To All interested vendors

Date: 20.03.2020

Subject: NOTICE INVITING QUOTATION FOR SUPPLY & INSTALLATION OF HIGH PRESSURE, HIGH TEMPERATURE COMBINATORIAL AUTOCLAVE REACTORS FOR THE DEPARTMENT OF CHEMICAL ENGINEERING (PROJECT NO.XCLESPNXL00860XXVX13), IIT GUWAHATI.

Dear Sir/ Madam,

The Director, Indian Institute of Technology Guwahati, invites quotations for supply and installation of High pressure, high temperature combinatorial autoclave reactors as per details mentioned in the CHECK-LIST attached herewith. The quotation in double bid [Details as per Check List] is to be submitted in sealed envelopes to the undersigned on or before 16.04.2020.

Please note -
(i) Tender document is divided into two parts i.e. (1) Instruction to Bidders and (2) Terms & Conditions;
(ii) There is no Tender fee and Tender document is to be downloaded from our website given below.  
http://www.iitg.ernet.in/home/tender/20 or http://www.iitg.ac.in/home/tender/20
(iii) Duly filled, signed and sealed copy of ‘Statement of Compliance to essential Terms & Condition’ and Technical Bid must be submitted along with the quotation.
(iv) The bid documents are not transferable and the seal and signature of the authorized official of firms must appear on all the papers and envelopes submitted.

Kindly read both the Instructions and Terms properly and see that instructions and terms are fully understood and complied. No correspondence shall be entertained in case your quotation is rejected on ground of not complying with our instructions, terms and conditions. In case of doubt please contact us at 0361 258 3089 or the Principal Investigator at 0361 258 2278.

Thanking you,

Yours Sincerely,

[Signature]
Assistant Registrar
Research and Development
Indian Institute of Technology Guwahati
Guwahati-781039, India
INSTRUCTION TO BIDDERS

A) Important Date and Time:
   (i) Last date & Time of receipt of Tender: 16.04.2020, (1700 HRS)
   (ii) Time of opening Tender: 20.04.2020, (1500 HRS)
   (iii) Venue of Bid opening: Department of Chemical Engineering, IIT Guwahati.

B) Quotations will have to be submitted in a DOUBLE Bid [Details as per CHECK - LIST]. The address of the firm submitting the quotation and the Officer to whom the quotation is addressed must appear distinctly on sealed covers. Further, on sealed cover, the following are to be written:

   QUOTATION FOR SUPPLY & INSTALLATION OF HIGH PRESSURE, HIGH TEMPERATURE COMBINATORIAL AUTOCLAVE REACTORS FOR THE DEPARTMENT OF CHEMICAL ENGINEERING (PROJECT NO.XCLESPPNRLO00860XXVK013), IIT GUWAHATI
   LAST DATE OF SUBMISSION: 16.04.2020

   To,
   The Assistant Registrar
   Research and Development Section
   Indian Institute of Technology Guwahati
   Guwahati 781 039, Assam, India.

   From: M/s _____________________
   Phone No.: ____________________
   Email ID: _____________________

C) Submission of Compliance Certificate: Duly filled and signed Compliance Certificate (as per format at ANNEXURE II) must be enclosed.

D) Bid not transferable: The bid documents are not transferable and the seal and signature of the authorized official of the firm’s must appear on all the papers and envelopes submitted.

TERMS & CONDITIONS:

(Please note the term ‘both foreign & indigenous’ wherever mentioned means the term is applicable to both foreign & indigenous purchase)

01. Rates: Rates quoted for indigenous items should be on FOR IIT Guwahati, on DOOR DELIVERY basis, with break-ups as per details below (For import items please refer ‘Additional Terms for imported goods’ below).

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Basic Price (Ex work)</td>
<td></td>
</tr>
<tr>
<td>II GST</td>
<td></td>
</tr>
<tr>
<td>III Transportation charge up to IITG premises</td>
<td></td>
</tr>
<tr>
<td>IV Transit Insurance covering All Risk up to 10 days after delivery</td>
<td></td>
</tr>
<tr>
<td>V Installation &amp; Commissioning Charge, if any</td>
<td></td>
</tr>
<tr>
<td>VI Grand total on door delivery at IIT Guwahati</td>
<td></td>
</tr>
<tr>
<td>VII Annual Maintenance Contract rate (after expiry of warranty period)</td>
<td></td>
</tr>
</tbody>
</table>

Note: Vague terms like “packing, forwarding, transportation etc. extra” without mentioning the specific amount will not be accepted. Such offers shall be treated as incomplete and rejected. Bidders shall indicate their rates in clear/visible figures as well as in words and shall not alter/overwrite/make cutting in the quotation. In case of a mismatch, the rates written in words will prevail.

02. Validity of Quotation: Quoted rates must be valid for 120 days from the last date of submission of quotation.

03. Warranty: The quoted equipment and components must be warranted for a minimum of one year.
04. **Literature a must**: All the quotations must be supported by the printed technical leaflet/literature and the specifications mentioned in the quotation must be reflected/supported by such printed technical leaflet/literature. The model and specifications quoted should **invariably be highlighted** in the leaflet/literature for easy reference.

05. **After Sales Service**: In case of imported goods, vendors should clearly state the available nearest after sales service centre and detail address in India, without which their offers shall be liable for rejection.

06. **Dealership Certificate**: Dealers or Agents quoting on behalf of Manufacturer must enclosed valid dealership certificate.

07. **Quality Certificates**: Valid certificate to prove that the products are genuine and of International standard, as mentioned below, must be enclosed:
   (a) Manufacturer's certificate; (b) ISO/ISI certificate.

08. **Performance Bank Guarantee**: In case of quotations having quoted value Rupees five lacs (INR 5,00,000/-) and above, the successful bidder shall furnish an unconditional Performance Bank Guarantee (as per format at **ANNEXURE III**) valid till 60 days after the warranty period from a scheduled Bank of India for 10% of the Purchase Order value within 21 days of placement of order. Where the performance bank guarantee is obtained by a foreign bank, it shall be got confirmed by a Schedule Indian bank and shall be governed by Indian Laws and be subject to the jurisdiction of courts at Guwahati. In exceptional case or on the request of the Indenting Officer competent authority may allow starting of PBG Period from the date of installation, in which case submission of PBG valid till 60 days after the warranty period may be made within 21 days from the date of installation.

The Performance Bank Guarantee (PBG) guarantees that,

(a) The Vendor guaranteed satisfactory operation of the Equipment & components against poor workmanship, bad quality of materials used, faulty designs and performance.

(b) The Vendor shall at his own cost rectify the defects/replace the items supplied, for defects identified during the period of guarantee.

(c) This guarantee shall be operative from the date of installation till 60 days after the warranty period.

09. **Delivery**:
   a) **Time Limit**: Maximum within 45 (forty-five) days from the date of issue of purchase order.
   b) **Safe Delivery**: All aspects of safe delivery shall be the exclusive responsibility of the vendor. At the destination site, the package will be opened only in the presence of IIT user/representative and vendor's representative. The intact condition of the package and the seal/indicators for not being tempered with shall form the basis for certifying the receipt in good condition.
   c) **Insurance**: The supplier is to establish ‘All Risk Transit Insurance’ coverage till door delivery at IIT Guwahati.
   d) **Part Delivery**: Part delivery is not allowed.
   e) **Penalty Delay delivery**: The date of delivery should be strictly adhered to otherwise the Director, IITG reserves the right not to accept delivery in part or full.

10. **Genuine Pricing**: Vendor is to ensure that quoted price is not more than the price offered to any other customer in India to whom this particular item has been sold, particularly to IIT/Institutes and other Government Organization. Copy of the latest price list for the quoted item, applicable in India, must be enclosed with the offer.

11. **Conditional tenders not acceptable**: All the terms and conditions mentioned herein must be strictly adhered to by all the vendors. Conditional tenders shall not be accepted on any ground and shall be rejected straightway. Printed conditions mentioned in the tender bids submitted by vendors will not be binding on IITG.

12. **Road Permit**: Road Permits (Waybills) shall be issued as applicable for delivery of materials against receipt of Order Acknowledgement and Proforma Invoice.

13. **GST**:
   a) Up-to-date Sales Tax clearance certificate, **GST Registration** number of the firm will have to accompany the quotation.
   b) GST Deduction at source as per Order/notification of the Govt.
   c) GST No of IIT Guwahati is 18AAAJI0130P1Z8
(d) HSN/SAC No of the items must be clearly mentioned in the quotation along with GST No.
(e) As per Notification No. 45/2007- Central Tax (Rate) dated 14.11.2017 and 47/2017-Integrated Tax (Rate) dated 14.11.2017, issued by Ministry of Finance, IIT Guwahati will avail 5% GST rate, on the items, as mentioned in the Notification.

14. Late and delayed tender: Late and delayed tender will not be considered. In case any unscheduled holiday occurs on the prescribed closing/opening date the next working day shall be the prescribed date of closing/opening.

15. Payment:
   (a) 100% Payment within 45 days from the date of successful delivery, installation and commissioning/ acceptance of goods at IIT Guwahati, generally through A/c payee cheque.

   OR

   (b) 90% Payment against delivery and 10% payment after successful installation and/ or commissioning of the ordered goods at site.

   Please note as per Institute’s norm advance payment is not allowed for indigenous purchase.

16. PENALTY FOR DELAYED DELIVERY:

   In case of supply order for the scientific equipments/ apparatus, the date of delivery should be strictly adhered to. In the event of delayed delivery, installation & commissioning i.e. after the expiry of the period as agreed by both the parties, the vendor shall be liable for a penalty deduction at a percentage of the value of the undelivered equipment subject to a maximum of 10% (ten percent) as detailed below:
   @1% up to one week;
   @2.5% up to two weeks;
   @5% up to three weeks;
   @10% for four weeks and above

   For the purpose of this clause, part of the week is considered as a full week. In case of delayed delivery, the Director, IIT Guwahati reserves the right not to accept the subject consignment.

17. Enquiry during the course of evaluation not allowed: No enquiry shall be made by the bidder(s) during the course of evaluation of the tender till final decision is conveyed to the successful bidder(s). However, the Purchase Committee or its authorized representative (IIT Guwahati) can make any enquiry/seek clarification from the bidders. In such a situation, the agency shall extend full co-operation. The bidders may also be asked to arrange demonstration of the offered items, in a short period notice, as such the bidders have to be ready for the same.

18. The acceptance of the quotation will rest solely with the Director, IITG, who in the interest of the Institute is not bound to accept the lowest quotation and reserves the right to himself to reject or partially accept any or all the quotations received without assigning any reasons.

19. Force Majeure:

   If the performance of the obligation of either party is rendered commercially impossible by any of the events hereafter mentioned that party shall be under no obligation to perform the agreement under order after giving notice of 15 days from the date of such an event in writing to the other party, and the events referred to are as follows:
   I) any law, statute or ordinance, order action or regulations of the Government of India,
   II) Any kind of natural disaster, and
   III) Strikes acts of the Public enemy, war, insurrections, riots, lockouts, sabotage.

20. Termination for default: Default is said to have occurred

   (a) If the equipment or any of its component is found having poor workmanship, faulty designs, poor performance and bad quality of materials used.

   (b) If the supplier fails to deliver any or all of the services within the time period(s) specified in the purchase order or any extension thereof granted by IIT.

   (c) If the supplier fails to perform any other obligation(s) under the contract.
(d) Under the above circumstances IIT may terminate the contract / purchase order in whole or in part and forfeit the PBG as applicable. In addition to above, IIT may at its discretion also take the following actions: IIT may procure, upon such terms and in such manner, as it deems appropriate, goods similar to the undelivered items/products and the defaulting supplier shall be liable to compensate IIT for any extra expenditure involved towards goods and services obtained.

21. Applicable Law:

(a) The contract shall be governed by the laws and procedures established by Govt. of India and subject to exclusive jurisdiction of Competent Court and Forum in Guwahati or India only.
(b) Any dispute arising out of this purchase shall be referred to the Director IIT Guwahati, and if either of the parties hereto is dissatisfied with the decision, the dispute shall be referred to the decision of an Arbitrator, who should be acceptable to both the parties, to be appointed by the Director of the institute. The decision of such Arbitrator shall be final and binding on both the parties.

ADDITIONAL TERMS FOR IMPORTED GOODS

Following terms besides the fore mentioned terms will be applicable in case of foreign purchases:

22. Rates: Prices quoted must be for destination including freight and insurance charges inclusive of delivery up to the door of department/centre IIT Guwahati premises, as per details below.

<table>
<thead>
<tr>
<th>(a)</th>
<th>Particulars</th>
<th>Rate</th>
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<tbody>
<tr>
<td>I</td>
<td>Basic Price (Ex work)</td>
<td></td>
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<tr>
<td>II</td>
<td>FCA/FOB dispatch port,</td>
<td></td>
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<tr>
<td>III</td>
<td>Total CIP/CIF Kolkata</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>CIP IIT Guwahati Price (Freight and Insurance charge from Kolkata to IIT Guwahati)</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Grand total on door delivery at IIT Guwahati</td>
<td></td>
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<tr>
<td>(b)</td>
<td></td>
<td></td>
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<tr>
<td>VI</td>
<td>Installation &amp; commissioning charge if any</td>
<td></td>
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<tr>
<td>VII</td>
<td>Custom duty (Approximate)</td>
<td></td>
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<tr>
<td>VIII</td>
<td>Agency Commission if any</td>
<td></td>
</tr>
<tr>
<td>IX</td>
<td>Annual Maintenance Contract rate (after expiry of warranty period)</td>
<td></td>
</tr>
</tbody>
</table>

Note:
(i) Vague terms like “packing, forwarding, transportation etc. extra” without mentioning the specific amount will not be accepted. Such offers shall be treated as incomplete and rejected. Bidders shall indicate their rates in clear/visible figures as well as in words and shall not alter/overwrite/make cutting in the quotation. In case of a mismatch, the rates written in words will prevail.
(ii) Rate of Foreign Exchange shall be the rate prevailing on the date of quotation opening.

23. After Sales Service: In case of imported stores, foreign manufacturing firms should indicate facilities available for after sales service in India without which their offers are liable to be ignored.

24. Delivery:
(a) Delivery of goods at IIT Guwahati, will have to be maximum within 95(ninety-five) days from the date of issue of the Purchase Order.
(b) Delivery at IIT Guwahati only.
(b) While transshipment will be allowed, part shipment will not be allowed.
25. **Payment**  
(a) **Above INR 5 Lacs**: By an irrevocable letter of Credit at CIF/CIP Kolkata value negotiable through any overseas branch of State Bank of India/ AXIS Bank with unrestricted provision.  
(b) **Below INR 5 Lacs by FDD/Wire Transfer as given below:**  
(i) **Advance payment Against Bank Guarantee**: 90% of the price will be paid in advance against equivalent bank guarantee from a scheduled bank provided by the supplier/Indian Agent. The remaining 10% shall be released only after receipt and acceptance of materials in good condition or after satisfactory installation and commissioning of the equipment.  
(ii) **Payment Against Proof of Despatch**: 90% of the price will be paid against delivery with receipt of proof of dispatch such as AWB, Invoice, Packing List, Insurance certificate, etc. The remaining 10% shall be released only after receipt and acceptance of materials in good condition or after satisfactory installation and commissioning of the equipment.  
(iii) **100% Payment Basis**: On request by the supplier's 100% payment by FDD will be made. In this case on receipt of your Order Acknowledgement an FDD will be established for total ordered value, thereupon, a Xerox copy of the FDD will be sent to you which will enable you to send the materials. On satisfactory receipt and acceptance of the materials or satisfactory installation and commission of the equipment the Original FDD will be sent to you.

Note: Please note FDD/LoC will not be opened unless and until Letter of Acknowledgement in original is received at IIT Guwahati, directly from the principal (Even in case of firms having subsidiary office in India). The Indian agents are therefore advised to submit quotation after consultation with their respective principals).

26. **Customs Duty**: The Institute is generally exempted from payment of Customs Duty vide GOI Notification No.51/96-Customs, dated 23.07.96, with Regn. No. TU/V/RC-CDE (351)/2006, dated 14.09.2006. [CUSTOMS DUTY EXEMPTION CERTIFICATE WILL BE MADE AVAILABLE BY THE INSTITUTE IN REGARD TO QUOTES IN FOREIGN CURRENCY ONLY [ NOT AGAINST QUOTES MADE BY A FIRM IN INDIAN CURRENCY, UNLESS THE CONCERNED FIRM IS A FOREIGN HOLDING COMPANY WITH 'FDI' CERTIFICATE ISSUED BY THE MINISTRY OF FINANCE, GOVT. OF INDIA].

27. **Agency Commission**: The percentage of ex-works value to be paid to Indian agent in equivalent Indian currency as agency commission as applicable will have to be clearly stated in the quotation.

28. **After Sales Service**: For equipment to be imported the quotation will have to clearly state the available nearest after sales service centre and contact no. in India.

29. **Country of Origin**: While Country of Origin Certificate will not be insisted, the same however will have to be stated in the Original Invoice for payment through LoC.

30. **LoC Amendment**: LoC/FDD amendment charges due to mistake on the part of the supplier, if any, will have to be borne by the supplier.

*Signature*  
Asstt. Registrar (R&D)

Encl.: ANNEXURE
Encl.: CHECK LIST
**ANNEXURE -II**

**COMPLIANCE CERTIFICATE**

*(A certificate of compliance to NIQ term to be enclosed in the Technical bid)*

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>NIQ Terms and Conditions</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Rate quoted as per instruction</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>AMC rate after warranty provided</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Validity of quoted rate for 120 days agreed</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>PBG term agreed</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>Payment term agreed</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>Delivery terms agreed</td>
<td></td>
</tr>
<tr>
<td>07</td>
<td>Warranty period agreed</td>
<td></td>
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<tr>
<td>08</td>
<td>Literature: Printed Literature provided</td>
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<tr>
<td>09</td>
<td>Dealership / distributorship certificate (in case of dealers/agents) provided</td>
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<tr>
<td>10</td>
<td>Sales Service: address of after Sales Service centre in India provided</td>
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<td>11</td>
<td>Manufacturer certificate provided</td>
<td></td>
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<tr>
<td>12</td>
<td>ISO/ ISI certification provided</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Applicable law terms agreed</td>
<td></td>
</tr>
</tbody>
</table>

Sign. :........................................

Vendor : M/s..................................

Official seal of the vendor
To:

Registrar,
Indian Institute of Technology,
Guwahati- 781 039

WHEREAS .......................................................... (Name of Supplier) hereinafter called "the Supplier" has undertaken, in pursuance of Contract No: .........., dated: ........ 20... to supply .................. .................................................. (Description of Goods and Services) hereinafter called "the order".

AND WHEREAS it has been stipulated by you in the said order that the Supplier shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with the Supplier's performance obligations in accordance with the order.

AND WHEREAS we have agreed to give the Supplier a Guarantee:
THEREFORE WE hereby affirm that we are Guarantors and responsible to you, on behalf of the Supplier, up to a total of .......................................................... (Amount of the Guarantee in Words and Figures) and we undertake to pay you, upon your first written demand declaring the Supplier to be in default under the order and without cavil or argument, any sum or sums within the limit of .................................. (Amount of Guarantee) as aforesaid, without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This guarantee is valid until the ........ day of ............... 20......

Signature and Seal of Guarantors

.............................................

.............................................

.............................................

Date.....................20....
Address:......................

.............................................

.............................................

All correspondence with reference to this guarantee shall be made at the following address:

Registrar,
Indian Institute of Technology,
Guwahati- 781 039, Assam.

Attention: Asst. Registrar (R&D)
### CHECK – LIST

FOR THE DEPARTMENT OF CHEMICAL ENGINEERING (PROJECT NO. XCLESPNXNRL00860XXVK013):

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Item Name &amp; NIQ Ref. No.</th>
<th>Bid Type</th>
</tr>
</thead>
</table>
| 01   | Item: High pressure, high temperature combinatorial autoclave reactors  
     Qty: 01  
     Details: As per description in Annexure IV  
     [For any technical clarification required please contact Ph. No: 0361- 2582278]  
     NIQ Ref. No.. R&D/XCLESPNXNRL00860XXVK013/2019-20 dated 20.03.2020 | DOUBLE Bid |
Detailed technical specifications

Item: High pressure, high temperature combinatorial autoclave reactors.

A. FOUR autoclave reactors two with 25 mL capacity and two with 50 mL capacity.

Detailed Technical Specifications:
- **The vessels volume:** Two autoclaves with 25 mL net filling capacity or higher and two autoclaves with 50 mL net filling capacity or higher.
- **Operating parameters:** FOUR High pressure and high temperature autoclaves each with design pressure of 100 bar or better (pressure operational range should be up to 90 bar or better) and design temperature of 300°C or better (temperature operational range should be 40–270°C or better). One should be able to operate all the four autoclaves simultaneously and independently.
- **Material of Construction (MOC):** All the four vessels, heads and wetted parts should be made from SS316 (or better) with no welding.
- **Head mounting style:** Removable head and vessel design (for each autoclave).
- **Vessel heating:** External electrical ceramic band heater with cladding & insulation. (for each autoclave) The CSTR should be supplied with a suitable external electric ceramic fiber heater (at least 2000 watt, 230 V) or better to maintain the desired temperature. Each heater should be controlled with a PID temperature controller with auto-tuning capability for precise temperature control (within ±0.1 °C or less), minimum overshoot (up to 2% or less) and ramp soak programming (10 segments or more).
- **Stirring type:** Common bottom magnetic stirrer with PTFE bar inside each autoclave.
- **Closer:** Split clamp with compression bolts or better (for each autoclave).
- **Gasket:** PTFE gasket or better (for each autoclave).
- **The each autoclave vessel head should be supplied with the following features:**
  - i. Gas inlet needle valve, with dip-tube.
  - ii. Gas vent needle valve.
  - iii. RTD PT100 temperature sensor.
  - iv. Rupture disc burst pressure 100 bar.
  - v. Pressure gauge with vacuum protection

- **The each autoclave vessel should be fitted with the following internal fittings:**
  - Dip-tube for gas inlet
  - Thermowell for RTD PT100 temperature sensor
Control panel features: The instrument should be supplied with a common control panel having FOUR programmable PID temperature controllers (with above-mentioned features), temperature display (precision: 0.1 °C or better) with high temperature alarm.

Power supply: Single phase, 230 V and 50 Hz

Mounting: Common stainless steel table top or better.

B. FOUR autoclave reactors with 100 mL capacity.

Detailed Technical Specifications:

- The vessels volume: 100 mL net filling capacity or higher.
- Operating parameters: FOUR high pressure and high temperature autoclaves each with design pressure of 100 bar or better (pressure operational range should be up to 90 bar or better) and design temperature of 300°C or better (temperature operational range should be 40–270°C or better). One should be able to operate all the four autoclaves simultaneously and independently.
- Material of Construction (MOC): All the four vessels, heads and wetted parts should be made from SS316 (or better) with no welding.
  - Head mounting style: Removable head and vessel design (for each autoclave) or better
  - Vessel heating: External electrical ceramic band heater with cladding & insulation. (for each autoclave) The CSTR should be supplied with a suitable external electric ceramic fiber heater (at least 2000 watt, 230 V) or better to maintain the desired temperature. Each heater should be controlled with a PID temperature controller with auto-tuning capability for precise temperature control (within ±0.1 °C or less), minimum overshoot (up to 2% or less) and ramp soak programming (TEN segments or more).
  - Stirring type, motor and drive: ¼ hp explosion-proof gas group IIB motor (zone 1) with 100-1450 RPM (for each autoclave) or better for each autoclave. Stirrer should be 4-bladed turbine stirrer (for each autoclave).
  - Shaft sealing: Zero leakage Magnetic drive coupling, (M-40) Material of Bush-carbon filled PTFE (CFT) or better (for each autoclave)
    - Closer: Split clamp with compression bolts or better (for each autoclave)
  - Gasket: PTFE gasket or better (for each autoclave).
  - The each autoclave vessel head should be supplied with the following features:
    i. RTD PT100 temperature sensor.
    ii. Pressure gauge with vacuum protection
    iii. SS-316 Pressure Transmitter, Safety rupture disc (Inconel) with vacuum protection
    iv. Gas inlet-valve & liquid sampling valve mounted on common dip tube
    v. Vent needle valve
    vi. Solenoid valve at the inlet of cooling coil for automatic cooling.
    vii. Note: All needle valves should be ¼” NPT end connections
• The each autoclave vessel should be fitted with the following internal fittings:
  i. Dip-tube.
  ii. Thermowell for RTD PT100 temperature sensor.
  iii. Helical cooling coil.

• **Cooling:** A coolant circulating pump and a coolant tank.

• **SS Pressure Regulator:** For H₂ gas for 0-140 bar cylinder pressure with inlet & outlet pressure gauge, flexible 4m hose pipe, non-return valve and adaptor for N₂/O₂/air gas cylinder. Quantity: ONE.

• **Common Digital gas mass flow controller:** (In both flow and pressure control mode) for any one gas with totalizer, flow indicator and flow control valve. (upto 50 LPM). Quantity: ONE.

• **Control panel features:** The instrument should be supplied with a common control panel having
  i. **FOUR** programmable PID temperature controllers (with above-mentioned features), temperature display (precision: 0.1 °C or better) with high temperature alarm.
  ii. **FOUR** Variable frequency drives for motor speed control, RPM displays (precision: 1 RPM or better).
  iii. **FOUR** digital pressure displays in bar and psi (precision: 0.1 bar or better) with high pressure alarm.

• **Power supply:** Single phase, 230 V and 50 Hz
  **Mounting:** Common stainless steel table top or better