



National Rural Support Programme

National Rural Support Programme

#7 Sunrise avenue, Near COMSATS University, Park Road, Chak Shahzad, Islamabad,

Tel: +92(51) 8746170-173

Tender#NRSP-HO/04/01/2022

Procurement of Goods and Services on EPC basis

(EPC= Engineering, procurement and Construction)

Tender Documents

For

Carrying out Planning, Design, installation, execution, testing and commissioning of Community based Solar PV based Lift Irrigation scheme with allied civil works in Village Amanpur, UC Tarap, Tehsil Jand, District Attock.

Newspaper Advertisement

NRSP

National Rural Support Programme

TENDER NOTICE

Karandaaz Pakistan (The Grantor) has set up Innovation Challenge Fund-Green (ICF-Green) with the institutional and financial support from the UK Government's Foreign, Commonwealth and Development Office ("FCDO"). Round 6 of the ICF-Green seeks solutions to address Innovative and efficient water management in Pakistan. NRSP has been selected as implementing partner of ICF-Green, for introducing green, viable, and efficient irrigation water management for the farmers.

National Rural Support Programme (NRSP) invites proposals from PEC registered firms for Carrying out Planning, Design, installation, execution, testing and commissioning of a community driven Solar PV based Lift Irrigation scheme with Allied Civil Works to irrigate approximately 300 to 400 acres of land benefitting over 100 farmers in Village Amanpur, UC Tarap, Tehsil Jand, District Attock in Engineering, procurement and Construction (EPC) mode.

The complete Tender Documents are available on NRSP website <https://nrsp.org.pk/tender-docs.html> which can be downloaded free of cost. Last date for submission of Proposal is **May 10, 2022 till 2:30pm** at NRSP office on below given address.

NRSP reserves the right to accept or reject any /all proposals without any reason thereof.

Procurement Section, National Rural Support Programme,
7 Sunrise Avenue, IRM Complex, Near COMSATS University, Park Road,
Chak Shahzad, Islamabad. Tel: +92-51-8746170-3

Published on 16th April, 2022 in The Daily Jang (RWP/Lahore editions) and The Daily News (RWP/KHI editions)

<i>Bid Details</i>		
1.	Date of availability of tender documents on NRSP website	16th April, 2022
2.	Pre Bid Meeting (in person and via zoom link)	21th April, 2022 at 11:00am (PST)
3.	Last date and time for sending queries/question or clarifications via email by firms	26th April, 2022
4.	Last date and time for reply of queries/question or clarifications by NRSP via email and upload on NRSP website	28th April, 2022
5.	Last date, time and address for receipt of Tender Documents/Proposals (in hard copies)	10th May, 2022 by 2:30 p.m.(PST) National Rural Support Programme, #7 Sunrise avenue, Near COMSATS University, Park Road, Chak Shahzad, Islamabad, Tel:+92(51) 8746170-173
6.	Date and Time of Opening of Technical Proposals	10th May, 2022 by 3:00 p.m.(PST)
7.	Place of opening	National Rural Support Programme, #7 Sunrise avenue, Near COMSATS University, Park Road, Chak Shahzad, Islamabad, Tel:+92(51) 8746170-173
8.	Address for communication and correspondence	National Rural Support Programme, #7 Sunrise avenue, Near COMSATS University, Park Road, Chak Shahzad, Islamabad, Tel:+92(51) 8746170-173
9.	Contact for Firms	Interested Firms are requested to send their queries on the following email: procurement@nrsp.org.pk . The email query should clearly mentioned the following details, so that in case of any clarification, the same maybe issued to them: • Name of Company, Contact person, Mailing address, Telephone No. Email address, Mobile No. etc

Note: Technical and Financial Proposals will be opened in presence of the firm's representative who chooses/authorized to attend.

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1. Introduction

Established in 1991, NRSP is the largest Rural Support Programme in the country in terms of outreach, staff and development activities. It is a not for profit organization registered under Section 42 of Companies Act 2017 (repealed Companies Ordinance 1984).

NRSP's mandate is to alleviate poverty by harnessing people's potential and undertake development activities in Pakistan. NRSP is currently working with 3.7 million poor households organized into a network of 238,252 Community Organizations. With sustained incremental growth, it is emerging as Pakistan's leading engine for poverty reduction and rural development.

2. Introduction of Project “Innovation Challenge Fund-Green-Karandaz” & its Rational.

NRSP has signed a contract with Karandaz Pakistan with an aim to partner Community based implementation of a green, viable and efficient irrigation water management intervention for a small and remote Village Amanpur, District Attock in Punjab.

Village Amanpur is spread across 600+ Acres of land with total 310 households. The proposed project for Amanpur is meant to address the challenges of limited or no access to irrigation water, reduced frequency of rains, low incomes, threatened food security and overall climate change challenges been faced by the farmers of this area.

The main objectives of this project is to encourage, support and facilitate farmers:

- *to switch over to environment friendly energy efficient Solar powered pumps and stop using diesel pumps for irrigation(contributing to GHG emissions)*
- *to replace the unabated ground water pumping (depleting underground water resources) with river water efficient piped irrigation and curb inefficient flood irrigation.*

To achieve the above objective the purpose of this assignment is to procure the planning, designing and construction services of a competent firm in a manner that the proposed Solar Powered lift Irrigation project components are aligned, configured in a manner, pattern, route and network feasible and practicable for laying and conveying piped distribution network of lifted river water stored and pumped into agriculture fields and lands through sprinklers, drip and gravity system.

The planning and execution of this assignment has to be carried out on the basis of already collected technical information in the form of a topographic survey and physical profile of the project area to cover all aspects of Project feasibility, viability and sustainability.

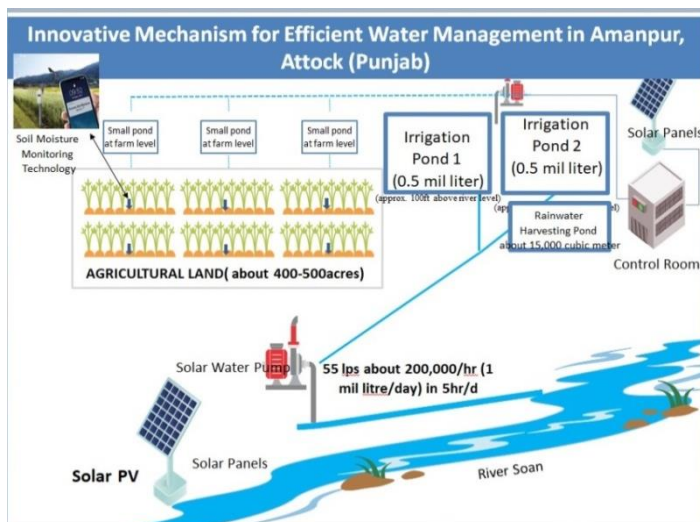
3. Scope, Salient features and components of Project with specifications:

Selection of firm to undertake the Design/Supply/Installation /Testing/Commissioning of Solar PV Pumping Systems and allied civil/E&M works under the project *“Innovative mechanism for community based efficient irrigation water management and climate smart and resilient agriculture at Village Amanpur ,tehsil Jand District Attock.”*

a) Model design & development process and technical requirements.

Idea: The project idea is a green, climate-friendly water harvesting, supply and management

scheme for a selected group of farmers having small land holdings about 2 to 3 acres. The proposal in question calls for water efficient Irrigation of about 300 to 400 acres of cultivable area by lifting and pumping water to a height of approx. 100 feet through Solar PV system and connected to a Smart Irrigation Water Conveyance and Distribution scheme having Pressured and Gravity Piped water network, Computerized water control valves, IOT/Data CLOUD from Moisture sensors.



Therefore, the thought out option is that water is to be harvested from run of river diverted and channelized water of river Soan in a nearby sump well from where water is to be lifted and pumped to purposely built high level storage ponds. There after the storage water from tanks will be distributed and supplied to farmers' lands, either on demand or as alerted by electronic sensing mechanism deployed to indicate water requirement on the agri fields. The Supply will be provided by means of laying closed loop (both) pressurized

and gravity piping network spread all over the serving area.

Water requirement: Considering crops requirements and area to be irrigated, a conservative flow rate of 55 liters/sec (200,000 liters/hour), a volume of about 1 million liters is required (average 5.44 hours) daily to be lifted and pumped from run of river water nearby Soan River bank by solar powered pumps and conveyed through GI or HDPE pipes to the proposed locations of high level water storage tanks each of Capacity over 0.5 million liters at a height of about 100 feet above river bank. The 1.0 million liters shall be stored in two RCC/Composite material surface storage tanks.

The stored water in tanks will be distributed by Gravity flow and Solarized pressurized flow to the field in two Zones through HDPE pipes, as per Irrigation water schedule agreed between farmers. One Irrigation water distribution network shall be laid down from Storage Reservoir (0.5 million liters) through Gravity to feed sub storage tanks built near Farmers fields fed by pipe irrigation. The other Irrigation water distribution network shall be laid down from the other Storage Reservoir (0.5 million liters) through Solar PV pressurized automatic pumping to feed the lands of those Farmers who shall avail loans through Kamyab Kissan Programme for installation of sprinklers and drip system.

Based on preliminary information, the proposed scheme shall have to mainly comprise of following components:

1. Civil/structural works for river Diversion channel, high level storage ponds and Solar PV panels platform, control room(s) and ancillary structures
2. Electrical & Mechanical works for Solar PV lifting and pumping system, Gravity & Solar powered pressurized pipe distribution system for drip/sprinkler Irrigation, security lights and CCTV monitoring system and allied works.

To conceptualize and refine the proposed idea, the design, cost and specification of the following Scheme components is desired:

1. Civil Structures (earthen/masonry/reinforced or plain concrete) for river water intake:

- a. Diversion Channel from river bank to sump well.
 - b. Sump well for diversion channel including screening/silt control system.
2. Solar PV system of Solar Panels, mounting, inverters, cables, Pump(s) and GI/HDPE (trenched) line to transport water from Sump to Highest level storage Ponds
3. RCC Highest level storage Ponds of specified capacity with:
 - a. Adjacent control room(s).
 - b. Automated Valve control system
 - c. Solar PV setup with pumping system for desired pressure in HDPE distribution system to sprinkler & drip.
 - d. Gravity water distribution Pipe Lines network system to feed farmer fields sub storage tanks
4. Web enabled CCTV security and monitoring systems at sump well near river bank, solar pumping station and PV platform and high level storage Ponds locations, powered by Battery system linked to Solar system.
5. Installation of emergency lights at Solar pumping station and PV platform , highlevel storage ponds, control room(s),powered by Battery system linked to Solar system
6. Provision of Net metering for surplus power supplied to WAPDA GRID.

Procurements and Infrastructure Indicative Proposed Costs						
Sr#	Technical Description of Component	Unit Name	Quantity	Unit (RFT, Nos, sft, cft,Dia)	Unit Rate ¹	Lump sum Cost ²
1	River Intake Structure: Excavation/De silting of river stream by making diversion Channel from river bank to sump well, including construction of sump well including screening/silt control system.	Excavation and Civil works				
2	Solar PV Pumping system of Solar Panels, mounting, inverters, cables, Pump(s) and GI/HDPE (trenched) line to transport water from Sump to Highest level					

¹ To be quoted by firm with some rationale based on careful market analysis and proposed scope understanding.

² To be quoted by firm

	storage Ponds					
	I. GI/HDPE pipe line(minimum 5 inch) from Sump well to Pumping Station (Existing Dug well structure)					
	II. Solar driven Pump for lifting(at least 90 hp)					
	III. At least 2 feet shingle/concrete filled compacted elevated platform/pad with precast RCC pole fence wire (including guard/control room) for mounting of solar PV panels					
	IV. Solar PV panels array of 70-80 KW with all accessories including inverters and batteries, cables etc.					
	V. GI/HDPE delivery pipe line (at least 4 inch) from Pumping station to High level storage Ponds					

2	Providing , trenching , laying and protection of 3 Core/50mm 600/1000 volt cable					
3	Construction of Highest level storage & distribution: a) RCC/Masonry/Composit e material tanks of specified capacity(appox 16x16x2m)					
	b) RCC/Masonry/composit e material adjacent control room/station(s).					
	c) Automated Valve control system					
	d) Solar PV setup with pumping system for desired pressure in distribution system to feed sprinkler & drips: a. At least 8 KWp mono Solar Panels to run 6 HP pumping system for desired pressure					
	e) Pressurized and Gravity water distribution HDPE Pipe Lines network					

	system(approx3,000 meters long) to feed farmer fields sub storage tanks and sprinkler/drips & Imported Electrical Parts.					
4	Web enabled CCTV security and monitoring systems at sump well near river bank, solar pumping station and PV platform and high level storage Ponds locations, powered by Battery system linked to Solar system having Imported Electrical Parts					
5	Installation of emergency lights at Solar pumping station and PV platform , high level storage ponds, control room(s),powered by Battery system linked to Solar system					
6	Provision of Net metering for surplus power supplied to WAPDA GRID.					
	Total cost in PKR with all applicable taxes as per law of land					

General Specifications of Material related to Civil, E&M, Water supply and sanitation works, Solar PV & allied equipment are illustrated as follows. The bidders are encouraged to refer to detailed specifications for each category mentioned in Annexure 8 and 9 (which shall supersede the general specifications in case of clarity if any)

A – CIVIL WORKS

1- Stone Ballast / Soling

The stone ballast shall be well graded and broken hard stone of 2" (50mm) maximum size obtained from an approved quarry.

2- Aggregates

Fine aggregates ASTM C – 33

Coarse aggregates ASTM C – 33 graded.

3- Cement

Cement shall conform to ASTM C – 150

Only one brand of each type of cement shall be used for concrete in any individual member of structure.

4- Strength

The specified compressive strength of the concrete cylinder shall be 3000 psi (21 N/mm sq)

5- Steel

Steel to be mild steel, new, free from rust and conform to American Standard Testing of Materials A 36 or equivalent to Grade 40.

6- Exposed Bricks

For all exposed bricks surface, Engineer approved bricks from local kiln will be used. They will be laid in minimum 1:4 cement sand mortar and the pointing will be recessed by 1/4" so that each brick reads separately.

7- Ceramic Tile Work

Non-slip matt finished glazed tiles will be of Shabbir Tiles(or as approved by engineer in charge) manufacture or equivalent and of approved colour and size.

8- Aluminum Doors and Windows

All aluminum sections for use in aluminum doors and windows should be extruded with aluminum Alloy 6063 – TS (50S- T5). /they will be Pak Cable manufacturer or equivalent.

a. Doors

Doors will be single and double shutter and of dimension as per drawings of Architect approved finish and texture and will include a 6" X 1/2" Deodar frame. All ironmongery accessories and 5 mm glass surfaces.

b. Windows/Ventilators

Windows and ventilators will be of best quality aluminum Pak Cable manufacturer or equivalent with 5 mm glazed fixed with manufacturer's product.

9- Plumbing ,Piped Drainage and Distribution

- a. HDPE pipeline of any diameter should conform to ISO 4427 and DIN 8074 standards.
- b. PPRC Pipes of any diameter should conform to DIN-8077/78 standards and UPVC Pipes in compliance with BS-3505 & PS-3051 standards.
- c. UPVC Electrical Conduit Pipes red according to BS-6099 standards.
- d. HDPE Butt-Fusion Fittings conform to ISO-4427 standards
- e. PP-R pipe & Fitting

All the cold and hot water pipe work pipe shall be PP-R (PN 20) Polypropylene Random-Copolymer sate). The pipe shall be of high molecular weight, stabilized to high temperature to DIN 8078 with socket welding by heating elements.

f. G.I. Cold and Hot Water Pipes & Fittings

The galvanized pipe shall be of Class 'B' and conform to British Standard Specifications 1387 for "Steel Tubes and Tubular suitable for screwing to BS 21 pipe threads".

g. UPVC Pipe and Fittings

Unplastised PVC pipe conforming to ASTM D-1785 Schedule 40 & fittings conforming to D-2466 for soil, waste and vent shall be non-pressure pipe fittings.

h. Hand Wash Basins

Washbasin shall be Vitreous China, complete unit including 15 mm CP mixer or 15mm CP pillar cock.

i. Water Closets (Asian/Orissa)

Squatting (Asian/Orissa) type water closet of Viterous China, complete unit including 15 mm CP

stopcock, plastic water inlet connection pipe.

- j. Sinks shall be stainless steel of approved make single bowl or double bowl with integral board of 915 mm X 510 mm size.
- k. Bronze Valves, all valves of 4 inch diameter specified to BS 5154.
- l. Taps and Cocks, All the taps and cocks shall be of brass, gun metal or other equally suitable corrosion resisting alloy conforming to BS 1010.
- m. Floor drains, Floor drains shall be of cast iron UPVC or of other anti-corrosive metal, minimum water seal of 50 mm.
- n. Float Valve:

Float valve shall be of copper alloy, piston type and conform to BS 1212. Float shall be of copper conforming to BS 1968.

B – ELECTRICAL WORKS

1- Low Voltage Switchgear(LC-PCB):

Short circuit breaking capacity IEC 60947-2 lcs rating or IEC 60157-1 category P2;

Applicable Standards and Codes;

<u>CODE</u>	<u>DESCRIPTION</u>
BS 3871	Specifications for miniature and moulded cases circuit breakers
BS 5486	Low Voltage switchgear and control-gear assemblies
IEC 60947-2	Circuit Breakers
IEC 60439	Factory Built Assemblies of LV Switchgear
BS 89/90	Ammeters and Voltmeters
BS 3938	Low Voltage Current Transformers
BS 3245	Bus Bars
BS 4099	Colours of indicator lights, push buttons, annunciators and digital readouts.

2- Low Voltage and Control Cables:

Copper conductor, PVC insulated, single and multi-core up to 300 sqmm.

Applicable Standards and Codes;

<u>CODE</u>	<u>DESCRIPTION</u>
BS 6004	For PVC insulated general wiring cables
BS 6346	For PVC insulated power cables
BS 7655	For PVC compounds for electrical cables
BS EN 60228	For Cable conductors
IEC 60502-1	For cable for rated voltages of 1 kV and 3kV

3- Conduit, Fitting & Accessories

<u>CODE</u>	<u>DESCRIPTION</u>
BS 31	Steel Conduits and fittings for electrical wiring
BS 4607	Rigid PVC conduits and conduits fitting
BS 4568	Steel conduits, bends and couplers

C – MECHANICAL WORKS

1. Sheet Metal Duct Work:

- a. Galvanized steel sheet shall be of lock forming quality (LFQ) with coating designation of G-90 (275 gm/m sq total for both sides) with regular spangles.
- b. The G.I. sheet shall conform to ASTM A-924/924M-9 (Formerly A-525) and ASTM A653/A-653M-94 (formerly ASTM A-A-527)

D – SOLAR PV PANELS AND RELATED EQUIPMENT:

Fundamental specs required:

- Class A panels certified by TUV Nord, TUV Germany or other agency registered with ILAC
 - IEC 61215 and IEC61730 standards
 - Certification verifiable on internet.
- SOLAR DEEP CYCLE battery with min 3 years warranty. Cycles should not be < 1000

cycles at 50% DoD.

- Battery certification IEC 60896 and IEC 61427 standards
- Inverters as per EN 50530, IEC 61683, 62109-1&2 standards
- Charge controllers as per IEC 60947 I ,II &III standards
- System protection devices between DC and AC interfaces

4. Eligibility

The firm failing to fulfill one of the requirements described in eligibility Criteria below will not be further considered for Technical Evaluation:

- The Firm should have at least 05 Years in Solar Powered Lift Irrigation projects.
- Proof of at least 01 completed project related to Solar power lift irrigation from perennial Nullah, stream, creek river, pond, lake or canal.
- Annual financial turn over for the last three years should be at least Rs.10M.
- Valid Registration Certificate from Pakistan Engineering Council (PEC) in category C6 and above.
- The firm must have approved Field of Specialization from PEC in Solar systems (EE-11/EE-04/EE-06)
- Firm must have Valid NTN Number and GST.
- Compliance to the technical specifications

5. Submission of Bid

- 5.1. Tender documents (Technical and Financial proposals) should be submitted in separate envelopes with clearly mentioned as

“Technical Proposal under Tender#NRSP-HO/04/01/2022”

and

“Financial Proposal under Tender#NRSP-HO/04/01/2022 ”

- 5.2. **Technical proposal should have the below mentioned documents at least:**

5.2.1 Documentary Evidence for the following:

- That the Firm has completed at least 05 Years in Solar Powered Lift Irrigation projects.
- That the firm has completed at least 01 completed project related to Solar power lift irrigation from perennial Nullah, stream, creek river, pond, lake or canal.
- Copy of audit report for the last two years reflecting the Annual financial turn over for the last three years.
- Copy of Valid Registration Certificate from Pakistan Engineering Council (PEC) in category C6 and above with Field of Specialization from PEC in Solar systems (EE-11/EE-04/EE-06).
- Copy of valid NTN Number and GST.

5.2.2 CVs of professional staff, specialists, mentioning exclusive experience in Renewable energy projects.

5.2.4 Description of working methodology steps to describe Organization of Works and working programme.

5.2.5 Details of planning schedule showing the time sequence of various activities and sub activities to support the Implementation Schedule

- 5.2.6 A post intervention plan indicating end user training, project sustainability, O&M and after sale services
- 5.2.6 Undertaking that Firm has never been blacklisted or never been involved in litigation with any government or private organization in PV line of business on Rs.100/- stamp paper duly attested by notary public. (as per format attached as **Annex 6**).
- 5.2.7 Technical Details for the items being offered with technical data sheet/broachers/catalog/etc.
- 5.2.9 Updated company Profile.
- 5.2.10 Any other documents which could be relevant and useful in technical evaluation.
(Refer to forms attached as **Annex 10**)
- 5.3 **Financial proposal should have the below mentioned documents at least:**
 - 5.3.1 Financial proposal showing itemized cost including all applicable taxes as per law of land.
 - 5.3.2 Earnest Money as per clause 7.1.
 - 5.3.3 Any other documents
- 5.4 Prices shall include transportation/freight, all applicable taxes and Transit Insurance charges, loading/unloading, installation/testing and commissioning of Solar PV Pumping Systems and allied civil/E&M works under the project at Village Amanpur, tehsil Jand District Attock.
- 5.5 The firm should take care in submitting the proposal and ensure that enclosed papers are not found loose and should be **properly** numbered and submitted in a file in proper manner so that the papers do not bulge out and tear during scrutiny.
- 5.6 **Last Date of Submission is May 10, 2022 till 2:30 pm local time.**
- 5.7 The proposals against this tender document must be submitted not later than **May 10, 2022** till 02:30 pm local time to the point of contact given below. **Electronic proposals will not be entertained. Any proposal delivered after due date and time will be considered non-responsive and disqualified from further consideration.**
- 5.8 The Tender documents should be addressed to:
 - (Technical Proposal under Tender#NRSP-HO/04/012022)**
National Rural Support Programme
#7 Sunrise avenue, Near COMSATS University, Park Road,
Chak Shahzad, Islamabad, Tel:+92(51) 8746170-173
 - And
 - (Financial Proposal under Tender#NRSP-HO/04/01/2022)**
National Rural Support Programme
#7 Sunrise avenue, Near COMSATS University, Park Road,
Chak Shahzad, Islamabad, Tel:+92(51) 8746170-173
- 5.9 Propose your best prices keeping in view the complete terms and conditions of the tender documents and will be fixed during the period of this project which is till **December, 2023**.
- 5.10 The purchaser reserves the right for conducting pre-shipment inspection by its own personnel or reputed third parties. The selected firm has to offer the items for inspection in such a manner that it does not affect the delivery schedule.
- 5.11 The proposal should remain **valid for a period of 90 days** from the closing date of the financial proposal. Any proposal falling short of the validity period is liable for rejection. If a firm re-extend proposal validity period then will also extend the proposal security period.
- 5.12 Clearance of the equipment from Tax/Govt. Authorities would be the responsibility of the firm.
- 5.13 Selected firm must undertake to provide the purchaser, the consignment note number(s) by which the items ordered had been dispatched from their site, so as to have online/ web access

- to the tracking system of physical movement of the consignments sent through courier.
- 5.14. The firm may withdraw its proposal after its submission, provided that written notice of withdrawal is received by the purchaser prior to the closing date and time prescribed for submission of Tender documents. No proposal can be withdrawn by the firm subsequent to the closing date and time for submission of proposals.

6. Deliverables

Design/Supply/Installation/Testing/Commissioning of Solar PV Pumping Systems and allied civil/E&M works under the project at Village Amanpur, tehsil Jand District Attock.

7. Terms of tender documents

7.1. Earnest Money

All firms shall furnish Security Deposit equivalent to **2% of the total Cost of Deliverables/Financial Proposal** in the form of Call deposit / Pay Order / Demand Draft in favor of **NRSP**. Cheque will not be accepted in any case. After selection of successful firms, NRSP will return / release the earnest money to the unsuccessful firms.

7.2 Performance Guarantee.

Successful firms need to furnish the, within 2 weeks after signing of contract, Bank Guarantee from any schedule bank in Pakistan for the 5% of the cost of the total project for the period of full 2 years after the commissioning and handing over of the project. (As per attach format as **Annex-7**)

8. Submission of tender documents

- 8.1. The proposal should comply with the technical specification required of the items as specified section 3 and **Annex-8 & 9**. The proposal should be complete in all respects and contain all information asked for, with prices the Technical specification must be organized neatly and securely in the following manner.

8.1.1. Technical proposal as per details given in Clause 5.2

8.1.2 Financial proposal as per details given in Clause 5.3

8.1.3. Any other supporting document, if any.

- 8.2. If the proposal is not submitted in the prescribed formats or any of the item in the as mentioned above, the proposal is liable for outright rejection.
- 8.3. Once the proposal is submitted in sealed cover by the firm, the purchaser will not accept any addition / alterations / deletions of the proposals. However, the purchaser reserves the right to seek clarification or call for supporting documents from any of the firms, for which the concerned firm will need to submit the documentary evidence(s) as required by the purchaser.
- 8.4. Any proposal, submitted within incorrect information will be liable for rejection. Further, if any firm is found to have submitted incorrect information at any time, he/she may be debarred from participation in the future procurement processes.

9. Evaluation Criteria

- 9.1. The Purchaser will scrutinize the proposals to determine whether it is complete, whether errors have been made in the proposal, whether required technical documentation has been furnished and whether the documents have been properly signed. Proposals with incorrect information or not supported by documentary evidence, wherever called for, would be summarily rejected. However, the purchaser, at its sole discretion, may waive any minor non-conformity or any minor irregularity in any proposal. The Purchaser reserves the right for such waivers and this shall be binding on all firms.

- 9.2 The overall weighting of Technical and Financial proposal is as follows:

Technical Proposal 70%

Financial Proposal 30%.

Evaluation criteria will be ranked in the order of:

- First-Eligibility as per clause 4
- Technical Evaluation as per below given criteria.

Description/Technical Scoring	Marks allocation (%)
Qualification and technical experience of staff	25
Understanding of the scope, proposed design approach, strategy and organization of works. This means: Description of working steps (e.g. mobilization, supplies, installations, commissioning, etc.) for overall project and every sub-project.	40
A time-schedule (Work plan) for the project based on the stated scope This means: Time schedule showing the various activities on a time axis including, time sequence of sub-projects and activities in each sub-project.	15
Post Project Plan on end user training, project sustainability, O&M and after sale services	20
Total	100

- 9.4. For proper scrutiny, evaluation and comparison of proposals, the purchaser may, at its discretion, ask form some or all firms for clarification of their proposals. The request for such clarifications and the response will necessarily be in writing.

10. Fees and payment Schedule

- 10.1. Tentative Payment schedule is as follows that shall be on milestones completed & delivered in a logical and sequential order of execution. Final payment schedule shall be negotiated at time of contract:

- **Completion and approval of Model Design (10%)**
- **Implementation and Execution stages (80%):**
 - I. Remodeling of Intake Channel from River and Sump well Structure and Installation of Solar PV Pumping system complete in all respect with construction of mounting platform and pump room----(25%)
 - II. Laying of GI/HDPE (trenched) line to lift water from Sump well to highest level storage Ponds including Construction of storage ponds & adjacent control

- room/station(s). Installation of Solar PV Pressurized pumping system for sprinkler & drips and automated Valve control system.-----(25%)
- III. Pressurized and Gravity water distribution HDPE Pipe Lines network system to feed farmer fields sub storage tanks and sprinkler/drips -----(20%)
- IV. Installation of Web enabled CCTV security systems at all specified locations and Installation of emergency lights at specified locations along with provision of Net metering and procurement, trenching , laying of 3 Core/50mm 600/1000 volt cable----- (10%)
- **System Testing and Commissioning (05%)**
- **End of DLP (05%) – 2 years after Commissioning**
- 10.2. Payment for each milestone would be made after the complete and satisfactory delivery / acceptance of the respective milestone by engineer in-charge/project manager within 2-3 weeks through cross cheque/online bank transfer in the name of firm by NRSP.
- 10.3. Applicable taxes from payment of each milestone would be deducted as per law of land. Deduction certificate would be provided within 4 weeks after each payment.

11. Paying Authority

The payments as per the Payment Schedule covered here in above shall be paid by NRSP.

Following Documents are to be submitted for each Payment:

1. Bill/Invoice with covering letter for release of payment.
2. Work completion report of milestone achieved as per agreed payment schedule dully signed/verified by engineer in-charge/project manager.

12. Completion Time

The Selected firms must undertake to complete, deliver and commission the Project within 16 months from the date of award.

13. Warranty & Maintenance

- 13.1. The firm shall be fully responsible for the defected items and will be responsible to replace at his own risk and cost within in 3-4 weeks.
- 13.2. Standard Warranty for the Electrical, Mechanical and **solar equipment and Services** would be 02 (two) years and for the civil works the defect/deficiency removal period would be 1.5 (one and half) years from the date of commissioning of the project.
- 13.3 The firm should be responsible for Operator and End user training /capacity building related to the machinery installed.

14. Penalty for down time

In case of delay in the supply of material against the terms indicated in the purchase order, the firm will have to pay a penalty @ 0.5 %(Half) percent of the approved cost of the balance quantity of equipment/supplies/works for each day of delay. If shipment is delayed for more than 45 days the Purchaser has the right to unilaterally cancel the contract/purchase order and his bid security will be forfeited.

15. Currency

All prices shall be expressed in Pakistani Rupees only.

16. Cost of tender documents

The firm shall bear all the costs associated with the preparation and submission of tender documents, samples & testing of samples and Purchaser will in no case be responsible or liable for these costs regardless of the outcome of the bidding process.

17. Deadline for Submission of tender documents

Tender documents must be received by the Purchaser at the address specified in the documents not later than the specified date and time as specified in the Tender documents. In the event of the specified date of submission being declared a holiday for the Purchaser, the Tender documents will be received upto the stipulated time on next working day.

The Purchaser may, at its discretion, extend this deadline for submission of proposals by amending the Tender documents.

18. Confidentiality Statement

All data and information received from Purchaser for the purpose of this assignment is to be treated confidential and is to be used ONLY in connection with the execution of these Tender documents. All intellectual property rights arising from the execution of these deliverables are assigned to Purchaser. The contents of written materials obtained and used in this assignment may not be disclosed to any third party without the expressed advance written authorization of Purchaser.

Purchaser may then disclose the draft, final report and/or any related information to any person and for any purpose they may deem appropriate.

19. General Terms & Conditions

- 19.1. The Purchaser does not bind itself to accept the lowest or any proposal and reserves the right to reject any or all proposals at any point of time prior to the issuance of purchase order without assigning any reasons what so ever.
- 19.2. Purchaser has the right to increase or decrease the quantity/scope of work (whole or part) before the time of final order placing/contract.
- 19.3. The Purchaser reserves the right to resort to repeat or repeal the process without providing any reason what so ever. The Purchaser shall not incur any liability on account of such rejection.
- 19.4. The Purchaser reserves the right to modify any terms, conditions, quantities or specifications for submission of Tender documents and to obtain revised proposals from the firms due to such changes as deemed fit by the donor/funding agency, if any.
- 19.5. Canvassing of any kind will be a disqualification and the Purchaser may decide to cancel the process from the tender process.
- 19.6. The firm is expected to examine all instructions, forms, Annexures, Terms and Conditions and specifications in the Tender documents. Submission of a proposal not responsive to the Tender documents in every respect will be at the firm's risk and may result in the rejection of its proposal

without any further reference to the firm.

20. Special Conditions.

- 20.1 Contract and subsequent work order will be issued by NRSP to successful firm. Firm has to sign contract agreement.
- 20.2. No change in the substance or price of the proposal shall be sought, offered or permitted.
- 20.3. In case of any default on part of the firm, the performance security shall be forfeited.

21. Rejection of the Tender documents

The Tender documents are liable to be **rejected** if:

- The document doesn't bear signature of authorized person.
- It is received **through** Fax/E-mail/whatsapp.
- If it is submitted without the security deposit in required shape of instrument.
- If only Technical or only financial proposal is received or if technical and financial proposal submitted in same envelop.
- It is received after **expiry** of the due date and time stipulated.
- **Incomplete Tender documents, including non-submission or non-furnishing of requisite documents/Conditional Proposals** not conforming to the Terms and condition stipulated in this Tender document are liable for rejection by Purchaser.
- If any of the information provided is found incorrect/false or misleading.

22. Modifications and Withdrawal of Proposals

Tender documents once submitted will be treated as final and no further correspondence will be entertained on this.

- No proposal will be modified after the deadline for submission.
- No firm shall be allowed to withdraw the Tender documents, if the firm happens to be a successful firm.

23. Opening and Evaluation

- The Purchaser will first open Technical proposal of the tender documents, in the presence of firm's representative(s) who choose/or are authorized to attend, at the time and date mentioned in Tender documents at the address mentioned.
- The firm's representatives who are present shall sign the sheet certifying their attendance. In the event of the specified date of opening being declared a holiday for Purchaser, the proposal shall be opened at the stipulated time and place on next working day.
- Firms satisfying the eligibility criteria, technical requirements as determined by the Purchaser and accepting the Terms and Conditions of this document shall be short-listed for the opening of financial proposals. The Purchaser will subsequently open the Tender documents (Financial proposal) of technically qualified firms, in the presence of firm's representative(s) who choose/or are authorized to attend, at the time and date to be

- communicated later.
- Decision of the Purchaser in this regard shall be final, binding on the firms and cannot be challenged in any court of law.
- The contract will be awarded only to the successful responsive firm(s).
- Purchaser reserves the right to negotiate with Second, third responsive firm, if successful firm is unable to supply the deliverables and fulfill his obligations and his earnest money will be forfeited.

24. Clarifications

To assist in the examination, evaluation and comparison of Tender documents, the Purchaser may, at its discretion, ask the firm for clarification. The mutual communication/correspondence for any clarification shall be via email only. A pre bid meeting is scheduled on 21st April, 2022 at 11:00am in person and via zoom link. The venue of meeting will be NRSP office National Rural Support Programme #7 Sunrise avenue, Near COMSATS University, Park Road, Chak Shahzad, Islamabad and to join via zoom, below is the zoom link:

Join Zoom Meeting

<https://us02web.zoom.us/j/81702185799?pwd=U2I1RTRHMHIRYkgwOUhKZ1NNZkZSUT09>

Meeting ID: 817 0218 5799

Passcode: 381749

The minutes of meeting would be uploaded on NRSP website along with queries and replies.

25. Purchaser's Right to accept or Reject any or all Proposals

The Purchaser reserves the right to accept or reject any proposal, annul or repeat the process and reject all proposals at any time prior to award of contract, without there by incurring any liability to the affected firm or firms or any obligation to inform the affected firm or firms on the ground for the Purchaser's action.

26. Governing Laws and Disputes

All disputes or differences what so ever arising between the parties out of or in relation to the meaning and operation or effect of these Tender documents or breach there of shall be settled amicably. If however the parties are not able to solve them amicably, the same shall be settled by arbitration in accordance with the applicable Pakistani Laws, and the award made in pursuance there of shall be binding on the parties. The Arbitrator/Arbitrators shall give a reasoned award.

27. Placement of Order and Acceptance

The firm shall give acceptance of the Contract/Work order placed within 10 working days from the date of order, failing which, the Purchaser shall have right to cancel the contract/order.

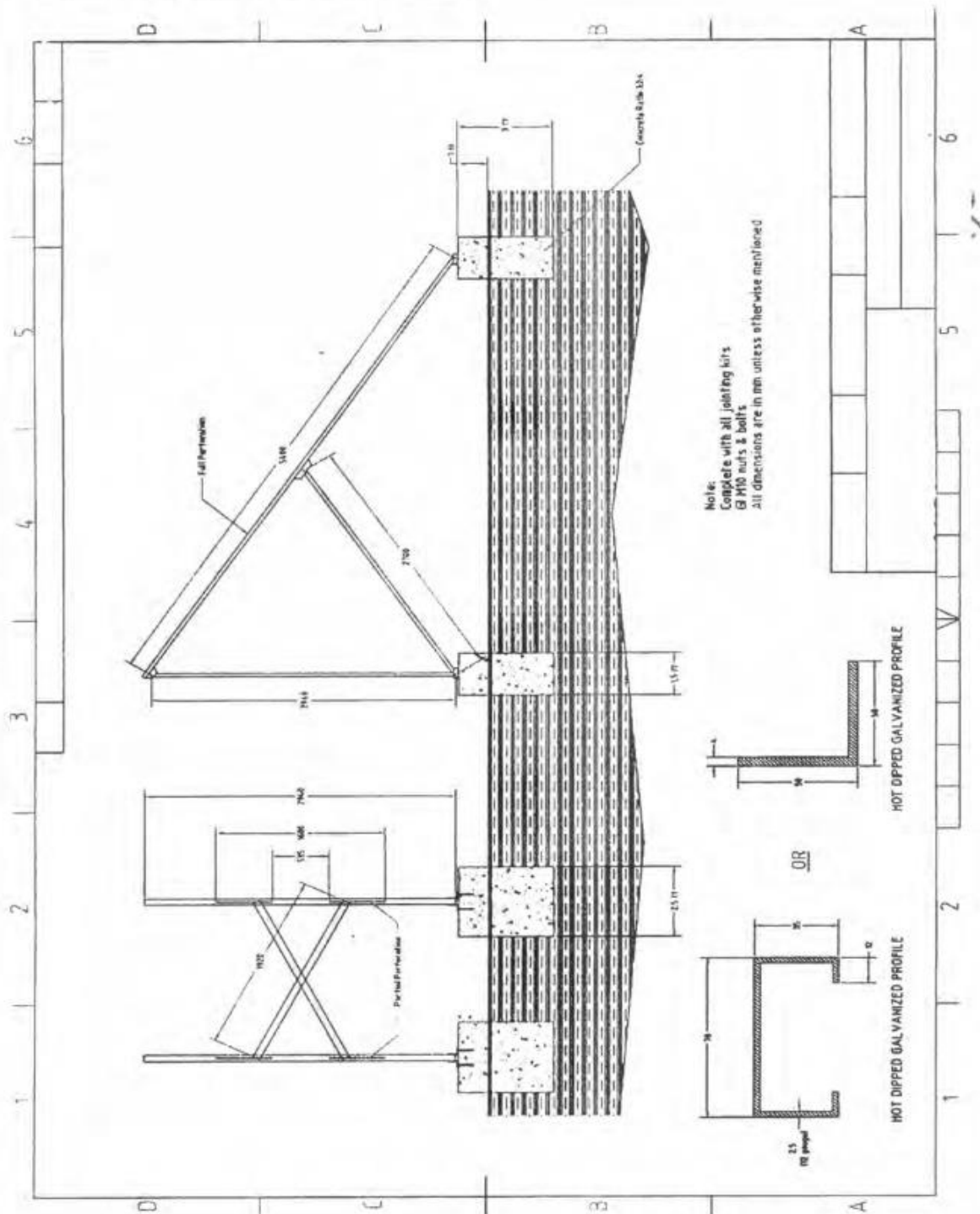
28. Authorized Signatory

The firm should indicate the **authorized officials from their firm** who can discuss, correspond, sign agreements/ contracts, raise invoice and accept payments and also to correspond.

29. Appeal.

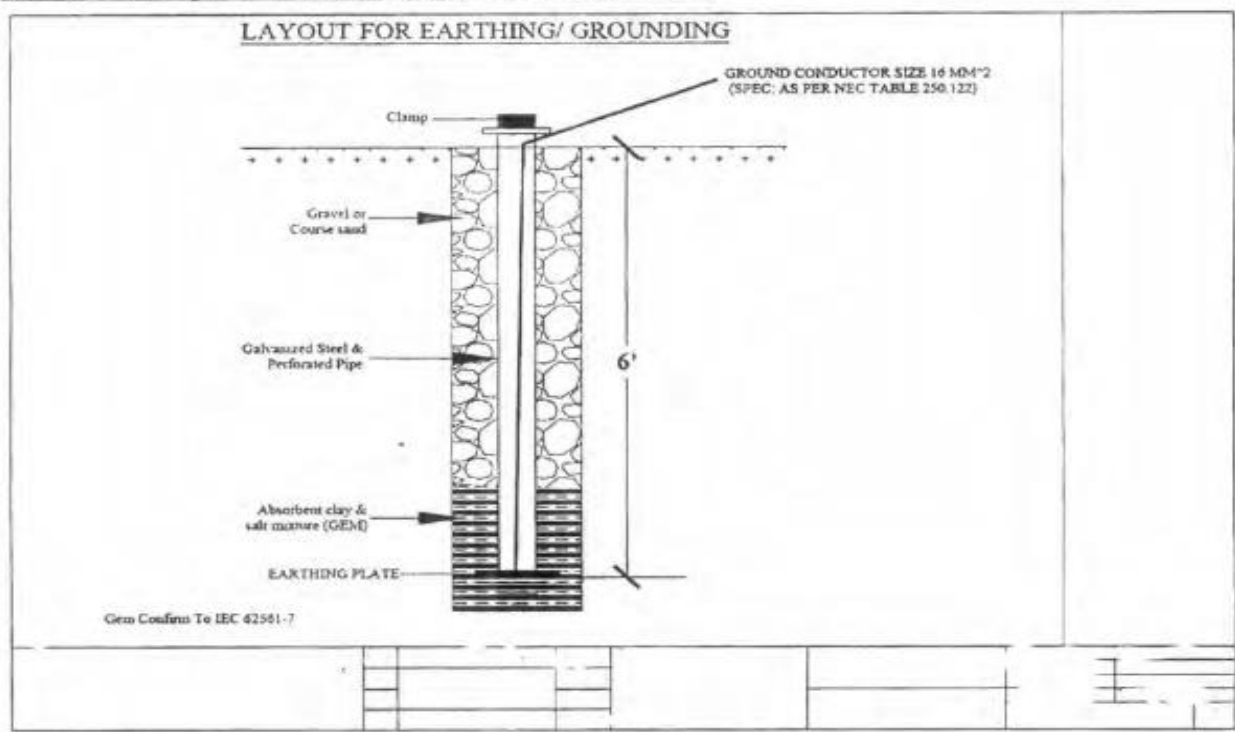
The firm can send their complaints or grievances in connection with this Tender and its shortlisting/finalizations to complaints@nrsp.org.pk.

ANNEXURE-1 (STRUCTURE DRAWING)

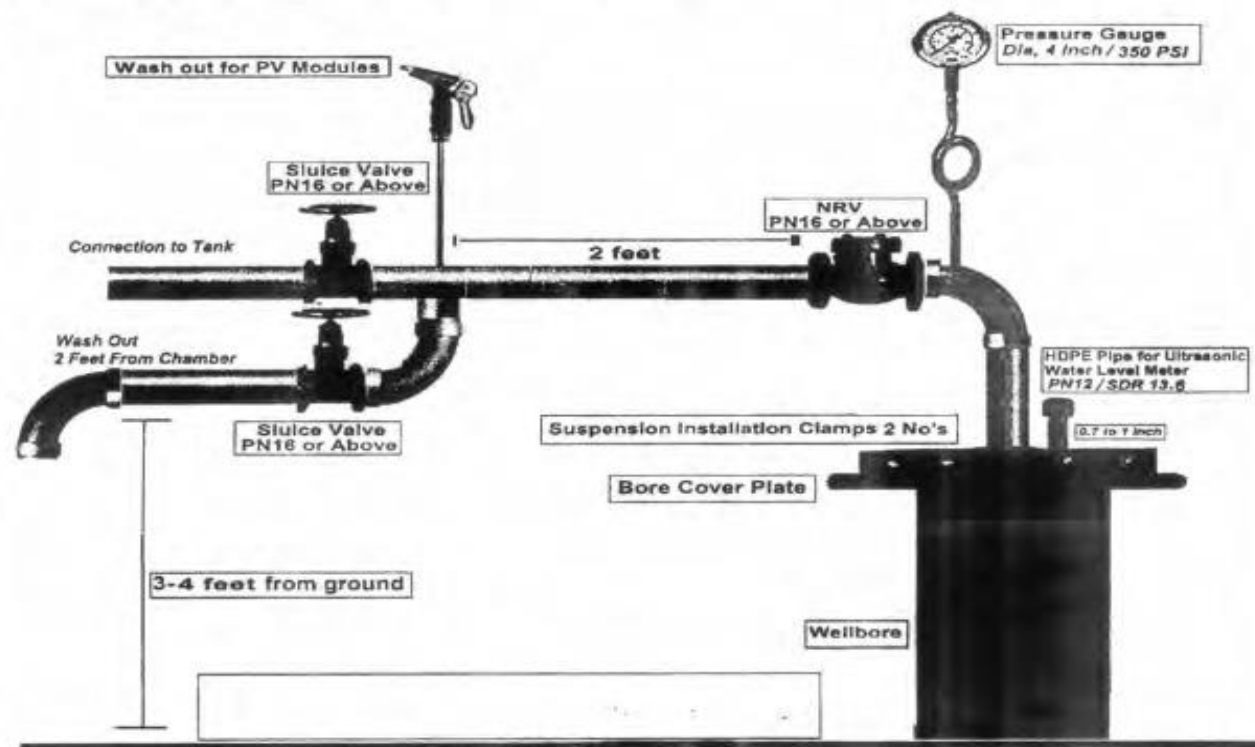


Annex-2 & 3

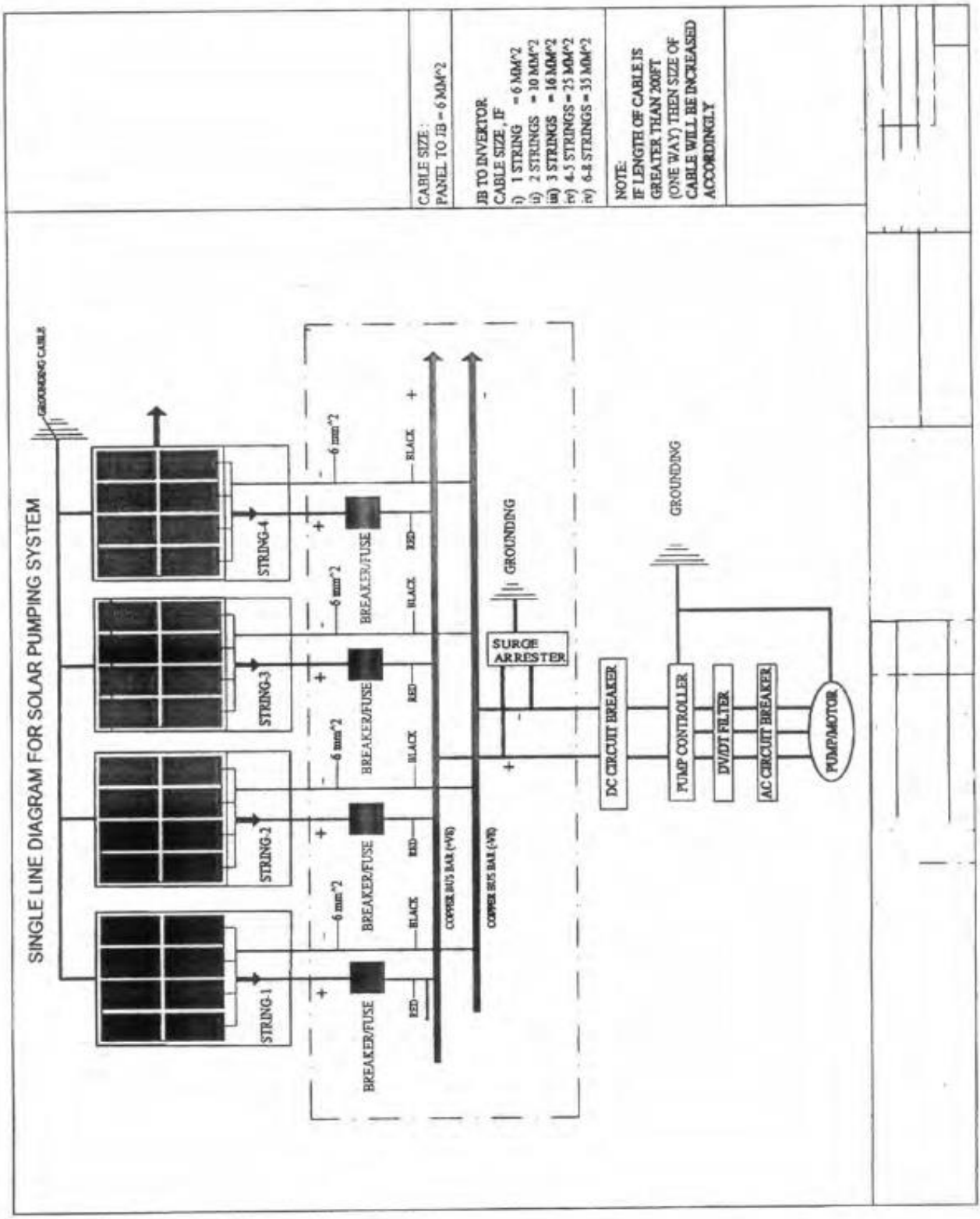
ANNEXURE-2 (EARTHING / GROUNDING DRAWING)



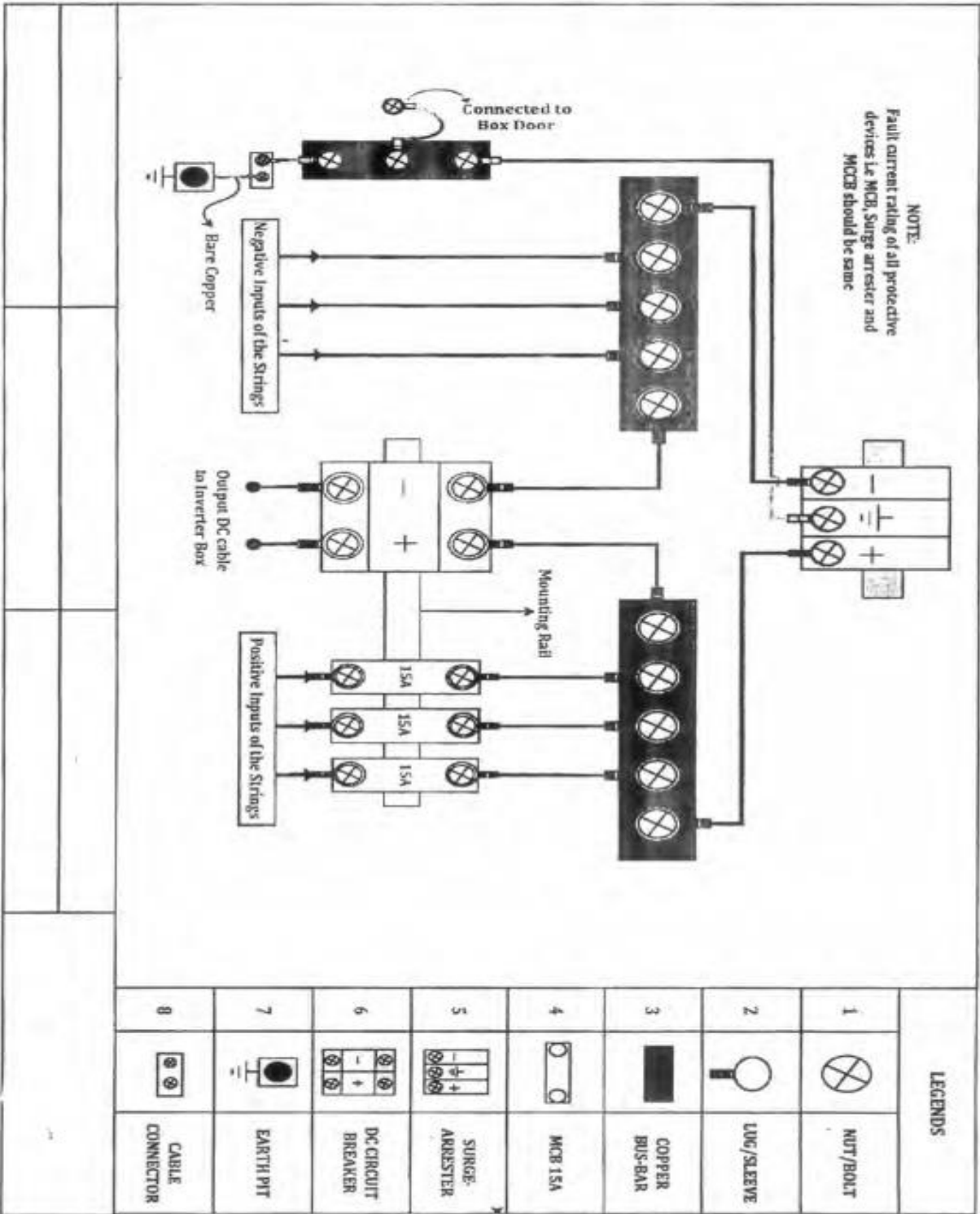
ANNEXURE-3 TOPSET LAYOUT:



ANNEXURE-4 (SYSTEM SINGLE LINE DIAGRAM-PUMPING)



ANNEXURE-5
(JUNCTION/COMBINER BOX SCHEMATICS DIAGRAM)



UNDERTAKING

(To be submitted on at least Rs.100/- stamp paper dully attested by notary public)

Date:

I, the undersigned representative of M/s..... having its
office at
.....

Do hereby affirms that our company/firm/organization is eligible because we;

- Are registered company/firm/organization.
- Are registered with NTN and GST.
- Are not bankrupt or in the process of going bankrupt.
- Have not been convicted for an offense concerning professional conduct.
- Have not been guilty of grave professional misconduct (proven by any means which the contracting authorities can justify).
- Have fulfilled obligations related to payment of taxes.
- Are not guilty of serious misinterpretation in supplying information.
- Are not in situations of conflict of interest (with prior relationship to project or family or business relationship to parties in NRSP)
- Were not declared at serious fault of implementation owing to a breach of their contractual obligations
- Have no relation, direct or indirect, with any terrorist or banned organizations under the provision of Anti money laundering and anti-terrorist financing act of Pakistan.
- Are not on any list of sanctioned parties issued by the Pakistan Government, DIFD, USAID, UN agencies, European Union and others.
- Are not blacklisted by any Local/International organization, Government/semi Government department, NGO or any other company/organization.
- Have not been reported for/under litigation for child abuse and child labour.
- Have never been involved in litigation with any government or private organization in PV line of business.

Declared By:

(Signature)

(Name)

(Designation)

Witness:

Signature:-----

Name: -----

CNIC: -----

Annexure-7

Format for Performance Security Form

To: [National Rural Support Programme,
[

WHEREAS [name of Firm](hereinafter called “the Firm”) has undertaken, in pursuance of Contract No. [reference number of the contract] dated _____ 20____, awarded by N R S P _____to supply [description of goods and services] (hereinafter called “the Contract”).

AND WHEREAS it has been stipulated by you in the said Contract that the Firm shall furnish you with a bank/ or insurance guarantee by a reputable bank/ or insurance company for the sum specified therein as security for compliance with the Firm’s performance obligations in accordance with the Contract.

AND WHEREAS we have agreed to give the Firm a guarantee:

THEREFORE WE hereby affirm that we are Guarantors and responsible to you, on behalf of the Firm, up to a total of [amount of the guarantee in words and figures], and we undertake to pay you, upon your first written demand declaring the Firm to be in default under the Contract and without cavil or argument, any sum or sums within the limits of [amount of guarantee]as aforesaid, without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This guarantee is valid until the _____ day of _____20_____.

Signature and seal of the Guarantors

[name of bank / or insurance Company (AA rated)]

[address]

[date]

TECHNICAL SPECIFICATIONS

(Civil works, Water supply, Sanitation and Electrical Works)

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TECHNICAL SPECIFICATIONS

PART I (CIVIL WORKS)

1.1 Specification for Excavation, Filling, Back Filling and Disposal

- 1.1.1** Excavation shall include removal of all materials of every name and nature. If rock is encountered, it shall be removed carefully. Blasting shall only be undertaken with the written permission of the Engineer.
- 1.1.2** Excavation shall conform to the dimensions and elevations as indicated on the drawings
or as directed by the Engineer. Foundations on made up ground shall have to be taken down to natural bottom soil as per drawing or as directed by the Engineer.
- 1.1.3** Excavation shall extend to a sufficient distance from wall and footing to allow for placing and removal of forms and for inspection but shall not be paid separately. Excess excavation beyond the levels shown on the drawings shall be made good by placing 1:4:8 Concrete at contractor's cost.
- 1.1.4** After each excavation is completed, the contractor shall notify the engineer and no
Concrete shall be poured until the Engineer has approved the size and depth of the excavation and character of the ground strata and has given permission in writing.
- 1.1.5** Back filling of the excavated pits/ trenches shall be done with the excavated stuff in
layers not exceeding 6" thickness. Clods etc. shall be broken. Broken bricks, stone pieces and all other external prices shall be removed. Each layer shall be properly moistened and compacted.
- 1.1.6** Extra- excavated earth not required for back filling shall be filled under floor and in
Depressions on the sites or disposed off away from the site to a suitable location.
-

1.2 Specification for Termite Control

Termite control treatment to soil will be applied after excavation, filling and grading operations are completed, except as otherwise required in construction operation. Provide a working solution of one of the following chemical elements in concentrations.

Chloride	1.0% in water emulsion
Aldrin	0.5% in water emulsion
Dieldrin	0.5% in water emulsion

Other solution may be used if acceptable to Engineer. Only those soil treatment solutions will be used which are not injurious to planting.

Application: Apply 2 liters of chemical solution per linear foot of trench, for each foot of depth from grade to footing, along outside of foundation walls.

Allow not less than 12 hours for drying after application, before beginning concrete placement or other construction activities.

1.3 Specification for Plain and Reinforced Concrete

1.3.1 Materials

1.3.1.1 Cement

Grey Portland Cement shall be normal setting cement of make and source as approved by the Engineer. Sulphates resistant cement where required shall be Sulphate resistant Portland cement of make and source as approved by the Engineer. Cement shall conform to the requirements of ASTM C 150 unless otherwise acceptable to the Engineer. One brand of cement shall be used throughout the project, unless otherwise acceptable to the Engineer.

1.3.1.2 Aggregates

All fine and coarse aggregates to be used shall be supplied from approved sources, which shall not be changed without prior permission in writing from the Engineer. Aggregates shall conform to the requirements of ASTM C-33.

1. Fine Aggregates

Fine aggregate shall be clean River sand from and approved source of supply and

of uniform quality having fineness modules between 2.3 and 3.10.

Fine aggregates shall comply with the requirements of the relevant ASTM C-33 specifications, and shall be graded as follows:

Sieve Number/ Size	% age by weight (passing)
9.50 mm 3/8"	100
4.75 mm (NO.4) 3/16"	95-100
2.36 mm (NO.8) 3/32"	80-100
1.18 mm (NO. 16) 3/64"	50-85
0.6 mm (NO. 30)	25-60
0.3 mm (NO. 50)	10-30
0.15 mm (NO.100)	2-10

Limits for deleterious substances of total sample shall be:

- Clay lumps and friable particles Maximum 3% by weight
- Material passing No. 200 Sieve Maximum 3% by weight
- Coal and lignite Maximum 0.5 by weight

Weight loss of sand subjected to 5 cycles of soundness test when sodium sulphate is used shall not be greater than 10%.

2. Coarse Aggregates

Coarse aggregates shall be 3/4" down hard crushed stone from a source approved by the Engineer. For members up to 3" thickness, 1/2" down crushed stone shall be used. Coarse aggregate shall comply with the gradation requirements of ASTM C-33 and shall be graded as follows.

Normal size of graded aggregates shall be 19mm (3/4") down

Sieve Number/ Size	% age by weight (passing)
19.00 mm (3/4")	90-100
12.50 mm (1/2")	-
09.50 mm (3/8")	20-55

04.75 mm (3/16")	0-10
02.36 mm (3/32")	00-05

Weight loss of coarse aggregate when subjected to 5 cycles of soundness test using sodium sulphate shall not exceed 12% and % age loss for Los Angeles Abrasion (500 revolutions) not be greater than 50. Aggregates shall be screened and washed if required to the satisfaction of Engineer.

1.3.1.3 Water

Water to be used in the work shall be potable water. It should be clean and free from injurious amounts of oils, acids, alkalis, salts, organic material, or other substance that may be deleterious to concrete or reinforcement.

1.3.1.4 Concrete

The contractor shall prepare the design mixes for each type and strength of concrete by laboratory trial batch method as specified in ACI 401. The contractor shall use an independent testing facility acceptable to the Engineer for preparing and reporting proposed mixed designs. The cost of designing the mix shall be borne by the contractor. The contractor shall submit to the Engineer the design of each proposed mix for each class of concrete at least fifteen (15) days prior to start of work. The contractor shall not begin concrete production until Engineer has reviewed the designed mixes.

Concrete mixes to be used in various parts of the work shall be indicated on the drawings and mentioned in the bill of quantities. The proportion of cement to fine aggregates and coarse aggregates shall be adjusted to provide the concrete of the required strength when tested as set out in Table 1 below

Table 1:-

Minimum required compressive strength of six inch concrete cube and minimum quantity of cement required per 100 cft of finished concrete for various mixes and under various conditions: Concrete mix ratio	Minimum No. of cement bags (110 lbs) per 100 cft of compacted concrete	Cube work strength		Max water consumption per bag (110 lbs) of cement (gallons)
		7 days after mixing & pouring (PSI)	28 days after mixing & pouring (PSI)	
1:4:8 Concrete	9	800	1150	7.25
1:3:6 Concrete	12	1200	1700	7.0

1:2:4 Concrete	18	2100	3000	5.25
----------------	----	------	------	------

1.4 Specification for Reinforcement

1.4.1 Material

1.4.1.1 Unless otherwise specified, all plain and deformed reinforcing bars shall comply with the requirements of BS 4449 and shall have minimum yield strength of 40,000 PSI.

1.4.1.2 Reinforcement shall be free from all loose or flaky rust and mill scale, or coating, including acids, and any other substance that would reduce or destroy the bond. Undersized section of steel reinforcement shall not be used.

1.4.2 Bar Bending Schedules.

The contractor shall prepare bar bending schedules of all the reinforcing steel bars and these bending schedules shall be submitted to the Engineer for his approval. The contractor shall obtain approval of the bar bending schedules before starting the actual bar bending works.

1.4.3 Fabricating, Bending & Placing

1. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or other embedded items. If bars are moved more than one bar diameter of enough to exceed the specified tolerances, the resulting arrangement of the bars shall be subject to the approval of the Engineer.
 2. Vertical bars in columns shall be offset at least one bar diameter at lapped splices. To ensure proper placement, templates shall be furnished for all column dowels.
 3. Reinforcement shall not be bent or straightened in a manner that will injure the material. No bar shall be bent twice in the same place, nor it shall be straightened after bending. Unless permitted, by the Engineer, reinforcement shall not be bent after being partially embedded in hardened concrete.
-

4. No splice of reinforcement shall be made except as shown on the working drawings.
5. No concrete is to be carried out until the reinforcement has been checked and approved by the engineer.
6. Bars samples from different lots will be taken for testing at contractor's cost for conformity with the following.

MS plain bars confirming to BS 4449.

- a) Minimum yield strength not less than 36 ksi
- b) Minimum Elongation 16% to 24%

MS deformed bars confirming to BS 4449.

- a) Minimum yield strength not less than 40 ksi
- b) Minimum Elongation 12% to 14%

1.4.4 Tying of Reinforcement

All reinforcement shall be suitable tied with 20 SWG annealed binding wire. All crosses are to be tied with wire and tying of alternate crosses shall not be allowed. Steel chairs and concrete spacer blocks shall be so fixed, as to achieve maintaining of proper cover to concrete.

All concrete spacer shall be made from the same ratio of concrete, as is being used for the structural member.

1.4.5 Concrete Clear Cover for Reinforcing Steel shall be as follows:

Structural Members	Minimum Cover, Inches
a) Concrete cast against and permanently exposed to earth	3
b) Concrete exposed to earth or weather: No. 6 through No. 18 Bars No.5 and smaller Bars	2 1-1/2
c) Concrete not exposed to weather or in	

contact with the ground:	
i) Slabs, Walls (No. 11 & smaller bars)	$\frac{3}{4}$
ii) Beams, Columns: (Primary Reinf, ties, stirrups, spirals)	1-1/2

1.5 Specification for Brick Masonry work

1.5.1 Material

1.5.1.1 Cement

Grey Portland cement shall be normal setting cement of make and source as approved by the Engineer. Sulphate resistant cement where required shall be Sulphate Resistant Portland cement of make and source as approved by the Engineer. Cement will be ASTM C 150 unless otherwise acceptable to the Engineer. Only one brand of Cement throughout the Project, will be used, unless otherwise acceptable to the Engineer.

1.5.1.2 Sand

Sand shall be river sand. Fineness modulus shall be between 2.2 and 3.10 and shall pass through 3/16" sieve and 2 to 10% by weight through No.100 sieve.

1.5.1.3 Water

Water to be used in the work shall be potable water. It should be clean and free from injurious amounts of oil, acids, alkalis, salts, organic minerals, or other substances that may be deleterious to concrete or reinforcement.

1.5.1.4 Bricks

Bricks shall be first class burnt kiln bricks, uniform in color, regular in shape and size, well burnt with clear ringing sound. Bricks shall be tested at Contractor's cost to comply the strength requirements. Minimum crushing strength shall be 1,700 Psi. The bricks shall not absorb more than 15% water when immersed in water for 24 hours.

1.5.2 Reinforced Brick Masonry

Reinforcement for the brick work wherever applicable (to be provided as per the details shown in the drawings) shall be furnished by the contractor and shall conform to applicable requirements for reinforcement specified in the section "Reinforcement".

1.5.3 Mortar

1. Mortar shall be composed of the ratio as shown in the drawing or as described in the BOQ. The ingredients shall be thoroughly mixed dry sufficient water added to make the mixture workable. Grout should comply to specific strength requirements.
2. Mortar shall be mixed in batches which could be consumed within half an hour.
3. Mortar shall be used within half an hour of mixing. Mortar standing for more than half an hour shall not be used.

1.5.4 Masonry and Jointing

1. Bricks shall be soaked in water tank for 24 hours before use. Regular replacement of water for subsequent lot of bricks be ensured. All masonry shall be laid in the plumb, true to line and level in correctly spaced courses with breaking joints.
2. All horizontal and vertical joints shall be completely and solidly filled with mortar as the bricks are laid.
3. Thickness of joints shall not exceed 3/8".

1.5.5 Curing

All masonry work shall be properly cured for 10 days after being built by keeping the masonry surface continually wet. Thereafter the curing shall be continued for further 7 days by sprinkling water twice a day.

1.5.6 Payment

Payment shall be made according to the agreed rates as per the contract. However, if the un-reinforced masonry is done with the approval of the Engineer, contractor shall have to submit the rate for the same for Engineer's approval & payment.

1.6 Specification for Flooring

1.6.1 Material

1.6.1.1 Specification for materials (cement, sand, coarse aggregates, water) shall confirm to the relevant sections under "Plain & Reinforced Concrete (Section 1.3)

1.6.1.2 Specifications for nominal concrete mixes (PCC 1:2:4 & PCC 1:4:8) shall confirm to the relevant sections under "Plain & Reinforce Concrete" (Section 1.3)

1.6.2 Cement Concrete Floor

1.6.2.1 The base course shall consist of 4" thick PCC 1:4:8 over 6" thick layer of course sand laid over thoroughly compacted natural ground surface. After the cement concrete bed has been cured, as directed by the Engineer, it shall be roughened

and well-watered before floor finishing is laid. The floor finishing shall comprise of 2 inches thick PCC 1:2:4 laid in panels of 4'x4' (or as directed by the Engineer) with marble dividing strips as indicated on the drawings and approved by the Engineer. After laying concrete, it shall be thoroughly rammed, and mortar worked up to the top and smoothed with a steel towel.

Freshly placed concrete floor and completed portions of the floor as finished shall be protected to prevent the loss of water by damp sand and shall be kept constantly damped for a period of ten days or longer as directed by the Engineer. The concrete shall be allowed to dry out slowly over a period of four days after curing is completed.

1.6.3 Terrazo Floors

1.6.3.1 Materials

Cement, sand and water shall conform to the specification as desired under Section 1.3 "plain & reinforced cement concrete".

Marble Chips

Marble chips shall be crushed marble and best quality white or colored, sound and hard local marble chips of the required size, as approved by the Engineer.

1.6.3.2 Samples

All materials used for Terrazzo flooring shall be submitted to the Engineer and his approval obtained and same type of material will be used throughout the work. If required the material be got tested by the contractor at his own cost from the laboratory approved by the Engineer.

1.6.3.3 Application

The area to be provided with Terrazzo flooring shall be made into a wearing surface by having provided a 1-1/4" thick PCC 1:2:4 laid in marble strip (1-1/2" x 3/8" thick) panels not more than 16 sft, well roughened and watered. Before the base course has set, the 3/4" thick Terrazzo mixture mixed in the proportion of 1:2 (1 Cement and 2 marble chips) shall be troweled into the surface of the sub base to thickness which after grinding shall result into the finished thickness as required. A layer of neat cement of the specified color shall then be troweled into the surface, leaving the plain smooth surface.

Not before 24 hours at least and not beyond 72 hours the contractor shall start smooth machine grinding the top layer with carborundum blocks of coarse, medium and fine grades so that all marble chips are evenly exposed all over the surface. If not so, the wearing surface shall be got removed and be relayed, by the contractor, at his own cost. The surface after grinding shall be left undisturbed and cured for at least 10 to 14 days. After the surface has dried final gloss shall be given by polishing the surface using Mansion Polish or approved equivalent to the

satisfaction of the Engineer.

1.7 Specification for Plastering and Pointing

A. Plastering

1.7.1 Materials

1.7.1.1 Portland cement shall be normal setting of approved make.

1.7.1.2 Sand shall be river sand.

1.7.1.3 Water shall be potable.

1.7.2 Mixing of Mortar for Plastering

All mortar shall be machine mixed. In case hand mixing is permitted in writing, by the Engineer, 10% extra cement shall be used at contractor's cost.

1.7.3 Application of Plaster

1.7.3.1 All the holes and blocking for installation of any fixtures and wiring, conduit, and pipe sleeves, opening for installation of equipment etc. shall be installed and approved before plastering. Cutting and drilling in finished plaster shall not be permitted.

1.7.3.2 Masonry joints shall be raked out in concrete surface thoroughly hacked to provide a rough surface for proper key to the plaster. Surface will be wetted and a spray coat of cement slurry be applied before laying plaster.

1.7.3.3 Plaster shall be made in 2 coats where thickness is more than ½".

1.7.3.4 All plaster shall be finished true in line, levels and plumb. The surface shall be even and smooth without trowel marks, kinks, bulges or deformities of any sort. All exposed corners and edges shall be chamfered or rounded off.

1.7.4 Patching

Plaster containing cracks, blisters and pits will not be acceptable. Such plaster shall be removed and replaced with plaster conforming to this specification and approved by the Engineer. Patching shall match with existing work in texture and color.

1.7.5 Curing

Plaster shall be kept continuously wet at least for 10 days and thereafter wetted at the interval of 4 hours for the next 10 days.

B. Struck Pointing

Where shown on the drawings the exterior faces of the walls shall be finished by struck pointing in joints in cement sand mortar of the ratio specified in the bills of

quantities and on the drawings. The green mortar shall be deep raked after brickwork has been laid. Cement sand mortar shall then be applied within the exposed joints. The joints shall then be struck with help of a pointing tool to form a groove 3/8"x 1/4" deep. Care shall be taken that striking tools do not develop a cutting edge as the objective of striking the joint is to compress the mortar into the joints.

The exposed faces of all brick masonry shall be thoroughly cleaned and left bare with struck joints as specified above.

1.8 Specification for Terrazzo Dado Skirting

1.8.1 Materials

Cement and sand water shall conform to the specification as desired under Section 1.3 "plain and reinforced cement concrete".

Marble chips

Marble chips shall be crushed marble and best quality white or colored, sound and hard local marble chips of the required size as approved by the Engineer.

1.8.2 Samples

All materials used for Daddo/ Skirting shall be submitted to the Engineer and his approval obtained and same type of material will be used throughout the work. If required, the material be got tested by the contractor at his own cost from a laboratory approved by the Engineer.

1.8.3 Application

The area to be provided with Daddo/ Skirting work shall be made into a wearing surface by having provided plaster surface in 1:4 cement sand mortar in required thickness well roughened and watered. Cement mortar of specified ratio shall then be plastered over the well roughened surface to the required thickness. Before the best course has set, the layer of Terrazzo mixture mixed in the proportion of 1:2 (1 Cement and 2 marble chips) shall be troweled into surface of the base to a thickness which after grinding shall result into finished thickness as required. A layer of neat cement of the specified color shall then be well troweled into the surface, leaving the plain smooth surface.

Not before 24 hours at least and not beyond 72 hours the contractor shall start smooth machine grinding the top layer with Carborundum blocks of coarse, medium and fine grades so that all marble chips are evenly exposed all over the surface. If not so, the wearing surface shall be got removed and be relayed, by contractor, at his own cost. The surface after grinding shall be left undisturbed and cured for at least 10 to 14 days. After the surface has dried, final gloss shall be given by polishing the surface using Mansion polish or approved equivalent to the

satisfaction of the Engineer.

1.9 Specification for Painting/ White Wash/ Color Wash Work

1.9.1 General

The term paint as used herein includes emulsions, enamel paints, distempers, durocem, varnishes, sealers, primers etc. All color shades shall be subject to the approval of the Engineer.

1.9.2 Materials

All paints shall be of ICI, Dulux Pak Limited or approved equivalent. All paints shall be of freshly manufactured batches.

1.9.3 Samples

Samples of each type of paint and primers etc. along with manufacturers technical literature, instructions and shade card shall be submitted to the Engineer for approval.

1.9.4 Preparation of Surface

1.9.4.1 General

Hardware, accessories, plates lighting fixtures and similar items shall be removed/ protected prior to painting operation. All surfaces to be painted shall be clean, smooth & dry.

1.9.4.2 Concrete and plastered surfaces

Plaster shall be at least 1 month old and shall be thoroughly dry and clean. Cracks and holes shall be repaired with patching plaster with approved epoxy bonding compound and treated with Berger make plastron.

1.9.4.3 Metal work

All metal work shall be coated with primer (red oxide paint) at shop. Metal work to be painted shall be clean and free from corrosion. All rust shall be removed by sanding blasting or chipping and wire brushing.

1.9.5 Application of paints

All the work shall be done in a workman like manner with no drips, ridges, waves, laps & brush marks on finished work. Sufficient time shall be allowed between coats to ensure proper drying. Paints shall be thoroughly stirred and kept at a uniform consistency during application.

1.9.5.1 Internal Finish of concrete/ plaster

1. All surfaces shall be prepared as in sub- Section-1.9.5.
 2. Irregular surfaces shall be made smooth by rubbing or grinding & applying proper putty.
-

3. Three coats of whitewash shall be applied.

1.9.5.2 External Finish of brick work

No external paint/ whitewash is required. Instead, external brickwork will be pointed. Color wash/ red oxide shall be applied on pointed brickwork if specified in the drawing.

1.9.6 Application of paints

Painting of steel Ventilator, Windows, and Fly Screen Panels (Enamel Paint) all operations as 1.9.5 above.

1.9.7 Cleaning

Upon completion of all work all staging, scaffolding and containers shall be removed from site. Paint spots, oils or stains on adjacent surfaces shall be removed, the entire job left clean & acceptable.

1.10 Specification for Steel Doors, Windows, Ventilators, Grill and Expanded Metal Wire Gauze Panels

1.10.1 Materials

Heavy duty Steel Z- Section/Box shall be of the sizes and gauge as shown in drawing or BOQ and shall confirm to ASTM A-36 with minimum yield strength of 36,000 Psi.

1.10.2 Fabrication and Installation

1.10.2.1 Structural steel shall be fabricated and assembled in the shop.

1.10.2.2 Contractor shall be responsible for fitting of members as shown on the drawings.

1.10.2.3 All holes/ voids should be accurately located. Holes/ voids shall be drilled and shall not be made or enlarged by burning either in the fabrication shop or in the field.

1.10.2.4 All connections, unless otherwise shown on the drawings, shall be made by welding. The welding shall be executed by duly qualified welders. Full width and depth of joint shall be welded and grinded smooth.

1.10.2.5 Finished windows and ventilators shall be painted. After removing rust, shop primer coat shall be applied. Further 3 coats of approved enamel paint shall be applied.

1.10.2.6 Windows and ventilators shall be erected in prepared opening in accordance with the relevant drawings/ details. They shall be set in plumb and properly aligned and securely anchored.

1.10.3 Glazing

- 1.10.3.1** All windows and ventilators shall be provided with best quality 5-mm thick clear glass, fixed with putty and steel beading.
- 1.10.3.2** Steel Grill with Expanded Metal (Burfi Jali).
- 1.10.3.3** Steel grills of approved design shall be of 12 gauge expanded metal with 1" openings shown in drawings or described in BOQ. Grills shall be painted with one primer coat and 3 coats of approved enamel paint.

1.11 Specification for Structural Steel Works for Roof Trusses

1.11.1 General

The work, covered under this section, shall comprise furnishing, fabricating, and erecting structural steel roof, to be constructed in accordance with these specifications and to the lines, grades, thickness and cross-sections shown on the drawings and /or as directed by the Engineer.

1.11.2 Conformity to AISC Specifications

Except as modified below, all steel structure work shall confirm to the requirements laid down by the Manual Steel Construction, Seventh Edition, of the American Institute of Steel Construction (AISC).

1.11.3 Material Requirements

Except when otherwise shown in the Drawings or specified in the Bill of Quantities the materials shall confirm to the following requirements.

1.11.4 Materials

General:

All the components shall be sound and free from injurious matter, cracks, air holes, blows, wounds, scales, spitted grains and blunt rises.

Structural Steel Sections:

Except where otherwise shown in the Drawings, all the structural steel sections shall conform to applicable requirements of ASTM A36 "Structural Steel" with minimum yield of stress of 36,000 Psi.

Steel Sheets and Plates:

Steel sheets and plates, where required, shall confirm to the requirements of BS 1449 "Steel plates, Sheet and Strips".

Steel Bolts

Except, where otherwise shown in the drawings, the steel bolts shall confirm to the applicable requirements of ASTM A307 "Specification for Low-Carbon Steel Externally and Internally Threaded Standard Fasteners".

1.11.5 Samples and Tests

- a. The samples of all the materials, to be used for metal work, shall be approved by the Engineer and same type of material shall be used during work.
- b. If the Engineer desires to get the material tested, this will be done by the Contractor, at his own expense from a laboratory, approved by the Engineer.

1.11.6 Construction Requirements

1.11.6.1 Fabrication and Installation of Trusses and Purlins

a. General

Fabrication and installation of roof trusses and purlins shall not be commenced until approval has been obtained from the Engineer.

b. Cutting

- 1) Metal sections shall be well formed, to shape and size, with the sharp line or angles. Shearing and punching shall leave clean, true lines and surfaces.
- 2) The metal sections shall be thoroughly straightened by methods that will not injure it before being laid off or worked in any way.
- 3) The members shall be so straightened that they are not, more than 1/16", away from a straight plane in either direction, for full length of members.
- 4) All members shall be so cut and formed that they can be accurately assembled without being unduly cracked, strained, or forced into position.

c. Jointing

- 1) The metal work shall be shop fabricated, but assembled at site, by welding, riveting, or bolting, as specified.
- 2) Splices and joints shall be made, only in such positions, as shown on drawings or as directed by the Engineer.
- 3) The welding, where required, shall be done with the help of electric/hydroxy flame.
- 4) Welding shall be continuous along entire line contact, except where spot welding is indicated on the drawings or is authorized by the engineer.
- 5) Welding points should be made smooth by filling and grinding, to the satisfaction of the Engineer.
- 6) Bending, straining, or pounding, with sledges, shall not be allowed, during erection.

d. Finishing

All finished members must be free from twists, bends and open joints.

1.11.6.2 Built in Items

All parts of metal or woodwork which are to be built into the roof structure shall be furnished and installed, as required, during the progress.

1.11.6.3 Painting

Except, where otherwise specified, all structural steel members shall receive one coat of rust inhibitive metal primer or red lead paint and two coats of finish painting, with enamel paint, of approved make and color.

1.11.6.4 Roof sheets

- a) Except where otherwise stated in the Bill of Quantities or shown in the Drawings, 0.70mm corrugated GI sheet shall be used, for roof. The said sheet thickness shall be exclusive of the thickness of galvanization.
- b) Sheets shall be fixed to the purlins or other roof members as shown in the drawings.
- c) In case of GI sheet, it shall be ensured that galvanizing is intact and has not been damaged or rubbed off.
- d) The corrugated sheets shall be laid with a minimum lap of 9" at the ends and of 3 corrugations at the sides.
- e) Holes in the corrugated sheets, for hook bolts, should be drilled and not punched in the ridges of the corrugation and should be made on the ground. The nuts, of the hook bolts, shall be tightened from above.
- f) Top surface of purlin should be painted before sheets are fixed.

1.11.7 Protection

- a. The Contractor shall take care to protect the work from any damage of whatsoever nature, during the construction period.
- b. In case of any damage done, to the work, the contractor shall remove, replace, or rectify such work at his own cost, without any additional compensation.

1.12 Specification for Roofing (Slab Structure)

1.12.1 Description

This work shall consist of furnishing and laying all types of roofing, in buildings, in accordance with these specifications and to the lines, grades, thickness and cross sections shown on the Drawings and /or as directed by the Engineer.

1.12.2 Material Requirements

1. Portland Cement, Brick Tile and Water: Portland cement, brick tile and water shall conform to the requirements laid down in various relevant sections under chapters on "Plain and Reinforced Concrete and Brickwork".
 2. Fine and Coarse Aggregate: Fine and coarse aggregates shall conform to the requirements, laid down in relevant sections under chapter on "Plain and Reinforced Concrete".
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3. Bitumen Polythene sheet and Clay: Bitumen polythene sheet and clay, for roofing, shall conform to the requirements, laid down here under.

Bituminous Material for Water Proofing

- a. Except where otherwise specified, special Industrial Bitumen of grade 10/20 (SIB 10/20) shall be used for, all damp proofing works. The material shall confirm to following specifications.

i. Specific Gravity at, 77°F	1.02/1.04
ii. Softening point (R&B), °F	170/200
iii. Penetration at 77° F, 100gm	10/20
iv. Ductility at 77° F (cms)	4/7
v Solubility in Ce 14 (min)	99.5%
iv Working Temperature, °F	300/350

- b. The approved material shall be brought in sealed containers, with a certificate of manufacturer, regarding the quality of material.
- c. The storage and application of material shall strictly follow the manufacturer's instructions

4. Polyethene Sheet: Polyethene sheet to be used shall be 50 micrometers (300gms) free from cuts.

5. Clay: _____

- a. Clay shall be plastic and obtained from sources approved by the Engineer.
- b. It shall not contain more than 10% fine sand; 0.5% soluble salts; 0.2% sulfate; and 4% organic contents. It shall not contain any gravel, coarse sand, roots of glass and plants.

1.12.3 Construction Requirements

1.12.3.1 General

The continuity of the roof treatment shall be ensured without any break.

1.12.3.2 Roofing Components

1. The roofing for buildings, shall be as shown in the drawings or directed by the Engineer.
2. Unless otherwise specified the roofing for buildings shall comprise the following:
 - i. 2 coats of hot bitumen (SIB: 10/20) @ 1kg per m² (20 lbs per 100 ft²), each coat, applied on cleaned roof surface.
 - ii. Polythene sheet (300gms)
 - iii. 50 to 125 mm (2" to 5") thick consolidated mud laid to slope.
 - iv. 38 mm (1 1/2") thick brick tiles laid in 1:3 cement sand mortar, flush pointed.

1.12.3.3 Bitumen Application

1. In all cases, bitumen shall be applied on dry surfaces.
2. The surface, of the roof, shall be cleaned, of dirt, dust, and all loose materials, by sweeping, it thoroughly with a broom.
3. The bitumen, applied shall have neat uniform uninterrupted surface, free from bubbles and pin holes.
4. The surface shall be allowed to dry before proceeding with the remaining roof treatment.

1.12.3.4 Polythene Sheet

The polythene shall be laid with a minimum lap of 150 mm(6").

1.12.3.5 Mud Laying

1. The clay shall be laid out in stack, not exceeding 300mm (12") in height, and saturated with water and allowed to stand for not less than 3 days, water being added during this period to ensure complete saturation.
2. The binding material, Bhoosa (not less than 4" long) shall then be added and the mixture well puddled and left for 2 days or so. It shall then thoroughly mixed to the required consistency and thickness.
3. The mud, so prepared, shall be laid, to the required slope, as shown on the drawings and/ or as directed by the Engineer.

1.12.3.6 Brick Tiles Laying

1. The brick tiles shall be laid wet, grouted, and pointed flush, in cement sand mortar (1:3).
 2. The top surface should be smooth and accurately laid to grade, in accordance with the specified slope.
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1.12.3.7 Curing

Tiles, after laying, grouting, and flush pointing, shall be cured, for at least seven days.

1.12.4 Protection

The contractor shall take each and every care to maintain the slopes, levels and shall protect the work from any damage during construction and maintenance period. The contractor shall have to remove, replace, and rectify such damaged work at his own cost and risk.

PART II
(WATER SUPPLY AND SANITATION WORKS)

1.13 Specification for Water Supply and Sanitation Work

1.13.1 Plumbing Fixtures

1.13.2 Materials and Installations

1.13.2.1 Materials shall conform to the latest referenced standard specifications & other provisions stipulated here and shall be new and unused.

1.13.2.2 All fixtures shall be of best quality & finish & shall be approved locally manufactured.

1.13.2.3 All taps and cocks to be installed with plumbing fixtures shall be chrome plated (CP) and shall be of appropriate class to work without damage or leakage on the specified pressure of 28 psi. The taps and cocks shall be of best quality locally manufactured.

1.13.2.4 Where practical, all pipes from fixtures shall be run to the nearest wall. Where fixtures come in contact with wall floors, the joint shall be watertight.

1.13.2.5 Wall hung fixtures shall be rigidly supported by metal supporting members so that no strain is transmitted to the connections & shall be secured by approved non-corrosive screws or bolts.

1.13.2.6 Fixtures shall be set level and in proper alignment with reference to the adjacent walls. The supply lines or fittings or every plumbing fixture shall be installed to prevent back flow.

All cuttings, making holes etc. & making it good shall be included in the work.

1.13.2.7 Water Closet (Orissa)-Asian Style

1. The squatting WC shall be pour- flush type, without flushing cistern manufactured by Karam Cera, Three Star, Victory or equivalent.
2. The squatting type pan shall be of non-absorbent glaze fire clay with 4" outlet and integral foot rests. The flushing water connection shall be from the rear end. The pan shall be sufficiently long to prevent urine from splashing out.
3. The pan outlet shall be fitted with separate 4" diameter glazed ceramic trap, with minimum of fouling area and a seal depth of more than 2".

Water Closet Type English WC(EWC)

English Style water closet type EWC should be consisted of the following:

1. Light Color vitreous china water closet P or S trap
 2. Seat cover
 3. One number couple flush tank with dual flush button
 4. Thimble
 5. Nuts and bolts
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1.13.2.8 Floor Trap

These shall be of cast iron or of other anti-corrosive metal. They shall be provided with removable stainless-steel strainers. The traps shall be self-cleaning type. Floor traps shall be well set in position so that there is no leakage at the joints between trap & the floor. They shall have a water seal of 2".

1.13.2.9 Taps and Cocks

Except where otherwise specified, water taps shall be as follows:

1. All taps should be of 1/2" size, screw down type, of chromium plated (CP) brass body, complying with BS 1010 manufactured by Three Star, Crown, Mehran or equivalent.
2. Spindles, glands, crutches, washer plates, and nuts shall be of brass or manganese.
3. All taps shall be eased and greased before fixing.

1.13.3 Cast Iron Soil, Waste, Vent, Rainwater, Drainage Pipes and Pipe Fittings

1.13.3.1 Materials

Cast Iron soil pipe, waste pipe & fittings should be of best quality and shall be centrifugal (SUNP) cast. The joints shall be lead or elastomeric (Rubber Ring) caulked. The packing material shall be pure jute. Cast iron pipe shall be CME manufactured or equivalent or as approved by the Engineer.

1.13.3.2 Installations

All cast iron pipes & fittings shall be installed to the lines and grades shown on the drawings or as directed by the Engineer. No piping shall be hung from the piping of other system. All steel clamps shall be given one coat of red oxide primer and two coats of synthetic enamel paint. Caulked joints for cast iron bell shall be firmly packed with jute and filled with molten lead not less than 25mm (1") deep. All vent pipes to be installed in the system shall be provided with approved cowl & shall rise at 2-6" above the roof.

The contractor underwater head test shall test the entire system of drains, waste & vent piping inside the building to the satisfaction of the Engineer.

1.13.4 Galvanized Iron Pipes and Pipe Fittings

1.13.4.1 Material

The galvanized pipe shall be of medium grade & shall conform to BSS 1387 manufactured by KPM, ILL or equivalent or as approved by the Engineer.

1.13.4.2 Installation

The run and arrangement of all pipes shall be as shown on the drawings and as directed by the Engineer during the installation. All vertical pipes shall be erected plumb & shall run parallel to the walls & other pipes. All horizontal runs of piping shall be kept close to the wall. Screwed joints in G.I pipes shall be made perfectly tight with approved jointing compound or tape. All water distribution system shall be pressure tested. The contractor shall pay for all devices, materials, supplies, labor, and power required for the test.

1.13.5 Reinforced Cement Concrete Pipes

1.13.5.1 Material

RCC pipes shall be best quality, having 1:2:4 cement, sand, and aggregate ratio & reinforcement cage according to prevailing RCC pipes standards.

1.13.5.2 Laying of RCC Pipes

Pipes & accessories shall be carefully examined before being laid & defective/damaged pipes shall not be used. The bottom of the trench shall be shaped to give substantially uniform circumferential support to the lower fourth of each pipe. Each pipe shall be laid true to line & grade & in such manner as to form close joint with the adjoining pipe. For RCC pipes, the cement-sand mortar to be used on joints shall be of 1:1 ratio as per plans. Trenches shall be kept free from water until the pipe jointing material has set. Test shall be applied before the pipes are hunched with concrete or covered after back filling of trench. Water test shall be carried out in drainage lines of RCC. Water should be added until absorption by pipes & joints has ceased. A slight amount of uniform sweating may be overlooked but excessive sweating in a particular part of joint shall be taken as defect.

1.13.6 Construction of Manhole

1.13.6.1 Material

Brick masonry, cement, concrete, and other materials shall meet the specified requirements of relevant sections of specifications.

1.13.6.2 Construction Requirements

Manholes shall be constructed with brick masonry or specified wall thickness laid in 1:4 cement-sand mortar. The cover slab shall be of RCC 1:2:4 fitted with heavy-duty CI frame with RCC cover. The internal walls of the manhole should be plastered in CSM 1:4. Benching and channels in PCC 1:2:4 shall be provided at the bottom of the manhole & mild steel ring steps should be provided as shown in the drawings.

PART III
(ELECTRICAL WORKS)

1.14 Internal Electrification

1.14.1 Internal electrification work shall consist of (but shall not be limited to) providing all materials, labor, tools/plants and supportive services for the complete supply, installation connecting up, testing and commission of the following:

1. Wiring for lights and fans
2. Light fittings
3. Ceiling Fans
4. Distribution Boards Complete with breakers
5. Switches, Switch Sockets, Holders, Brackets
6. Earth System (if new distribution board is provided)

1.14.2 The contractor without any extra cost, shall provide all allied and small works/ materials not mentioned in the BOQs/ drawings that are required to complete the installation.

1.14.3 Light Fixtures

1.14.3.1 Cable and Wire

Cable shall be 3-1/2 core copper conductor PVC/ PVC armored or non-armored of Pakistan Cables, AGE or Pioneer Cables. Melange wires shall be copper conductor, PVC insulated manufactured by Million or equal or as acceptable to the Engineer.

1. Cable for light points should be 3/29 points PVC for conduit wiring with 99.9% copper. The cable would be tested for insulation and resistance as per standard.
2. For power points 7/29 PVC single core shall be used. The conductor shall be 99.9% copper.

1.14.3.2 PVC Conduit

PVC conduit shall be installed or concealed in the roof, wall, column etc. At all joints, bends etc. PVC jointing solution as manufactured by Pakistan PVC LTD or (approved equivalent) shall be used to strengthen and seal the joints. Smooth bends shall be used. Bending of conduit by heating or otherwise including sharp 90 degrees bends and or tees shall not be allowed.

1.14.3.3 Fluorescent Lights

All fluorescent lights such as TMS, GMS or patti fittings shall be Phillips type locally manufactured or equal or as acceptable to the Engineer.

1.14.3.4 Incandescent Light

NBR 501, NCD 533 shall be Phillips type locally manufactured or equal or as acceptable to the Engineer.

1.14.3.5 Fans

Fans shall be capacitor type manufactured by Millat, Younas, Pak Fans, GFC or equal or as acceptable to the Engineer.

1.14.3.6 Switches and Sockets Outlets

All switches, 5 Amp switch-socket outlet, 15 Amp switch- socket outlets shall be of PPI make or equal or as acceptable to the Engineer.

1.14.3.7 Distribution Board

Molded case circuit breakers and miniature circuit breakers shall be of Terasaki, BBC or equal or as acceptable to the Engineer.

1.14.4 Earthing

Earthing system shall consist of (but not limited to):

- a. Earth electrodes
- b. Earth continuity conductor
- c. Earthing leads
- d. Earth connecting points

It shall also include all other accessories to complete an effective earthing system.

1.14.5 Earth Electrodes.

1. Earth electrodes shall be made of perforated G.I pipe and minimum diameter of pipe shall be 25 mm (1inch) and shall not be less than 2.0 meters (6.5ft) long
 2. Copper conductor from the distribution board shall be connected at the top by means of brass bolts/nuts with washers on both ends.
 3. A minimum of one earth electrode shall be provided for buildings where Distribution Board is to be provided.
 4. A 300mm. (12 inches) diameter hole shall be excavated in the ground at a minimum distance of 6ft from nearest plinth protection and pipe electrode shall be erected vertically in the hole. A mixture of coke breeze and salt shall be packed around the pipe electrode up to a depth of 3ft from ground level. The remaining portion of the holes shall be filled with sweet earth duly watered and rammed. Top end of the pipe shall be covered with G.I socket and plug.
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SPECIFICATIONS
FOR
SUPPLY AND INSTALLATIONS OF SOLAR PANELS AND
ALLIED EQUIPMENTS

INTRODUCTION:-

These specifications have been derived and referred from the Government of KPK document recommended and approved by their standardization committee of Engineering product / Materials / equipment's titled as **"Revised Technical Specifications for Solar Panels and Allied Equipment (Rev 2019)"**.

A- SPECIFICATION FOR SOLAR SYSTEMS-COMMON PART

1- SOLAR PANELS:

- a. The PV modules (s) shall contain mono crystalline silicon Grade-A Solar cells. (N-Type Mono PV Cell Modules and bifacial double Glass modules due to the better performance will be given preference)
 - b. The PV module should Work well with high-voltage input inverters/charge controllers (1000 Vdc)
 - c. The PV Panel must have clear anodized aluminum frame with anti-reflective, hydrophobic, low – iron Tempered cover glass
 - d. The solar modules shall meet following valid IEC Standards or latest:
 - a. IEC 61215-1, IEC 61215-1, IEC 61215-2: 2016 (Design Qualification)
 - b. IEC 61730-1:2016 (Safety Requirement for construction)
 - c. IEC 61730-2:2016 (Safety – Requirements for testing)
 - d. IEC TS-62804-1 (i.e. TUV PPP-58042 or Equivalent) Anti- PID Certification.
 - e. IEC 61701 Salt Mist corrosion Resistance Test (Latest)
 - f. IEC 62716 Ammonia Corrosion Resistance Test (Latest)
 - g. IEC 60068-2-68 Sand and Dust Erosion Resistance Test
 - e. Unique Serial Number, name /logo of manufacturer and separate date of manufacturing (DD/MM/YYYY) should be laminated inside the modules so as to be clearly visible from the front side.
 - f. Properly laminated stickers containing the following details should be available at the back side of the module.
 - a. Name of the manufacturer /distinctive logo
 - b. Model name and type of Cell Technology
 - c. Peak Watt Rating (Wp) and Power Tolerance Range
 - d. Voltage (V_{mp}) and Current (I_{mp}) at STC
 - e. Open Circuit Voltage (VOC) and Short Circuit (ISC)
 - f. Maximum System Voltage (Vdc) (i.e: This should not be less than 1000 Vdc)
 - g. Dimensions of PV Module
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- h. Test Standard (s) to which the modules has been tested and certified.
- g. Following essential technical parameters of solar panel / modules should be provided with each panel supplied as well as in the technical proposal.
- h. I-V curve for the solar photovoltaic module/panel
- i. Date and year of obtaining IEC PV module standardization qualification certificate
- j. PV Module efficiency at STC
- k. Working Temperature range of PV Module
- l. Each panel should have factory equipped weather proof terminal junctions box having at least IP67 protection with provision of opening for replacement of DC cables blocking diodes and easy debugging if necessary.
- m. Limited performance guarantee: panel power in standard conditions will not be less than 90% of nominal power by the end of 10 Years of operation and at least 80% at eh end of 25 years of operation with 25-year limited power warranty
- n. The PV Module should have at least 17.50% Module efficiency with Positive Power tolerance.
- o. The PV module should have at least 10 Years warrant for any defects and efficiency as mentioned above. It should be provided On Stamp paper Signed and Sealed by contractor at the time of Handing /Taking Over.
- p. The PV modules offered should not be more than 12 month old from the date of issue of work order
- q. PV Module should have a Snow Load bearing of 5400 pa and Wind load bearing of at least 2400 pa how ever if department deem appropriate may go for 3800 pa wind load depending upon their requirement.
- r. The solar Module should be free from visual and cosmetics defects.
- s. The department/consultant on the expense of contractor /supplier shall verify Flash test report with serial numbers from manufacturer to each panel (at the time of supply).
- t. All information regarding solar panel with above mentioned featured data should be accessible and verifiable online on the manufacturer website.
- u. IEC accredited lab test for solar panels is mandatory.
- v. EL (Electro-Luminous) test will be performed randomly for each individual at the cost of contractor/supplier.

2. CABLE & WIRING:

- a. The AC/DC cables should be made of 99.9% copper strands and Flexible
 - b. From PV Panel to Junctions Box, ELPE or XLPO insulated & EXLPE/PVC Sheathed, UV stabilized single core, Double Insulated, Stranded/flexible cables conforming preferable to EN 50618 OR IEC FDIS 62930) be used.
 - c. From JB to inverter, the Dc cable must have Single Core, double insulated and suitable for minimum 1000 V_{DC} transmission.
 - d. From Inverter to batteries, the DC able can be single insulated, Single Core and suitable for minimum 300 V_{DC} transmission.
 - e. DC Circuit Breaker (not fuse) of $\geq$ Voc of String Voltage and suitable ampere rating (1.25 to 1.50 times of rated Current of all strings connected) must be installed between PV modules and controllers / inverter.
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- f. AC Circuit Breaker (s) of suitable rating (1.25 to 1.350 times of connected load) must be installed between controller /inverters to Load and Grid to Controller /Inverter.
- g. AC/DC breakers rating should be approved from Engineering In-charge before installations at site
- h. DC/AC breakers rating should be approved from Engineer In-charge before Installation at site.
- i. To prevent solar panel from damage and appropriate size of DC Breaker / Fuse should be installed from each PV string and Surge Protection should be installed for combined Array (before Main DC Breaker /Inverter)
- j. DC Breaker, Ac Breaker and Change overs should be placed in a enclosure. All enclosures / Junctions boxes should be made from Hot Dipped Galvanized Sheets of minimum 16 SWG.
- k. Cables shall be clearly labeled with essential electrical parameters including manufacturer name, Voltage Range standards etc.
- l. All Dc wiring shall be aesthetically neat and clean, over all wiring connections losses shall not exceed 1% of the total rated output power.
- m. All connections/sockets outlets among array, controller, inverters batteries and pumping set etc must be made in junction boxes of adequate protection level.
- n. All Sires /cables should be in standard flexible UV-Resistant conduits /HDPE of PN12, SDR 13.6, PE100, outdoor installation & (2-3 feet deep) for underground wiring /Cabling and PVC ducts for indoor Installations.
- o. The DC Combiner Junction Box should be properly earthed including earthing of door as well.
- p. The DC Combiner should contain proper buss bars of adequate size each for Positive, Negative and Earthing.
- q. The Inverter Junction box should be properly earthed as well as vetted design of the Engineer in-charge
- r. All wiring should be in proper conduit of capping casing. Wire should not be hanging loose
- s. All wires should be terminated properly by using lugs / thimble connectors /Sleeves.
- t. Distribution board must be installed with proper screws.
- u. Electrical Hazards Safety Labels should be pasted on DC combiners /VFD Enclosure /Charge Controller /Battery Enclosures.
- v. Following lab tests are mandatory

Conductor resistance test, Insulation resistance test, Pressure test Spark test

- w. DC Cable from PV Module to Junction Box / Inverter for each string should be Minimum size $6mm^2$
- x. DC Cable sizing (for Pumping Schemes) from Junction Box to inverter as per details below

S. No	Nos of Strings	Cable size (mm^2)	Remarks
1	1	6	If Cable length is >200 ft (One Sided) than cable size should also be increased accordingly
2	2	10	
3	3	16	
4	4-5	25	
5	6-8	35	

3. PANEL MOUNTING & STRUCTURE:

- a. The Panel mounting and structure should be made of hot dipped (80 microns Average Galvanized steel of minimum thickness of **12 SWG / 2.64 mm Channel / Pipe or 8 SWG / 4.06 mm Angle**(profile of channel and Sketch Attached for References)
- b. A sketch of the mounting frame (As per actual Site Requirement) showing dimensions of the frame parts should be provided at the time of supply.
- c. PV to ground clearance must not be less than 1.5 feet. The height of the upper edge of the structure should not exceed 10 feet above the ground and 6 feet of the roof top installations.
- d. To avoid Shading, Distance between two rows of PV panels and from walls should be maintained at a minimum of 1.6 times the height of structure/walls.
- e. The pit size for concrete works should be minimum 1.5x1.5x2 feet for each individual legs or 1.5x1.5x2 for double leg and the concrete should be extended at least 1 foot above ground. The concrete ratio should be 1:2:4.
- f. The Surface azimuth angle of PV module 180° and the Tilt angle (slope) of PV Module should be 33°.
- g. The PV modules will be mounted on metallic structures of adequate strength and appropriate design, which can withstand load of modules and high wind velocities up to 150 km per hour
- h. Due to land non availability or any other problem, structure design can be modified as per site requirement. Pole Mounted or manual Tracker Structure can be provided with the approval of engineer in-charge
- i. Array fasteners (nut/bolts/washer) between PV Module and Structure shall be Stainless steel. Washer should be installed on both sides and Module frame.
- j. The minimum space between two PV Modules should be 2.54cm (1 Inch), to avoid air push over PV modules. \
- k. Mechanism/arrangement for cleaning of PV Panel should be provided i.e: Space and ladder between panels or at the back side of structure, so that the operator can safely climb and clean the panels
- l. All other array fasteners Structure shall be stainless steel or Galvanized steel that provides the required mechanical strength
- m. The PV modules will be mounted on metallic structures at the inner holes for cantilevered installation, which will evenly distribute the load of the panel around the support structure both sides and in the middle

4. EARTHING / GROUNDING:

- a. The PV Panel frame and structure should be connected by the shortest practical route to an adequate earth contact (of Less than 5 Ohms resistance) as per requirement of equipment manufacturer and site earth conditions, using an uninterrupted conductor. Grounding can reduce risks of damage from lightning –induced surges.
 - b. The size of Earthling conductor will be done as per NEC Table 250.122
-

- c. The Grounding conductor should be 99% Copper and PVC insulated / Bare Copper if installed underground along a defined path there size & design shall be approved from Engineer In-charge before installation at site
- d. Motor, inverter, Battery / Battery Box (if required), Main Distribution Board should be connected to an adequate earth contact / Grounding.
- e. Ground enhancement material (GEM) shall be used below and above the Earthling plate for proper Grounding. Gravel or coarse sand shall be pour along with soil in the pit
- f. Grounding / Earthing plate should be mad of copper plate of 4mm thickness & Size minimum 1.0 x 1.0 ft.
- g. Grounding / Earthing conductors should be connected to the plate /Rode /GI Pipe by proper connector of minimum depth of 6 feet.
- h. Alternatively Earthing rod of Suitable size and length can be installed (instead of Plate). If given / Mentioned in the BOQ/Design and Engineer In-charge Approval.

5. BATTERIES:

- a. The battery should be deep Cycle, GEL OPzV/ OPzS, Lithium LiFePO4, Lead Carbon Type or equivalent. (Note: battery type shall be specified in the bidding documents.)
- b. The battery must ensure safe reliable operations in the whole range of ambient temperatures from -5°C to +50° C.
- c. The maximum permissible self-discharge rate should not be more than 5% of rated capacity of per month at 25°C.
- d. The Battery shall have a certificate of compliances, issued by a recognized laboratory.
- e. The Batteries should have two years Comprehensive replacement warranty.
- f. The battery shall meet the requirements and recommendations given in IEC 61427, IEC 60896 21/22 (for VRLA) or equivalent. Lab Test Reports for battery cycle life should be provided.
- g. The Battery must support parallel connection to increase capacity in case of future expansions Each battery should have following minimum information printed on battery:
 - Model Number, Serial Number and Type of battery.
 - Rated Voltage and Capacity (AH) at discharge rate of 10 Hours.
 - Origin of Made.
 - Manufacturer Name with distinct logo
- h. The following information must be provided in the data sheet while submitting technical bid.
 - Certification /Test Standard (S) of Battery.
 - Information regarding cycles and self-discharge rate.
- i. In case of rechargeable battery bank (having more than one Battery), the Interconnection shall be made using lead plated copper buss bars or properly insulated flexible copper conductors.
- j. Battery disconnect switch / Breaker of suitable size should be installed between batteries and inverter/ charge controller.
- k. The Battery must have low self –discharge rate, No memory effect and no Gassing.

5.1. GEL BATTERIES:

5.1.1. Cycle Life of the GEL battery (12V) before 80% capacity of Initial Capacity must be minimum 1000 cycles @ 50% depth of discharge (DOD) at discharge rate of 10 Hours.

5.1.2. Cycle life of the GEL battery (2V Cell Before 80% Capacity of Initial Capacity must be minimum **1300** cycles @ 50% depth of discharge (DOD) at discharge rate of 10 Hours.

5.2. LEAD CARBON:

5.2.1. Cycle life of the Lead Carbon battery (12V before 80% capacity of Initial Capacity must be minimum **2000** cycles @ 50% depth of discharge (DOD) at discharge rate of 10 Hours.

5.2.2. Cycle life of the Lead Carbon battery (2V) before 80% capacity of Initial Capacity must be minimum **2500** cycles @ 50% depth of discharge (DOD) at discharge rate of 10 Hours.

5.3. OPzV / OPzS BATTERIES:

5.3.1. Cycle life of the OPzV / OPzS battery (12V) before 80% capacity of Initial Capacity must be minimums **2500** Cycles @ 50% depth of discharge (DOD) at discharge rate of 10 Hours

5.4. LEAD CARBON:

5.4.1. Cycle life of the Lead Carbon battery (12 V) before 80% Capacity of Initial Capacity must be minimum **2000** cycles @ 50% depth of discharge (DOD) at discharge rate of 10 Hours.

5.4.2. The Battery must have integrated Battery Management system (BMS) to ensure battery safety and reliability.

5.4.3. The BMS of the battery must have following specification:

- Temperature protection
- Over charge protection
- Low voltage disconnect
- High voltage disconnect
- Short circuit alarm function
- Self-balancing function

5.4.4. The LiFe PO4 Battery must have LED status and alarm indication.

5.4.5. The charge and discharge rate of the battery must be designed at 0.2C minimum but capable of handling 0.5 c charge and discharge current.

Note:

- **Product brochure, catalogue and certificates must be attached with the Technical Bid.**

6. BOX/STAND FOR BATTERIES , SHS-INVERTER & CHARGE CONTROLLER:

- a. The Batteries should be housed in a vented compartment/stand that prevents users from coming in contact with battery terminal. This compartment/stand be strong enough to accommodate the weight of the battery.
 - b. A mechanism to prevent opening and entry of the battery should be provided.
 - c. This compartment should be manufactured of mild steel of at least **18 SWG**
-

- d. The compartment should be powder coated paint
- e. The entire enclosure/stand must be constructed to last at least twenty years without maintenance and should be protected against corrosion. The enclosure should have a clean and neat appearance, battery box/ stand should be installed at a place in accordance with user's preference.

7. LED FLOOD LIGHTS:

- a. Solar Based LEDs/Light fixtures shall conform to the latest IEC/ISO internationally recognized standards.
- b. LEDs/Light fixtures should not be Chip on board (COB) single chip type due to their poor heat dissipation.
- c. LEDs/Light fixtures shall be modular type with proper heat sinks.
- d. Solar based lights (LED fixtures etc) should provide at least Lumen /watt.
- e. The color rendering Index (CRI) must be equal or greater than 70
- f. LEDs /Light fixtures should be designed to deliver at least 10 years of services.
- g. Complete lightening unit shall be weather proof (Protection Class IP65).
- h. The output from the LEDs/Light fixtures should be constant throughout the duty cycle.

8. AC ENERGY EFFICIENT LED LIGHT BULBS:

SHAPE	Cap/Fitting/ Base Type	Colour	Lumens Per Watt	Colour Temperat ure	Colour rendering Index (CRI)	Life time of Lamp (Hours)	Power Factor & Rated Voltage
Globe	E27	Cool or Warm white	Min 100w	2700 k / 6500 k	70	10000	≥ 0.70 & 220 Vac

Note:

- LED Light Bulbs should be marked with the manufacturer model number, rated voltage, Wattage.

9. AC ENERGY EFFICIENT CEILING FANS :

Sweep		Rated Power	Speed		
Inches	MM	Watts	Rpm		
56	1400	50 Max	≥ 320		

- a. 10% + in Power Consumption is allowed as per PSQCA Standard
- b. Rated Voltage : 230 V- (±10V)
- c. Rated Frequency: 50 Hz
- d. Insulation Class: 155(F) or better
- e. Motor Core: electrical Steel Sheet
- f. Winding Wire: 99.99% Super Enameled Copper CA Wire or 99.99% Pure Copper wire.

Note:

- Energy efficient fan should be marked with the manufacturer model number, rated voltage and wattage

10. DC ENERGY EFFICIENT LED LIGHT BULBS:

- The LED lamps must have luminous efficacy of at least 80 lm/w (at 25 °C ambient temperature).
- The LED lamp must be protected against reversed polarity of the operations voltage.
- Base shall be a E-27 thread type
- The emitted light shall be cool or warm white
- The Wide angle shall be between 120° to 125°
- Operating Voltage 12Vdc/ 24Vdc
- Lamps should be marked with the manufacturer model number, rated voltage, wattage and date of manufacturer or batch number.

11. DC CEILING FANS:

Sweep	Rated Power	Speed	Service Value	Operating Voltage
Inches	Watts	Rpm	Air Delivery/W	V
48 ((with speed Control Metal Blades)	30-36	> = 320 RPM	9.54	12/24

12. DC PEDESTAL FANS:

Sweep	Rated Power	Speed	Service Value	Operating Voltage
Inches	Watts	Rpm	Air Delivery/W	V
18 Inches (With Speed Control)	18-30 w	1250 RPM(Full Speed)	5.22	12/24

13. INVERTER BASED SPLIT AC

Inverter based AC with both heating and cooling options.

S. No	Description	UNIT	DETAILS
1	Compressor	Type	Multistage Rotary
2	Noise Level (Indoor)	DB (Max)	< 50
3	Voltage Range	Volts (Min & Max)	180 to 250 Vac

14. PVC CHANNEL DUCTS AND PIPES:

- A product of good quality standard material standardized by the provincial standardization committee with suitable size to be provided/ used as per direction /approval of Engineer In-charge.
- Ducting must done with proper steel nails and clips
- All ducting (wiring) must be align. +

15. FLEXIBLE PVC PIPE

- a. The flexible PVC pipe should be of good quality material standardized by the provincial standardization committee with suitable size to be provided / used, as per direction/approval of Engineer In-charge.

16. CIVIL WORK:

The following civil works should be carried out for ground installation of SPV Modules/mounting structures.

- a. Minor Cutting and clearing of trees/plantation to avoid shadows
- b. Civil work for earthing system as per the statutory requirement

17. REFLECTIVE / INSULATING PAINT

The Roof paint should be ultra-white, high reflective, 100% acrylic elastomeric roof sealer designed for fixing leaks in roofs the paint should contain heat reflective pigments and additives that provide an excellent, highly protective barriers which reflects that sun's heat and destructive UV rays leaves a brilliant ultra-white finish, reducing surface heat absorption up 20 °F.

The Reflective paint should comply with ASTM D6083, Fiber Reinforced for more protection strength and durability which allows for contraction and expansion, Resists surface fungal growth.

18. WARRANTY/AFTER SALES SERVICE:

Two years comprehensive free replacement, repair and maintenance Warranty at site (Free of Cost) should be provided for all the components of solar system. (if not mentioned separately otherwise).

B- SPECIFICATION FOR SOLAR PUMPING SYSTEMS

19. PUMP (SUBMERSIBLE):

Pump should be supplied having standard ISO-9906 specifications. The pump must be submersible, made of stainless steel. The characteristic curves (Original form manufacturer) showing the efficiency at duty point and performance of the pump should be provided in the technical proposal and also at the time and pre-supply testing. The quoted pump should be tested for its performance and certified as per ISO-9906 standard. The pump should 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 part. 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 wearing 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 liquid handled.

Specification for main components of the Pumps:

S.NO	Components	Specification
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1	Casing/Diffuser	The Casing/Diffuser should be in fabricated stainless steel AISI 304/316
2	Impellers	Stainless steel AISI 304 / 316.
3	Driving Shaft	Stainless Steel 304/402/316
4	Sleeves	Stainless Steel AISI 329 /304/316
5	Gaskets	Rubber Gaskets
6	Bearing	AISI 329 stainless steel
7	Coupling & Screen + Cable Guard	Stainless Steel AISI 316/319/304/420
8	Non-Return valve/ Sluice Valve	As per British standard specifications (BSS), Minimum PN16 (16 bar) or above (as per site requirement) PN Value / Bar Capacity of Valves must be more than installed Pump Max /shut-off Head Minus Static Water level of Bore . (Leakages in Valves are NOT Acceptable).
9	Pressure Gauge	As per British standard specifications (BSS), Having PSI or Bar scale (4 inch size), Liquid Filled, minimum 350 PSI Range, Looped siphon tube pipe, stainless Steel / Polypropylene Casing
10	Clamps	Steel - Pressed
11	Pump Efficiency	Minimum efficiency of the pump (for discharge of 3000 GPH and more) should be 70% ensured at duty point. (Duty Point of the Pump be preferable selected at the peak efficiency point or (Within $\pm 10\%$ of discharge) of Pump peak efficiency Point)

20. MOTOR:

The winding material should be 99.99% copper. The Motor should have we 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 at the time of pre-supply testing. The Testing report with the basic parameters should also be provided at the time of pre-supply testing. 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 380Volts at 50 Hz. The motor should be capable of operating with variable speed through V/F control. Winding of the motor shall of remind able type with class - IC40 insulation and IP68 protection. The synchronous speed should be 2850-2950 RPM, Motor shall be capable for continues operations. Motor must be filled with water without any chemical additives hazards to health for cooling. The motor must be properly protected against the entry of well water sand etc by double mechanical seal one is rotating and other stationary and must be made of Silicon carbide / Tungsten carbide is 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 lower part of the motor. The axial thrust bearing of the motor should be able to bear a download thrust force from the water pump and upward thrust force produced while starting the water pump. Motor in open well / water tank should be installed with cooling jackets shroud / sleeve and when motor is installed in bore then installing of

cooling jacket in also required. Motor shall be capable of maximum of 20 starts in an hour. Motor efficiency of motors 7.5 HP and above should not be less than 75% at Full load and Motor Rated Voltage.

Technical specification of rewindable wet stators, three phase squirrel cage water filled submersible Motor

S. No	Component	Specification
1	Winding	Made of pure electrolyte copper and the winding insulation should be suitable for > 1000 Volts and must full fill resistant test range.
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
3	Rotor	Energy efficient low-Losses electrical magnetic sheet fixed with high grade copper bars, M800 or M600 magnetic sheets are preferable to use
4	Spline Shaft	AISI 420 stainless steel, flange dimension according to NEMA standard, over size design to ensure stiffness in severs condition.
5	Shaft bearing	Water lubricated guide/general bearings fixed in upper and lower brackets should be made of metal impregnated carbon.
6	Lower Thrust bearing	Thrust sliding block bearings, self-aligning Mitchel type, should be able to withstand 20000N axial load
7	Mechanical Seal (Stationary & Rotary)	Silicon carbide or tungsten carbide mechanical seal.
8	Cooling Filling Fluid	Water mixed with non-toxic anti-freeze provide cooling and lubrications also protect and prevent inside parts from corrosion.
9	Degree of protection	IP68
10	Insulation Class	Insulation Class B (130°C) NEMA Insulation Class F (155°C) NEMA or above will be given Preference
11	Voltage Tolerance	+6% to -10%
12	Mounting Position	Capable of both Vertical and Horizontal Installation
13	Class	IC40
14	Maximum immersion	150 Meters
15	Starting per hour	20

21. SUBMERSIBLE FLATE ELECTRIC CABLE (4-Core):

The Submersible cable (4-Core) should be made of 99.9% copper stands with double PVC insulation for **1000 VAC**, should be adequately flexible and environment friendly. Stranded and flexible insulated copper wires and cables must be used for all outdoor and indoor installations. The wiring that leads into the building shall be protected in a conduit. The cable must have undergone quality test as per BSS standards. Cable size should be selected so that the Voltage drop of losses in the drop cable should not be more than 2.5%

Following lab tests are mandatory,

- Conductor resistance test.
- Insulation resistance test
- Pressure test.
- Spark test
- Note: the supplier should provide the quality tests certificates at the time of pre-supply testing and inspection

22. COLUMN PIPE:

The column pipe shall be flanged ERW steel pipes confirming the ASTM designation A-53 with a minimum thickness of **3.6/ 4.0 mm (3.6 mm for pipes upto 2.5" dia and 4 mm for pipes above 2.5" dia)** and shall be painted with corrosion resistance paint of suitable thickness. Flanges thickness of 19-20 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 a approximate length of 10 feet column pipe shall be flanged perpendicular to the axis of pipe. Column pipe size should be selected so that the HEAD Losses in the column pipe should not be more than 5%.

For Reference a table-1 is given below.

HDPE pipe of ≥ 0.75 inch diameter, SDR 13.6, PE 100, confirming to ASTM F-2160 Standard without joints to be installed / included along with and equal to column pipe for confirming Water level testing purpose.

FEATURES:

- Manufacturer's pipes should meet international standards like BSEN 10255 & ASTM 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
- Pipe should be NDT tested (Non-destructive – Eddy current)
- Pipes should be hydrostatically pressure as per manufacturing standard.
- Pipes should be gone through straightening process to remove bendiness

23. TOPSET:

Top set shall comprise of Bore covers plate, (covering bore hole completely and securely installation/suspension clamps (2-Nos), sluice valve (BSS/ASTM), reflex valve (BSS/ASTM), washout valve approx. 3-4 feet above the ground (T- connection for testing Pump's discharge connector and able jointing material (Cable connection from motor to switching device shall be joint free), Liquid Filled Pressure gauge minimum 4 inch diameter suitable / appropriate for the required head pressure and cable ties. Bore Cover Plate should have provision for water level testing facility (i.e., Hole for sonic Water Level Meter / HDPE pipe insertion).

For cleaning of solar Panels, plastic pressure should be provided of suitable length to reach the furthest / last solar Panel.

Every Water Supply Scheme should have a non-removable name plate fitted at suitable place / box having essential information and bearing the name of supplier, Consultant and Client.

24. SOLAR PUMP INVERTER /CONTROLLER:

- a. The solar pump inverter / controller should have built in advance version of auto MPPT controller over load protection, Soft start / Soft Stop Features and Variable Frequency Drive (VFD) with integrated Gate Bipolar Transistors (IGBTs) of European, USA or Japanese origin or at least equivalent.
- b. The make and origin of the inverter /controller should be clearly mentioned in the catalog and submitted in the technical proposal.
- c. The inverter offered should comply to or equivalent standards.
 - I. CE/RoHS
 - II. Low Voltage directive 2014 / 35 / EU
 - III. EMC Directive 2014 /30 /EU
 - IV. IEC 62109- (Safety of Power converters for use in PV Systems)
- d. The complete datasheet showing all the electrical parameters like input and output voltage ranges should be provided in the technical bid.
- e. All the electrical parameters like input and output voltage ranges, and efficiency should be provided at the time of pre-supply testing and inspection
- f. Efficiency of inverters should be 96% and above at Rated Capacity.
- g. Efficiency of inverter should be 98% and above
- h. The inverter < 25kW ingress protection of inverter must be minimum IP 65 rating or above and for inverter > 25KW ingress protection of inverter / enclosure will be minimum IP 54 rating or above .
- i. Inverter / controller having the capability to run both on AC and DC Power would be given preference.
- j. Inverter should have at least two (2) years product and performance warranty.
- k. The Pump controller / Inverter should have an ON/OFF Switch/Button to Start and Stop the Pump.
- l. Inverter should have active RS232/485 etc communication port available, the Data available through this port can be used for Remote monitoring .
- m. Inverter circuit must include protection again
 - I. Over or Low voltage and current beyond critical level of the inverters circuits.
 - II. Protection against accidentally short circuits & reverse polarity connections.
 - III. Protection against lightning induced transients.
 - IV. Over load protection.
 - V. Low RPM protection (i.e. Frequency <30 HZ or as per pump characteristic curve) Motor Should Stop
 - VI. Dry run protection (PF / Current Based)

25. dV/dT or Sine Filters with Inverter (VFD):

- a. The Use of Load reactors increase the liability , performance, and efficiency of VFD systems extends the life of Both drives and motors and reduces the amount of energy consumed by the motor / drive system.
-

- b. Output dV/dT or Sine Filters (between VFD and Motor) of appropriate size (for 3-phase $\geq$ 380 Vac Motor of Class B insulation should be used where the cable length between motor and inverter is more than fifty (50) feet or as advised / recommended by the inverter manufacturer in their technical documentation. For Cable lengths of more than 150 meters sine filters should be used
- c. Filter should be enclosed in a vented box
- d. Filter efficiency should be minimum 97%
- e. Filter should have a current rating of equal or greater than Motor FLA Rated current
- f. Distance between filter and pumping inverter should not be more than 2 meters.
- g. Motors with insulation Class F, H or above are exempted from the requirements of dV/dT filter.

26. SYSTEM DESIGN FOR PUMPING SYSTEM:

- a. Suitable factor of safety should be applied while designing the system in order to have compensations for variations in irradiations.
 - b. For Fix Structure and Auto Tracker, the PV panel **peak power at STC (Wp) should be 75% more** than the motor basic input power (**PV Loss Compensation Factor = 1.75**).
 - c. For Auto /Manual Tracker, the PV panel **peak power at STC (Wp) should be 50% more** than the Motor basic input power (**PV Loss Compensation Factor = 1.5**) as per direction of Engineer In-charge.
 - d. If Single Axis Auto Tracker Structure is installed on the above factor, then daily operational timings of pumping can be increased by 10-20%, as compared to fixed structure installation.
 - e. Total PV Power (WP)(Imperial Gallons) =
$$\frac{Q \text{ (iGPH)} * TDH \text{ (ft)} * 746 * \text{PV Loss Factor}}{60 * 3300 * \eta_{\text{pump}} * \eta_{\text{motor}}}$$
 - f. Total PV Power (WP) (US-Gallons) =
$$\frac{Q \text{ (US-GPH)} * TDH \text{ (ft)} * 746 * \text{PV Loss Factor}}{60 * 3960 * \eta_{\text{pump}} * \eta_{\text{motor}}}$$
 - g. Total PV Power (WP) (Metric Units) =
$$\frac{Q \text{ (m}^3\text{/hr)} * TDH \text{ (m)} * 9.81 * 1000 * \text{PV Loss Factor}}{3600 * \eta_{\text{pump}} * \eta_{\text{motor}}}$$
 - h. Voltage (V_{mp}) of Each string of PV Panels should be as per details given below and string Voltage (V_{mp}) should be within the MPPT range of Inverter.
 - i. For 380 Vac 3- Phase Motor = $380 * 1.414 * 1.06 = 570$ VDC String, Minimum
 - ii. For 220 Vac 3-Phase Motor = $220 * 1.414 = 310$ Vdc String
 - iii. Small inverters (i.e : 3 phase, 220 Vac) with voltage boost function are exempted from the above string voltage requirements. String can made as per boost inverters / Controller recommended String DC Voltage and should not be less than 230 VDC in any case.
 - i. Details of each PV Panel string should be submitted in Technical proposal (I. e NOS of total strings and Nos of PV panel in each string along with wattage and V_{mp} of each PV Panel).
 - j. Unjustified oversizing, in PV Panels Wattage is not allowed
 - k. To avoid any oversizing in PV Panels Wattage is not allowed.
-

- l. Solar pump inverter should have a kW Capacity equal or greater than the Motor Rated input Power.
- m. Solar pump inverter / controller Size (kW) $\geq$ (Motor Rated Power in kW / motor efficiency).
- n. Solar Pump Inverter / controller should have current rating of 1.15 Times minimum of Motor FLA Rated current.
- o. Motor should not be loaded more than 90% (i.e. Design /calculated BHP should not be more than 90% of Motor rated Horse Power)
- p. Along with this specification, contractor should also follow manufacturer's recommendations for all major components of Solar Pump Systems.
- q. Requirement of Efficiency for Motor i.e. 75% will not apply on Motors smaller than or equal 5.5 HP and the requirement of Efficiency for Pump i.e. 70% will not apply on pump having discharge equal to or lower than 3000 GPH

27. PRESSURE PUMPS (UPTO 5.5 HP):

- a. Submersible pump conforming to ISO-9906 Standard.
- b. Pump + AC Motor (3-phase -220 / 380 V) of Dc Motor and Pump with display Unit.
- c. Solar Pump inverter / controller should be MPPT based and Minimum Ingress protection of IP65.
- d. In Case, where the column pipe diameter is less than or equal to 1.5 inch (For discharge equal or less than 6000 LPH and/or for Motor 4 hp and below), HDPE pipe of at least PN 12 /SDR 13.6 / PE100 (for TDH of equal or less than 300 ft) without joint may be used instead of MS Pipe for better economics and to avoid hydraulic losses. However stainless steel rope of minimum diameter of 6 mm (28 mm²) for suspension of pump-set must be supplied with HDPE pipe. (Note: for TDH of more than 300 ft, HDPE pipe type / thickness may be increased / changed accordingly)+
- e. Top set shall comprise of suitable Galvanized stand (Design should be verified from Engineer In-Charge before start of work)+
- f. For Pressure Pump $\leq$ 5.5 HP schemes, solar module efficiency requirement is minimum 16% (Only for cut cells PV Modules or Cell size of 5 Inches PV Modules)
- g. Connection to overhead water storage tank. Top bend, S.S fasteners & Erection Clamps.
- h. Civil work to protect borehole i/e foundation
- i. The pump should operate safely with Sand particles up to (50) gram/m³

28. DC SOLAR WATER PUMP – SETS (UPTO 5.5 HP)

- a. DC Motor can also be provided for equal or less than 5.5 hp
 - b. Motor should be capable of both AC and Dc operation. There must be auto power source recognition feature
 - c. The motor should be brushless permanent magnet type.
 - d. The controller must have display Unit, showing all essential parameters (i.e. Current, Voltage Etc).
 - e. The controller must be MPPT efficiency should be equal or more than 98%
 - f. Pump should have auto and soft start / stop feature
 - g. The Pump – Set should have following protections
 - Dry Running protection
-

- Reverse Polarity Protection
- Over Phase Protection
- Over Head Protection
- Lose Phase Protection
- Electronic Protection
- Over current / over Head protection

Note: The specification at serial number 27 and 28 above for Pressure Pumps(upto 5.5 HP) and DC Solar water pump-sets(upto 5.5 HP) are for illustrative and reference purposes, the designer or proponent of Solar Pump motor set (greater than 5.5 HP upto 60 HP) shall mention the modified or relevant applicable standards (including the above applicable) to the specific higher HP designed.

29. SOLAR AUTO TRACKER:

- The solar tracker offered should be fully automatic and intelligent, and must be capable of single axis tracking (from east to West) and should have it own power supply (PV panel, Battery and Charge controllers) other than PV Panel used for Pumping setup.
- Individual Auto tracker should be ≥ 4 kW each and Tacking Accuracy should be within $\pm 5^\circ$.
- The auto tracker should also have manual control mode to adjust the tracking angle manually, structure material should be Hot dipped Galvanized Steel (Minimum 80 Microns).
- All nuts, bolts washers, and other fasteners for mounting structure shall be made of minimum A2 grade stainless steel. \
- Foundation and other details will be separately provided.
- Two years comprehensive Free replacement, repair and maintenance Warranty (free of cost) should be provided for all the components of auto tracker (including Batteries).

30. PV MOUNTING FRAME WITH MANUAL TRACKERING:

Suitable for 2.5 or 3.5 KW PV Panels easily movable in multi directions having flanges with bearing balls $\frac{1}{2}$ " and having angle adjustment. Base steel cage $\frac{3}{4}$ " MS rod and 3.5 feet length with nut bolts systems for strong anchoring Piller pipe 6 mm with 5.5" dia, base plate 15" x 15" x $\frac{1}{2}$ " size with 04 number of supports, support for PV, 5 mm thickness 4" dia pipe and 24"x12"x $\frac{1}{4}$ " side plates. MS Angle side bracing 2"x 2" x $\frac{1}{4}$ ", for panel mounting. Steel structures/frames shall be powder coated Galvanized nuts, bolts and washers for tracker fitting. Steel frame shall be properly designed and shall withstand wind speed/load of at least 130 Km/hr and though weather condition. **The above are desirable minimum mounting frame structure specs, the higher KW PV panels systems supporting mounting frame should be accordingly strengthened with steel sections and members of standard specifications.**

31. PRE-SUPPLY TESTING & INSEPCTION:

The firm applying for the tender hast to provide the recent test bed reports from the pump / motor manufacturer or any other third party as per ISO-9906 standard. Each of the offered pump set models must undergo these test prior to supply installation. In order to endure the quality and

standard of the equipment contractor may be asked to provide test insult conducted by third party for re-verification.

32. OPERATION AND MAINTENANCE MANUAL:

An operation and Maintenance Manual, in English and Urdu language, should be prepared and provided by the contractor with the solar PV pump system. The manual should have information about solar energy, photovoltaic, modules DC/AC motor pump set, tracking system (if any), mounting structures, electronics and switches. It should also have clear instructions about mounting of PV module, DO's and DON'T's and on regular maintenance and trouble shooting of pumping system name and address of the person or center to be contracted in case of failure or complaint should also be provided.

C- SPECIFICATION FOR SOLAR HOMES & BUILDING SYSTEMS

33. GRID TIE INVERTER (ON –GRID without battery backup / Hybrid with battery backup)

1. UL - 1741 certificate or IEC 62109-1 and IEC 62109-2 or Equivalent Certificates.
 2. Minimum 95% conversion Efficiency at Rated Capacity (High Frequency Inverters).
 3. Minimum 87 % efficiency for Transformer based inverters (Low frequency Inverters).
 4. The inverter should have built in MPPT controller
 5. The Priority of the inverter should be set that load will be running from the solar energy than grid and in the end will be running from the Battery Backup
 6. Inverter (Hybrid Only) must be capable of configuring for charging GEL, Lead Carbon, OPzV/OPzS batteries and Lithium Iron phosphate batteries (LifePO4).
 7. Hybrid Inverter (If Quoted along with Lithium Batteries) must be capable of communication with the BMS of Lithium batteries.
 8. Rated output voltage of inverter / Controller shall be pure sine wave AC.
 9. Total harmonic distortion (THD) IN AC output should not exceed 3% at rated capacity.
 10. The degree of protection of the ON-Grid inverter installation should be IP-65 rated and for indoor hybrid inverter installation, the IP rating should be IP-20 or above
 11. Wide Input voltage range capability, (i.e. Voltage Range can be adjustable / selectable)
 12. Natural convection cooling for maximum reliability.
 13. Outdoor enclosure for unrestricted use under any environmental condition.
 14. Capability to connect external sensors for monitoring environmental conditions.
 15. The output of the inverter must synchronize automatically is AC output to the exact AC voltage and frequency of the Grid
 16. The inverter should have the capability of Parallel operation upto three units. (Only for Projects, where more than one inverter should be installed).
 17. Inverter should have active RS232/485 etc communication port, the Data available through this port can be used for remote Monitoring.
 18. Liquid crystal display should at least be provided on the investors front panel or on separate data logging/ display device to display following.
 - a. DC Input voltage
-

- b. DC Input current
- c. AC Power output (kW)
- d. Current time and Date
- e. Temperatures (C)
- f. Converter Status

19. Inverter circuit must include protection against:

- Over or Low voltages and currents beyond critical level of the inverters circuits.
- Protection against accidental short circuits
- Protection against lightning induced transients
- Over load protection

34. OFF-GRID / HYBRID INVERTER:

1. The inverter must be pure sine wave output suitable for 220 Volt, 50Hz.
2. Inverter must be capable of configuring for charging GEL, Lead Carbon, OPzV/OPzS Batteries and Lithium Iron Phosphate Batteries (LifePO4)
3. The inverter / system must have a MPPT Solar Charge controller.
4. Minimum 92% Conversion Efficiency at Rated Capacity (High Frequency Inverters).
5. Minimum 87% Efficiency for Transformer based inverters (Low frequency Inverters).
6. Total harmonic distortion (THD) in AC output should not exceed 3% at rated capacity.
7. The Inverter must be user programmable for selecting PV, Grid and battery Priority as well as Built in Programmed and user defined voltage and current settings of the charge controller for GEL, Lead Carbon, OPzV/OPzS batteries and lithium Iron Phosphate batteries (LiFePO4).
8. The Inverter must have protective function limits for :
 - a. AC under Voltage protection
 - b. AC over Voltage protection
 - c. Battery under Voltage alarm
 - d. Low Voltage Disconnect
 - e. High Voltage disconnect
 - f. Overload and short Circuit Protection
 - g. Over Temperature Protection
9. Then inverter must be ISO 9001, ISO 14001 and CE Certified.
10. Then Inverter must have IEC 62109-1 and IEC 62109-2 or equivalent Certificate.
11. The degree of protection of the outdoor inverter Installation should be IP-55 rated and for indoor Inverter Installation, the IP rating should be IP-20 or above
12. Wide input voltage range capability.
13. Inverter should have active RS232/485 etc communication port, the Data available through this port can be used for Remote Monitoring.
14. Inverter (if Quoted along with Lithium Batteries) Must be capable of communication with the BMS of Lithium Batteries.

Note:

- Product Brochure, Catalogue and certificates must be attached with the Technical proposal.
-

D- SPECIFICATION FOR SOLAR STREET LIGHT

35. SOLAR STREET /ROAD LIGHT SYSTEM DESIGN:

- a. Assessment of Wattage of the LED Luminaire, Pole Height, Pole thickness, pole top diameter, pole base diameter, base plate size, Base Plate thickness, Stiffener size, Stiffener thickness, Pole arm design, Pole Arm length, Pole arm thickness, Pole arm diameter, Pole arm Placement / Fixing position, RCC foundation size, Anchor / J-bolt size, Steel Rebars cage (Mesh and Number of Poles (Pole to Pole Distance) should be according to the design provided /approved by the engineer in-charge.
- b. Round conical or Octagonal Hot dipped Galvanized Pole of average 80 Microns should be installed
- c. All Nuts, Bolts and Washers should be stainless Steel
- d. Pole Baseplate should be tightened in between two stainless steel nuts and washers (one nut and washer at upper and one nut and washer at lower side of the base plate).
- e. All Anchor / J-Bolt shall be in level and align to each other.
- f. All Anchor/J-Bolt shall be galvanized.
- g. All Anchor / J-bolt shall have at least 150 mm minimum threads.
- h. All poles shall be installed on leveling nuts secured to the anchor bolts and with locking nuts on the top of the based flange
- i. The concrete ration should be 1:2:4 for RCC foundation
- j. Proper sketches of Pole, base plate, RCC Foundation and Steel Rebars cage (Mesh) should be provided and approved from the engineer in-charge.
- k. In Order to focus on winter sun availability and easy cleaning of Solar Panel from dust etc with Rain Water, Solar panels should be installed at 180° Azimuth Angle and the Tilt angle (slope) of PV Module should be between $45^{\circ} \pm 5^{\circ}$ (Only for solar Street Light)

36. LED SOLAR ROAD /STREET LIGHT FIXTURE:

1. LED Efficacy must be greater than or equal to 130 Lumens/Watt.
 2. The fixture must be IP-66 Rated or above
 3. The color temperature of the LED should be Pure white in the rage of 5000-6000k.
 4. The LED light distribution must be IESNA type II
 5. The LED must be suitable for working Temperature from -40°C ~ $+60^{\circ}\text{C}$ with relative humidity of 15% ~ 90%
 6. The color rendering index (CRI) must be equal or greater than 70
 7. The LED light fixture must be LM79 and LM80 Tested.
 8. LEDs / Light fixtures should not be chip in board (COB) single chip type due to their poor heat dissipation.
 9. LEDs/Light fixtures shall be modular type with proper heat sinks.
 10. The output from the LEDs/Light fixtures should be constant throughout the duty cycle.
 11. LED life should be greater or equal to than 50,000 Hours.
 12. The LED light fixture must have the following certification
-

- ISO 9001
- ISO 14001
- CE (EMC and LVD) Certified or equivalent.
- International Standard Certification

Note: Product Brochure, catalogue and certificates must be attached with the Technical proposal

37. SOLAR CHARGE CONTROLLER (FOR STREET / ROAD LIGHTS):

- The charge controller must be suitable for the required battery voltage, auto voltage recognition feature and capable of charging OPzV & Lithium Ferrous Phosphate (LiFePO4) Batteries.
- The Charge controller must be IP-67 rated or above for outdoor installation.
- The charge controller must be Remote Controlled for parameter setting, the system must have the following feature:
 - *Remote Parameter setting and Monitoring*
 - *Remote control of the Lights (on/off, Timer setting Etc)*
- The charge controller must have MPPT Technology.
- The charge controller must have at least three stage flexible dimming function (0-100%)
- The Maximum power point tracking (MPPT) efficiency should be minimum 97%
- It must have temperature compensation for charging batteries in higher temperatures.
- Charge controller must have the following protections:
 - PV short circuit
 - PV reverse polarity
 - PV over Voltage
 - PV over current
 - Battery Over charging
 - Battery Over Discharging
 - Battery reverse polarity protection
 - Load short circuit
 - Load Lower load protections
- It must have proper heat sink to dissipate excessive heat
- The charge controller must have protection for reverse flow of current through the PV modules.
- Controller should have active port for GSM based communication for Remote Monitoring.
- Mid Night based timing controller will be preferred.
- The solar charge controller must have the following certification:
 - ISO 9001
 - CE Certified

Note: Product Brochure, catalogue & certificates must be attached with the Technical proposal

38. Battery and Controller Box:

- a. The battery box should be made of Hot dipped Galvanized sheet of average 80 microns.
- b. The battery box must have vented compartment having inverted louvers.
- c. For pole mounted batteries battery box must be made of minimum 16 SWG sheet and must have proper locking arrangement for protection against theft
- d. For underground battery installation, the battery box should be made of minimum 16 SWG sheet and should be properly sealed to ensure protection against water. Proper cable glands and packing material should be used to ensure water proofing of the box.
- e. The battery and controlled box should be at least IP65 ingress protection.

39. Electric Cable:

The Specifications of electric cables are as under

- a. Flexible copper cable of proper size along with MC-4 connectors (TUV approved) from solar panel to charge controller and charge controller to battery as well as to light fixtures.
 - b. The cables should be made of minimum 99.9% Pure copper Cable.
-

Form 1: Bid Submission Sheet

Date:

Invitation for Bid No.:

To:

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Document, including Addenda No.: ;
 - (b) We offer to supply in conformity with the Bidding Document and in accordance with the delivery schedule specified in the Schedule of Supply, the following Goods and Related Services: ;
 - (c) The total price of our Bid, excluding any discounts offered in item (d) below is:
P K R;
 - (d) The discounts offered and the methodology for their application are: ;
 - (e) Our Bid shall be valid for a period of _____ calendar days from the date fixed for the bid submission deadline in accordance with the Bidding Document, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
 - (f) If our Bid is accepted, we commit to obtain a Performance Security in the amount of % (percent) of the Contract Price for the due performance of the Contract;
 - (g) Our firm, including any subcontractors or suppliers for any part of the Contract, have nationalities from the following eligible countries;
 - (h) We are not participating, as Bidders, in more than one Bid in this bidding process, other than alternative offers in accordance with the Bidding Document;
 - (i) Our firm, its affiliates or subsidiaries, including any subcontractors or suppliers for any part of the Contract, has not been declared ineligible.
-

(j) The following commissions, gratuities, or fees have been paid or are to be paid with respect to the bidding process or execution of the Contract:

Name of Recipient	Address	Reason	Amount (EUR)
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(If none has been paid or is to be paid, indicate “none.”)

(k) We understand that this Bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal Contract is prepared and executed.

(l) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

Name

In the capacity of

Signed _____

Duly authorized to sign the Bid for and on behalf of Date

Form 2: Declaration of Undertaking

We underscore the importance of a free, fair and competitive procurement process that precludes abusive practices. In this respect we have neither offered nor granted directly or indirectly any inadmissible advantages to any public servant or other person nor accepted such advantages in connection with our bid, nor will we offer or grant or accept any such incentives or conditions in the present procurement process or, in the event that we are awarded the contract, in the subsequent execution of the contract. We also declare that no conflict of interest exists in the meaning of the kind described in the corresponding Guidelines¹.

We also underscore the importance of adhering to minimum social standards (“Core Labour Standards”) in the implementation of the project. We undertake to comply with the Core Labour Standards ratified by the country of _____.

We will inform our staff about their respective obligations and about their obligation to fulfil this declaration of undertaking and to obey the laws of the country of _____.

We also declare that our company/all members of the consortium has/have not been included in the list of sanctions of the United Nations, nor of the EU, nor of the German Government, nor in any other list of sanctions and affirm that our company/all members of the consortium will immediately inform the client and KfW if this situation should occur at a later stage.

We acknowledge that, in the event that our company (or a member of the consortium) is added to a list of sanctions that is legally binding on the client, the client is entitled to exclude our company/the consortium from the procurement procedure and, if the contract is awarded to our company/the consortium, to terminate the contract immediately if the statements made in the Declaration of Undertaking were objectively false or the reason for exclusion occurs after the Declaration of Undertaking has been issued.

Place

Date

Name of bidding company(ies)

.....

Signature(s)

Form 3: Manufacturer's Authorization

Date: LCB No.:

Invitation for Bid No.:

To:

WHEREAS who are official manufacturers of having factories at do hereby authorize to submit a Bid in relation to the Invitation for Bids indicated above, the purpose of which is to provide the following Goods, manufactured by us and to subsequently negotiate and sign the Contract.

We hereby extend our full guarantee and warranty in accordance with relevant clause of the tender documents, with respect to the Goods offered by the above firm in reply to this Invitation for Bids.

Name:

In the capacity of:

Signed: _____

Duly authorized to sign the Authorization for and on behalf of:

Date:

Form 4: General Information about the Bidder

Name of company:

Registered address:

Telephone: ; Fax: ; E-mail:

Names and nationalities of principals/directors and associates:

Type of company (natural person, partnership, corporation, etc.):

Description of company (e.g. general civil engineering contractor):

Company's nationality:

Number of years of experience as contractor:

(1) in own country: ; (2) internationally:

Registration details (Please attach copy of the registration certificate):

Equity in the company shares %

Name(s) and address(es) of companies involved in the project and whether parent/subsidiary/subcontractor/other:

If the company is a subsidiary, what involvement, if any, will the parent company have in the project?

Foreign companies must state whether they are established in the state of the Contracting Authority in accordance with applicable regulations (for information only)

Signature: _____

(a person or persons authorised to sign on behalf of the bidder) Date:

Organisation Chart

Please give details here below of the organisation chart of your company, showing the position of directors, key personnel and functions.

For Joint Ventures each Partner shall submit one separate Organization chart of its own company.

In addition, the Bidder shall submit an organization chart of the Joint Venture including distribution of responsibilities among the partners.

Signature: _____

(a person or persons authorised to sign on behalf of the bidder) Date:

Form 5: Power of Attorney

Please attach here the power of attorney empowering the signatory of the Bid and all related documentation.

Signature: _____

(a person or persons authorised to sign on behalf of the bidder) Date:

Form 6: Overview of Bidder's Personnel

i - Overview/ Summary (Please summarize across all Lots of your bid)

	Skill	Number	Full time/part time
a	Directors and management:		
b	Administrative staff:		
c	Technical staff:		
	- Engineers		
	- Surveyors		
	- Foremen		
	- Mechanics		
	- Technicians		
	- Machine operators		
	- Other skilled staff.		
	- Labourers and unskilled staff		
	Total		

ii - Site operatives to be assigned on the contract

	Skill	Number	Full time/part time
a	Directors and management:		
b	Administrative staff:		
c	Technical staff:		
	- Engineers		
	- Surveyors		
	- Foremen		
	- Mechanics		
	- Technicians		
	- Machine operators		
	- Other skilled staff.		
	- Labourers and unskilled staff		
	Total		

Signature: -----

(a person or persons authorised to sign on behalf of the bidder) Date:

Form 7: Key Personnel made available for the assignment

The following list must be completed for all engineers and senior staff to be employed.

Position	Name	Age	Education	Year of experience (with bidder in Solar and construction)	Major works for which responsible
Contractor's representative/Site Manager					
Electrical Engineer					
Civil Engineer					
Site Engineer					

Signature: _____

(a person or persons authorised to sign on behalf of the bidder) Dat

Form 8: Professional Experience of Key Personnel

To be completed for every key person listed in Form 8.

CURRICULUM VITAE (Maximum 3 pages)

Proposed position in the contract:

1. Personal Details

Surname:	
Name:	
Date of birth:	
Nationality:	
Address: (incl. phone/fax/email)	

2. Education (mention the two highest)

Degree:	
Name of institution:	
From – To (month/year)	

Degree:	
Name of institution:	
From – To (month/year)	

3. Language skills

Indicate on a scale of 1 to 5 (1 – excellent; 5 – basic):

Language	Level	Spoken	Written
	Mother tongue		

4. Computer literacy

5. Professional experience (Please mention the last three positions)

From – To (month/year):	
Place & country:	
Employer:	
Position:	
Responsibilities:	

From – To (month/year):	
Place & country:	
Employer:	
Position:	
Responsibilities:	

From – To (month/year):	
Place & country:	
Employer:	
Position:	
Responsibilities:	

I, the undersigned, certify to the best of my knowledge and belief that

- (i) this CV correctly describes my qualifications and my experience in the extent required;
- (ii) I am not employed by the Employer or PPAF;
- (iii) In the absence of medical incapacity, I will undertake this assignment for the duration and in terms of the inputs specified for me in the Personnel Schedule provided team mobilization takes place within the validity of this proposal or any agreed extension thereof;
- (iv) I am committed to undertake the assignment within the validity of Proposal;
- (v) I am not part of the team who wrote the terms of reference for this consulting services assignment;
- (vi) I am not sanctioned (ineligible for engagement) by donor

I understand that any willful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Signature of expert

Date.....

Form 9:Pending Litigation

To be filled in by each Bidder or member of a Joint Venture

Year ☐	Matter in Dispute	Value of Pending Claim inEUR Equivalent	Value of Pending Claim as a Percentage of Net Worth
☐			