipment's sole agencies represented by the Contractor
☐	☐	Written description of internal quality control program for specified works

EVALUATION CRITERIA

1.1 Eligibility for Qualification

Keeping in view the complexity of the Project, eligibility of Applicants for qualification evaluation is as mentioned below:

Sr. No.	Description	Yes/No
1.	Registration with Pakistan Engineering Council (PEC) in relevant category with field of specialization EE-11 **(Specified for Solar Energy)**	If "YES" the applicant will be Eligible for further Evaluation for qualification (copy of valid PEC certificate shall be attached).
2.	Blacklisting from any Government/Semi-Government Agency/Department.	If "YES" the applicant will not be Eligible for further Evaluation for qualification. (Original Affidavit on Judicial Stamp Paper that the firm has not been black listed from any Government/ Semi Government Agency/ Department till date shall be provided).
3.	System Design	System Design must be submitted in technical bid otherwise applicant will not be Eligible for further Evaluation.
4.	i. Firm must have ISO 9001-2008 certificate quality management system ii. Firm must have pumping machinery according to ISO 9906 Roto dynamic acceptance test. iii. Warranty period for solar panel etc will be 20 years and pumping machinery 2 – years for electrical/mechanical parts. iv. Firm must have 100 Million Accumulative turnover for last 3 Years in Solar Pumping System. Must be attached Sales Tax Returns, Income Tax Returns & Financial Audited Balance Sheets. v. Goods declaration (bill of entry) must be provided for each product (i.e Solar Panel, Pumps, Motors, Inverter & Tracker Sleeve Drive). vi. Performance curves at STC for both solar panel and pumping machinery	Attach Valid documents

		should be provided for each work separately along with bidding documents	
	vii.	The PV modules offered should not be more than One (01) year old with respect to the date of manufacturing.	
	viii.	Brand name(s) of PV modules, the supplier intends to supply must be included in the technical proposal.	
	ix.	Solar Manual Tracker slow speed DC Motors driven.	
	x.	Defect liability period of Electrical / Mechanical workswill be 2 years.	

1.2 Evaluation Criteria

Keeping in view the complexity of the Project works, criteria for qualification has been evolved by considering the prevailing market trends as mentioned below:

Sr. No.	Category	Weightage/Marks
i.	General Capabilities	10
ii.	Financial Soundness	20
iii.	Experience Record	30
iv.	Personnel Capabilities	20
v.	Equipment Capabilities	20
	Total:	100

Qualification will be carried out on the point scoring basis. Any applicant securing overall minimum score of 60 % as total will be considered as qualified.

An applicant may score below 60% in any one category provided it is not less than 50%.

Applicants having score of less than 60% in any two categories shall not be considered for further evaluation.

Qualification Evaluation Criteria

i) General Capabilities

a)	Copy of Valid dealer ship(pumps & solar panels) certificate from Sub-Contractor/JV Partner	2	▪ No marks will be given if license is not attached and 2 points will be added in case of valid certificate.
c)	Litigation History in which Decision has been given against the firm(s)	6	▪ In case the firm is involved in any litigation, -5 will be given and 6 points will be added in case original affidavit of no litigation is attached.
d)	Description of Internal Quality Control assurance program for Construction/ Erection/Maintenance	2	▪ 2 Marks will be given if Description is provided.
Total Marks Allocated			**10**

ii) Financial Soundness

Sr. No.	Description	Marks Assigned	Criteria for Marks Obtained
a)	Bank Certificate including Bank Credit Line (Evidence in Original from Guarantor Bank)	5	**<u>Bank Certificate (2-Marks)</u>** • 2 Marks are given if Original Bank Certificate is provided. **<u>Bank Credit Line (3-Marks)</u>** • 2 Marks are given if the available bank credit line limit is equal to 10 Million. • For limit less than 10 Million, use following weight-age: 2 x (A/50) • For the limit more than 10 million but less than 20 million use following weight-age:

			2 + (A/100) A = Available Bank Credit Line Limit • Full Marks are given in case of limit is 20 million or more.
b)	Audited Balance Sheets for at least last three years	5	• No marks will be given if Audited Balance Sheets are not attached. Two (2) points will be given for one year audited balance sheets, four (4) points for two years and full points for three years.
c)	Working Capital in last 5 years	5	• 3 Marks are given if the available average working capital for last three years is equal to 25 Million. • For the capital less than 25 million use following weight-age: 3 x (A/50) • For the capital more than 25 million but less than 50 million use following weight-age. 3+ (A/100) A = Average working capital in last three years. • Full Marks are given in case of limit is 50 million or more.
d)	Registration with income tax & sale tax department	5	• No marks will be given if NTN& GST Registration certificate is not attached and 5 points will be added in case of valid certificates.
Total Marks Allocated			**20**

iii) Experience Record

Sr. No.	Description	Marks Assigned	Explanation for Marks Obtained
a)	Projects of similar nature and complexity 4.0 Million each (Supply & Installation of Solar Based Pumping Machinery) completed in last five years in any Public Works Department/NGOs.	16	• 8 Marks are given if the applicant has completed at least 5 projects of similar nature in last five years. • For less than 5 projects completed use the following weight age. 8 x (A/5) • For more than 5 projects but less than 10 projects completed use the following weight age. 8 + (A/5) x 4 A = No of projects of similar nature completed in last five years • Full Marks are given in case of 10 projects or more.
b)	Projects of similar nature and complexity 4.0 Million each (Supply & Installation of Solar Based Pumping Machinery) in-hand in any Public Works Department/NGOs.	9	• 4 Marks are given if the applicant has completed at least 5 projects of similar nature in last five years. • For less than 5 projects completed use the following weight age. 4 x (A/5) • For more than 5 projects but less than 10 projects completed use the following weight age. 4 + (A/10) x 4 A = No of projects of similar nature completed in last five years Full Marks are given in case of 10 projects or more.
c)	Enlistment record with Government Organizations & other agencies	5	• 1 Mark for each enlistment up to maximum of five enlistments.
Total Marks Allocated			**30**

iv) Personnel Capabilities

Sr. No.	Description	Marks Assigned	Explanation for Marks Obtained
i)	B.Sc. Engineers registered with Pakistan Engineering Council (PEC)	14	**Experience (6-Marks)** • 6 Marks will be given if the individual relevant experience of at least 1 numbers of B.Sc. Engineer Electrical/Electronics/Mechanical (professional) is equal to 15 years or above. **Strength of Engineers (8 Marks)** • 4 Marks will be given if the total no. of Engineers registered with PEC is 3. • 8 Marks will be given if the total no. of engineers registered with PEC is 5 or above.
ii)	Associates Engineers (DAE)	6	**Experience (4-Marks)** • 4 Marks will be given if the individual relevant experience of at least 1 number of Associates Engineers Electrical/Mechanical (DAE) is equal to 8 years or above. **Strength of Associate Engineers (2 Marks)** • 2 Marks will be given if the total no. of Associate Engineers (DAE) are 3 or above.
Total Marks Allocated			**20**

v) Equipment Capabilities

Sr. No.	Description	Marks Assigned	Explanation for Marks Obtained
a)	1. Test Bed for verification / testing of Solar pumps along with all accessories as per ISO-9906 in company premises. (Firm must have Third Party Certification regarding Test Bed arrangements).	13	13 Marks for complete setup are given. (Attached Third Party Certificate)
b)	Workshop facilities. Attach layout sketch of workshop.	5	No marks will be given if Contractor has no workshop facilities.
c)	Equipment sole agencies represented by the Contractor	2	1 mark for each agency Upto maximum 2 points
Total Marks Allocated			**20**

Appendix C to
Instructions to Bidders

Domestic Goods (Value added in Pakistan)

NOT USED

SPECIFICATION FOR THE SUPPLY AND INSTALLATION OF SOLAR BASED PUMPING UNITS

1. SOLAR PANELS:

1.1 Solar cell type:

The photovoltaic cell should use technology of Mono Crystalline Silicon Cell with high efficiency and the w module efficiency should be minimum 17% or above. More power per square meter than other panel. Low temperature coefficient. The PV modulus have an ability to works well with high voltage input inverter/charger controllers (1000 Vdc). Fully automated production cycle, reducing sources of variation in production, Manufacturer should have their own in house solar cell and solar panel manufacturer facility.Multi award winning company should preferred.

1.2 Protections:

Panel should have series fuse rating of 15 Amp with a bypass diodes for reverse current protection. Junction box should be there with water resistant capability. Ingress protection of panel should be at least IP-65. Cable connectors should be ingress protected by at least IP-67 with application classification of class A. Panel should have capability to sustain its functionality with wind load of at least **3.8 KPa** & Robust frame up to **5400 Pa** snow load. Ammonia and salt mist corrosion resistance.

1.3 Material & finishing:

The encapsulation material must be Ethylene Vinyl Acetate (EVA) and its lamination with temperature safety glass. Special glass etching and anti-reflective coating.

1.4 Traceability:

A strip containing Serial number should be laminated inside the module so as to be clearly visible from front side.

1.5 Life Time and Warranty:

The PV cells should be designed for more than 25 years of its life with power decrease of not more than 20% after completion of 20 years. Solar panel should have at least 20 years of guarantee with all its subsystem. The PV module offered should not be more than one (01) year old with respect to the date of manufacturing. Unique Serial No of PV Modules and date (DD/MM/YYYY) of manufacturing should be laminated inside of the module to make it clearly visible from the front side. Brand name of PV modules, the supplier intends to supply must be included in the technical proposal.

1.6 Wiring:

Panel wire should be specifically designed for solar usage with Plug and play connectors. Wiring should have compatibility of field serviceable contact removal.

1.7 PID Free Certification:

Potential Induced Degradation (PID) refers to potential induced performance degradation in crystalline photovoltaic modules. It occurs when the module's voltage potential and leakage current cause ion mobility within the module. The degradation accelerates with exposure to humidity, temperature and voltage potential. Consequently, PID can have a profound adverse effect on the financing and operation of PV plants. PID tests simulate the practical conditions in the PV system, and verify the module performance and power output under high voltage and temperatures.

1.8 Standard Conformity:

The PV module should fully conform to following specifications.

- IEC 61215-1 : 2016
- IEC 61215-1-1 : 2016
- IEC 61215-2 : 2016

- IEC 61730-1 : 2016
- IEC 61730-2 : 2016
- IEC-61701(latest).
- IEC-62716.
- IEC-60068-2-68.
- PPP58042

1.9 Submittals:

Following details should be provided in Technical Bid otherwise bidder will not eligible for further evaluation:

- PID Free Certificate from TUV.
- TUV certification of IEC-61215:2016 and IEC-61730: 2016 Conformity.
- I-V curve for solar photovoltaic module panel.
- PV module efficiency at STC.

Note: All above mentioned certificate must be provided for offered panel and all information regarding solar panel with above mentioned featured data,EL and Flush test report from manufacturer for each panel should be accessible and verifiable online on manufacturer website or verifiable in writing from the manufacturer through fast track courier.

2. INVERTER/CONTROLLER:

The solar pump controller should have built-in MPPT controller, Voltage Frequency (V/F) regulation, over load protection, soft start/ soft stop features and variable frequency Drive (VFD) with integrated Gate Bipolar transistors. The make and origin of the inverter/controller should be of Japanese and European origin or approved equivalent and clearly mentioned in the technical proposal. The inverter offered should comply to or equivalent standards:

- CE/ROHS/international standards (ISO 14001, OHSAS 18001 applicable).
- Low Voltage Directive 2014/35/EU with supplements.
- EMC Directive 2004/108/EU with supplements.
- The efficiency of inverter should be 92% and above.
- Inverter should have at least three (3) years extendable to 10 years' performance warranty.

2.1 Inverter circuit must include protection against:

- Over or low voltages and currents beyond critical level of the inverters circuits.
- Protection against accidental short circuits & reverse polarity connections.
- Over load protection.
- Low RPM protection (i-e: efficiency < 30 Hz) Motor should be stop.
- Dry run protection.

2.2 Submittals:

Following details should be provided with the tender submission.

- LVD certificate
- Origin country Certificate for module quality
- CE marking
- Test report for weather-Proof Test (IP65)

The complete datasheet showing all the electrical parameters like input & output voltage ranges should be provided in the technical bid.

3. MOUNTING STRUCTURE:

The panel mounting structure should be made of hot dipped galvanized steel pipes, or epoxy coated mild steel pipes (minimum wall thickness 2.5 mm) and should have the provision for vertical (east to west) automatic Sun-Tracking by slewing drive. A sketch of the mounting frame showing dimensions of the frame parts should be provided in the technical proposal.

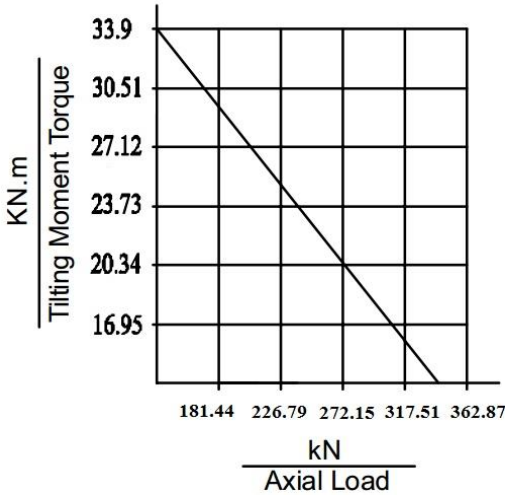
4. Manual TRACKING SYSTEM: (As per BOQ).

The tracker offered should be fabricated from GI pipes or channels having minimum wall thickness of 2.6 mm. It should have large mounting capacity 4000 Wp to 5500 Wp in order to achieve better land area utilization. The tracker offered should have robust structure capable of withstanding 150 km/hr wind speed. The tracker structure should rest on standard 9-Inch gear drive/ slewing drive having following minimum specifications. Three years' comprehensive free replacement, repair and maintenance warranty (Free of cost) should be provided for all components of Manual tracker (including Batteries).

Detail catalog showing material specifications, load characteristics, make & origin of the slewing Drive and rated speed, voltage and power of the DC motor used must be provided in the Technical Proposal.

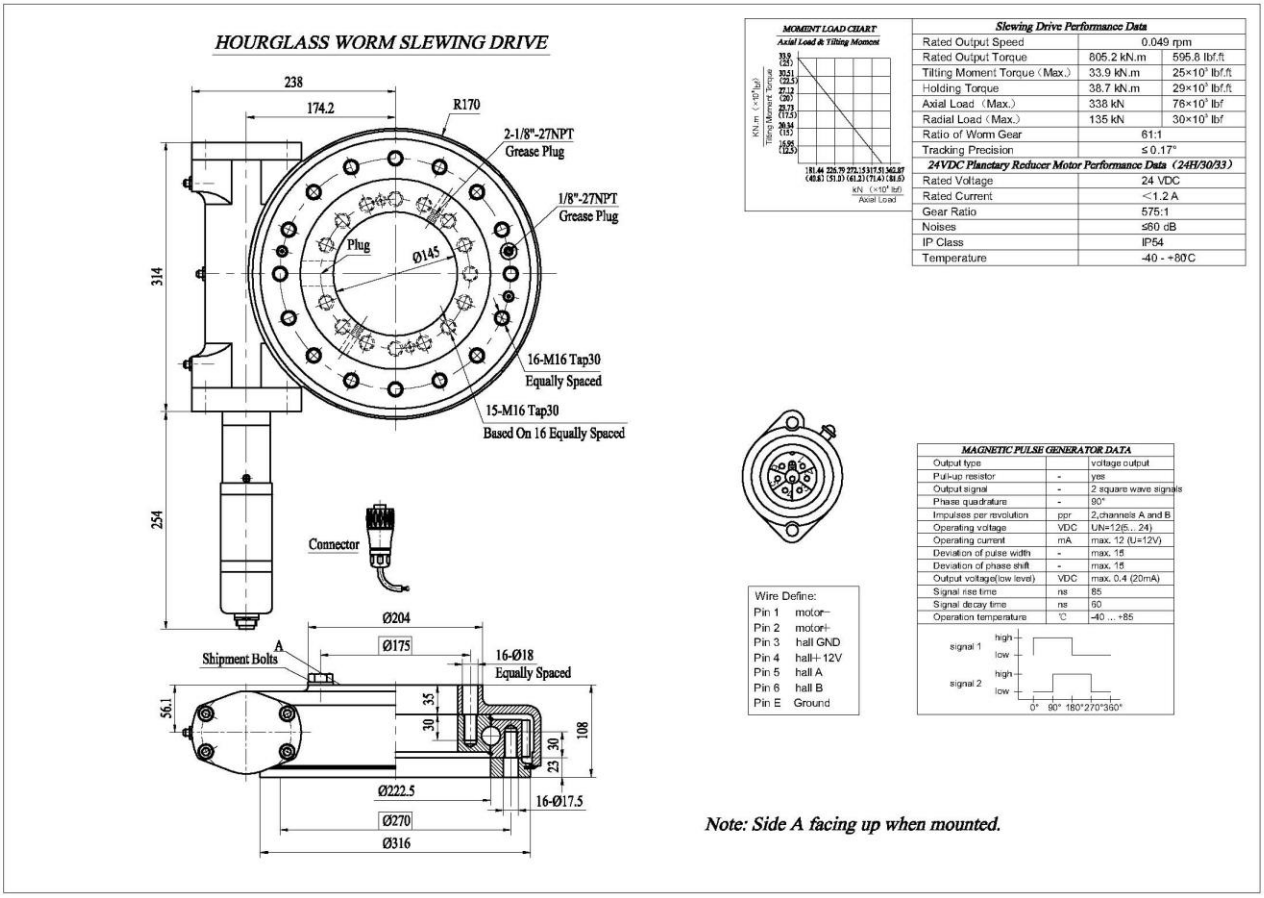
Slewing Drive Performance Data		
Rated Output Speed	0.049 rpm	
Rated Output Torque	805.2 kN.m	595.8 lbf.ft
Tilting Moment Torque（Max.）	33.9 kN.m	25×10^3 lbf.ft
Holding Torque	38.7 kN.m	29×10^3 lbf.ft
Axial Load （Max.）	338 kN	76×10^3 lbf
Radial Load（Max.）	135 kN	30×10^3 lbf
Ratio of Worm Gear	61:1	
Tracking Precision	≤ 0.17°	

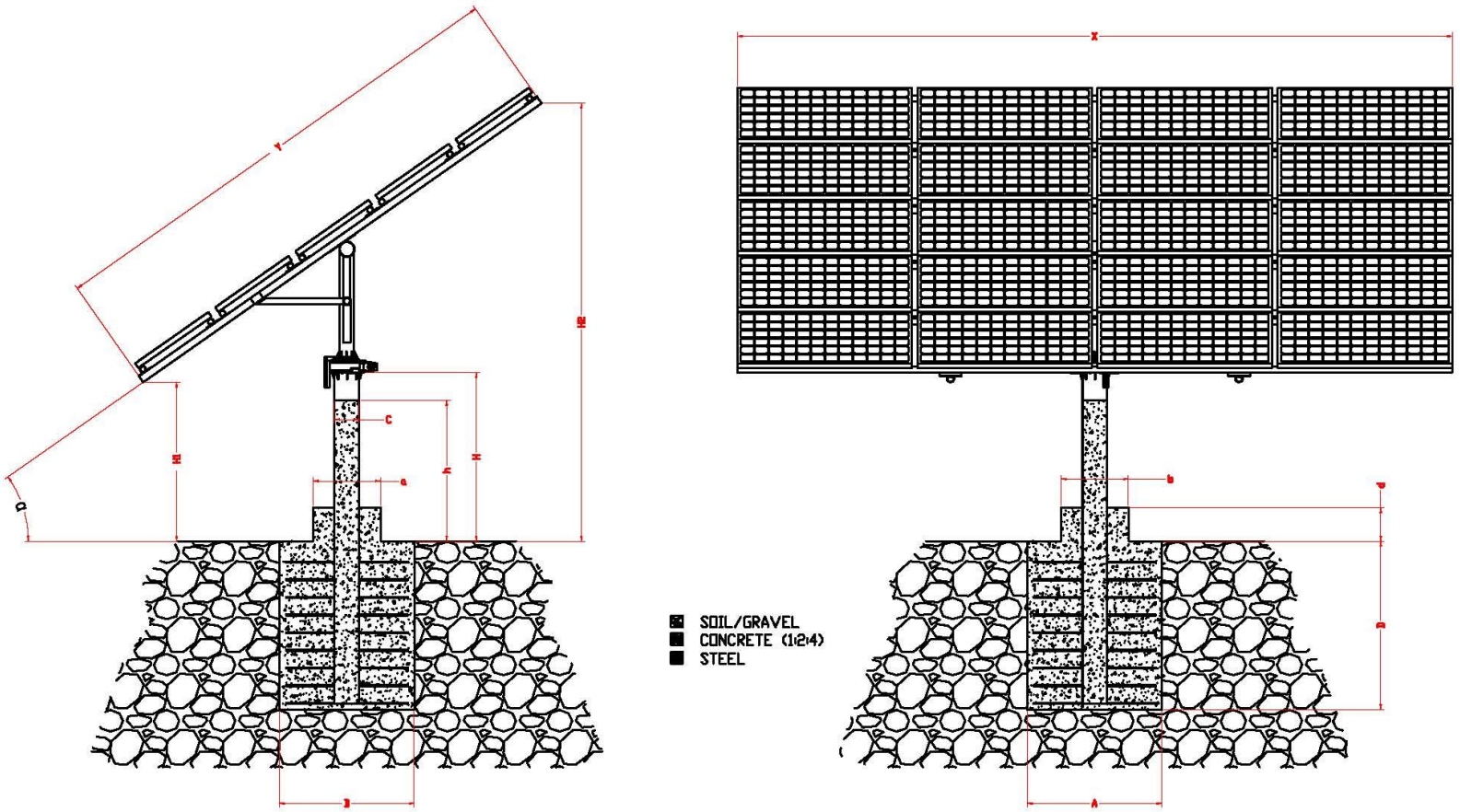
The tilting moment/ axial load characteristics should meet or exceed the following



The slewing drive offered should be maintenance free. The drive control should be

fully autonomous and based on real time sun sensing (not timer based control). There should be safety limit switches to restrict the movement of tracker. The control should have protection for tracker overloading due to jamming and or other reason. There should be provision for manual movement of tracker. Reference drawings showing concrete plan, general dimensions and slewing drive size are enclosed herewith.





General Dimensions and Concrete Plan of Single Pole PV Mounting Structure with Single Axis Tracking System

Sr. No.	Type/Size	X (ft)	Y (ft)	H1 (ft)	H2 (ft)	α	A (ft)	B (ft)	D (ft)	a (ft)	b (ft)	d (ft)	C (in)	H (ft)	h (ft)
1	5/72x20	20.7	13.25	>3	<12	30-36	4	4	5.5	2	2	1	8	4.5	4
2	5/72x21	18.5	15.55	>3	<12	30-36	4	4	5.5	2	2	1	8	4.5	4
3	6/60x18	19.52	16.10	>3	<12	30-36	4	4	5.5	2	2	1	8	4.5	4
4	6/60x20	21.5	16.27	>3	<12	30-36	4	4	5.5	2	2	1	8	4.5	4

5. SYSTEM DESIGN/SIZING:

De-rating factors should be applied while designing the system in order to have compensations for variations in irradiance. The motor output (BHP) should be at least **20%** more than the pump required input power (Shaft Power). Also the panel peak power at STC (Wp) should be **50%** more than the maximum required input power of the motor (motor consumption).

6. PRE-SUPPLY TESTING & INSPECTION:

The firm applying for the tender must have test bed facility to carry out pump performance acceptance test witnessed by third party inspector/Client as per ISO-9906 standard. Each of the offered pump set models must undergo this witness test prior to supply and installation.

7. DC CABLE / WIRING:

99% copper wires of size at least 6 mm for single and 6 mm or above for multi strings and rated current 30A to be used. Working temperature range should be in between -40C to +85C. The cable must have double insulation suitable for 1000 VDC transmission, and all the relevant test reports i.e.

- Conductor resistance test.
- Insulation resistance test.
- Pressure test.
- Spark test.

Are to be provided in the technical proposal. The wiring must be protected by PVC conduits for underground installations. DC circuit breakers (not fuse) of at least 800V and suitable ampere rating must be installed between PV modules and PV pump controller in order to avoid short-circuiting. No direct jointing in DC power line is allowed, junction boxes of at least IP-44 rating are to be used for easy debugging where necessary. The cable should have safety level class II and standard flame class. Shell protection degree should be IP67 with connector rating IP67 (plug and play). The insertion and withdrawal force up to 50N can be bearable by the cable.

The Supplier should provide the manufacturer quality tests certificates at the time of supply.

SPECIFICATIONS FOR PUMPING MACHINERY AS PER ISO-9906 STANDARD

1. PUMP:

Pumps are to be supplied having standard ISO-9906 specifications. The pump must be submersible, made of stainless steel. The characteristic curves showing the efficiency and performance of the pumps are to be provided in the technical proposals. The quoted pump is to be tested for its performance and certified as per ISO-9906 standard. The pump must be suitable for installation and operation in tube wells/dug wells/open well with clear water discharge. Pump shall comprise of bowl assembly and non-return valve as integral part of pump's parts. Pump and motor shall rigidly couple through NEMA standard coupling. The stage casings of pumps should be connected as per NEMA/ANSI/AWWA/ASTM/BSS standard. Each stage casing must have replaceable wear ring. The impellers shall be secured to the pump shaft with tapered conical sleeves pressed into the taper bore of impeller or impeller secured through chrome plated stainless steel hexagonal sleeves. Suction casing must be between pump and motor with suction strainer as protection of pump against coarse impurities of the liquid handled.

Specification for Main Components of the Pumps:

1.1 CASING/DIFFUSER: The Casing/Diffuser should be in fabricated stainless steel AISI 304.

1.2 IMPELLERS: stainless steel AISI 304

1.3 DRIVING SHAFT: Stainless steel 304/420

1.4 SLEEVES: Stainless steel AISI 329/ 304

1.5 GASKETS: Rubber Gaskets

1.6 BEARINGS: AISI 329 stainless steel

1.7 COUPLING & SCREEN + CABLE GUARD: Stainless steel AISI 316/319/304/420

1.8 NON-RETURN VALVE: As per British standard specifications (BSS), Minimum 16 bar pressure sustaining design

1.9 PRESSURE GAUGE: As per British standard specifications (BSS), having PSI or Bar scale

1.10 CLAMPS: Steel – Pressed

1.11 PUMP EFFICIENCY: Minimum efficiency of the pump should be 70% at duty point

2. MOTOR:

The origin, make and material of the motor should be clearly mentioned in the technical proposal. The winding material should be 99.99% copper. The motor should have wet type, water cool rewind-able/repairable stator. The motor should have non-disposable/non-hermetically sealed winding. The insulation class of the winding material should be mentioned. For each model quoted, all the technical parameters such as rated voltage, power factor, efficiency, full load ampere, speed and other similar parameters should be provided in the technical proposal. The testing report with all basic parameters should also be provided at the time of supply.

The motor shall be manufactured in compliance with National Electrical Manufacturer Association (NEMA) standards. The motor shall be three-phase submersible and shall be capable of operating at rated voltage of 380 Volts at 50 Hz. The motor should be capable of operating with variable speed through V/F control. Winding of the motor shall of rewind able type with class – IC40 insulation and IP68 protection. The

synchronous speed should be 2850-2950 RPM. Motor shall be capable of operating in well water with temperature starting from 40C. Motor should be designed for continuous operation. Motor must be filled with water without any chemical additives hazardous to health, for cooling. The motor must be properly protected against the entry of well water sand etc. by double mechanical seal i.e. one rotating and other stationary and the seal must be made of Silicon carbide/ Tungsten carbide and must be protected with sand protection guards. All supports shall be high grade cast iron and stator outer side jacket body should be in stainless steel in AISI 304. The excessive pressure due to heating up of the filled water must be compensated by a pressure equalizing rubber diaphragm in the lower part of the motor. The axial thrust of the pump shall be countered by oscillating sliding block type thrust bearing. The thrust bearing of the motor should be able to bear a download thrust force from the water pump and the upward thrust force produced while starting the water pump. Motor shall be capable of minimum of 20 starts in an hour. Motor efficiency should not be less than 70%.

Material/technical specifications of rewind-able wet stators, three phase squirrel cage water filled submersible motor.

2.1 WINDING: Made of pure electrolyte copper a non-hygroscopic poly vinyl chloride for normal temperature and must full fill resistant tests range.

2.2 STATOR: Energy efficient low-losses electrical magnetic sheet should be fixed in stainless steel casing. M800 or M600 magnetic sheet are preferable to use.

2.3 ROTOR: Energy efficient low-losses electrical magnetic sheet fixed with high grade copper bars. M800 or M600 magnetic sheets are preferable to use.

2.4 SPLINE SHAFT: AISI 420 stainless steel, flange dimension according to NEAM standard, over size design to ensure stiffness n severs condition.

2.5 SHAFT BEARING: Water lubricated guide/general bearings fixed in upper and lower brackets should be made of metal impregnated carbon.

2.6 LOWER THRUST BEARING: Thrust sliding block bearings, self-aligning Mitchell type, should be able withstand 15500N/20000N axial load.

2.7 MECHANICAL SEAL (STATIONARY & ROTARY): Silicon carbide or tungsten carbide mechanical seal.

2.8 COOLINGFILLING FLUID: Water mixed with non-toxic anti-freeze provides cooling and lubrication also protect and prevent inside parts from corrosion.

2.9 DEGREE OF PROTECTION: IP68

2.10 INSULATION OF CLASS: Class B.

2.11 VOLTAGE TOLERANCE: -6% to -10%

2.12 MOUNTING POSITION: Vertical horizontal

2.13 Class: IC40

2.14 MAXIMUM IMMERSION: 150 Meters

2.15 STATING PER HOUR: 20

3. SUBMERSIBLE FLAT ELECTRIC CABLE:

The submersible cable should be made of 99% copper coated with double PVC, should be adequately flexible and environment friendly. The cable must have undergone quality tests as per BSS standards. Following lab tests are mandatory.

- Conductor resistance test.
- Insulation resistance test.
- Pressure test.
- Spark test.

Note: The Supplier should provide the manufacturer quality tests certificates at the time of supply.

4. COLUMN PIPE:

The column pipe shall be flanged ERW steel pipes confirming to ASTM designation A-53 with a minimum thickness of 3.5 mm and shall be painted with corrosion resistance paint of suitable thickness. Flanges thickness of 20 mm shall have grooves for cable passage. Each column pipe shall be complete with gaskets, bolts/studs, washers and nuts. All nuts, bolts, and washers shall be made of minimum A2 grade stainless steel.

The column pipe shall be supplied in interchangeable section having an approximate length of 10 feet. The flanges should be welded perfectly perpendicular to the axis of the pipe.

FEATURES:

- Manufacturer's pipes should meet international standards like BSEN 10255 &ASTMA 53.
- Dimensional accuracy circularity and plan end cut should be observed,
- Weld strength of pipe and mechanical properties or raw material should be tested as per manufacturing standards.
- Pipes should be NDT tested (Non-destructive – Eddy current)
- Pipes should be tested for hydrostatic pressure as per manufacturing standard.
- Pipes should be gone through straightening process to remove bendiness.

5. TOP SET:

Top set shall comprise of Bore covers plate, (covering bore hole completely and securely), installation/suspension clamps, sluice valve, reflex valve, connector and cable jointing material (Cable connection from motor to switching device shall be joint free) pressure gauge and cable ties.

SPECIFICATION FOR THE SUPPLY AND INSTALLATION OF SOLAR BASED LIGHTING SYSTEM

The bidders are also required to supply and install solar system with battery backup for lighting up the pump premises and ceiling fan in operator room. The specifications for the major components of the system are as under:

1. PV Modules:
(As described in the specifications for supply and installation of solar based pumping units.)

2. Charge Controller: MPPT charge controller of suitable ampere rating, with battery over charge/ discharge protection.

3. Battery:

3.1 Battery Type: The battery offered should be maintenance free and VRLA/ GEL/ AGM type

3.2 Technical Features:

- Real front-access terminal connections for fast and easy installation and maintenance
- Easy on easy off multi-purpose design terminal protector
- Suitable for 19", 23" racking or cabinet
- Micro-porous glass mats in low resistance as separator
- Flame retardant ABS material container and cover compliant with UL94 V-0
- Self-regulating pressure relief valve
- Self-discharge rate: < 2% per month at 77^{o}F (25^{o}C)
- Design life: more than 12 years at 68^{o}F (20^{o}C)
- Shelf life: 6 months at 68^{o}F (20^{o}C)
- Valve regulated system, no water addition needed

3.3 Compliant standards: The battery offered should comply with:

- IEC 60896-2
- BS 6290 Part 4
- Telcordia SR-4228
- EUROBAT GUIDE
- UL

4. FLOOD LIGHTS: The lights offered should have single LED with at least 80 Lumens per watt. The lights offered should have IP-66 enclosure.

5. DC WIRING: As described in the specifications for supply and installation of solar based pumping units.