



DEPARTMENT OF APPLIED MECHANICS  
INDIAN INSTITUTE OF TECHNOLOGY MADRAS  
CHENNAI – 600036, INDIA

03 July.2019

Ref. No. APM/1819/156/ARCI/SATN/001

Opening date:03July.2019

Due date: 23July.2019

Dear Sir/Madam,

On behalf of the Indian Institute of Technology Madras, offers are invited for the supply of “ADVANCE ULTRA SUPERCRITICAL AUTOCLAVE SYSTEM” conforming to the specifications given in (Annexure – 1).

**Instructions to the Bidder**

1. Pre-bid technical discussion: Pre-Bid Technical Discussion will be conducted on **10July.2019; 2pm at Fluid mechanics conference room, Fluid mechanics Building, Department of Applied Mechanics**. It mandatory pre bid tech prior to submission of the bid.
2. Preparation of Bids: The Limited tenders should be submitted under two bid system, (i.e.) Technical bid and Financial bid. The Technical bid should consist of all technical details / specifications only. The Financial bid should indicate item-wise price for each item and it should contain all Commercial Terms and Conditions including Taxes, transportation, packing & forwarding, installation, guarantee, payment terms, pricing terms etc. The Technical bid and Financial bid should be put in separate covers and sealed. Both the sealed covers should be put in a bigger cover. The Tender for supply of “ADVANCE ULTRA SUPERCRITICAL AUTOCLAVE SYSTEM” should be written on the left side of the Outer bigger cover and sealed.
3. Delivery of the tender: The tender shall be sent to the below mentioned addresses either by post or by courier so as to reach the following address before the due date and time specified in our Schedule:  
**Dr. Satyanarayanan Seshadri, Dept. of Applied Mechanics, IIT Madras, Chennai 600 036**
4. Prices: The price should be quoted in net per unit (after breakup) and must include all packing and delivery charges to Department of Applied Mechanics. The offer/bid should be exclusive of taxes and duties, which will be paid by the purchaser as applicable. However, the percentage of tax & duties should be clearly indicated. The price should be quoted without custom duty and excise duty, since
5. I.I.T. Madras is exempt from payment of excise duty, and the custom duty will be paid at concessional rate against duty exemption certificate. In case of import supply, the price should be quoted on EX-WORKS and CIP basis indicating the mode of shipment.
6. Agency Commission: Agency commission, if any, will be paid to the Indian agents in Rupees on receipt of the equipment and after satisfactory installation. Agency Commission will not be paid in foreign currency under acircumstances. The details should be explicitly shown in Tender even in the case of ‘Nil’ commission. The tenderer should indicate the percentage of agency commission to be paid to the Indian agent. The foreign Principal should indicate about the percentage of payment and it should be included in the originally quoted basic price, if any
7. Terms of Delivery: The item should be supplied to our Departments as per Purchase Order. In case of import supply, the item should be delivered at the cost of the supplier to our Institution. The Installation/ Commissioning should be completed as specified in our important conditions.
8. IIT Madras reserves the full right to accept / reject any tender at stage without assigning any reason.

Yours sincerely,

Dr. Satyanarayanan Seshadri

Email: [satya@iitm.ac.in](mailto:satya@iitm.ac.in)

Phone: [+91] (44) 2257 4078



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**SCHEDULE**

Important Conditions of the tender:

- (1) **Pre-bid technical discussion: Pre-Bid Technical Discussion will be conducted on 10 July 2019 2pm at Fluid mechanics conference room, Fluid mechanics Building, Department of Applied Mechanics. It mandatory pre bid tech prior to submission of the bid.**
- (2) The due date for the submission of the tender is 23.07.2019, 3:30 pm. The offers / bids should be submitted. (i.e.) Technical bid and Financial bid. The Technical bid should consist of all technical details / specifications only. The Financial bid should indicate item-wise price for each item and it should contain all Commercial Terms and Conditions including Taxes, transportation, packing & forwarding, installation, guarantee, payment terms, pricing terms etc. The Technical bid and Financial bid should be put in separate covers and sealed. Both the sealed covers should be put in a bigger cover. The Limited Tender for supply of “**ADVANCE ULTRA SUPERCRITICAL AUTOCLAVE SYSTEM**” should be written on the left side of the Outer bigger cover and sealed
- (3) If an Indian agent is involved, the following documents must be closed:
- (4) Foreign principal’s proforma invoice indicating the commission payable to the Indian Agent and nature of after-sales service to be rendered by the Indian Agent. Copy of the agency agreement with the foreign principal and the precise relationship between them and their mutual interest in the business. The enlistment of the Indian agent with Director General of Supplies & Disposals under the Compulsory Registration Scheme of Ministry of Finance.
- (5) The offer/bids should be sent only for a machine that is available in the market and supplied to a number of customers. A list of customers in India and abroad with details must accompany the quotations. Quotations for a prototype machine will not be accepted.
- (6) Original catalogue (not any photocopy) of the quoted model duly signed by the principals must accompany the quotation in the bid
- (7) Documentary proof for the claimed position and repetition accuracies must be obtained from the principals and submitted along with the relevant pages of the standards.
- (8) Compliance or Confirmation report with reference to the specifications and other terms & conditions should also be obtained from the principal.
- (9) Validity: Validity of Quotation not less than 90 days from the due date of tender.
- (10) Delivery Schedule: The tenderer should indicate clearly the time required for delivery of the item. In case there is any deviation in the delivery schedule, liquidated damages clause will be enforced or penalty for the delayed supply period will be levied.
- (11) Risk Purchase Clause:
  - a. In the event of failure of supply of the item/equipment within the stipulated delivery schedule, the purchaser has all the right to purchase the item/equipment from other sources on the total risk of the supplier under risk purchase Clause



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- (12) Payment: No advance payment is generally admissible. In case of specific percentage of advance payment is paid the Foreign Vendor
- (13) On-site Installation: The equipment or machinery has to be installed or commissioned by the successful bidder within 15 to 20 days from the date of receipt of the item at site of IIT Madras.
- (14) Previous Experience: The offer should clearly specify the warranty or guarantee period for the machinery/equipment. Any extended warranty offered for the same has to be mentioned separately (for more details please refer our Technical Specifications). **The vendor should clearly specify the details and references of the at least five organizations (Specifically include Public sector undertakings, Central government and Institution of National Importance) where such systems have been supplied.**
- (15) Late offer: The offers received after the due date and time will not be considered. The Institute shall not be responsible for the late receipt of Tender on account of Postal, Courier or any other delay.
- (16) Acceptance and Rejection: I.I.T. Madras has the right to accept the whole or any part of the Tender or portion of the quantity offered or reject it in full without assigning any reason.
- Do not quote the optional items or additional items unless otherwise mentioned in the Tender documents /Specifications.
- (17) Disputes and Jurisdiction:
- Settlement of Disputes: Any dispute, controversy or claim arising out of or in connection with this PO including any question regarding its existence, validity, breach or termination, shall in the first instance be attempted to be resolved amicably by both the Parties. If attempts for such amicable resolution fails or no decision is reached within 30 days whichever is earlier, then such disputes shall be settled by arbitration in accordance with the Arbitration and Conciliation Act, 1996. Unless the Parties agree on a sole arbitrator, within 30 days from the receipt of a written request by one Party from the other Party to so agree, the arbitral panel shall comprise of three arbitrators. In that event, the supplier will nominate one arbitrator and the Project Coordinator of IITM shall nominate one arbitrator. The Dean IC&SR will nominate the Presiding Arbitrator of the arbitral tribunal. The arbitration proceedings shall be carried out in English language. The cost of arbitration and fees of the arbitrator(s) shall be shared equally by the Parties. The seat of arbitration shall be at IC&SR IIT Madras, Chennai.
  - The Applicable Law: This Purchase Order shall be construed, interpreted and governed by the Laws of India; Court at Chennai shall have exclusive jurisdiction subject to the arbitrate on clause.
  - Any legal disputes arising out of any breach of contract pertaining to this tender shall be settled in the court of competent jurisdiction located within the city of Chennai in TamilNadu.
- (18) All Amendments, time extension, clarifications etc., will be uploaded on the website only and will not be published in newspapers. Bidders should regularly visit the above website to keep themselves updated. No extension in the bid due date/ time shall be considered on account of delay in receipt of any document by mail.



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(19) Acknowledgement: It is hereby acknowledged that the tenderer has gone through all the conditions mentioned above and agrees to abide by them.

SIGNATURE OF TENDERER

ALONG WITH SEAL OF THE

COMPANY WITH DATE



## **Annexure I**

Ref. No. APM1819156ARCISATN/001

Opening date:03July.2019

Due date: 23July.2019

### **TECHNICAL SPECIFICATION FOR ADVANCE ULTRA SUPERCRITICAL AUTOCLAVE SYSTEM**

#### **OBJECTIVE:**

To test materials for steam behavior under Ultra supercritical steam conditions of 800 °C and 400 barg.

#### **BASIC FUNCTIONALITY:**

Test materials are treated under high pressure (400 barg) and high temperature (800 °C) for sufficient amount of time in autoclave, which mimics the Advance Ultra Supercritical Boiler conditions. High pressure is obtained using a high-pressure pump. The outlet is pressure controlled using a backpressure system. Electric heating is used to supply necessary heat load for generating steam. A PID based temperature and pressure feedback is used to control system temperature and pressure respectively.

#### **SCOPE:**

Supply, Installation and commissioning of Advance Ultra Supercritical Autoclave setup along with accessories as per following specification.

#### **ACCEPTANCE CRITERIA:**

1. Detailed Design document along with make and model of the parts for bought out components and drawings, including standards followed for fabricated components.
2. After successful installation and commissioning, the capability of system (as per the design) shall be demonstrated operating the autoclave at max temperature and for a continuous period of 24 hours.
3. The test rig operation should be demonstrated for a range of operating pressures and temperatures up to the maximum rated capacity
4. Provision for de-mineralizing water to be used in the test rig to be provided along with the system
5. Detailed operational, and troubleshooting manuals to be provided, along with list of spares and maintenance procedure

#### **DESIGN REQUIREMENTS:**

1. Water leaving the autoclave needs to be cooled with a heat exchanger
2. Backpressure regulator should step down pressure to atmospheric at outlet of autoclave
3. The autoclave should be completely closed and sealed during experiments
4. Max pressure rating of the system shall be 400 ±20 bar(gage) and temperature capability shall be 800 ±40 °C



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**SPECIFICATIONS:**

**Mix Tank:**

**(Quantity: 1 Unit)**

SS 316 tank material to supply feed water

Design pressure: 4 bar or more

Automatic water filling provision

Water flow meter to monitor flow

On-line digital pH meter with retransmission output

Analog pressure gauge, Safety valve, vent valve Connected to pressure switch

Mass flow controller to control ammonia flow 0-200 sccm

Minimum dimensions of tank: 300 mm (dia) X 300 mm (Height)

Minimum thickness of the chamber: 3mm made of SS 316

Minimum thickness of flange: 6mm

**Feed Tank:**

**(Quantity: 1 Unit)**

SS 316 tank to maintain the feed water level.

Design pressure: 4 bar or more

Water flow meter to check the flow to High pressure pump.

Mass flow controller transfer water in dedicated levels from mix tank.

Minimum dimensions of tank: 300 mm (dia) X 300 mm (Height)

Minimum thickness of the chamber: 3mm made of SS 316

Minimum thickness of flange: 6mm

**High pressure pump:**

**(Quantity: 1 Unit)**

A high-pressure water pump to supply pressurized water of the order 1000 bar with a pumping speed of atleast 0-100 mL/min working on flow rate control, pressure rate control and frequency control.

e.g. Parameters and features matching EXTRAPUMP LAB 1000 high pressure pump

(<http://www.extratex-sfi.com/Pumps>)

**Waterlines:**

**(Quantity: 1 Unit)**

Sufficient length of both low temperature and high temperature water lines with proper fitting must be provided.

High temperature lines made of Haynes 230 material with minimum 6mm OD and 2mm ID seamless tube

Low temperature lines made of SS 316 material with minimum 6mm OD and 2 mm ID seamless tube.

Insulation should be provided to keep the temperature on outer surface below 50 °C.

**Backpressure Regulator:**

**(Quantity: 1 Unit)**

Piston sensing back pressure regulator with a regulator tank of 500 bar and 100 litres capacity with a flow coefficient of 0.06 to regulate the pressure.

e.g. Swagelok back pressure regulator K-series of pressure 500 bar, flow coefficient 0.06.



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**Water preheater:**

**(Quantity: 1 Unit)**

The pre heater tank should be made of SS316.  
The water shall be heated by inserting coil heating element.  
Water level indicator should be provided.  
Typical Power: 4 kW  
Maximum temperature: 350 deg C  
Electrical power: 3 phase, 32 A MCB with neutral  
Electrical heating element made of Kanthal.  
PID temperature controller to control temperature.  
K-type thermocouple to sense temperature.  
Sufficient insulation to keep outer surface temperature less than 50 deg C.

**Autoclave heater:**

**(Quantity: 1 Unit)**

Typical Power: 4 kW  
Electrical power: 3 phase, 32 A MCB with neutral  
Electrical heating element made of Kanthal.  
Working temperature: 800°C or above with +/- 1 deg C accuracy and stable operation.  
Heating rate: 5 to 10 °C /min  
Temperature indicator and control: 16 segments PID programmer.  
K-type thermocouple to sense temperature.  
Power control through phase angle thyristor,  
Hotzone length: 300 mm

**Autoclave:**

**(Quantity: 1 Unit)**

Design pressure and maximum stable working temperature 400 bar/800 °C.  
Autoclave connected to preheater through Pressure relief valve.  
Design life of autoclave shall be 1000 hours under the operation of 400 bar/ 800 °C  
Size of autoclave: 60 mm dia (ID) X 300 mm (height)  
Chamber made of H230  
Thickness of chamber: minimum 10 mm  
Thickness of flanges: minimum 50 mm  
Self sealing type locking mechanism mandatory  
Suitable sample holder to hold samples of sizes ranging between 10 X 10 mm to 25 X 25 mm with thickness of 10 mm.  
Sufficient insulation to keep outer surface temperature less than 50 °C  
The maximum steam flow rate shall be 12 mL/min and pressure inside will be controlled by back pressure regulator.  
Tubing and connector should be steam rated at inlet and outlet.

**SAFETY:**

Maximum pressure and temperature of the system is 420 bar/840 °C and automatic electrical cut-off system other than steam relief outlet should be provided to vent the system if pressure has exceeded the limit.  
Light indicators shall be provided and available safety devices should be able to shutoff the whole system, if it exceeds the safe operating conditions.