

	INDIAN INSTITUTE OF TECHNOLOGY MADRAS Chennai 600 036 Telephone: (044) 2257 4176 E-mail: nkaisare@iitm.ac.in	
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Prof. Niket S. Kaisare
Project Coordinator

Ref: CH/2020/NSK/TrickleBed
Dated: 04.05.2020

Limited Tender No: CH/2020/NSK/TrickleBed

Due Date: 26.05.2020, 3:00pm

Pre-Bid meeting: - Not required.

Technical Bid opening meeting on Due Date: 26.05.2020, 4:00pm

Dear Sir/Madam,

On behalf of the Indian Institute of Technology Madras, offers are invited for the supply of “**Trickle-Bed Reactor for Gas-Liquid-Solid Catalytic Reactions**” conforming to the specifications given in (**Annexure-I**).

Terms and Conditions of Limited Tender

1. **Preparation of Bids:** - The Limited tenders should be submitted under **Two bid system** (i.e.) Technical- and -Financial bid.
2. **Delivery of the tender:** - The tender shall be sent to the below-mentioned addresses either by post or by courier (duly sealed and super scribed on the envelope with the reference No and due date) so as to reach the following address before the due date and time specified in our Schedule:
Prof. Niket S. Kaisare,
Department of Chemical Engineering
IIT Madras
Chennai - 600 036
3. **Price:** - The price should be quoted in net per unit (after breakup) and must include all packing and delivery charges to **Department of Chemical Engineering**.
 - a. The offer/bid should be exclusive of taxes and duties. The percentage of tax & duties should be clearly indicated separately. IIT Madras is eligible for concessional GST and relevant certificate will be issued.
 - b. In case of import supply, the price should be quoted without custom duty. IIT Madras is exempted from levy of IGST on Imports and eligible for concessional custom duty (not exceeding 5%) and the price should be quoted on EX-WORKS and CIP (stating the Cost, Insurance, Freight separately) and indicating the mode of shipment.
4. **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.
5. **Catalogue:** Original catalogue (not any photocopy) of the quoted model duly signed must accompany the quotation in the Technical bid
6. **Late offer:** - The offers received after the due date and time will not be considered
7. **Payment:** - No Advance payment will be made for Indigenous purchase. However, 90% Payment against Delivery and 10% after installation are agreed to wherever the installation is involved. In case of import supplies the payment will be made only through 100% Letter of Credit i.e. (90% payment will be released against shipping documents and 10% after successful installation wherever the installation is being done).
8. **Advance Payment:** - No advance payment is generally admissible. In case of specific percentage of advance payment is required, the Vendor has to submit a Bank Guarantee from a Nationalized Bank of India equal to the amount of advance payment.

9. **On-site Installation:** - The equipment or machinery has to be installed or commissioned by the successful bidder within number of days (as prescribed by PI's) from the date of receipt of the item at site of IIT Madras.
10. **Warranty/Guarantee:** - The offer should clearly specify the warranty or guarantee period for the machinery/equipment.
11. **Validity:** Validity of Quotation not less than 60 days from the due date of tender
12. **Technical Bid Opening:** The technical bid will be opened on **26.05.2020 4:00pm** at the **Department of Chemical Engineering, IIT Madras** and the **financial bids** of those tenders who are technically qualified will be opened at a **later date under intimation to them.**
13. **Performance Security:-**The successful bidder should submit Performance Security for an amount of 5% of the value of the contract/supply within 21 days from the issue of work/purchase order. The Performance Security should be furnished in the form of an Account Payee DD / FD Receipt from the commercial bank (or) Bank Guarantee from any nationalized bank in India.
14. **Accept /Reject:** IIT Madras reserves the full right to accept / reject any tender at stage without assigning any reason.
15. **Settlement of Disputes:** 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 Tamil Nadu.
16. **Risk Purchase Clause:** - 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.
17. **Unsolicited offers:** “This notice is being published **for information only** and is not an open invitation to quote in this limited tender. Participation in this tender is by invitation only and is limited to the selected registered suppliers. Unsolicited offers are liable to be ignored. However, suppliers who desire to participate in such tenders in future may apply for registration as per procedure.” The Website for Registration of vendors is **<http://web.iitm.ac.in/supplier/>** and the mail address for queries is “ workflow@rt.iitm.ac.in “.

Yours sincerely,

Prof. Niket S. Kaisare,
Department of Chemical Engineering
IIT Madras,
Chennai - 600 036

Technical Specifications for Trickle Bed Reactor

Description of the Application

IIT Madras is looking to procure a *Trickle Bed Reactor* designed to study the gas-liquid-solid catalytic reactions under pressures up to 50 bars and temperatures up to 250 °C. The reactions proposed to be carried out involve transformation of multi-phase reactants (gas and liquid phases) into multi-phase products. The trickle-bed may be operated in co-current and counter-current modes, with liquid down-flow. The reaction will be carried out in an aqueous or organic solvent systems. Oxidation reaction using air may also be carried out under atmospheric pressure. The products of the reactions will be in both liquids and gases.

The reactor set up will consist of a gaseous and liquid feed sections, a reactor, a furnace, a stainless steel liquid collection section (with mini-chiller unit), a pressure pneumatic control unit and facilities for periodic sampling of the liquid or gaseous products for online analysis.

The entire unit should be suitable for continuous operation up to 50 bars pressure and temperature up to 250 °C. The material of construction of all the components in the unit should be suitable for use under highly oxidizing or highly reducing conditions.

Necessary Features of the System

Reactor and Furnace

- Furnace with Fixed-bed down-flow type reactor
- Material of construction for the reactor should be stainless steel (SS 316)
- Reactor volume = 10 ml (reactor dia: ½ to ¾ inch; length: 10 to 20 cm)
- Catalyst charge = 0.5 – 5 g
- Max. design pressure = 50 bars
- Max. design temperature at 50 bar = 250 °C
- Single thermocouple to be placed in the middle of the catalyst bed inside thermowell for reaction temperature measurement
- Reactor and fittings to be designed for easy loading and unloading of catalyst without disturbing the thermocouple
- Inlet for two reactant gases and one liquid feed.
- The furnace maximum temperature must be at least 300 °C, and temperature accuracy $\pm 2^{\circ}\text{C}$

- Temperature inside the reactor to be controllable to ± 2 °C (or lower) when no reaction is occurring; vertical temperature gradient to be less than 2 °C from top and bottom of reactor when no reaction is occurring.
- High temperature safety cut off (with indicator) for preventing run away temperatures or similar safety arrangement.
- Sealed heating coils to be used in the furnace

Feed Section

- Two reactant gases must be metered using mass flow controllers (MFC) that are designed for flowrates of 1 – 100 ml/min. The MFCs must be of Bronkhorst, Brooks, Alicat or equivalent recognized manufacturer.
- Gases from cylinders (procured separately by IITM) are to be pressure controlled with regulators before entering MFCs. By pass for MFCs to be provided for directing of gas from regulators using needle valves
- Liquid feed pump, feed rate 0.1 - 5 ml/min, with possibility of continuous flow variation
- Liquid feed vessel (50 ml valve) may be provided
- Feed flow rate to be set manually with digital indication of actual flow

Product Section

- Product condenser and high pressure product separator (50-100 ml volume level indicator type) with manual drain using a needle valve.
- Transfer line for the gaseous products to GC (length ~ 5 meters)

Pressure Control

- Back pressure regulator (BPR) of low dead volume
- Provision for bypassing BPR during atmospheric pressure operation may be provided.

Control System and Data Acquisition

- Electronic control system should be PLC or PID based control panel integrated with SCADA software package. All the process parameters should be controlled by analog and digital I/O and as well as ASCII Communication. Data should be accessible through control panel as well as SCADA on PC.
- A branded computer to be connected to the instrument. This is not a part of this tender (please quote separately).

General Specifications

- All fittings expected to be of Swagelok type. All valves to be of low dead volume and to be operated manually.
- Manual control of all systems (temperature, pressure, liquid and gas flows) with digital read outs
- Suitable safety features for pressure and temperature to be incorporated in the system, wherever possible.
- Spares for three years of continuous operation to be provided with on-site warranty of three years.
- The entire unit should be suitable for Indian power system.
- A detailed flow diagram (PID) of the entire unit with the specifications of the individual components (manufacturer, pressure and temperature rating) to be supplied along with the technical quotation.

Prior Experience

The vendor must have experience in supplying same model at least to five educational institutions such as IITs, IISc and other Technological Institutions/Universities.

The vendor must provide the details of organizations and contact person where such systems have been supplied.

For technical enquiries, please contact Prof. Niket Kaisare at

nkaisare@iitm.ac.in or [+91] (44) 22574176