

Annexure-I

SCOPE, TECHNICAL SPECIFICATIONS AND EVALUATION CRITERION FOR SUPPLY, INSTALLATION, TESTING & COMMISSIONING OF 500KVAr HYBRID APFC PANELS

1. **SITE LOCATION:** Propellant Complex Rasayani (PCR), Rasayani, District-Raigad, MH-410207.
2. **DELIVERY:** Prices shall be quoted on the basis of delivery of APFC panels & other required material to PCR. Cost of Transportation & Transit Insurance are fully covered in the scope of supplier and the same shall be included in the cost quoted by the bidder.
3. **GENERAL CONDITIONS:**
 - a. **Site Visit :** Bidder is expected to visit the site before submission of offer. The bidder will be deemed to have satisfied himself by actual inspection of the site and locality of the works, that all conditions liable to be encountered during the execution of the works are taken into account and that the rates quoted by him are adequate and all inclusive, for the completion of works to the entire satisfaction of the purchaser.
 - b. Bidder shall sign and stamp each of tender document as a token of his acceptance & submit along with his offer.
 - c. The offer shall be complete in all respects and shall be submitted together with requisite information. Any offer incomplete in any particulars is liable for rejection.
 - d. Till commissioning of equipment, the safe storage and handling of all equipment and other items supplied are in the scope of contractor.
 - e. Contractor should have valid license issued by statutory authority to carry out the work.
 - f. The bidder shall provide all the relevant data / details required for evaluating the bid technical and commercially in the specific formats enclosed with the tender. Apart from this, Bidder is free to add any other relevant information.
 - g. During evaluation, PCR may request Bidder for any clarification on the bid/ additional documents/ information required. Bidder shall submit all clarifications/ additional documents/ information requested in original. If not submitted within the stipulated time PCR has right to reject such bids.
 - h. The complete scope of work is defined in the Tender document. Bidders, who undertake total responsibility for the complete scope of work as defined in the Tender document will only be considered.
 - i. In case Bid does not fully comply with the requirement of Tender document and the bidder stipulates deviations to the clauses of the proposal, which are unacceptable to the PCR, the Bid will be rejected.
 - j. Performance of Bidder on similar nature of works executed shall be taken into consideration before selecting the Bidder for opening his price bid.

- k. The time schedule for completion is given in the Tender document. Bidder is required to confirm the completion period unconditionally.
- l. Free electricity and water will be provided by the PCR at one location close to the site for the erection, testing and commissioning works.

4. SCOPE OF WORK

Scope of work includes the following,

- a. Disconnection, Dismantling, Shifting of existing 350KVAR APFC panels (2Nos) to PCR Stores.
- b. Submission of following drawings upon receipt of Purchase Order for approval of PCR before manufacturing:
 - Wiring Diagram and bill of material.
 - Specifications of major components of the panel- Capacitor, Control Relay, Contactor, Series reactor, ACB and Thyristor module.
 - Foundation drawings
- c. Supply including Loading / Unloading and Transportation of APFC Panels to site location.
- d. Installation, Testing at site and Commissioning of 500KVAR Hybrid APFC panels as per specifications- 2Nos.
- e. System Nominal Voltage 433V, 3 Phase, 50Hz, Neutral solidly grounded.
- f. Providing End Terminations to existing 3.5Cx300sqmm power cable including required material (two cables per panel). Extending body earthing to APFC panels.
- g. Supply, Laying and Termination of 2Cx 4sqmm multistrand copper cable for making CT connections as per given in this specification. Approximate distance between panel and LT Incomer/Bus-coupler is 30m.
- h. Supply and installation of busbar CTs (04Nos) for sensing current including disconnection of LT busbar as required.
- i. Demonstration of cascading facility of APFC Relay at site with necessary wiring.
- j. All necessary tools & tackles required for commissioning of panels to be arranged by the contractor.
- k. Providing necessary Technician, Engineer, unskilled manpower & Material handling equipment for carrying out above works at site shall be the responsibility of the contractor.

5. SPECIFICATIONS FOR HYBRID APFC PANEL

Specifications of major components are mentioned below. However bidder shall ensure that design of APFC panel, all its switchgears and other components as per bill of material shall be strictly as per applicable standards.

5.1 PANEL

- a. The APFC panel shall be indoor type, floor mounted with bottom cable entry, compartmentalized and powder coated. The Panel structure, frame and all steel parts shall undergo seven tank process surface treatments.
- b. The load bearing structure & front doors of the panel shall be of 2 mm sheet steel and partitions of 1.6 mm sheet steel.
- c. Panel enclosure shall be provided with forced air cooling with louvers at the bottom.
- d. Panel shall have base mounting channel with locking arrangements.
- e. The degree of protection for enclosure shall be IP 41 and as per IEC60529.
- f. APFC Control panel shall have auto and manual control facility.
- g. Panel shall have 08 Nos 50kVAr contactor switched units and **05Nos 20kVAr** thyrosterised units.
- h. All controls shall be wired with 2.5sqmm multistrand copper wire.
- i. For Current Transformer wiring 2Cx4sqmm copper cable shall be used.
- j. All CT wires shall be brought to the main panel and each shall be provided with CT shorting link.
- k. Busbar CTs (04Nos) for sensing circuit current shall be 1200/1 or 5A, class: 1.0 and copper wound. Size of busbars where sensing CT are to be installed is 150x110mm.
- l. Panel shall have TPN busbars made of electrolytic copper. Current density shall not exceed 1.6A/sqmm.
- m. All power connections shall use long barrel type copper lugs and shall be double crimped.

5.2 INCOMER

Incomer shall have following major accessories and protections,

- a. Incomer shall be 433V, 3pole, 1000Amp, STR-50kA/1s, EDO air circuit breaker.
- b. Incomer shall have microprocessor based O/L, S/C, E/F protection and U/V release.
- c. Resin Cast C.T. 1000/5A or 1A, 10VA, CL-1.0 for current measurement.
- d. R/Y/B phase indications, ON/OFF and TRIP LED indications.
- e. Multifunction meter indicating Volts, Current, Power Factor, Reactive kVAr.
- f. Analog voltmeter & Ammeter with selector switch.

5.3 CAPACITOR UNITS

Capacitors shall be Heavy Duty, Super Heavy Duty or Ultra Heavy duty type only. Type of Capacitor should be APP NPCB Oil Filled. The capacitor unit shall have over pressure disconnecter protection or Internal fuse elements. Discharge resistance shall reduce the residual voltage to less than 50 volts within one minute.

General specifications of capacitor units shall be as mentioned below,

- a. 3 phase, delta connected, 50 Hz
- b. Rated effective kVAr – 50kVAr & 20kVAr**
- c. Overvoltage +10%
- d. Overcurrent: 2.5 x In
- e. Peak Inrush current withstand: 350 x In
- f. Total watt-losses: < 0.45 W / kVAr
- g. Temperature category: -40° C to 65° C
- h. Switching operations per year -15000
- i. Applicable standard : IEC 60831

5.4 CONTACTOR SWITCHED CAPACITOR FEEDERS

Each contactor switched capacitor feeder shall have effective rating of 50kVAr and following major components

- a. MCCB -3 Pole, 125A, 25kA with O/L and S/C release.
- b. Capacitor Duty Contactor rated for 50KVAR & 20KVAR capacitor unit.
- c. Three Phase Heavy Duty , copper wound, 7% Detuned Reactor.
- d. APP heavy duty capacitor units of rating as per design.
- e. Analog ammeter with single phase class 1.0 CT
- f. ON/OFF push button
- g. LED ON/OFF indication.

5.5 THYRISTOR BASED CAPACITOR FEEDERS

Each contactor switched capacitor feeder shall have effective rating of 50kVAr and following major components

- a. MCCB- 3 Pole, 125A, 25kA with O/L and S/C release
- b. Thyristor switching module suitable for **20kVAr capacitor unit**.
- c. Adequately sized fan should be mounted on the thyristor unit for better heat dissipation.
- d. Automatic thermal cut off should be inbuilt in the module.
- e. The module shall have inbuilt Auto Manual changeover facility.
- f. Three Phase Heavy Duty , copper wound, 7% Detuned Reactor with 200% Linearity.
- g. APP heavy duty type capacitor unit as per design.
- h. Analog ammeter with single phase class 1.0 CT
- i. ON/OFF push button
- j. LED ON/OFF indication.

5.6 DETUNED REACTOR

- a. Detuned harmonic filter reactors shall be used along with power capacitors to mitigate harmonics amplification and to avoid electrical resonance in LV electrical networks.
- b. The reactors shall be made of copper and insulation shall be Class H. The Reactor shall be fully impregnated for low noise and high insulation level.
- c. The reactor should conform to IEC 60289 / IS 5553.
- d. The permitted tolerance of inductance is $\pm 3\%$ of rated inductance value.
- e. Reactor tuning factor shall be 7 % (189 Hz) and the current rating of the reactor shall include the effects of harmonics and other possible over-currents.
- f. For better tuning results reactors and capacitor units shall preferably be of the same make.
- g. Reactors shall have continuous Over Current Loading at 1.3x rated current.
- h. The limit of linearity of inductance of the filter reactor is: $1.8 \cdot I_n$ with $L=0.95 \cdot L_N$.
- i. The reactor shall be fitted with a temperature sensitive micro-switch at the centre of coil (normally open) for connection to trip circuits in case of high operating temperatures.
- j. Power loss in each reactor shall be less than 5 W/kVAr.

5.7 APFC Relay

An automatic power factor correction relay shall be microprocessor based. The relay should decide optimum configuration of capacitor banks in order to achieve desired power factor by taking into consideration the kVAr of each step, no of operations, total usage time, re-connection time of each step etc. The relay should have automatic and manual mode of operation that makes it possible to turn the capacitor banks "on" and "off" manually regardless of the line value measured. In auto mode, the relay should offer power factor correction without any need for manual intervention.

The APFC controller should have the following basic features

- a. APFC Relay should have **14 Steps**.
- b. Backlit LCD display with multiple parameters displayed at the same time.
- c. Cascading should be available at least up to 32 steps
- d. Inbuilt RS485 MODBUS Communication Protocol
- e. Dual PF Setting should be available
- f. APFC Relay should have single phase CT Input.
- g. Individual capacitor's ON/OFF status
- h. It should have step failure detection i.e. alarm if individual step fails

- i. It should provide counter for each step operation and give alarm if value exceeds a programmed value.
- j. Capable of measuring VTHD and ITHD values at least up to 31st order for individual harmonics.
- k. Automatic CT reversal sensing and correction.
- l. CT secondary current shall be 1A / 5A CT selectable.
- m. Display of average power factor and real time power factor.
- n. Alarms for under/over compensation, high VTHD/ITHD, over temperature, capacitor failure, over/under current, over/under voltage, MODBUS Fail Alarm
- o. Temperature sensing feature with alarm in case of panel over heating
- p. Time stamping of the latest 32 alarms should be available.

5.8 GUARANTEED TECHNICAL PARTICULARS OF APFC PANEL

Guaranteed technical particulars of APFC panel shall be submitted along with the tender as mentioned below. All specifications mentioned shall be as per relevant IS specifications.

TABLE : GTP OF APFC PANEL

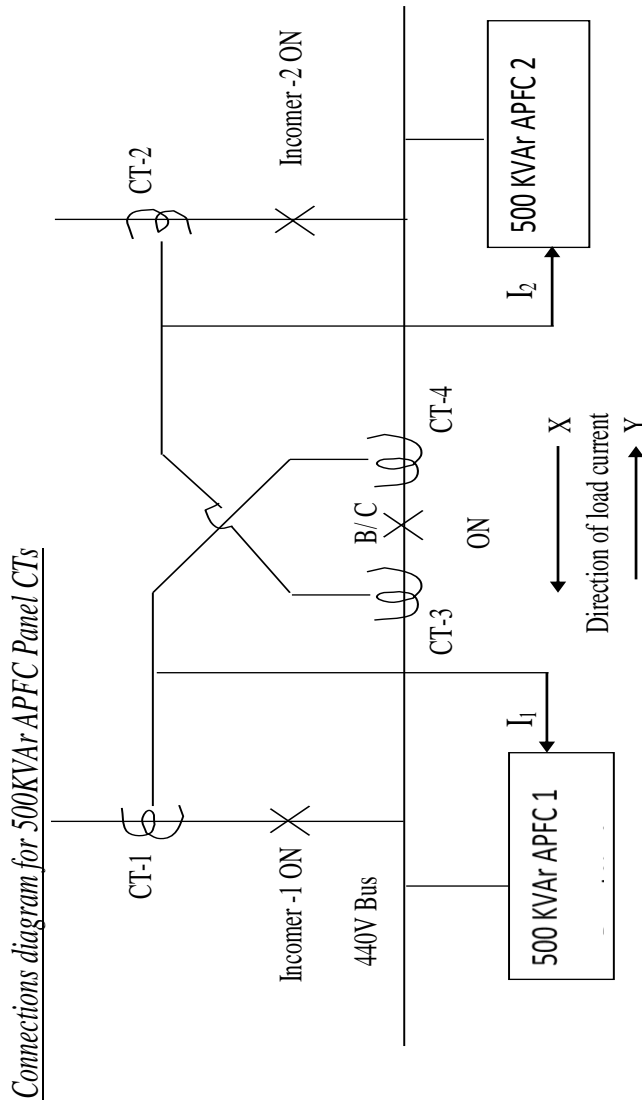
S.N.	Technical Particulars	As per Tender	As Furnished by Bidder
A	PANEL		
1	Installation	Indoor	
2	Power Supply	433V, 50Hz, 3Ph 4Wire	
3	Busbar	TPN Copper	
4	Busbar current Density	≤ 1.6A/sqmm	
5	Busbar size	Bidder to specify	
6	Cooling Fans with size	Bidder to specify	
7	Control cable size	2.5sqmm copper	
8	Size of Panel	Bidder to Specify	
B	INCOMER		
1	No of Poles	Three	
2	Type	EDO	
3	Current Rating	1000A	
4	Protections	O/L, S/C, E/F protection and U/V release.	
5	Make	Bidder to specify	
6	Metering CTs	1000/1or 5A, 10VA, CL-1.0	
7	Make of CTs	Bidder to Specify	
8	STC	50kA/1s	
9	Voltmeter & Ammeter	3Ph analog with S/S	
10	Make of MF Meter	Bidder to specify	

C	Power Capacitor		
1	Power Capacitor Type	APP Heavy Duty	
2	Make of Capacitor	Bidder to Specify	
3	Effective KVAR rating	50kVAR & 20kVAR	
4	Connection	Delta	
5	Voltage Rating	Bidder to specify	
6	Overvoltage	+10%	
7	Pick Inrush withstand	350 x In	
8	Temperature category	-40 to 65°C	
9	Discharge Device	External Resistance	
D	CAPACITOR FEEDER		
1	Feeder Switch	125A MCCB & 70A	
2	Make of MCCB	Bidder to specify	
3	Power Cable size	Bidder to specify	
	Power Contactor Rating	Bidder to specify	
4	Power Contactor Make	Bidder to specify	
5	Thyristor switching module rating	Bidder to specify	
6	Cooling fan for thyristor module	Specify size of fan	
E	DETUNED REACTOR		
1	Make	Bidder to specify	
2	Tuning Factor	7%	
3	Tolerance	± 3% of rated inductance	
4	Insulation Class	H	
5	Conductor material	Copper	
6	Continuous O/L current	1.3x Rated Current	
7	Linearity of inductance	Bidder to specify	
8	High Temperature Trip	To be provided	
F	APFC RELAY		
1	Make	Bidder to Specify	
2	No of Steps	14	
3	Cascading facility	Required	
4	Individual Capacitor Unit Status	Required	
5	Step Failure Protection	Required	
6	CT reversal sensing & correction	Automatic	
7	CT Input	Single Phase	
8	Display of Average & Realtime PF	Required	
9	CT range 1A or 5A	Selectable	

6. INPUT CT CONNECTIONS

Wiring diagram for sensing CT secondary circuit shall be as per following connection diagram. The diagram elaborates flow of current depending upon ON/OFF status of incomers & Bus-coupler.

DRAWING-1 : CT CONNECTION DIAGRAM



Note : For X direction of load current signal feeding the P.F. controller should be such that,

For Panel No 1, $I_1 = I_{CT1} + I_{CT4}$

For Panel No 2, $I_2 = I_{CT2} - I_{CT3}$

For Y direction of load current signal feeding the P.F. controller should be such that,

For Panel No 1, $I_1 = I_{CT1} - I_{CT4}$

For Panel No 2, $I_2 = I_{CT2} + I_{CT3}$ All subscripts refer to secondary side.

Panel No 1 includes supply of CT-1 & CT-4 . Panel No 2 includes supply of CT- 2 & CT- 3. ALL CT Ratio 1200/1A or 5A

7. INSTALLATION, TESTING AND COMMISSIONING

Following activities shall be carried out at site to complete installation & commissioning of the APFC panels in all respect.

- a. Disconnection pf power & control cables, removal and shifting of existing 350KVAR APFC panels to stores to make way for installation of new panels.

- b. Site inspection: New APFC shall be inspected at site to ascertain that there is no damage to any of it's components and accessories.
- c. Checking Insulation resistance to ascertain healthiness of insulation.
- d. Making power cable connections with existing 2x3.5Cx300sqmm AL cables for each panel including end terminations along with supply of material.
- e. Earthing shall be extended to panel at two locations with earthing cable of suitable size.
- f. Disconnection of LT PCC busbar for installation of Busbar CTs and extending CT secondary connections up to APFC panels with 2Cx 4sqmm copper cable.
- g. Testing for real time kVAr compensation at running load. APFC panel shall achieve desired power factor as per setting.
- h. Demonstration of cascading facility of APFC Relay at site with necessary wiring.
- i. Operation of cooling fans, all indications, display of parameters shall be checked for normal operation.
- j. All necessary safety precautions during, installation, testing and commissioning of APFC shall be strictly adhered by the contractor.
- k. Purchaser reserves the right to accept / reject any part of work, which is not acceptable as healthy engineering practice of carrying out such work as the case may be.

8. APPROVED MAKES

Approved makes of major components of APFC panel are as below.

TABLE: APPROVED MAKES

SN	Component	Approved Makes
1.	LT ACB	SCHNEIDER, L&T, ABB, SIEMENS, GE, C&S ELECTRIC, LEGRAND
2.	Power Capacitors	SCHNEIDER, EPCOS, L&T, UNISTAR, SIEMENS, ABB, KHATAU JUNKER, ASIAN POWER, SPRAGUE, CROMPTON GREAVES.
3.	Automatic Power factor Correction (APFC) Relay	SCHNEIDER, L&T, BELUK, POWERMONITOR, PROK DV's, EPCOS
4.	Moulded Case Circuit Breakers (MCCBs)	SCHNEIDER, L&T, LEGRAND, HAVELLS, STANDARD, C&S ELECTRIC, ABB, SIEMENS
5.	Measuring Instruments	L&T, SCHNEIDER, MECO, NEUTRONICS, NIPPEN, CG SCHLUMBERGER, ELMEASURE, RISHAB, KRYKARD, CIRCUTOR, RIKEN, AUTOMATIC ELECTRIC (AE), SATEC, SECURE

9. QUALITY ASSURANCE

Quality Assurance Plan for the APFC panel shall include following information,

- a. Test certificates of Capacitors, Incomer, Detuned reactors, Contactors & accessories from respective OEM.
- b. Statement giving information about names of sub-suppliers, list of testing standards, list of tests normally carried out for bought out item.
- c. Copies of Type Test certificates in respect of following bought out items.
 - ACB
 - Power Capacitors
 - Detuned Reactors.
- d. The limitations in testing facilities shall be very clearly brought out as deviation from specified test requirements.
- e. The purchaser reserves right to participate in the Inspection at any stage of fabrication & the supplier has to intimate the work progress periodically.
- f. The following QAP is an indicative only, Supplier has to submit the QAP for purchaser's approval before start of Fabrication.

Table: QAP

Sl. No.	Checks	Acceptance Criteria	Reference Documents	Supplier	Purchaser
1	Bus Bar	Tender Specification Clause 5.1(l)	OEM Test Certificate.	H	R
2	Capacitors	Tender Specification Clause 5.3 IS :13585 latest	OEM Test Certificate.	R	R
3	Panel Assembly and Checks	Design Specifications	Manufacturer's In-process Check List	P	R
4	Routine Test (Internal)	1. Approved Drawings 2. Test Procedures	OEM Test Certificates.	P	R
5	Factory Acceptance Test	Bill of Material Check, Operation Test, HV Test, IR before & after HV Test.	Routine Test Results- Internal.	P	W

10. INSPECTION

- a. The inspection may be carried out by the purchaser at any stage of the manufacturing process. The contractor/manufacturer shall grant free access to the purchaser's representative/s at a reasonable notice when the work is in progress.
- b. Inspection and acceptance of any equipment under this specification by the purchaser shall not relieve the supplier of his obligation of furnishing equipment in accordance with the specification and shall not prevent subsequent rejection if the equipment is found to be defective.
- c. The supplier shall keep the purchaser informed in advance, about the manufacturing program so that arrangement can be made for stage inspection.
- d. Notwithstanding above, final inspection shall be carried out at the manufacturer's facility in presence of purchaser's representative and before dispatch of the panel to site. Routine/ acceptance tests as per IS/IEC shall be carried out on fully assembled panel during the final inspection.
- e. At least two weeks prior intimation shall be given to purchaser for final inspection.
- f. Acceptance tests may be witnessed by two representatives from the purchaser.
- g. Two copies of acceptance tests reports (original) shall be submitted to the purchaser.

11. DELIVERY SCHEDULE

Delivery schedule is essence for this contract. Party shall adhere to the delivery date mentioned in this tender and same shall be confirmed along with the offer. In case Party is unable to meet the delivery schedule, the offer is liable for rejection.

TABLE : DELIVERY SCHEDULE

SN	Description	Time Line
1	Issue of Order	T0
2	Submission of all Drawings	T0+ 02 weeks
3	Approval of Drawings by PCR	T0 + 03 weeks
4	Delivery of APFC panels at site	T0 + 15 weeks
5	Removal & shifting of Old panels and Installation, testing & commissioning of new panels after site clearance.	T0 + 18 weeks

Above delivery schedule is the maximum period. Early delivery schedule is preferred. Intermediate milestones can be identified mutually after placement of order.

12. OFFER VALIDITY

The validity of the offers / tenders should be 120 days from the date of opening of the tenders. Tenders with offer validity less than the period mentioned above, will not be considered for evaluation.

13. LIQUIDATED DAMAGES

Liquidated Damages will be levied @ 0.5% per week or part there of subject to a maximum of 10% of order value.

14. WARRANTY

- a. Warranty period shall be Twenty Four months from the date of commissioning.

15. GST : The GST for this work shall be considered as 18% on the tax invoice.

16. PAYMENT TERMS

- a. 100 % payment shall be paid within 30 days of completion of work in all respect.

17. TWO PART BID

Online bids shall consist of the following. Technical bids shall be evaluated first and only technically suitable offers shall be considered for Price bid evaluation. Bidder should not disclose any prices in the technical bid submission & evaluation.

Part-I : Technical and Unpriced Commercial Bid

Following documents/information shall be submitted in Technical and Un-priced commercial part.

- a. Duly filled BID QUALIFICATION CRITERION
- b. Wiring diagram & Guaranteed Technical Particulars for APFC Panel
- c. Type test certificates & Bill of material
- d. Delivery Schedule
- e. Duly Filled Compliance Statement.
- f. Any other relevant document bidder desires to submit.

Part-II : Price Bid

Price bid shall contain schedule of prices to be filled online. Quoted price shall be inclusive of transportation, labour, material cost as mentioned in scope of work. As the items are interdependent, combined lowest cost shall only be considered for award of work. **No splitting of order is envisaged.**

18. BID QUALIFICATION CRITERIA

Bidders who are qualifying / meeting the following Technical and Financial capabilities only are eligible to participate in this tender.

TABLE : BID QUALIFICATION CRITERIA

Sr No	Criterion / Requirement	Fulfilled / NOT Fulfilled
1	The complete scope of work is defined in the tender document. Bidder undertakes total responsibility for the complete scope of work as defined in the tender document. Self-Declaration certificate shall be enclosed.	
2	The Bidder should be an organization with previous experience of having executed Supply, Installation, Testing and Commissioning of at least TWO 433V APFC panels of rating not less than 250kVAR in the last Five years ending on 31.03.2024. Enclose Documentary evidence like order issued, completion certificates etc.	
3	The Bidder should confirm that make of the items are as per Approved Makes clause of the specifications.	
4	Bidder should have executed orders of similar nature Supply, Installation, Testing and commissioning of any 433V Panels of values as stipulated below in the last THREE years ending on 31.03.2024. Submit copies of a. Single order of value not less than Rs 25 lakhs Or b. Two orders of value not less than Rs 17 lakhs each Or c. Three orders each of value not less than 12 lakhs along with completion certificates.	
5	Solvency certificate in the current Financial year from any Nationalized/Scheduled bank shall be submitted for a value of minimum ₹12 lakhs.	
6	The Bidder should have of average annual turnover minimum 20 Lakhs for the last 3 Audited financial years ending with FY2023-24.	
7	The bidder should not have been blacklisted by Central Government, PSU or any State Government organization / department in India at the time of submission of the Bid (Self-declaration has to be attached)	

19. COMPLIANCE STATEMENT

Compliance statement which shall be necessarily filled and submitted failing which the offer will be summarily rejected.

TABLE-4 : COMPLIANCE STATEMENT

SN	DESCRIPTION	Compliance Yes/ No
1	Scope of work as per tender document	
2	Make & Specifications for major components as per tender	
3	Bill of material GTP of APFC panels as per tender	
4	Delivery Schedule as per tender document	
7	Terms and conditions as per tender document	
9	Warranty as per tender document	
10	Supporting documents as per Bid Qualification Criteria	
11	Payment terms as per tender document	
12	Deviations if any from the Terms & Conditions Attach separate sheet if required Otherwise mention as "NIL"	

20.PRICE BID FORMAT

Prices must be quoted through EGPS Portal only.

SrNo	Description of Item	Qty	Basic Cost	GST	Total Amt
1	Supply, Installation, Testing & Commissioning of 500KVAR Hybrid APFC Panels as per tender specifications	2 Set	Do not mention Price	Do not mention Price	Do not mention Price
	TOTAL				Do not mention Price

End of Document.