



**INTERNATIONAL ADVANCED RESEARCH CENTRE
FOR POWDER METALLURGY AND NEW MATERIALS (ARCI)**

Balapur PO, Hyderabad – 500 005, Telangana, India
Tel: 040-24452326 Fax: 040-2444269; Email : stores@arci.res.in
URL: www.arci.res.in

Tender No.CF20150086

Date 22.11.2016

TENDER DOCUMENT

Electrochemical work stations for Energy Storage Applications: Supply Installation, Commissioning and Demonstration.

Tender Documents	:	Documents can be downloaded from www.arci.res.in
Address for Submission of the Tender	:	International Advanced Research Centre for Powder Metallurgy and New Materials , Balapur Post, Hyderabad – 500 005, Telangana, India
Cost of Tender Document	:	Rs 1000.00
Publication of Tender Notice	:	5 th January 2017
Last Date for Submission of Tender	:	27 th January 2017
For any enquiry	:	Tel : 91-40-24452478 and +91-40-24452326 Fax No. +91-40-24452699 email : anandan@arci.res.in and stores@arci.res.in



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Instructions to Bidder

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RE-TENDER NOTICE

International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI) is an Autonomous Research and Development Centre of Department of Science and Technology (DST), Government of India with main campus at Hyderabad and with operations in Chennai and Gurgaon

ARCI would like to procure the following equipment. The Technical Specifications Schedule of Requirements and Allied Technical details are given in Part-1 of tender document.

- **Item: Electrochemical work stations for Energy Storage Applications - Supply Installation, Commissioning and Demonstration as mentioned below:**
 - 1) *Supercapacitor testing station with 24 (twenty four) channels or more.*
 - 2) *Electrochemical Analyzer.*
 - 3) *Electrochemical workstation for high voltage batteries with two channels or more.*
 - 4) *Multichannel battery cycler for low and medium current applications with 32 channels.*

- Tender Enquiry No: (Case No.) CF20150086 dated 22.11.2016
- Last date of submission of Tender (Both Technical and Price Bid): 27th January 2017
- Technical Bid should enclosed Demand Draft drawn in favour of ARC-International, payable at Hyderabad towards cost of tender document.

- **The firms, who have already submitted their offer earlier need not re-submit, unless they desire to revise their earlier offers.**

- The item (**Sl. No. 1&2–Annexure-1**) to be delivered and installed at:
INTERNATIONAL ADVANCED RESEARCH CENTRE FOR POWDER METALLURGY AND NEW MATERIALS, BALAPUR POST, RCI ROAD, HYDERABAD -500 005.

- The item (**Sl. No. 3 &4 –Annexure 1**) to be delivered and installed at :
**CENTRE FOR AUTOMOTIVE ENERGY MATERIALS (CAEM)
ARCI-CHENNAI
IITM RESEARCH PARK, PHASE 1, SECTION B
6 KANAGAM ROAD,
TARAMANI, CHENNAI 600 113, TAMIL NADU**

NOTE: Technical and price bid for the above four items must be quoted separately

The tender document should consist of the following :

Two bid systems should be followed for this tender. In this system the bidder must submit offer in three separate sealed envelopes i.e., one envelope for each for technical bid, EMD and commercial bid. These envelopes should be securely sealed and stamped separately for each quoted equipment and clearly marked as “Envelope No.1 – Technical Bid”, “Envelope No. 2- EMD” and “Envelope No.3 – Commercial Bid”. All the sealed envelopes should be placed in another larger envelope. The main envelope which will contain all the envelopes should be superscribed with the tender enquiry no. CF20150086 date 22.11.2016 due on 27th January 2017 with name of the equipment /item and is to be submitted to the address given below so as to reach **on or before 27th January 2017**.

The Bidder should ensure that the Prices are mentioned only in the Financial Bid and nowhere in the Technical Bid.

Address for submission of the Tender:

International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Balapur Post, RCI Road, Hyderabad- 500 005, Telangana, India.

Last date for submission : 27th January 2017

Tender should be submitted before last date stated above. The Tenders not accompanied EMD and cost of tender document in form of Demand Draft favoring Director, ARCI, payable at Hyderabad are liable for rejection.

The bid can be submitted in person or through post/courier. ARCI will not be responsible for transit delay for tenders submitted by Post / Courier etc.

All the tenders, in which any of the prescribed conditions are not fulfilled or incomplete in any respect are liable to be rejected.

DISQUALIFICATION OF TENDERS:

The tenders are liable for rejection in the following circumstances:

- If they are not in line with the terms and conditions of this tender notice.
- Conditional quotations
- Incomplete tenders
- Tenders without EMD and cost of tender document
- Tenders submitted through Fax or e-mail
- If two bid system is not followed

Director, ARCI reserves the right to accept or reject any or all tenders either in part or in full or to split the order without assigning any reasons there for.

IMPORTANT NOTE: Amendment, Corrigendum if any to this tender document, WILL BE HOSTED ONLY IN ARCI WEBSITE and no separate Press Notification will be issued. Bidders are advised to visit our website regularly to know such details.

Director, ARCI, Hyderabad

PART-1

TECHNICAL BID

I. Vendor qualification criteria:

- A. Original equipment manufacturer (OEM) or authorized representatives of OEM only can quote for this tender. Vendor should submit authorization letter valid on tender date from OEM along with the quotation.
- B. The OEM should have proven expertise in manufacture and supply of the item.
- C. The bidder should have supplied at least 5 or more similar units in India or abroad in the last 5 years.
- D. It is essential that the manufacturer shall provide the list of users of the equipment with contact particulars.
- E. OEM is required to submit a letter of commitment at the time of quote for supply of spares and also for efficient and prompt after sales service of the equipment for a minimum period of 5 years after the guarantee/warranty period under mutually agreed terms and conditions.
- F. Failure to meet any of the above vendor qualification criteria may lead to disqualification of tender at technical evaluation stage itself and vendor's quotation may not be considered for procurement.

II. Pre dispatch inspection

- A. The manufacturer/supplier of the unit shall demonstrate, if required, at their works during pre-dispatch inspection by ARCI personnel and shall satisfy all the technical specifications as described in the tender document.
- B. The manufacturer /supplier of the unit shall demonstrate the features as provided in **Annexure-I (Scope of supply work)**.
- C. All the consumables, raw materials, required for the above demonstration should be arranged by the tenderer.
- D. All the utilities and manpower required for the demonstration shall be arranged by the supplier only

III. Acceptance criteria:

- A. The manufacturer/supplier should carry out installation and commissioning of the unit at ARCI.
- B. The entire functionality of the equipment according to the specifications should be demonstrated at ARCI
- C. The manufacturer /supplier of the unit shall demonstrate the features as specified in **Annexure I (Scope of Supply)**
- D. Required infrastructure required for the above demo will be arranged by ARCI.

IV. Other aspects:

1. PATENT RIGHTS:

The Supplier shall indemnify ARCI against all third-party claims of infringement of patent, trademark or industrial design rights, copy rights arising from use of the Goods or any part thereof in India.

2. Training:

The manufacturer shall impart training in the operation and preventive/breakdown maintenance of the complete unit including sub-parts during installation to ARCI personnel for at least 4 no. of days at ARCI.

Optional training at OEM site: (on case-to-case basis during pre-dispatch inspection,

3. Utilities/Infrastructure for installation:

A. Supplier shall indicate all the required utilities/infrastructure such as power, water, gas, etc including power backup requirements.

B. Supplier shall provide overall dimensions of the Unit along with floor area/height of the site or building, including foundation details if any, for accommodating the Unit.

C. The operating environment for the Unit including temperature and humidity control, anti-vibration, EMI, EMC etc. should be indicated.

D. If any charges extra are payable for Installation and Commissioning, the same should be specified in the commercial offer (**Price Schedule**).

4. Manuals, software and other drawings etc:

The following documents (in English) shall be provided along with the Unit in both hardcopy and softcopy forms:

- A. Operation and maintenance manuals, troubleshooting procedures, calibration methods, wiring and other schematic diagrams, list of components, spares and accessories.
- B. If there are any bought-out systems and components, manuals should be provided in hardcopy and softcopy forms for the same.
- C. Calibration certificates for sensors, instruments, gauges, display units etc. must be provided.
- D. Software upgrades pertaining to the supplied Unit should be provided free of cost as and when new versions are released by the OEM.
- E. Safety and security instruction manual should be provided.

5. After-sales service:

The supplier shall guarantee efficient and prompt after-sales service including the supply of

the spares for a minimum period of 5 years after the guarantee/warranty period under mutually agreed terms and conditions.

6. Bought-out items:

All bought-out sub-systems and components if any should be of reputed make conforming to international standards. Make and details of all bought-out sub-systems and components shall be specified.

7. General Quote:

The breakup for accessories or sub system(s) /attachments apart from the basic system, if any, should be quoted separately.

8. Export License: The supplier should clearly indicate their ability/readiness to obtain the export license /clearance from the concerned authority for the supply of the unit as per the contract specifications to ARCI.

9. Technical compliance statement: The vendor should provide item wise details against each and every specification, Deviations if any are to be highlighted.

10. Guarantee/warranty:

The Unit shall be under warranty **for a period of three year from the date of acceptance.** During the warranty period, all software and hardware updates shall be provided free of cost. Items, if any, excluded from the warranty shall be explicitly mentioned by the supplier.

The Unit shall be guaranteed for satisfactory performance for 3 no. of years from the date of installation, commissioning and acceptance at ARCI. The manufacturer shall replace premature failure of parts during the guarantee period at their cost and risk.

11. Delivery/ time schedule:

The offer shall be accompanied by a detailed delivery time schedule showing the individual time schedule required for submission of initial equipment layout drawings, foundation drawings along with load data, main equipment and sub-assembly drawings, shipment schedule of the equipment as well as the time for installation, commissioning and performance tests.

12. Packing:

The Supplier shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the Goods' final destination and the absence of heavy handling facilities at all points in transit.

In order to maintain safety of the equipment, we prefer to have wooden crating with adequate cushion inside for transportation of any goods. The Material has to be dispatched with International standard packing to withstand rigors, and to avoid any transit damages.

13. **Packing Instructions:**

Each package will be marked on three sides with proper paint/indelible ink, the following:

- i. Purchaser Name & Address
- ii. Item Nomenclature
- iii. Order/Contract No.
- iv. Country of Origin of Goods
- v. Packing list reference number

14. **Insurance:**

The Goods supplied under the Contract shall be fully insured in Indian Rupees against loss or damage incidental to manufacture or acquisition, transportation, storage and delivery.

For delivery of goods at the purchaser's premises, the insurance shall be obtained by the Supplier in an amount equal to 110% of the value of the goods from "Warehouse to warehouse" (final destinations) on "All Risks" basis including war Risks and Strikes. The insurance shall be valid for a period of not less than 3 months after dispatch **or upto installation and commissioning of stores whichever is later** . However, in case of orders placed on FOB/FCA basis, the purchaser shall arrange insurance.

15. **General instructions:**

- A. The Technical Bid must be submitted in an organized and structured manner. No brochures/leaflets etc. should be submitted in loose form. Please indicate page nos. on your quotation. **The price should not be mentioned anywhere in this document.**
- B. Tenders, which are submitted without following the Two-Bid Offer System, are liable to be rejected.
- C. The technical offer should be complete to indicate that all products and services asked for are quoted. Each page of the bid and cutting/corrections shall be duly signed and stamped by the bidder. Unsigned Tenders are liable to be rejected. Failure to comply with this requirement may result in the bid being rejected.
- D. The purpose of certain specific conditions is to get or procure best product/service etc. for ARCI. The opinion of Technical Committee shall be the guiding factor for technical short listing.
- E. Vendor should provide list of deliverables / bill of materials and services.

PART- 2

EARNEST MONEY DEPOSIT

Earnest Money Deposit in the form of Indian or foreign demand draft Drawn in favour of Director, **International Advanced Research Centre, Payable at Hyderabad.**

No interest is payable on EMD. The EMD will be returned to the bidders(s)/Agents whose offer is not accepted by ARCI within one month from the date of the placing of the final order(s) on the selected bidder(s). EMD of the successful bidder shall be converted into performance guarantee and shall be release on submission of bank guarantee.

EMD in the form of BG is not acceptable.

Only one EMD for all four equipment.

Amount of EMD Rs.1,50,000.00 (Rupees one lakh fifty thousand only) in INR or equivalent foreign currency.

PART-3
PRICE BID

I. Terms and Conditions:

- a) Envelope 3 should contain price schedule (as per the table) complete in all respects with proper seal and signature of authorized person.
- b) Tender with any condition, including conditional rebate, are liable to be rejected.
- c) Cost of all the items should be mentioned clearly and individually in the Commercial Offer (Part- II) only.
- d) AMC scope with associated costs including number of visits has to be quoted separately.
- e) The Bidders are requested to quote for research institutional price for Machine/ Equipment and, since ARCI is eligible for the same.
- f) Printed conditions of the vendor submitted with the tender will not be binding on ARCI.
- g) The commercial bids of only the technically qualified bidders shall be considered for further processing.
- h) The price quoted shall be considered firm and no price escalation will be permitted during the currency of contract. The quotation should be in standard currency on Ex works/FOB/FOR basis. Freight, insurance, Agency commission (if any) and commissioning charges, if not included, may be quoted separately in Commercial Bid.
- i) Commercial Bid (prices quoted) should not be enclosed in the technical bid envelope. If the price quote is submitted with technical bid the tender are liable to be rejected.
- j) The Director ARCI reserves the right to accept the offer in full or in parts or reject summarily or partly thereof.

II. Payment terms:

- a) For import:

An irrevocable Letter of Credit [L/C] for 100% of the order value will be established by the purchaser in favour of the supplier, through purchaser's bank in India once the following condition is met:

Receipt of order acknowledgement and acceptance of the order.

THE ACTUAL PAYMENT TO SUPPLIER WILL HOWEVER BE RELEASED IN TWO STAGES IN THE FOLLOWING MANNER:

Payment for 90% of the order value will be made upon shipment of the equipment and negotiation of the following shipping documents through L/C:

- 1) Signed Commercial Invoice - Original + 5 Copies

- 2) Airway Bill/Bill of lading - Original + 5 Copies.
- 3) Packing List -Original + 5 Copies
- 4) Certificate of conformity from the supplier that stores/equipment has been tested by the supplier and the same meet the technical specification - Original + 3 Copies.
- 5) Supplier's Certificate to the effect that the contents in each package are not less than those entered in the Invoice and the Packing List - Original + 3 Copies.

Balance 10% of the order value will be released through L/C upon submission of the following documents:

- 1) Commercial Invoice for 10% order value.
- 2) Final Acceptance Certificate [FAC] issued by the purchaser/authorized representative in original against satisfactory installation and commissioning of the equipment at ARCI Site.
- 3) Bank Guarantee Equivalent to 10% of total order value covering warranty period of the equipment issued or counter guaranteed by an Indian Bank clearly mentioning the relation with OEM if submitted by Indian Agent.
- 4) If the above-mentioned performance bank guarantee is not provided, 10% of the order value (i.e. second stage payment) will be released only after the expiry of the warranty period from the date of FAC.

1) Domestic purchase:

Payment Terms

Subject to deduction of taxes at source, if any,

90% of the goods cost + 100% taxes will be paid after receipt of the goods at our site subject to inspection & acceptance of the goods/works/commissioning by ARCI authorities.

Balance 10% will be paid against submission of Performance Bank Guarantee (i.e. 10% of the total order value excluding taxes etc.) from a Nationalized /Scheduled Bank valid till the expiry of the warranty period OR after completion of warranty period from the date of successful commissioning of equipment at ARCI.

III. Final acceptance certificate (FAC)

On installation, the working of the equipment should be demonstrated so as to comply with all the technical specifications. In this connection, it is to be noted that the installation report is not to be treated as the Final acceptance certificate (FAC)

The FAC will be issued by the PURCHASER only on demonstration of the technical specifications. The warranty shall commence only from the date of the issuance of the

FAC. The FAC shall be issued by the PURCHASER at a date not later than 30 (thirty) days from the date of installation provided the equipment functions as per the specifications.

IV. Liquidated damages (LD)

As time is the essence of the contract, delivery period mentioned in the Purchase Order should be strictly adhered to. Otherwise, LD clause will be applicable /enforced. If the supplier fails to Supply, Install and Commission the equipment as per specifications mentioned in the order within the due date, ARCI may levy a penalty for such delay by way of liquidated damages, at 0.5% per week of delay or part thereof, and in aggregate not exceeding 5% of the order value. Such LD will be deducted from any amount due or which may become due to the supplier.

V. Order acceptance

The successful bidder, on award of contract / order, must send the contract / order acceptance in writing, within 15 days of award of contract / order failing which the EMD will be forfeited.

VI. Award of contract:

ARCI reserves the right at the time of award of Contract to increase or decrease the quantity of items specified in the Schedule of Requirements without any change in price or other terms and conditions.

VII. Corrupt or Fraudulent Practices:

ARCI requires that the bidders who wish to bid for this project have highest standards of ethics. ARCI will reject a bid if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices while competing for this contract. ARCI may declare a vendor ineligible, either indefinitely or for a stated duration, to be awarded a contract if it at any time determines that the vendor has engaged in corrupt and fraudulent practices during the execution of contract.

VIII. Interpretation of the clauses in the Tender Document / Contract Document:

In case of any ambiguity / dispute in the interpretation of any of the clauses in this Tender Document, Director, ARCI's interpretation of the clauses shall be final and binding on all parties.

The equipment must be supported by a Service personnel trained by the principal vendors

The vendor will have to arrange for all the testing equipment & tools required for installation, testing & maintenance etc. Installation and integration of all supplied hardware and software shall be done by the vendor. The vendor shall install and configure all required hardware and software. The bidder must install and configure user application / software, and demonstrate its running in parallel as part of the system acceptance. The application software will be provided by the Institute.

IX. Indemnity:

The vendor shall indemnify, protect and save ARCI against all claims, losses, costs, damages, expenses, action suits and other proceeding, resulting from infringement of any law pertaining to patent, trademarks, copyrights etc. or such other statutory infringements in respect of all the equipment's supplied by him.

X. Arbitration

For Domestic Supplier

In case of Dispute or difference arising between the Purchaser and a domestic supplier relating to any matter arising out of or connected with this agreement, such disputes or difference shall be settled in accordance with the Indian Arbitration & Conciliation Act, 1996, the rules there under and any statutory modifications or re-enactments thereof shall apply to the arbitration proceedings. The dispute shall be referred to arbitrator appointed by Director ARCI. The award of the arbitrator so appointed shall be final, conclusive and binding on all parties to this order.

The venue of the arbitration shall be the place from where the purchase order/contract is issued.

Notwithstanding any reference to arbitration herein, (a) the parties shall continue to perform their respective obligations under the Contract unless they otherwise agree; and (b) the Purchaser shall pay the Supplier any monies due the Supplier.

For Imports

In the case of a dispute between the purchaser and a Foreign Supplier, the dispute shall be settled by arbitration in accordance with provision of sub-clause (a) above. But if this is not acceptable to the supplier then the dispute shall be settled in accordance with provisions of UNCITRAL (United Nations Commission on International Trade Law) Arbitration Rules.

Declaration by the Vendor

It is hereby declared that I/We the undersigned, have read and examined all the terms and conditions etc. of the tender document for which I/We have signed and submitted the tender under proper authorization. It is also certified that all the terms and conditions of the tender document are fully acceptable to me/us and I/We will abide by the conditions of the tender. We have not given any printed conditions beyond the scope of this tender. This is also certified that I/We/our principal manufacturing firm has no objection in signing the purchase contract if the opportunity for the supply of the items against this tender is given to me/us.

Date:

Signature:

Name:

Address:

Designation:

On behalf of:

PRICE SCHEDULE FOR FOREIGN SUPPLIERS

Currency:

Sl. No.	Name of the equipment	County of Origin	Quantity	Price in foreign currency
1.	Main equipment			
2.	Accessories			
3.	Spares and consumables			
Packing and forwarding Charges				
Ex-works Price				
Discount if any				
Net Ex-works Price				
FOB Charges				
FOB Price				
Charges for freight and insurance				
Total price (CIF/CIP)				
AMOUNT IN WORDS				

Note: The Bidder may please fill in this form or the same may be typewritten on the Letter Head of the Bidder exactly as per the above format and submit the same as per the instructions given in the tender document.

ARCI is exempted from paying Excise Duty as per Notification No.10/96 & exempted from paying Customs duty as per Notification No.51/96-Cus (as amended from to time). Hence rates to be quoted accordingly.

Other information:

- a) Any installation and commission charges
- b) Any other optional item and their prices should be mentioned separately
- c) AMC Charges

[SIGNATURE OF BIDDER]
NAME AND ADDRESS OF BIDDER

PRICE SCHEDULE FOR DOMESTIC SUPPLIERS

Sl No.	Name of the equipment	Quantity	Unit/Price	Total Amount(Rs)
1	Main equipment			
2	Accessories			
3.	Spares and consumables			
Discount if any				
Net Price				
Taxes if any				
Total price (FOR – ARCI)				
AMOUNT IN WORD:				

Note: The Bidder may please fill in this form or the same may be typewritten on the Letter Head of the Bidder exactly as per the above format and submit the same as per the instructions given in the tender document.

ARCI is exempted from paying Excise Duty as per Notification No.10/96 & exempted from paying Customs duty as per Notification No.51/96-Cus (as amended from to time). Hence rates to be quoted accordingly.

Other information:

- a) Installation and commission charges, if any
- b) Optional items and their prices should be mentioned separately
- c) AMC Charges

[SIGNATURE OF BIDDER]
NAME AND ADDRESS OF BIDDER

SCOPE OF WORK

1) Supercapacitor testing station with 24 (twenty four) channels or more.General requirements

- Multichannel Potentiostat/Galvanostat with in-built EIS analyzer designed for Energy: Super capacitor, Battery cycling & electrochemical research over a broad spectrum of applications.
- 24 [twenty four] channels or more required. All the channels should operate simultaneously, independently and synchronous mode. Hardware & Software should have provision to integrate and upgrade to 64 channels or more in future.
- All the channels should be electrically isolated; floating ground and should operate in single cell-multiple working electrode combination with following operating modes, Constant current (CC), Constant Voltage (CV), Constant Power (CP), Constant resistance (CR), Voltage scan (Cyclic voltammetry).
- Capable of performing two, three, and four-electrode measurements.

Specific requirements

- (a) 2 (two) channels of supercapacitor testing station should have the following specifications:
- (i) Impedance measurement facility with minimum frequency range of 10 μ Hz and maximum frequency range of 5-10 MHz or more
 - (ii) AC voltage amplitude 0.5 mV rms to 1000 mV rms
 - (iii) Voltage range \pm 30V
 - (iv) Current range \pm 1A
- (b) Remaining 22 (twenty two) channels should have cyclic voltammetry measurement facility with two/three electrodes configuration with the following specifications:
- (i) Voltage control potentiostat mode must available in all the channels
 - (ii) Applied voltage range \pm 10V or better
(Resolution: 0.5 μ V in the mV range & 0.5mV in the V range; Voltage accuracy \pm 0.2%)
 - (iii) Maximum scan rate 500V/s or better
 - (iv) All the channels should have the following specifications,
 - i. Number of cycles- 1 to 9999 or more
 - ii. Number of steps per cycle-1 to 15000 or more
 - iii. Independent controllers for each channel
- (c) Current control Galvanostat mode should have the following specifications:

- (i) Current range: Max. $\pm 2\text{A}$ & Min. $\pm 5\text{nA}$
 - (ii) Current accuracy: $\pm 0.2\%$
 - (iii) Current resolution: $100\mu\text{A}$ at $\pm 2\text{A}$ & 500fA at 5nA
- (d) 2 (two) Current boosters with the following specifications must be provided to enhance the maximum current of any two channels in the system to $\pm 10\text{A}$, preferably in-built with the same chassis.
- (i) Compliance voltage : -1V to $+6\text{V}$ or more
 - (ii) EIS bandwidth : 300KHz or more
- (e) Electrochemical Impedance Spectroscopy should be provided for 2 (two) channels with the following specifications:
- (i) Mode: Potentiostat/Galvanostat
 - (ii) Frequency range: Minimum frequency of $10\ \mu\text{Hz}$ and maximum frequency of $5\text{-}10\ \text{MHz}$ or more
 - (iii) AC voltage amplitude: 0.5mV rms to 1000mV rms
- (f) iR compensation must be available with positive feedback and dynamic iR.
- (g) Software & PC requirements –
- (i) Single software to drive all the circuits
 - (ii) USB controlled system /8GB RAM, i5 processor, 1 TB hard disk along with 21 inch LED screen (DELL) with suitable software for data acquisition and compatibility of recent software's with different versions of Windows
 - (iii) 1 PC with two individual monitors, Keyboard, Optical mouse, printer are required
 - (iv) PC Ethernet card, cable, connectors and switch including network adapter.
 - (v) 32 bit or 64 bit windows 10 OS program for electrochemical experiments & analysis.
 - (vi) Techniques required: Potentio Galvanostatic & Potentio Galvanodynamic EIS software with facility for equivalent circuit fitting & simulation. Data presentation of Nyquist Bode plots & Admittance. All impedance related measurements etc. CV, LSV, SWV, SLSV, Multiple CV, CC, CP, Pulse voltammetry, potential or galvanic pulses, Power CCD, Resistance CCD, constant resistance, constant power, open circuit potential, cyclic polarization, galvanic corrosion, LPR, Tafel polarization, NPV, DPV, RNPV, charge & discharge, capacitor measurements, ZRA etc.
 - (vii) Chronopotentiometry, Chronoamperometry, Chronocoulometry techniques.
 - (viii) Hardware & Software should have provision to integrate & upgrade to 64 channels or more in future.
 - (ix) Option for simultaneous DC & EIS measurements of cell should be possible with any one of the channels.
 - (x) Capable of performing two, three & four electrode measurements.
 - (xi) It should be able to work for other measurements like EQCM, RRD, RRDE etc.
 - (xii) Free upgradation of the software.

- (xiii) Pre-installed software should be provided along with the system.
- (xiv) One UPS system for minimum 2hrs backup
- (xv) In the event of power failure, the instrument should continue from the point where power failure occurred on resumption of the power automatically.
- (xvi) Data and program should be protected during power failures-Should have provision for:
 - i. Reset and Restart facility at any moment of running time
 - ii. Changing the running programme of any circuit at any time
- (xvii) Necessary temperature control system and temperature sensors for all 24 channels
- (xviii) Provision for protection for short circuit and overload
- (h) Hardware requirements
 - (i) Cell cables with four or five terminal leads for all channels should be supplied along with the system
 - (i) Electric power feed through
230V, 50Hz or 3 phase, 415 V, 50 Hz
Minimum 15 amps
Length of the cable should be minimum 3 meters

Accessories required

Silver/Silver Chloride Reference Electrode	Minimum 5 Nos
Working Electrode – Platinum, AU, GCE [2mm]	Minimum 5 Nos
Platinum Wire Electrode 5mm	Minimum 5 Nos
Platinum Mesh	Minimum 5Nos
Saturated Calomel Reference Electrode	Minimum 5 Nos
Mercury-Mercurous Sulfate Reference Electrode	Minimum 5 Nos

Flat cell (two electrode system)-10 Nos with following specifications
 Dimensions – Dia. 58 mm x Height 30 mm
 Material - SS304 or better
 Internal cell size suitable for 13 mm of electrode.
 PP or PTFE stopper
Voltammetry Cell - 50ml & 100ml Volume cell-10 Nos

Reliable safety protection:

- i. Protect from over voltage and over current
- ii. Independent upper and lower clamp circuits to protect from over and under voltage during charge/discharging
- iii. Channel status indication should be provided
- iv. Temperature compensation facility to control the set voltage with respect to reference & ambient temperature
- v. Provision for calibration and correction for Current, voltage, power, etc
- vi. Essential spares kit to be provided
- vii. Tester mobility-Roller wheeled cabinet

- viii. Should have protection for short circuit and overload
- ix. Input power supply- 230V, 50Hz or 3 phase, 415 V, 50 Hz

(n) Warranty details

- i. Three years from date of installation. During installation any defective parts should be replaced, Manufacturer shall maintain warranty of all the bought out items.
- ii. AMC after the warranty period: AMC shall be quoted for two years, Purchaser reserves the right whether or not to have AMC

(o) Test certificates & reports should be provided

- i. Origin of manufacturing certificate, Original manufacturer certificates, warranty and date of manufacturing for imported items.
- ii. Calibration certificates whenever needed.

(p) Installation and Commissioning

- i. Installation & Commissioning needs to be done by the Factory Trained Engineers.
- ii. On completion of commissioning, the performance of the equipment should be demonstrated by the manufacturer as per accepted technical specifications.
- iii. Minimum of 15 process runs/trials shall be demonstrated after completion of commission at user's site as per the process parameter given by user.
- iv. All the interconnecting cables, cables from equipment to main panel are in vendor's scope.

(q) User manuals and circuit diagrams

- i. One hardcopy & softcopy of details operation and service manual with component details and circuit drawings shall be provided.
- ii. Name and address of end users of at least 5 numbers should be provided
- iii. Technical capability (of the proposed equipment) indicated in the offer must be very specific, concrete to the point and clear enough in response to all the features of the specifications as above.

2) *Electrochemical Analyzer:*

- a) AC Impedance measurement facility with frequency range 10 μ Hz to 10 MHz and frequency analysis software must be provided
- b) Channel should have cyclic voltammetry measurement facility with three electrode configuration
- c) Both Potentiostat/galvanostat features should be provided
- d) Max. Current output +/- 2.5 amp and Compliance Voltage +/- 10 V.
- e) Current accuracy should be +/-0.2%.
- f) System rise time: <250 nS
- g) Linear sweep voltammetry and I-t curves (amperometry) to be provided to study the photo-electrochemical performance of solar cells
- h) PC for controlling the parameters.
- i) Voltage sweep rate 0.001-1000 V/S
- j) Current resolution in the minimum range should be in the order of 5 pA.
- k) Voltage resolution in the minimum voltage range 500 nV
- l) Cell configuration: 2 , 3 or 4 terminals
- m) Following support softwares for the full system must be provided.
 - (i) Cyclic Voltammetry,
 - (ii) RDE with programmable rotation speeds must be provided.
 - (iii) Linear sweep Voltammetry(LSV)
 - (iv) TAFEL plot
 - (v) Chrono techniques
 - (vi) Voltammetry Techniques
 - (vii) IR Compensation
 - (viii) Square Wave Voltammetry
 - (ix) AC Voltammetry
 - (x) Steps and Sweeps
- n) Following electrochemical Impedance Spectroscopy Software must be provided
 - (i) Variety of data analysis tools,
 - (ii) Bode plot,
 - (iii) Mott schottkey plots measurement and analysis,
 - (iv) Equivalent circuit fitting with graphical representation of circuit elements, different elements for equivalent circuit such as resistance,
 - (v) Capacitance,
 - (vi) Inductance,
 - (vii) Warburg element,
 - (viii) fitting and simulation.
- o) Data analysis features of following software must be provided
 - (i) Convolution and deconvolution
 - (ii) Kinetics
 - (iii) exponential and polynomial base line correction
 - (iv) IR compensation
 - (v) transient time
 - (vi) Analysis for chronoamperometry, chronopotentiometry and chronocoulometric plots

(vii) Automatic polarization resistance determination using TAFEL plots

p) Counter electrode (5 cm X 5 cm platinum foil electrode) and Ag/AgCl and SCE Reference electrodes must be provided

q) Electric power feed through

(i) 230 V

(ii) Minimum 15 amps

(iii) Length of the cable should be minimum 3 meter

USB controlled system slash 8GB RAM 500GB hard disk along with 21 inch LED screen DELL with suitable software for data acquisition

3) Electrochemical workstation for high voltage batteries with two channels or more

(a) All channels of electrochemical workstation should have the following specifications:

i. Voltage range	0 – 80 V (variable)
ii. Voltage resolution	0.01 V
iii. Maximum current	50 A
iv. Current resolution	0.001 A
v. Current range	0-50 A
vi. Current rise time	< 1 ms
vii. Number of Channels	2 or 4
viii. Amp hour resolution	0.01 AH
ix. Watt hour resolution	0.01 WH
x. Accuracy	± 0.1% or better
xi. Step time/data collection speed	1 ms
xii. Maximum operable current in parallel mode	100 A or 200 A
xiii. Charging mode	CC/CV/CW
xiv. Discharge mode	CC/CV/CW/CR
xv. Testing for single cells to zero volts	Yes
xvi. DC cable length	6 m

(b) Operating Modes: All channels should be able to operate in the following modes:

Constant current (CC), Constant voltage (CV), Constant power (CP), Constant resistance (CR), Voltage scan (Cyclic voltammetry)

(c) Software should be capable of doing the following experiments

i. Open Circuit Voltage

ii. Ohmic drop determination (internal resistance of the electrochemical cell)

iii. Galvanostatic charge-discharge cycles with potentials limitations which can cover Galvanostatic intermittent titration techniques (GITT)

- iv. Potentio-dynamic experiments to carry out Potential intermittent Titration techniques (PITT)
 - v. Various C-rate analysis in one single program
 - vi. Constant power experiments
 - vii. Internal Resistance (IR) by analog/ digital method should be provided
- (d) All channels should have the following specifications:
- iv. Number of cycles- 1 to 9999
 - v. Number of steps per cycle-1 to 15000 or more
 - vi. Independent controllers for each channel
 - vii. Efficiency should be 95%
 - viii. Power factor should be 0.9 or better
 - ix. Output current ripple should be less than 0.1%
- (e) Software requirements:
Software package for test control and data Management
- i. Single software to drive all circuits
 - ii. Compatible with different version of Windows
 - iii. Provision to print out test results
- (f) Electrochemical workstation should have the following provision:
- i. Count and Display the charging and discharging cycles
 - ii. To display the elapsed time
 - iii. Discharge must be stopped at a preset table terminal voltage for respective circuits
- (g) Should have data view software with provision for graphical data presentation & Analysis of previous charge & discharge cycle
- (h) PC Ethernet card, cable, connectors and switch including network adapter.
- (i) In the event of power failure, the instrument should continue from the point where power failure occurred on resumption of the power automatically.
- (j) Data and program should be protected during power failures
Should have provision for:
- iii. Reset and Restart facility at any moment of running time
 - iv. Changing the running programme of any circuit at any time
- (k) PC Requirements:

- i. USB controlled system/8GB RAM, i5 processor and 1TB Hard disk along with 21” LED screen (DELL) with user-friendly software for data acquisition.
- ii. 32-bit/64 bit Windows 10 OS program for electrochemical experiments and analysis.

(l) Hardware requirements:

- i. i Cell voltage monitoring with necessary cables

Number of channels	20 per channel
Voltage range	0 to 8 ± 0.001 V
Voltage cable length	6 m

- ii. Temperature monitoring with necessary cabling and interfacing connectors

Number of inputs	40
Temperature range	-40 to $+ 200$ °C ± 0.5 °C
Thermocouple type	J type
Thermocouple probe	Thermistor
Thermocouple cable length	6 m

(m) Reliable safety protection:

- x. Protect from over voltage and over current
- xi. Independent upper and lower clamp circuits to protect the batteries from over and under voltage during charge/discharging
- xii. Channel status indication should be provided
- xiii. Temperature compensation facility to control the set voltage with respect to reference & ambient temperature
- xiv. Support for external inputs not limited to temperature cycling chamber, thermocouple Devices, high impedance cell voltage monitoring, Pressure monitoring, specific gravity monitoring, high impedance reference electrodes
- xv. Provision for calibration and correction for Current, voltage, power, etc
- xvi. E essential spares kit to be provided
- xvii. Tester mobility-Roller wheeled cabinet
- xviii. Should have protection for short circuit and overload
- xix. Input power supply- 3 phase, 415 V, 50 Hz

(n) Warranty details

- iii. Three years from date of installation. During installation any defective parts should be replaced, Manufacturer shall maintain warranty of all the bought out items.

- iv. AMC after the warranty period: AMC shall be quoted for two years, Purchaser reserves the right whether or not to have AMC
- (o) Test certificates & reports should be provided
- iii. Origin of manufacturing certificate, Original manufacturer certificates, warranty and date of manufacturing for imported items.
 - iv. Calibration certificates whenever needed.
- (p) Installation and Commissioning
- v. The equipment shall be installed by the manufacturer at user site.
 - vi. On completion of commissioning, the performance of the equipment should be demonstrated by the manufacturer as per accepted technical specifications.
 - vii. Minimum of 15 process runs/trials shall be demonstrated after completion of commission at user's site as per the process parameter given by user.
 - viii. All the interconnecting cables, cables from equipment to main panel are in vendor's scope.
- (q) User manuals and circuit diagrams
- iv. One hardcopy & softcopy of details operation and service manual with component details and circuit drawings shall be provided.
 - v. Name and address of end users of at least 5 numbers should be provided
 - vi. Technical capability (of the proposed equipment) indicated in the offer must be very specific, concrete to the point and clear enough in response to all the features of the specifications as above.

4) Multichannel battery cycler for low and medium current applications with 32 channels

(a) All channels should be independent and capable to measure

- (i) Two, three electrode system
- (ii) Voltage range 0 to ± 10 V (variable)
- (iii) Voltage accuracy Less than or equal to plus or minus 0.2 percent of set value
- (iv) Voltage resolution 10 micro volt
- (v) Maximum current Continuous current per channel should be 2.0 A
- (vi) Current range 2 A with minimum three variable current ranges (10 micro A/ 100mA/2 A). During current charge/discharge, the measured/applied current should migrate from one range to another automatically
- (vii) Current resolution 5 nano ampere or less
- (viii) Current raise time 10 micro second or less
- (ix) Data recording time Minimum 200 data points per second per channel
- (x) Time resolution 5 micro second is highly preferred
- (xi) Minimum Pulse width 0.5 micro second
- (xii) Data recording interval 0.1 micro second
- (xiii) Operating Modes Constant current (CC), Constant voltage (CV), Constant power (CP), Constant resistance (CR), Voltage scan (Cyclic voltammetry)

(b) Software Requirements:

Software should be capable of doing the following experiments

- i. Open Circuit Voltage
- ii. Ohmic drop determination (internal resistance of the electrochemical cell)
- iii. Galvanostatic charge-discharge cycles with potentials limitations which can cover Galvanostatic intermittent titration techniques (GITT)
- iv. Potentio-dynamic experiments to carry out Potential intermittent Titration techniques (PITT)
- v. Various C-rate analysis in one single program

- vi. Cyclic Voltammetry (Chronoamperometry/ Chronocoulometry and chronopotentiometry)
- vii. Constant power experiments
- viii. The inserted/ disinserted amount of lithium/ sodium etc. calculation (x-coefficient determination) facility should be provided in the software.
- ix. Battery testing software
Software should be able to load in any number of PCs.
- x. Batter capacity determination and coulombic efficiency determination facility should be provided.
- xi. Software should be capable of combining minimum 10 techniques in a single program
- xii. Number of steps per cycle should be 1 to 2000 and number of cycles 1 < cycles < 2000
- xiii. End Step conditions
Voltage, Current, Time, Capacity, Power, Number of Cycles, Warnings,

(c) Instrument should have provision for

- i. Reset and Restart facility at any moment of running time
- ii. Changing the running programme of any circuit at any time
- iii. Should have protection for short circuit and overload

(d) Hardware Requirements:

- i. Cables for Swagelok cells as well cell holders for coin cells including temperature sensors for all 32 channels should be provided.
- ii. Necessary temperature measurement option should be provided for all 32 channels independently. Thermocouples (for coin cells type and for Swagelok cells) should be capable of measuring -10 to 200 degree Celsius.

(e) PC requirements

- i. USB controlled system/8GB RAM, i5 processor, 1 TB Hard disk along with 21" LED screen (DELL) with user-friendly software for data acquisition
- ii. 32-bit/64 bit Windows 10 OS program for electrochemical experiments and analysis.

(f) Electrical mains input:

Should be compatible to 230V, 50Hz or 415V 50 Hz

(g) Network hardware package

Ethernet card/16 port Ethernet switch and necessary cables

(h) Warranty details

- i. Three years from date of installation. During installation any defective parts should be replaced, Manufacturer shall maintain warranty of all the bought out items.

- ii. AMC after the warranty period: AMC shall be quoted for two years, Purchaser reserves the right whether or not to have AMC
- (i) Test certificates & reports should be provided
- i. Origin of manufacturing certificate, Original manufacturer certificates, warranty and date of manufacturing for imported items.
 - ii. Calibration certificates whenever needed.
- (j) Installation and Commissioning
- i. The equipment shall be installed by the manufacturer at user site.
 - ii. On completion of commissioning, the performance of the equipment should be demonstrated by the manufacturer as per accepted technical specifications.
 - iii. Minimum of 15 process runs/trials shall be demonstrated after completion of commission at user's site as per the process parameter given by user.
 - iv. All the interconnecting cables, cables from equipment to main panel are in vendor's scope.
- (k) Optional items:
- i. Cell Kit, Electrode and Accessories.
 - ii. Electrochemical Cell with 80-100 ml, saturated calomel electrode, Platinum electrode with ASTM standards
 - iii. Cables with 5m length should quoted
Additional electrodes required
 - iv. Ag/AgCl electrode and non-aqueous reference electrode.
 - v. RRDE electrode: Glassy carbon, Platinum ring,
 - vi. Platinum disc working electrodes-2 numbers
- (l) User manuals and circuit diagrams
- i. One hardcopy & softcopy of details operation and service manual with component details and circuit drawings shall be provided.
 - ii. Name and address of end users of at least 10 numbers should be provided
 - iii. Technical capability (of the proposed equipment) indicated in the offer must be very specific, concrete to the point and clear enough in response to all the features of the specifications as above.

Note: The complete job involves supply, installation, commissioning and training of the equipment and all accessories as above.

1. Necessary accessories/ parts for the system to be used for a period of three years have to be supplied free of cost.
 2. All machine manuals and software to be supplied with media / hardcopy.
 3. Bidder should submit (a) all original product brochures and technical literature with detailed machine specifications
 4. Training at customer site to be provided.
 5. Service Support, Factory trained Engineers: specify the no. of Engineers with base location, Response time, Availability of Parts / Consumables / Warranty /
 6. Warranty: Three year Comprehensive Warranty from the date of installation on the complete system, including all the subsystems.
 7. Test & performance reports of various accessories
 8. A separate technical complains with ARCI's each specifications for every part must be given in the technical bid. Any deviation from the requested specification need to be clearly mentioned in the compliance sheet.
 9. For equipment Sl. No.1 (Annexure-1): Supply, installation, commissioning, training and services must be done at
Centre for Nanomaterials (CNAM)
ARCI-Hyderabad
Balapur PO
Hyderabad-500005, Telanganna
Tel: 040 24452478
Fax: 040 24442699
 10. For equipment Sl. No. 2 (Annexure-1): Supply, installation, commissioning, training and services must be done at
Centre for Solar Energy Materials (CSEM)
ARCI-Hyderabad
Balapur PO
Hyderabad-500005, Telanganna
Tel: 040 24452448
Fax: 040 24442699
 11. For equipments Sl. No. 3 and 4(Annexure-1): Supply, installation, commissioning, training and services must be done at
Centre for Automotive Energy Materials (CAEM)
ARCI-Chennai
IITM Research Park, Phase 1, Section B
6 Kanagam Road,
Taramani, Chennai 600 113, Tamil Nadu
Tel: 044 66632808
Fax: 04466632802
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