**M/s** _____

Dear Sir / Madam,

**Reference: TENDER ENQUIRY NO: 05-LP-Solar Power Plant-PUR-WBM-2025-26, dt. 22-7-2025**

Wah Brass Mill, a production unit of Wah Industries Limited intends to procure Solar Power Plant with a capacity of 2.5 MWp as per detail, specs given in the Schedule of Tender and attached Annexures. It is requested to submit sealed quotations for the items noted on the schedule of the Tender. Tender will be opened at **1030** hours on **13-8-2025** (Wednesday) and must reach POF Bids Centre through Air mail / courier before 1000 hrs. The tender received late will not be entertained. The bids "By hand" must be received in the Bid center 30 minutes before the time of Bid opening. You may witness the opening of the tender if so desired. If a representative is deputed, he should bring a **letter of authority**. The venue of Tender Opening is **POFs Bid Centre (Room No. 02), Behind Rabta Hall, POF, Wah Cantt**.

## 1. SUBMISSION OF TENDER

1.1 Please quote as per following **Two Stage Two Envelope method**. You are required to quote in two parts: -

Each part should be placed in a separate sealed cover. The envelopes should be inscribed with: Part I "Technical Quotation without Price" and Part II "Commercial Quotation with Price".

**a)** **Part I "Technical Offer":** It should exclusively give technical details and literatures/brochures of the offered items; validity date; delivery schedule; and signed undertaking given on the schedule to this Tender Enquiry. **It must not indicate price, costs etc**. Bid Money of **Rs 10 Million** should accompany in the shape of **Pay Order / Bank Guarantee** with Technical offer. Tenders received without Bid Money will be rejected.

**In the first stage**, bidders shall submit both a technical proposal and a financial proposal in two separate sealed envelopes. Only the technical proposals will be opened and evaluated at this stage. The Purchaser may hold discussions with bidders to clarify technical requirements, and bidders will be given the opportunity to revise their technical proposals accordingly.

**b)** **Part II "Commercial Offer":** It should indicate the commercial terms e.g. price, terms of payment, mode of payment, mode of supply.

**In the second stage**, bidders who agree to the revised technical requirements will submit a revised technical proposal, if needed, along with a supplementary financial proposal. The original sealed financial proposal will remain valid and will be opened together with the supplementary financial proposal at a specified date, time, and venue announced in advance. **The bid evaluated as the most**

**advantageous based on the combined technical and financial evaluation shall be accepted for award of the Contract.**

1.2 Only one tender should be included in one envelope. The outside of the envelope should be inscribed with: -

**Tender Enquiry No: 05-LP-Solar Power Plant-PUR-WBM-2025-26, DT. 22-7-2025**
**Tender to be opened on: 13-8-2025**
**Address : GENERAL MANAGER, Wah Brass Mill**
**POF's Bid Centre (Room No 02) behind Rabta Hall,**
**POFs Wah Cantt Post Code (47040)**
**Phone : 051-9055-22283 Ext. 106, 108, 402**
**Email :** moeez@wahindustries.com, purchase.wbm@wahindustries.com, Mgrmaint.wbm@wahindustries.com

## 2.0 GENERAL INSTRUCTIONS (as per details mentioned in Annex-B)

2.1 The quotation must remain valid for at least 120 days from the date of revised opening of second stage.

2.2 The quotation should hold good for any reduced or enhanced quantity without notice.

2.3 Conditional offers or alternative offers are likely to be ignored.

2.4 Quotations should be based on "Free Delivery" at Wah Brass Mill Quaid Avenue, (Adjacent to POF Main Gate), Wah Cantt.

2.5 The suppliers registered with Sales Tax Dept. are only eligible to participate in the T.E. The competitive supplier shall have to furnish Sales Tax Invoice and Professional Tax Clearance Certificate.

## 3.0 TENDER FEE

The Tender must be accompanied by a non-refundable fee of rupees **Rs. 2,500/-** by means of a **Pay Order** in favour of CEO / MD Wah Industries Ltd., Quaid Avenue, Wah Cantt. **The Tender fee must be made part of Technical offer**.

## 4.0 BID MONEY

4.1 Bid Money amounting to **Rs 10 Million** should accompany in the shape of Pay Order / Bank Guarantee issued from a Scheduled Bank drawn in favour of CEO / MD Wah Industries Limited. **Tenders received without Bid Money will be rejected. Bid money must be made part of technical offer.**

4.2 Bid Money of the unsuccessful bidder will be returned as soon as the scrutiny of the tenders is completed. Bid Money of the successful tenderers will be retained until the contract is finalized. Bid Money will be forfeited in case the quotation is withdrawn before the expiry of its validity date.

## 5.0 PERFORMANCE GUARANTEE

5.1 The successful bidder will provide Performance Guarantee at the rate of 10% of the contract value in favour of CEO / MD Wah Industries Limited, Wah Cantt. The Performance Guarantee will be furnished in the form of Pay Order / Bank Guarantee from any scheduled bank valid for 24 months. The Performance Guarantee will be submitted within 30 days after issuance of LOI, prior to the placement of Contract and the same will be returned on satisfactory completion of the contract after 24 months. In case the firm fails to supply the contracted store / contractual obligations, PG will be forfeited.

## 6.0 INSPECTION (as per Annex-B)

6.1 Supplies shall be subject to:-

a) **Local Inspection:** The supplier will arrange preliminary inspection & tests of AC Cables, DC Cables, Power Transformers, LV Panels & MV Panels at manufactures premises conducted by 03 x officials of purchaser.

b) **Foreign Inspection**: The supplier will arrange pre shipment inspection & tests of PV Modules & Inverter at manufactures premises conducted by 02 x officials of purchaser.

6.2 All charges related to boarding & lodging of PSI team including air tickets (for foreign inspection) & TA/DA for local inspection will be borne by the supplier.

6.3 Final Inspection will be carried out at Wah Brass Mill premises.

| | | |
|---|---|---|
| a) | Inspection Authority | = CTO-WIL or his authorized rep. |
| b) | Inspection Agency | = Q.C WBM, Manager-Maint-WBM |
| c) | Place of Inspection | = WBM Wah Cantt |

## 7.0 Packing

The store shall be packed adequately and appropriately to the mode of dispatch against rough handling involved during transportation.

## 8.0 Installation / Commissioning

Successful Installation / commissioning of Solar Power Plant will be carried out by the supplier / firm on its cost.

## 9.0 Training

**Local Training:** On-site training of Wah Brass Mill's technicians / persons during installation / commissioning of Solar Power Plant.

**Foreign Training**: Supplier will arrange training of 02 x personnel of purchaser for 02 weeks at manufacturer premises preferably during PSI. The training shall include the operation, troubleshooting and maintenance / overhauling of the PV Modules & Inverters.

**All charges for local & foreign training to be borne by the supplier**

**10.0 Final Acceptance Test (FAT)**

As per Annex-G

**11.0 ACCEPTANCE OF OFFERS**

The Right to accept or reject any offer in full or in part, without assigning any reason is hereby reserved.

**12.0 FAILURE TO COMPLETION OF THE CONTRACT / PROJECT**

Performance Guarantee @ 10% of the total value of contract will be submitted prior to the placement of contract. The Performance Guarantee will be returned on satisfactory completion of the contract. In case of failure to complete the project, the Performance Guarantee will be forfeited.

**13.0 MATERIAL / STORES**

The material / stores shall conform to the specifications as laid down in the schedule / Annexures to Tender Enquiry.

**14.0 WARRANTY / GUARANTEE**

The stores shall be supplied on Warranty / Guarantee subject to Inspection at WBM as detailed at Annexures. Rejected stores will be removed and replaced with the acceptable store by the supplier at his own expenses within specified time.

**15.0 PAYMENT**

i) **20%** advance payment against equal amount of Bank Guarantee.
ii) **50%** payment after receipt & successful physical inspection of the store at WBM premises.
iii) **30%** payment on successful project completion and acceptance of FAT

**16.0 TERMINATION OF CONTRACT**

If at any time during the currency of this contract, the purchaser decides to terminate the contract for any reason whatsoever (other than for reasons of FAILURE TO SUPPLY THE STORES) he shall have the right to do so.

**17.0 SITE VISIT & PRE-BID MEETINGS**

The interested suppliers / firms who require technical deliberations or clarifications, may visit Wah Brass Mill **between July 23'2025 and August 12'2025** during working days (time 10 am to 4 pm), with prior request via email by mentioning detail particulars of the visitors.

**NOTE:** **Offers / quotations received through E-mail will not be entertained. Offers must be submitted via courier to the address mentioned in clause 1.2 of this TE.**

Yours faithfully,

General Manager-WBM
Wah Industries Limited - Wah Cantt

SCHEDULE TO TENDER NO: **05-LP-Solar Power Plant-PUR-WBM-2025-26,Dt: 22-7-2025**
DUE ON **13-8-2025**

| Sr # | Description with Specs etc. | Qty | Unit Price (Excl GST) up to WBM | Total Value up to WBM | Project Lead Time |
|---|---|---|---|---|---|
| 1 | Solar Power Plant 2.5 MWp, (Specification as per attached Annexures A to G) | 01 off | | | 6 months from the date of Contract |
| **Note**: | Annexure-A attached. (Technical Specification) | | | | |
| | Annexure-B attached. (General Terms & Conditions) | | | | |
| | Annexure-C attached. (Commercial Offer) | | | | |
| | Annexure-D attached. (Bid Evaluation Criteria) | | | | |
| | Annexure-E attached (MV Switchgear Specifications) | | | | |
| | Annexure-F attached. (Power Transformer Specifications) | | | | |
| | Annexure-G attached. (Final Acceptance Test) | | | | |

## Most Important:

*For convenience of the suppliers / firms, Technical Specification, General Terms & Conditions, Bid Evaluation, Transformer and FAT Test are attached herewith in Excel Format for endorsement of the compliance by mentioning 'Yes' or 'No' in the relevant column. The suppliers / firms are required to attach hard copy of the same with the technical offer duly signed stamped and soft copy of the same must be forwarded via e-mail after Tender Opening.*

## UNDERTAKING:

Should our offer be accepted, we hereby undertake to supply the stores/render the services contracted, failing which it shall constitute a breach of contract, and Wah Industries Limited shall have the right to purchase the stores/services from elsewhere at our risk and cost.

Place_____

Date_____

Firm's Name_____

Name_____

Position_____

Address_____

E-mail_____

Cell No_____

Signature of the Tendered _____

**ANNEXURE – A**

1. **Technical Requirements**

| Sr | Equipment | Preferred Vendor | Specifications |
|---|---|---|---|
| 1. | Type | | Ground mounted. |
| 2. | Capacity | | 2.5 MWp. |
| 3. | Coordinates & Location | | 33°45'51"N 72°46'35"E<br>Wah Brass Mill, Wah Cantt. |
| 4. | Mode of operation | | Grid tied with POF network, Captive Mode with option to export surplus energy to Grid. |
| 5. | Operating Voltage | | **For Inverter**<br>a. Nominal AC Voltage 3 / PE, 800 V.<br>b. Nominal grid frequency 50 Hz.<br>c. THD < 3 % (at nominal power).<br>**For Transformer**<br>Stepped up to 11KV through transformer for grid connection. |
| 6. | Grid Voltage | | 11KV, 50Hz (Nominal). |
| 7. | Metering | Elester / Equivalent | a. ± 0.2 % Accuracy Metering<br>b. Test Certificate to be provided by supplier.<br>c. Metering and recording of following parameters to be done: -<br>(1) Total units (KWh) consumed by WBM.<br>(a) Consumption from Solar Plant.<br>(b) Consumption from POF Grid.<br>(2) Total units (KWh) generated by Solar Plant.<br>(a) Solar units injected to WBM.<br>(b) Solar units injected into POF Grid (Weekdays). |

| | | | |
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| | | | (c) Solar units injected into POF Grid (Holidays).<br>(3) Net running load (MW) of WBM. |
| 8. | SCADA | Any vendor meeting specs | a. Latest SCADA Controller to be used.<br>b. Selection for Captive Mode (Zero Export) to be provided.<br>c. Calculation of generation loss KWh (during maintenance / breakdown / captive mode / other)<br>d. Provide Local and Remote Connectivity simultaneously.<br>e. Transformer Status, ACB Status, VCB Status to be shown on Screen.<br>f. Data logging of Pyranometers and Atmosphere Temperature Sensor, PV Module Temperature Sensor, Humidity Sensor, Wind Speed Sensor, Wind Direction Sensor, Irradiation Sensor, current, voltage, power, faults, breakdowns, etc. All the data from inverter & energy meters should be available on monitoring system.<br>g. Monitoring system shall be able to create Excel spreadsheets / reports for data acquisition based on Daily, Weekly, Monthly, Yearly and defined intervals.<br>h. System should be able to display and record all types of electric warnings & faults.<br>i. All monitoring data should be available in both local and remote monitoring system through internet on Web Browser & Mobile.<br>j. Monthly, quarterly, annual performance and maintenance reports.<br>k. All data must be stored safely to avoid loss. |
| 9. | Solar PV Modules | Jinko / Canadian / Longi / Equivalent | a. N Type, Mono crystalline, Bifacial, BC cell/ TopCon.<br>b. +620 Watt, 23% efficiency or latest version.<br>c. 12 Years Product Workmanship Warranty.<br>d. 30 Years Linear Performance Output Warranty.<br>e. Fill Factor (FF) is more than 80%. |

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| | | | f. Free of PID and must include PID free certificate.<br>g. Annual Degradation of 1% (Max) for the first year and 0.4% (Max) from onward 2 - 25 years.<br>h. Power thermal coefficient should be -0.29% / degree C or better.<br>i. Plant design/layout will be provided along with PVsyst simulation study in technical offer.<br>j. TUV Certified & should be in Tier 1 list.<br>k. Compliance with IEC61215, IEC61730, IEC61701, IEC62716 Standards. |
| 10. | Inverters | Sungrow / Huawei / Equivalent | a. Capacity: 300 - 400 KW.<br>b. Type: String Inverter.<br>c. Inverter Efficiency (Max): >99%.<br>d. Product Warranty: Standard (min 05 Years) + Extended (min 05 Years).<br>e. IP66 and C5 protection.<br>f. Type II SPD for both DC and AC.<br>g. With data logger.<br>h. Must be suitable for outdoor installation.<br>i. Compliant with global safety and grid code.<br>j. Compliance with UL 1741, IEC62116:2014, IEC61727, IEC62109, CE and EMC Certifications and also IEC 61683 for safety, grid connectivity and parallel operation.<br>k. Positioned to ensure minimum AC / DC transmission losses.<br>l. Placed under shed and covered with fence. |
| 11. | PV Module Mounting Structure / Frames | Any Reputable Firm meeting the specs | a. Hot dip Galvanized Iron (A36) / Aluminum (6063-T6), screw / concrete pilling type Mounting Structure for Ground Mounted installation. Railing Fixed Tilted to withstand wind speed of at least 40 meters per second.<br>b. Salt Spray test for Hot Dip Galvanized Iron shall be provided from certified 3rd Party. |

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| | | | c. Material Testing will be conducted from certified 3rd Party.<br>d. At least 25 years guaranteed lifetime. |
| 12. | System and Environment Monitoring | Any Vendor meeting the specs | a. All necessary equipment of environment monitoring system including efficiency “Class A” Pyranometer, Irradiation, wind speed, wind direction, PV module temperature, ambient temperature and humidity sensors etc (Brand and model to be mentioned in offer).<br>b. Compatible with Inverter and data monitoring up to string level.<br>c. Emergency Shutdown Buttons, where required.<br>d. 02 x Complete PC with Intel core i7 minimum 8th generation, 2TB SSD Storage for monitoring to be provided by supplier with genuine windows backup.<br>e. 01 x HP or equivalent heavy duty latest laser jet printer for System.<br>f. 75 inch & 32 inch 4K HD LED for monitoring systems.<br>g. Data storage capacity for one year. |
| 13. | DC Cables | Pakistan Cable / Fast Cable / Equivalent | a. Cable should be Tin Coated Copper (99.99% pure).<br>b. Minimum 4 sq mm 1 Core, Flexible Cu.<br>c. DC loss not more than 2%.<br>d. Insulation of Cable should be XLPO.<br>e. Sheeting of Cable should be XLPO.<br>f. Operating Temperature 120 Degree.<br>g. Cable rated capacity must be minimum 120 % of maximum load.<br>h. Free from joints.<br>i. UV, Ozone, hydrolysis resistant.<br>j. Rated 1500 VDC.<br>k. Cable Warranty: 2 Years.<br>l. At least 25 years lifetime. |

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|---|---|---|---|
| 14. | AC LV Cables | Pakistan Cable / Fast Cable / Equivalent | a. Conductor: Copper (99.99% Pure).<br>b. AC loss not more than 3%.<br>c. Insulation of Cable should be PVC.<br>d. Sheeting of Cable should be PVC.<br>e. Operating Temperature 90 Degree.<br>f. UV, Ozone, hydrolysis resistant.<br>g. Maximum Voltage 1000 V.<br>h. Cable Warranty: 2 Years.<br>i. IEC60502 or latest. |
| 15. | AC MV Cables | Pakistan Cable / Fast Cable / Equivalent | a. Conductor: 3 core Copper (99.99% Pure).<br>b. Cable rated capacity must be minimum 120 % of maximum load.<br>c. Insulation of Cable should be XLPE.<br>d. Sheeting of Cable should be PVC.<br>e. Operating Temperature 90 Degree.<br>f. UV, Ozone, hydrolysis resistant.<br>g. Maximum Voltage 8.7/15kV.<br>h. Design Short Circuit: 25kA@1 Sec.<br>i. Cable Warranty: 2 Years, IEC60502 or latest. |
| 16. | Electrical Safeties | Siemens / Schneider | a. The system should at least be incorporated with the following electrical safeties (Panel Relays).<br>b. Transformers with all primary protections.<br>c. Differential Protection relay MICOM P521 for Feeder Protection OG Panel / IC Panel.<br>d. MICOM P122 Schneider France for TRF panel.<br>e. Surges / Spikes protection (for grid supply and lightening) should be installed in cable side of OC / IC panel. |
| 17. | Power Transformer | PEL / ABB / Siemens / Grit | a. 01 x Transformer with VCB, 630A,25KA Motorized 11KV Panel.<br>b. Capacity: 4 MVA.<br>c. Vector Group: Dyn11. |

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| | | | d. Output Voltage: 11kV.<br>e. Cooling Type: ONAN / ONAF.<br>f. 0.8/11 KV (compatible with inverter).<br>g. Insulation Class A.<br>h. Ambient Temp 50 Deg.<br>i. Tapping: ± 2.5%, ± 5% & ± 7.5%.<br>j. Standard IEC600761 (latest), IEC 60296 (Latest).<br>k. Specification attached as **Annexure F**.<br>l. Placed under shed and covered with fence for Safety. |

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| 18. | LV Panel | ABB / Schneider / Siemens / PEL / Tariq / Bilal Switchgear / Equivalent | a. 01 x Steel sheet , floor mounted with key lock, cubicle structure of standard height, width and depth (2200 mm x 800 mm x 800 mm)<br>b. 01 x set of 3 Phase with neutral HDHC copper bus bars.<br>Main Busbar 3000A rating, Size 2 x 100 x 10 mm per phase with incoming and outgoing.<br>Neutral Busbar size 1 x 100 x 10 mm<br>Earth Busbar size 1 x 50 x 10 mm<br>Triple pole **Air circuit breaker 3200 A** with adjustable rating, draw out mounting, ICU = 100 KA with built in long time, short time, instantaneous (LSI), Dust proof plastic cover for ACB<br>Type : NW 32 H2 (5.0E) Make: Schneider / Equivalent.<br>c. Shunt Trip Coil 30VDC Make: Schneider / Equivalent.<br>d. Closing coil 30VDC Make: Schneider / Equivalent.<br>e. 01 x Digital Ampere meter, 01 x digital voltmeter Make: LUMEL / Equivalent.<br>f. 01 x 4-Position Ammeter selector switch, 01 x 7 position voltmeter selector switch (Make: GGT / Equivalent.<br>g. 03 x CT Ring Type Ratio 3200 / 5 A, Burden 15VA class 1.0 for protection, Make: FICO / PEL / MATLAX Pakistan / Equivalent.<br>h. 03 x CT Ring Type Ratio 3200 / 5 A, Burden 15VA class 0.2 for metering, Make: FICO / PEL / MATLAX Pakistan / Equivalent.<br>i. Low voltage energy meter (ModBus based) for 3-Phase, 4 wire system, suitable for 5A CT and 800 VAC, 50Hz. Make: PEL / BLUESTAR / Equivalent.<br>j. MICOM P-122, earth fault, over current protection relay, communication MOD Bus, Auxiliary voltage |

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|---|---|---|---|
| | | | 24-240VDC / 48-240VAC. Make Schneider France.<br>k. LED type indication lights red, yellow, blue for phase, Green for ON, Red for OFF, Make GG<br>l. Push Button for Off, ON. Make GG / Equivalent<br>m. Panel light 10 Watt, 230 VAC, 50 Hz.<br>n. Door switch for panel light.<br>o. 3P MCB 06A for control (Make : Schneider).<br>p. 2P MCB 10A for control (Make : Schneider).<br>q. Panel exhaust fan suitable for 220 VAC, size 8".<br>r. Auto / OFF / Manual selector switch for exhaust fan (Make : GG)<br>s. Thermostat for PFI (Make : STEGO)<br>t. Breaker Selection as per IEC Standards.<br>u. Panel Design & Fabrication as per IEC Standards.<br>v. Panel contain all standard accessories.<br>w. All live parts of LV panel should be enclosed.<br>x. Front and Rear panel door should be in two parts.<br>y. Cables and Busbar components should be separated by installation of sheet steel, backside of ACB. |
| 19. | MV Panel (IC + OG) | ABB / Schneider / Siemens / PEL / Equivalent | a. Type tested, Grid connected 11kV Panel as per attached **Annex – E**.<br>b. Breaker Selection as per IEC Standards.<br>c. Panel Design & Fabrication as per IEC Standards.<br>d. Energy Meter with CT & PT (Acc=+-0.2%, Make Elester / Equivalent). |
| 20. | Cable Ties and Ducting | Local | a. GI Cables trays (14 Gauge) of suitable dimensions with solid top cover, must be installed at safe distance from ground.<br>b. The joints and bends of trays are to be fastened with GI bolts.<br>c. Cable trays should be suitably sized for easy cable laying and proper wall thickness is to be ensured for |

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| | | | strength.<br>d. All the DC cables shall be properly ducted in GI cable trays.<br>e. All the Communication cables including fiber optic shall be properly routed through GI pipes, separate from power cables.<br>f. Steel Cable ties of good quality, shall be used to ensure proper routing of cables in outdoor environment.<br>g. Any sharp edges must be removed / addressed. |
| 21. | Cable Laying | | a. AC cables to be properly laid in underground PVC / HDPE pipes (Class B).<br>b. DC cables to be properly laid in GI Ducts.<br>c. All cables should be dressed properly.<br>d. Ends of cables must be marked as per drawing. |
| 22. | MC4 Connectors | Any Tier 1 Vendor meeting the specs | a. Minimum IP67 Rated MC4 Connectors for PV Modules Connectivity.<br>b. Rated for 1500 VDC.<br>c. TUV Certified. |
| 23. | Earthing / Grounding Network and Lightning Arresters | Any Tier 1 Vendor | a. Earth Pits Construction (Earth Pit Construction design / drawing to be given in the Technical Offer for evaluation).<br>b. Proper grounding of each PV module, inverters, transformers, structure and all other equipment's.<br>c. Lightning Arresters for protection from lightning.<br>d. Earthing pit resistance shall be less than 1 Ohm. |
| 24. | PV Module Cleaning Network | Any Vendor meeting the specs | a. Water network of Poly Propylene (PPR) / GI pipes and valves / nozzles for PV modules cleaning<br>b. Pipes shall be laid in the field at easy approach of water in complete field<br>c. Tap water source (up to 1.5 Bar) shall be provided by purchaser (required line size and pressure to be mentioned in technical offer) |

| | | | |
|---|---|---|---|
| | | | d. Supplier will furnish the complete design / layout of water network for cleaning |
| 25. | Parameter lighting & CCTV | | a. Parameter lights and CCTV including poles for site. (Specs to be mutually agreed during designing) |
| 26. | Fire Alarm System | | a. Fire Alarm System for Control Room and Panel Room consist of following:<br>(1) Fire Alarm Control Panel (Programmable Zones) along with backup batteries<br>(2) Power Supply: 220/240Vac, 50 Hz.<br>(3) Smoke Detectors, Type: Optical<br>(4) Fire Alarm Manual Call Points<br>(5) Fire Alarm Sounder<br>Supplier will furnish the complete design / layout of fire alarm system |
| 27. | Civil Works | | a. The construction of all civil works related to Power Plant according to the Design and Drawings including but not limit to the following:<br>(1)Appropriate size Control Room & Operator Room including electrification & air conditioning, lighting, CCTV and furniture. (Details to be mutually agreed during designing)<br>(2)Separate area for placement of MV panel (Transformer side).<br>(3)Covered area (outdoor) for placement of Inverters and Transformers.<br>b. Soil testing, Land Leveling, Grading, Compaction of PV Area & paving of tuff tiles between PV string.<br>c. Air-Conditioned Control Room for Monitoring station shall be constructed with required furniture and accessories will be provided by supplier. |
| 28. | Installation & Commissioning | Local | Installation, commissioning & grid connectivity shall be carried out by supplier |

| | | | |
|---|---|---|---|
| 29. | Deliverables | Documentation | a. 03 x sets of Schematic Single Line Diagrams (SLDs).<br>b. 03 x sets of operations and maintenance manual.<br>c. 03 x sets of As-built Drawings including DC and AC wiring diagrams, PV modules layout, mounting structure drawings, earthing/grounding network diagram, water network diagram.<br>d. List of IP addresses of complete network.<br>e. Licensed Software's along with programs / parameter backup of all programmable devices (including environment monitoring system) with English language.<br>f. Necessary communication cables for programming of devices.<br>g. PV Modules Datasheets and Certificates.<br>h. Inverter Datasheets, User Manuals, Installation Guide and Certificates.<br>i. System and Environment Monitoring Systems User Manuals, Installation Guide and Certificates.<br>j. All other equipment Test Certificates.<br>(1)Equipment and Complete System Warranty Certificates. |
| 30. | Spares | | a. Recommended Spares, Tools / Instruments for 02 years operation and maintenance will be provided by Supplier.<br>b. 01 x Pellet (approx. 35 panels) of PV modules completely packed.<br>c. 02 x sets of inverter service kit (IGBT's etc).<br>d. 01 x Transformer winding leg fully assembled and properly packed (Primary & Secondary).<br>e. Supplier will furnish the recommended list of spare parts in technical offer along with the Price of offered and recommended spares in commercial offer.<br>Supplier to confirm spares availability for minimum 15 |

| | | | |
|---|---|---|---|
| | | | Years. |
| 31. | Threats at site | | Following threats to be addressed in technical offer.<br>a. Industrial environment.<br>b. Wild growth.<br>c. Wild Animals e.g. jackal, rats, porcupine, snakes etc. |
| 32. | Safety | | a. All Plants / Machinery should be environment friendly, equipped / provided with all safety gadgets / accessories according to latest international safety standards.<br>b. System should be equipped with necessary earthing, under / over voltage protection and safe to handle spike, surge & transients etc.<br>c. Noise level: As per international standards, for all plants / machinery.<br>d. Safety Signs & color coding in the Control Room and Outdoor area. |
| 33. | Misc | | Any other device / equipment considered essential during installation / commissioning for smooth and safe operation will be responsibility of supplier. |

**Annexure-B**

## GENERAL TERMS & CONDITIONS

a. **Offer & EPC Cost**

(1) The prices should be filled in commercial offer as per **Annex – C**.

(2) The project will be on **Turn Key Basis**, firm will responsible for provision of equipment, site development, successful installation commissioning & grid connectivity. Any unforeseen situation / technical issues during execution of project will be responsibility of the firm without any extra cost.

(3) Bidder should give technical details and literatures / brochures of the offered plant, machinery and equipment.

(4) Bid will be evaluated as per bid evaluation criteria (**Annex – D**).

b. **Generation & Performance Ratio**

Estimated generation per year along with yearly degradation for a period of 25 years be indicated. The supplier will guarantee the performance Ratio for first 02 years as per provided **PVsyst Simulation Study**.

c. **Post Shipment Inspection & Final Acceptance Test**

(1) The project shall be considered complete once the Material Acceptance Test and Final satisfactory Performance Test of plant are witnessed, accepted and approved by purchaser.

(2) The Material Acceptance Test will include the equipment quality and specifications verification, quantity of the items supplied. Material such as mounting structure/frames, pipes, DC and AC cables shall be tested from 3rd Party in the presence of purchaser representative and accepted upon test results compliance with specifications.

(3) Final Acceptance Test (Plant Operation) means the Eight (08) weeks performance test which will include the DC output of PV strings, AC output of each inverter, anti-islanding protection, earthing/grounding network test and overall system performance. The test will be carried out over a time of Eight (08) weeks.

(4) The bidder shall give the Guaranteed Performance Ratio for the period of Final Acceptance Test, mentioned in the Technical Offer. If the power plant fails to achieve the Guaranteed Performance Ratio, then the supplier shall make necessary arrangements and improvements in power plant to achieve the guaranteed figure. Final Acceptance Test shall be performed again after the said improvements.

(5) Final Acceptance Test (FAT) shall be carried out after the commissioning of the Power Plant as per attached **Annex – G.**

(6) Physical inspection of the equipment, Stage Inspection and Final acceptance test will be conducted by WBM technical team.

d. **TRAINING AT WBM SITE**

During the commissioning of the Power Plant at WBM site, the supplier shall provide training (Operation & Trouble Shooting) of PV Modules, Inverters, LV panel, MV Panel, Monitoring system & Transformer to the purchaser's personnel. The training shall spread over 14 working days.

e. **OPERATION & MAINTENANCE AND PERFORMANCE BOND**

(1) Supplier will provide the O&M of plant for first 02 years during warranty period.

(2) The successful bidder at the time of contract will furnish **10% performance bond (EPC Cost)** in the shape of Bank Guarantee for a period of 02 years within 30 days of issuance of LOI. The BG will be released after satisfactory performance of whole plant for a period of 02 years starting from the date of Final Acceptance Test (FAT). In case of any type of performance issue, the bond will be extended for sufficient time (equivalent to underperformance / downtime of plant) to achieve the satisfactory performance. The performance bond will be released after the satisfactory completion of Warranty period.

(3) If the Supplier fails to furnish the Performance Bond within the specified time, such failure will constitute a breach of the contract and the Purchaser shall be entitled to make other arrangements for purchase of the stores at the risk and expense of the Supplier.

(4) Supplier will furnish guarantee for output of plant (E-Grid) **1st year minimum 3.8 Mn KWH**. In case of noncompliance of guaranteed 1st year E-Grid output 3.8 Mn KWH, a penalty equivalent to deficient KWH @ current off-peak rate of IESCO will be imposed on supplier.

(5) The supplier shall guarantee the **Performance Ratio of minimum 80.81%** of 1st Year of the plant. Time period of 1st year shall begin after completion and acceptance of Final Acceptance Test.

(6) The supplier shall guarantee a maximum reduction of 1.0% in the Performance Ratio for the 1st year and 0.4% after 1st year of operation throughout the period of 25 years.

f. **PRE-SHIPMENT INSPECTION & TRAINING AT MANUFACTURES PREMISES**

(1) **Local Inspection:** The supplier will arrange preliminary inspection & tests of AC Cables, DC Cables, Power Transformers, LV Panels & MV Panels at manufactures premises conducted by 03 x officials of purchaser / POF.

(2) **Foreign Inspection:** The supplier will arrange pre shipment inspection & tests of PV Modules & Inverter at manufactures premises conducted by 02 x officials of purchaser.

(3) **Foreign Training:** Supplier will arrange training of 02 x personnel of purchaser's for 02 weeks at manufacturer premises preferably during PSI. The training shall include the operation, troubleshooting and maintenance / overhauling of the PV Modules & Inverters. Supplier will bear the TA/DA, boarding / lodging & return air tickets of PSI / Training Team.

g. **PROJECT TIMELINE**

(1) The project completion deadline should not be more than **Six (06) Months** from the date of contract signing.

(2) The supplier shall provide the Project Timeline/Gantt Chart in the technical offer.

h. **POWER PLANT GUARANTEE / WARRANTY OF EQUIPMENT**

(1) PV module should have 12 Years Product Workmanship Warranty. 30 Years Linear Performance Output Warranty.

(2) Inverter should have 05 Years standard warranty + next 05 years extended warranty.

(3) Mounting Structure shall be guaranteed for a minimum of 10 years.

(4) Apart from Inverters & PV Module Warranty & Mounting Structure, supplier will furnish warranty / guarantee for Two (02) year of complete power plant after successful commissioning and operation of complete system.

(5) The supplier shall guarantee the availability of spares for the equipment of the power plants for a period of 15 years to ensure uninterrupted operation

(6) Warranty Period of the power plant and individual equipment shall begin after completion and acceptance Final Acceptance Test.

(7) Performance Bond period will be extended for further 01 year:

(a) If the downtime of plant is more than 15 days due to fault.

(b) If the system not to achieve the guaranteed PR.

(c) Warranty / guarantee period will be started from the date of satisfactory completion of performance test / FAT of plant.

(8) Any damage / or loss to the plant and equipment procured due to faulty design, material workmanship including loss / damage to life and property shall be the responsibility of the manufacturer / supplier(s) who shall have to compensate the Purchase according to the consultation and decision of the two parties. However, the total amount of consequential damages and penalties including but not limited to liquidate damages will not exceed the total value of the contract.

i. **PENALTY**

If the supplier fails to achieve the guaranteed Generation (KWh) & Performance Ratio (PR) as provided in PVsyst Simulation, then the Supplier shall take the remedial actions and compensate the Purchaser as follows:

(1) Replace or add panels and equipment any time during the first year or any extended period to achieve the guaranteed generation & PR.

(2) The period for achieving guaranteed generation & PR will be extended for one year from the date of adding panels. Consequently, the purchaser will be entitled

to withhold the BG, which will be extended for one year from the date of modification of the system to achieve the guaranteed generation & PR.

(3) Maximum allowed down time of plant during 02 years performance bond will be 48 hours. If in case down time increases, supplier will bear the loss equivalent to generation @ IESCO off peak tariff.

j. **SUBMISSION OF TENDER**

Case will be processed as per **two stage - two envelope bidding procedure** in favor of most advantageous bid. You are required to quote in two parts: -

(1) **Part I "Technical Offer":** It should exclusively give technical details and literatures/brochures of the offered items, at least 120 days validity and delivery schedule. It must not indicate price, costs etc.

(2) **Part II "Commercial Offer":** It should indicate the commercial terms e.g. price, terms of payment, delivery terms and mode of payment.

Each part should be placed in a separate sealed cover. The envelopes should be inscribed with: Part I "Technical Quotation without Price" and Part II "Commercial Quotation with Price".

k. **BID MONEY**

(1) The bidders shall pay a Bid Money of **Rs. 10 million** in the form of Pay Order / Bank Guarantee in favor of “Wah Industries Limited”.

(2) Bid Money of the unsuccessful bidder will be returned as soon as the scrutiny of the tenders is completed. Bid Money of the successful tenderers will be retained until the contract is finalized. The Bid Money shall be **enclosed in the Technical Offer**.

(3) The bids submitted without bid money shall not be entertained.

l. **PAYMENT TERMS**

(1) 20% advance against equal amount of Bank Guarantee.

(2) 50% after receipt & successful physical inspection of store at WBM.

(3) 30% on successful project completion and acceptance of FAT.

m. **LIQUIDATED DAMAGES**

If the supplier fails to supply the contracted store in-accordance with the delivery schedule as specified in the contract, liquidated damages at the rate of 2 % per month

or part of the month of the value of the late delivered stores may be levied, but the total damages shall not exceed 10 % of the contract value. However, if the delay occurs due to force majeure or such other circumstances which the purchaser may consider unavoidable the purchaser may extend the delivery period.

n. **ARBITRATION**

All matters of dispute or difference, except regarding rejection of stores by the inspector and/or cancellation of contract by the purchaser arising out of this agreement between the parties hereto, the settlement of which is not otherwise specially provided for in this agreement, shall be referred for adjudication to two arbitrators, one to be named by each party, who before entering upon the reference shall appoint an umpire by mutual agreements, and if they do not agree a judge of superior court shall appoint the umpire, the arbitration proceedings shall be held in Pakistan under the Pakistan law. The arbitration awards shall be un-spoken.

## Annexure - C

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| **Sr#** | **Equipment** | **Make / Brand / Model** | **Qty (Nos)** | **Unit Price in Rs. (Excl GST)** | **Total Price in Rs (Excl GST)** | **Delivery Date** |
| 1. | Solar PV Modules | | | | | |
| 2. | a. Inverter With Standard warranty | | | | | |
| | b. Inverter With Extended warranty | | | | | |
| 3. | PV Module Mounting Structure / Frame | | | | | |
| 4. | PLC / SCADA | | | | | |
| 5. | Metering Equipment | | | | | |
| 6. | System and Environment Monitoring | | | | | |
| 7. | DC Cables | | | | | |
| 8. | AC LV Cable | | | | | |
| 9. | AC MV Cable | | | | | |
| 10. | Electrical Safeties | | | | | |
| 11. | Power Transformer | | | | | |
| 12. | LV Panel | | | | | |
| 13. | MV Panel<br>(01 IC + 01 OG) | | | | | |
| 14. | Cable Ties and Ducting | | | | | |
| 15. | Plastic Pipes, GI Cable Tray and Cable Laying in Trenches | | | | | |
| 16. | MC4 Connectors | | | | | |
| 17. | Earthing / Grounding Network Lightning Rod and Lightning Arresters | | | | | |
| 18. | PV Module Cleaning Network | | | | | |
| 19. | Fire Alarm System | | | | | |
| 20. | Civil Works | | | | | |
| 21. | System and Safety Signs | | | | | |
| 22. | Installation & Commissioning | | | | | |
| 23. | Spares | | | | | |
| 24. | TA/DA, Boarding / Lodging & Return Air Tickets of PSI & Training Team | | | | | |
| 25. | Miscellaneous Accessories | | | | | |
| **Total Price (Rs) Excluding GST** | | | | | | |
| **Total Price (Rs) Including GST** | | | | | | |

**Annexure – D**

## BID EVALUATION CRITERIA

| | Description | Criteria |
|---|---|---|
| i. | Technical Offer | Must Qualify |
| ii. | AEDB LICENSE (C1) | Mandatory |
| iii. | PEC LICNESE (C3) | Mandatory |
| iv. | Minimum 1MW as Main EPC Contractor at 11KV interconnection | Mandatory |
| v. | Minimum 10MW as cumulative | Mandatory |
| vi. | Authorized dealership / representative of OEM (Inverters & Solar panels) & Backup services in Pakistan | Mandatory |
| vii. | Certified / trained manpower having relevant authorization from OEM to work on the OEM equipment (List to be provided) | Mandatory |
| viii. | Professional Tax payer & registered with sales tax & income tax department | Mandatory |
| ix. | Not Blacklisted / involved in arbitration / litigation with any client during last 10 years (Affidavit to be provided) | Mandatory |
| x. | Commercial offer | Most Advantageous Bid |

## Annexure – E

| Sr# | Description | |
|---|---|---|
| 1. | **11KV , 630A 25KA Feeder Panel (Motorized) with vacuum circuit breaker**<br>**(Qty. 02 No).**<br>Rated voltage 17.5KV, 630A, 25KA transformer Panel (Motorized) with vacuum circuit breaker, Sheet Steel, floor mounting, metal clad, totally enclosed, indoor type, fully interlocked, air insulated, medium voltage switchgear suitable for operation on 11 KV, 3-phase, 50Hz supply tested in accordance with latest IEC standard for rupturing capacity of 25KA BIL 95KV. Each panel comprising of Following: - | |
| | Mild sheet steel (min 14 SWG), Floor mounting, cubicle structure provided with anti-corrosive base coat of painting uniform layer (70-80 micron) on internal and external surface, spray finished powder coated with standard color RAL-7032. | 01 No |
| | 3 phase set of H.D.H.C. Main copper Bus bar 800A rating<br>(Size 1 x 60 x 10mm or 2 x 60 x 5mm) & Dropper Busbar 630A rating<br>(Size. 1 x 50 x 10mm or 2 x 50 x 5mm) | 01 Set |
| | Single pole, fixed and moving cluster type isolating contact giving double isolation facilities per phase. | 06 Nos |
| | Sets of Automatic safety shutters marked “BUSBARS & CABLES” respectively | 02 Set |
| | T/pole draw out cassette type vaccum circuit breaker<br>Rated voltage =17.5KV,<br>Normal current = 630A<br>Short circuit breaking current = 25KA,<br>Duration of short circuit = 3 sec<br>Rated peak with stand current making capacity (Peak value) = 63 KA<br>Power frequency withstand voltage = 38KV / 95KV<br>Lighting impulse withstand voltage = 95 KV<br>Frequency = 50 Hz<br>**Model: VD4/P 17.06.25 or eqv**<br>Duly certified and mounted on withdrawable truck to facilitate horizontal installation and withdrawal fitted with following. | 01 No |

| | | |
|---|---|---|
| | • 01 Circuit breaker isolation mechanism.<br>• 01 Motor charging mechanism 230V AC along with manual charging facility.<br>• 01 Shunt trip coil 24-30V DC.<br>• 01 Closing coil 24-30V DC.<br>• 01 push button to trip.<br>• 01 push button to close.<br>• 01 auxiliary switch.<br>• 01 counter meter.<br>Make. ABB Italy<br>Surge Arrestor Metal Oxide Polymeric 12KV, 10KA (imported) | |
| | Dry Type Current transformer 400/5/5A, 15VA, 5P 20 Class for protection and 10 VA, Class 1.0 for metering. BIL 12/36/95KV<br>(Make FICO, PEL, MATLAX Pakistan /equivalent) | 03 No |
| | Dry Type SP Potential Transformer ratio 11000/1.732/110V/1.732 burden 100VA class 0.5, BIL 12/36/95KV<br>Make FICO, METLAX Pakistan /Equivalent. | 03 Nos |
| | 3 Phase 4 wire, 50 Hz, Digital KWH meter, CT input 5A, PT 110 VAC, Accuracy ±0.2% import/ export (Make. PEL, Blue star, Elester/ equivalent) | 01 No |
| | Digital type Ammeter<br>**Make: LUMEL /** equivalent | 01 No |
| | Amp selector switch (4-Position)<br>**Make: GGT-Italy** /equivalent | 01 No |
| | Digital Voltmeter **Make: LUMEL /** equivalent | 01 No |
| | Volt selector switch (7-Position) **Make: GGT/** equivalent | 01 No |
| | Feeder differential protection Relay, Communication Mod Bus, BOGZ112DEO, Fiber optical cable connection, Aux voltage 24-250VDC/48-240VAC<br>**MICOM-P521 (Make: Schneider France**) | 01 No |
| | Panel Heater 80/100 watt suitable for 220V AC with thermostat (Make. STEGO/Eqv) | 02 Nos |

| | | |
|---|---|---|
| | 3-position Auto/off Manual selector switch for panel heater (Make. GGT/Eqv | 01 No |
| | TP MCB rated 6A for control (make. Schneider / Eqv)<br>DP MCB rated 6A for panel light (Make Schneider / Eqv) | 02 Nos<br>02 Nos |
| | SP RCBO 10A,30mA 6KA Type: DSE201 (Make. Schneider / Eqv) | 02 Nos |
| | Designation Label | 01 No |
| | lED type indication light “Red, Yellow, Blue for phase. | 03 Nos |
| | LED type light indication “green for ON. | 01 No |
| | LED type light indication “red for Off. | 01 No |
| | LED type light indication “yellow for trip. | 01 No |
| | LED type light indication “green for Heater. | 02 No |
| | LED type light indication “for transformer Buchholz trip. | 01 No |
| | Push button green for ON<br>**Make: GGT /**eqv | 01 No |
| | Push button red for off **Make: GGT /**eqv | 01 No |
| | Push button yellow for trip reset **Make: GGT /**eqv | 01 No |
| | Set of vermin screen | 01 No |
| | Door limit switch, 230VAC, 50 Hz (Make. OMRON / Eqv) | 01 No |
| | Panel Light/ suitable Lamp, 6-12 Watt, for 220VAC **Make: Local** | 01 No |

| Sr# | Description | |
|---|---|---|
| 1. | **<u>11KV , 630A 25KA Transformer panel (Motorized) with vacuum circuit breaker (Qty. 01 No).</u>**<br><br>Rated voltage 17.5KV, 630A, 25KA transformer Panel (Motorized) with vacuum circuit breaker, Sheet Steel, floor mounting, metal clad, totally enclosed, indoor type, fully interlocked, air insulated, medium voltage switchgear suitable for operation on 11 KV, 3-phase, 50Hz supply tested in accordance with latest IEC standard for rupturing capacity of 25KA BIL 95KV. Each panel comprising of Following: - | |
| | Mild sheet steel (min 14 SWG), Floor mounting, cubicle structure provided with anti-corrosive base coat of painting uniform layer (70-80 micron) on internal and external surface, spray finished powder coated with standard color RAL-7032. | 01 No |
| | 3 phase set of H.D.H.C. Main copper Bus bar 800A rating<br><br>(Size 1 x 60 x 10mm or 2 x 60 x 5mm) & Dropper Busbar 630A rating<br><br>(Size. 1 x 50 x 10mm or 2 x 50 x 5mm) | 01 Set |
| | Single pole, fixed and moving cluster type isolating contact giving double isolation facilities per phase. | 06 Nos |
| | Sets of Automatic safety shutters marked “BUSBARS & CABLES” respectively | 02 Set |
| | T/pole draw out cassette type vaccum circuit breaker<br><br>Rated voltage =17.5KV,<br><br>Normal current = 630A<br><br>Short circuit breaking current = 25KA,<br><br>Duration of short circuit = 3 sec<br><br>Rated peak with stand current making capacity (Peak value) = 63 KA<br><br>Power frequency withstand voltage = 38KV / 95KV<br><br>Lighting impulse withstand voltage = 95 KV<br><br>Frequency = 50 Hz<br><br>**Model: VD4/P 17.06.25 or eqv**<br><br>Duly certified and mounted on withdrawable truck to facilitate horizontal installation and withdrawal fitted with following.<br><br>• 01 Circuit breaker isolation mechanism. | 01 No |

| | | |
|---|---|---|
| | • 01 Motor charging mechanism 230V AC along with manual charging facility.<br>• 01 Shunt trip coil 24-30V DC.<br>• 01 Closing coil 24-30V DC.<br>• 01 push button to trip.<br>• 01 push button to close.<br>• 01 auxiliary switch.<br>• 01 counter meter.<br>Make. ABB Italy<br>Surge Arrestor Metal Oxide Polymeric 12KV, 10KA (imported) | |
| | Dry Type Current transformer 400/5/5A, 15VA, 5P 20 Class for protection and 10 VA, Class 1.0 for metering. BIL 12/36/95KV<br>(Make FICO, PEL, MATLAX Pakistan /equivalent) | 03 No |
| | Dry Type SP Potential Transformer ratio 11000/1.732/110V/1.732 burden 100VA class 0.5, BIL 12/36/95KV<br>Make FICO, METLAX Pakistan /Equivalent. | 03 Nos |
| | 3 Phase 4 wire, 50 Hz, Digital KWH meter, CT input 5A, PT 110 VAC, Accuracy ±0.2% import/ export (Make. PEL, Blue star, Elester/ equivalent) | 01 No |
| | Digital type Ammeter<br>**Make: LUMEL /** equivalent<br>Amp selector switch (4-Position)<br>**Make: GGT-Italy** /equivalent | 01 No<br>01 No |
| | Digital Voltmeter<br>**Make: LUMEL /** equivalent<br>Volt selector switch (7-Position)<br>**Make: GGT/** equivalent | 01 No<br>01 No |
| | MICOM P-122 earth fault over current protection relay. Communication Mod Bus, Aux voltage 24-240VDC/48-240VAC<br>**(Make: Schneider Electric France**) Mandatory requirement | 01 No |

| | | |
|---|---|---|
| | Panel Heater 80/100 watt suitable for 220V AC with thermostat (Make. STEGO/Eqv) | 02 Nos |
| | 3-position Auto/off Manual selector switch for panel heater (Make. GGT/Eqv | 01 No |
| | TP MCB rated 6A for control (make. Schneider / Eqv)<br>DP MCB rated 6A for panel light (Make Schneider / Eqv) | 02 Nos<br>02 Nos |
| | SP RCBO 10A,30mA 6KA Type: DSE201 (Make. Schneider / Eqv) | 02 Nos |
| | Designation Label | 01 No |
| | LED type indication light “Red, Yellow, Blue for phase. | 03 Nos |
| | LED type light indication “green for ON. | 01 No |
| | LED type light indication “red for Off. | 01 No |
| | LED type light indication “yellow for trip. | 01 No |
| | LED type light indication “green for Heater. | 02 No |
| | LED type light indication “for transformer Buchholz trip. | 01 No |
| | Push button green for ON<br>**Make: GGT /**eqv | 01 No |
| | Push button red for off<br>**Make: GGT /**eqv | 01 No |
| | Push button yellow for trip reset<br>**Make: GGT /**eqv | 01 No |
| | Set of vermin screen | 01 No |
| | Door limit switch, 230VAC, 50 Hz (Make. OMRON / Eqv) | 01 No |
| | Panel Light/ suitable Lamp, 6-12 Watt, for 220VAC<br>**Make: Local** | 01 No |

**Note:**

i. Panel internal wiring diagram, Booklet of relay, Energy Meter & VCB are also to be provided.
ii. Cable gland for XLPE Cable should be on bottom side of each panel.
iii. All panels should be coupled with one another on site by supplier. Therefore, coupling facility/arrangement and extendibility on both sides of panel is necessary. Panel to panel coupling copper bus bar pieces/fish plates are also to be provided.

iv. Provision of 24-30V DC for relays and trip /close coil is scope of user.
v. Type tested composite material wall bushing tested on 48/95 KV should be installed as a barrier between panels on side window.

## TYPE /TEST REPORT OF HT PANELS AND BREAKERS.

1. Preliminary inspection/testing of HT / LT Panels will be carried out by **WBM & ED - Services reps** at firm's premises before delivery of store.
2. Final inspection will be carried out at WBM Wah
3. 02 Year warranty for free replacement of all parts of 11 KV, 630 A, 25KA Feeder Panel.
4. Panel door must have mechanically / Electrically interlock for safety purpose.
5. Panel manufacturing firm offering 11KV Panel should be WAPDA approved & must have type tested certificate of 11KV Panel from any foreign standard testing lab or HVSC Lab Rawat Pakistan.
6. The product shall confirm latest IEC Standard.

## Annexure F

**POWER TRANSFORMER SPECIFICATIONS 4000 KVA (OUTDOOR TYPE).Qty. 01 No.**

Outdoor type 4000 KVA 3-phse 50Hz. Oil immersed/ conservator, ONAN cooled for use in an ambient temperature of $50^0$ C. Delta star winding with neutral brought on LV side. Vector Group – Dyn 11, A dial indicating thermometer on the Tank, silica gel breather, an oil gauge with the conservator and Buchholz relay to be incorporated.

| | | |
|---|---|---|
| Rated Power. | = | 4000 KVA |
| Rated Voltage | = | 11000/800 Volts. |
| Rated Frequency. | = | 50 Hz |
| Full Load Current. | = | 210/2836 Amps. |
| No of Phases. | = | 03 |
| Neutral. | = | On LV Side. |
| Impedance. | = | ±5% to ±10%. |
| Type of Cooling. | = | ONAN. |
| Ambient Temperature. | = | $50^0$ C. |
| Temperature Rise. | = | $50^0$ C. |
| Tapping of HV Side . | = | ±2.5% ±5% ±7.5%. |
| Efficiency. | = | 98.45. |
| Winding Connection. | = | Dyn – 11. |

**FOLLOWING STANDARD FITTING TO BE PROVIDED.**

1. Oil conservator with oil level Gauge.
2. Silica gel Breather
3. Roller Bi-Directional
4. Off load tap changer (OCTC) (C.A.P.T Italy) (Model. Rotary Type 086 Series)
5. Rating and diagram name plate.
6. Oil Drain Valve (Imported).
7. Earthing Terminal.
8. Dial type Thermometer with contact (imported).
9. Double Float Buchholz Relay (Make. Elmek Turkey)
10. Pressure relief devices. (imported).
11. Lifting Lug.

**Note.**

i) Transformer must have HV/LV bushings on top covered with sheet steel duct separately.

ii) Only WAPDA approved firms/ manufacturers can participate in bid of transformer.

iii) Firm/ manufacturer must have valid type test certificate of any 1000 KVA or above capacity transformer from HV &SC lab Rawat (WAPDA) or any foreign STL Lab.

iv) The Product shall be confirmed to latest IEC/BSS)

**Annexure - G**

## FINAL ACCEPTANCE TEST (FAT)

## (SECTION- I)

## SOLAR POWER PLANT AND ITS COMPONENTS

## GRID-IN FAT CHECKLIST FOR SOLAR PV POWER SYSTEM

**Contract No:** _____
**The Applicant or Organization:** _____
**Installation Company:** _____
**Checking Date:** _____ **(MM/DD/Year)**

**1. The Fundamental Inspection Items**

1.1 RD =? % (The average of the sum of all PV array, RD≧ 80% as pass)
(Measurement conditions: sunshine intensity ≧ 300 W/m2)

1.2 Is the solar PV system is shaded:
□ Completely shaded.
□ Partially shaded, please specify: _____

1.3 Wattage-hour Meter:
□ Mechanical type
□ Digital type
Readings: from_____(MM/DD/Year) ( kWh),
to_____(MM/DD/Year) ( kWh), the accumulated days:
_____ days, the average daily electricity generated _____ kWh / d / kWp.

**2. Checking List for PV Array:**

2.1 The installed location of PV systems should be the same as the installed location from the Contract. □ Yes □ No

2.2 The solar modules have passed the certification (Performance/ Environment testing): □ Yes □ No
Silicon Standard: □ IEC-61215 □ JIS-C8990 □ UL1703 □ CEC-503
□ Other, please specify: ___
Non-silicon standard: □ IEC-61646 □ JIS-C8991 □ UL1703 □ CEC-701 □ Other, please specify: ___
CPV Standard: □ IEC-61646 □ Other, please specify: _____
Certification Organization:□ German TUV □ American UL □ Japan JET □ Other, please specify: _____

2.3 The Vmp Temperature Coefficient for solar modules: _____
The Voc Temperature Coefficient for solar modules: _____

2.4 Is providing the module OQC information, including module type, serial number and the measured power, etc. □ Yes □ No

2.5 The back label of solar module agrees with the specification □ Yes □ No

2.6 The actual installed module capacity agrees with the specification □ Yes □ No

| | | |
|---|---|---|
| 2.7 | Solar PV systems actual installed capacity (rated power) ≧ proclaimed capacity | □ Yes □ No |
| 2.8 | Is there are damage, scratches or discoloration on the solar panels? | □ Yes □ No |
| 2.9 | Is the glass surface of the solar PV module clean | □ Yes □ No |
| 2.10 | Is the piping, ducting and wiring installation meets safety regulations (diameter, color, etc.) | □ Yes □ No |
| 2.11 | Is the solar PV system is indeed grounded well (using the O-terminal) | □ Yes □ No |
| 2.12 | Is the solar azimuth angle is within the error tolerance of ± 10º | □ Yes □ No |
| 2.13 | Is the solar tilt angle is within the error tolerance of ± 5º | □ Yes □ No |
| 2.14 | The material of the module supporting frame:<br>□Galvanized steel<br>□ Stainless steel<br>□ Aluminum alloy (anodized coating thickness of 7μm or more)<br>□ Other, please specify: _____ | |
| 2.15 | Any proof on frame material composition provided? | □ Yes □ No |
| 2.16 | Is the solar PV array frame is rusted | □ Yes □ No |
| 3. | **System-related information** | |
| 3.1 | Is the operation manual is provided | □ Yes □ No |
| 3.2 | Is the training is conducted to the system administrators | □ Yes □ No |

| | | |
|---|---|---|
| 4. | **AC power distribution box checked list** | |
| 4.1 | AC distribution box is either damaged or deformed | □ Yes □ No |
| 4.2 | AC distribution inside box is clean | □ Yes □ No |
| 4.3 | AC distribution box environment is clean | □ Yes □ No |
| 4.4 | Wiring inside AC distribution box is neat | □ Yes □ No |
| 4.5 | Warning signs are well-posted on the lid of AC box | □ Yes □ No |
| 4.6 | AC distribution box is located at reachable distance | □ Yes □ No |
| 4.7 | AC distribution box with correct electrical diagram attached inside | □ Yes □ No |
| 4.8 | Quantity and specification of AC circuit breakers should correspond to the design | □ Yes □ No |
| 4.9 | Digital electrical meters should be certified and sealed with label | □ Yes □ No |
| 5. | **Inverter check list** | |
| 5.1 | Inverter pass certified specification (Grid connection related)<br>**Certified standards:**<br>□ VDE0126 □ VDE0126-1-1□ UL1741 □ IEEE929 □ IEC62109<br>□ Other, please specify: _____<br>**Certified Institutes:**<br>□ German TUV, BGFE □ UL □ United States United Kingdom Japan JET □ ETL<br>□ Other, please specify: _____ | □ Yes □ No |
| 5.2 | Inverter quantity and specifications correspond to the design | □ Yes □ No |
| 5.3 | Does the range of the maximum power point tracking correspond to the output voltage and temperature characteristics of PV arrays | □ Yes □ No |
| 5.4 | Inverter surrounding environment is clean | □ Yes □ No |

| | | |
|---|---|---|
| 5.5 | Inverter installation location is reachable | □ Yes □ No |
| 5.6 | Inverter installation location is well ventilated | □ Yes □ No |
| 5.7 | Screws for connector of inverter is tighten properly | □ Yes □ No |
| 5.8 | Inverter with unusual sound or smell | □ Yes □ No |
| 5.9 | Inverter is operated properly | □ Yes □ No |
| 5.10 | Once the power from the connecting point is off, the inverter should be off-Grid Simultaneously. | □ Yes □ No |
| 5.11 | Once the power from the connecting point is on, the inverter should be on Grid Simultaneously | □ Yes □ No |
| 6. | **Transformer check items** | |
| 6.1 | The electrical phases, voltage, capacity should correspond to the design | □ Yes □ No |
| 6.2 | Transformer installation location is well-ventilated | □ Yes □ No |
| 6.3 | Transformer installation should be off-ground (to avoid damp dangerous) | □ Yes □ No |

7. **Performance evaluation of the solar photovoltaic power gene system**

| | | |
|---|---|---|
| 7.1. | Grid connected system test items | □ Yes □ No |
| 7.1.1 | Is the system can function properly with Grid connected | □ Yes □ No |
| 7.1.2 | The system is capable to disconnect from the Grid when the Grid fails | □ Yes □ No |
| 7.2 | The temp of the backside of the Panel is lower than 75℃ (Sunlight intensity: _____ $W/m^2$, required intensity: ≧ $500W/m^2$) | □ Yes □ No |
| 7.3 | The insulation resistor measurements (Tested at > DC300V, insulating resistance > 0.04MΩ) | |

| String # | String 1 | String 2 | String 3 | String 4 | String 5 | String 6 |
|---|---|---|---|---|---|---|
| Measured insulating resistance (MΩ) | | | | | | |
| String # | String 7 | String 8 | String 9 | String 10 | String 11 | String 12 |
| Measured insulating resistance (MΩ) | | | | | | |
| String # | String 13 | String 14 | String 15 | String 16 | String 17 | String 18 |
| Measured insulating resistance (MΩ) | | | | | | |

(Note: Can add more if needed)

8. **SURGE ARRESTOR:**

If there is only one MPPT (Maximum Power Point Tracking) for the inverter: After the installation of the strings in parallel correlated to the inverter, then install the surge arrestor at both the positive and negative side to the ground for each array.

i. The tolerable maximum continuous DC voltage of the surge arrestor must be higher than the Voc of the corresponding string or array at 0 ℃.
ii. The tolerable current of the surge arrestor at 8/20μsec surge wave (or lightening) must be greater or equal to 20kA, peak.

## FINAL ACCEPTANCE TEST (FAT)

## (SECTION-II)

## ACCEPTANCE PERFORMANCE TESTS OF THE SOLAR POWER PLANT & ITS COMPONENTS

Performance tests of the power plant shall be conducted after its installation, commissioning & grid connectivity by joint team of Contractor and Employer. In addition to FAT, following tests will also be carried out:

i) **PV Array Test**
   a) Insulation Test
   b) Open circuit voltage test.

ii) **Inverter test**
   a) Max. efficiency ＞98% from DC to AC Power. (by factory outgoing report)
   b) Harmonics test through power analyzer meter. (by factory outgoing report)
   c) Safeties: Isolate the system from Grid in case of Grid failure.

iii) **Monitoring System Test**
   Verification of monitoring system data with data recorded through calibrated meters.

iv) **Array Test**
   Conversion efficiency of each array will be tested as per Contractor's declared efficiency i.e. generation of electric power (DC) from available irradiance.

v) **Power Plant performance test**
   a) Total / output electric power of the plant shall be measured for at least 8 consecutive Weeks.
   b) The irradiation will be measured on irradiance meter (uninterrupted) and the output power generation will be measured in the monitoring system and MOF at Site.
   c) The PR will be calculated according to the calculation specified in the FAT (Section-III) with irradiation data recorded in 8 consecutive weeks.
   d) Power Plant shall be accepted if the calculated PR is not less than the guaranteed PR at FAT.

## FINAL ACCEPTANCE TEST (FAT)

### (SECTION-III)
### INSPECTION METHODS AND ACCEPTANCE STANDARDS

**MONITORING SYSTEM:**

Recording interval of irradiance intensity and electricity generated by the installed Monitoring System:

i. Electricity generated: every 5 minutes
ii. Irradiance and temperature: every one minute
iii. Calculation of PR
iv. Indication of nature of faults and alarm
v. Date & Time
vi. Irradiation in plane of photovoltaic array
vii. Ambient temperature
viii. Module (cell) temperature
ix. Array voltage
x. Array DC current per string of modules
xi. Array power
xii. Array DC current total
xiii. DC power to inverter
xiv. AC voltage
xv. AC current
xvi. AC power from inverter
xvii. Inverter efficiency
xviii. Statistical charts output

**PERFORMANCE RATIO MONITORING PERIOD:**

One engineer of Contractor will remain at site for monitoring and recording of data for a period of consecutive Eight (08) weeks after the installation of solar PV system and starting to generate electricity. The inspection / testing team must complete the associated equipment adjustment on performance testing, preparation and PR test.
Note that PR test is continuously monitored as specified in the scope of maintenance.

**TESTING METHOD:**

Intercept operation data from the solar PV monitoring system installed by Contractor (any system interruption or data loss) can be waived, if rationalized information is presented to and agreed upon by Employer.
After extracting recorded data, the amount of generated AC electricity (MOF reading at site) and accumulated irradiance (uninterrupted) of the sun can be obtained.

**VERIFICATION:**

1. Performance Ratio (PR):
   PR is calculated as the formula below by the obtained data during the testing period, and then compared with the guaranteed PR.

   PR (Performance Ratio) = $(Z_1/Z_2)/(Z_3/Z_4)$ x 100% =

   $Z_1$: Accumulated electricity generated during testing period (MOF reading at Site)
   $Z_2$: Total system installed capacity
   $Z_3$: Accumulated irradiation during testing period
   $Z_4$: Intensity of irradiance under STC condition = 1,000W/$m^2$

2. DC generation ratio ($R_D$):
   DC generation ratio is to measure the array efficiency under the sunshine condition≧300W/$m^2$. The formula is as below and $R_D$ shall be ≧0.8.

   $R_D=\{[P/P_0]\times[1000(W/m^2)/G_I(W/m^2)]\}$

   P: Instantaneous DC output power
   $P_o$: Rated Power
   $G_I$: Measured Instantaneous Irradiance

If the measured DC generation ratio ($R_D$) of this solar PV system fails to reach 0.80, Contractor is required to make improvement free of cost to achieve the targeted DC generation ratio.