



सीएसआईआर-केंद्रीय खनन एवं ईंधन अनुसंधान संस्थान
CSIR-CENTRAL INSTITUTE OF MINING & FUEL RESEARCH
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद)



(Council of Scientific & Industrial Research)

बरवा रोड परिसर, धनबाद – ८२६ ००१, झारखंड, भारत

Barwa Road Campus, Dhanbad – 826 001, Jharkhand, India

क्रय आदेश/ PURCHASE ORDER

फाइल सं०/ File No. CIMFR/PUR-14(08)2022

दिनांक/ Dated: 20.10.2023

सेवा में/ To,

M/s RL Solutions LLP,
101, Liberty Palm, Gangapur Road,
Nashik – 422 013, Maharashtra, India.

विषय/ Sub: फिक्स्ड बेड ट्यूबलर माइक्रो रिएक्टर के क्रय हेतु/ Procurement of Fixed Bed Tubular Micro Reactor.

सन्दर्भ/ Reference: कोटेशन सं० - RLS-PE-JP-0822-P034 dated 30.08.2022

प्रिय महोदय/ Dear Sir,

उपरोक्त ऑफर के संदर्भ में सक्षम प्राधिकारी, यह क्रय आदेश फिक्स्ड बेड ट्यूबलर माइक्रो रिएक्टर के क्रय हेतु सहर्ष जारी करते हैं/ With reference to above offer, the competent authority has been pleased to place a Purchase Order towards the procurement of Fixed Bed Tubular Micro Reactor.

क्र० सं०/ S. No.	Description of the Item	Qty.	Amount (Rs.)
1.	Fixed Bed Tubular Micro Reactor. Skid-Mounted Fluidized Catalytic Reactor System. Detailed specifications are as per Annexure-II attached.	01 Set	44,95,528.00
Ex-Works Price			44,95,528.00
Packing and Forwarding charges; Transportation Charges; Insurance Charges; Installation and Commissioning Charges and Training Charges			Included
GST @18%			8,09,195.00
Final Landing Cost at CSIR-CIMFR, Digwadih Stores			53,04,723.00
(Rupees Fifty Three Lakh Four Thousand Seven Hundred Twenty Three Only)			

Yours faithfully,


Controller of Stores and Purchase
CSIR-CIMFR

प्रतिलिपि/ Copy to:

(I) IO: Dr. Shweta Kumari, Sr. Scientist; (II) Stores; and (III) Office Copy; B/h: P-50

अनुबंध की विशेष शर्तें / Special Conditions of Contract

The following Special Conditions of Contract (SCC) shall supplement and/ or amend the General Condition of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

1. General	<p>(i) Supplier has to submit acknowledgement within 15 days from the date of Purchase Order.</p> <p>(ii) CSIR-CIMFR will not be responsible for payment without completion of contractual/ LOI cum PO liabilities.</p> <p>(iii) The ordered items must comply strictly with the specifications as mentioned in the LOI cum Purchase Order and your submitted Offer.</p>
2. Price	FOR CSIR- CIMFR Stores, Digwadih Campus.
3. Destinations	CSIR-CIMFR Stores, Digwadih Campus, Dhanbad, Jharkhand.
4. Delivery Period	07 Months from the date of issue of LOI cum PO.
5. Installation & Commissioning	Within 02 weeks from the date of delivery at CSIR-CIMFR, Stores.
6. Period of Demo/ Trial run	For 02 weeks from the date of installation and commissioning.
7. Training Period	For 02 Weeks from the date of installation and commissioning to at least 04 persons.
8. Warranty	<p>The whole system including all supplied items will be with One Year standard warranty from the date of Installation & Commissioning.</p> <p>During standard warranty, the supplier has to rectify/ replace the faulty components free of cost. In the above-said warranty periods, the supplier has to visit at-least two times a year on a half-yearly basis for preventive maintenance. For breakdown maintenance, the supplier has to visit the site as and when informed by the user. The user will inform the supplier by either telephone or e-mail. The rectification/ replacement of spares should be done within 15 days of a written request, failing which the warranty period of the entire system will be extended for those many days/ months of delay in attending and putting the system in operation.</p> <p>Supplier's promptness in providing services during the warranty period will be confirmed by CSIR-CIMFR user vide their recommendation before a confirmation of commencement of extended warranty period to the supplier.</p>
9. Extended Warranty	<p>The whole system including all supplied items will be with two years Chargeable Extended warranty. Rs.3,50,000 + GST for 1st year and Rs.5,00,000.00 + GST for 2nd year.</p> <p>During extended warranty, the supplier has to rectify/ replace the faulty components free of cost. In the above-said warranty periods, the supplier has to visit at-least two times a year on a half-yearly basis for preventive maintenance. For breakdown maintenance, the supplier has to visit the site as and when informed by the user. The user will inform the supplier by either telephone or e-mail. The rectification/ replacement of spares should be done within 15 days of a written request, failing which the warranty period of the entire system will be extended for those many days/ months of delay in attending and putting the system in operation.</p>
10. Payment Terms	<p>(I) For equipment and accessories: 100% payment will be released subject to fulfillment of the following- after the receipt of goods, challan, inspection report, warranty certificate, satisfactory installation & commissioning report from the competent committee, training completion certificate, final acceptance certificate of the user and completion of verification of the PBG by the Institute.</p> <p>(II) For extended warranty: The firm will be paid the extended warranty charges on half-yearly basis after certification by the user.</p>

11. PBG:

Performance Bank Guarantee (PBG) for 10% of Rs. 53,04,723 = Rs. 5,30,473.00 (Rupees Five Lakh Thirty Thousand Four Hundred Seventy Three Only) to be submitted within 21 days from date of issue of PO and valid up to 14 months from the date of installation & commissioning and acceptance of the user.

The subsequent amendments in the rules by Govt. of India will be applicable.

Annexure -IA

अनुबंध की सामान्य शर्तों/ General Conditions Of Contract

१. **सामान्य:** मुद्रित शर्तों, यदि कोई हो, जिसे दर सूची के साथ भेजा गया है, को मानने के लिए हम बाध्य नहीं होंगे। अनुबंध सम्बन्धी बाध्यता को उद्धृत विनिर्देशों, नियमों व शर्तों के अनुसार पूरा किया जाना होगा।
1. **General:** Printed conditions, if any, contained in or sent along with the quotation shall not be binding on us. Contractual Obligation may be completed strictly as per cited specifications and terms & conditions.
२. इस आदेश की संख्या व तिथि बिल में और इस आपूर्ति से संबन्धित सभी समाचार पत्र में उद्धृत किया जाना चाहिए।
2. The Number and Date of this order must be quoted in the bill and in all correspondences relating to this supply.
३. **कर:** सभी करों/ लेवी की लागू दरों का स्पष्ट उल्लेख होना चाहिए।
3. **Taxes:** Applicable rates of all taxes/ levies should be mentioned clearly.
४. **बिल व भुगतान:** इस आदेश की संख्या, दिनांक तथा वस्तु की क्रम संख्या, वस्तु की संख्या और वस्तु की एचएसएन संख्या बिल में उद्धृत किया जाना चाहिए। आपूर्तिकर्ता का बिल स्याही में तैयार या टाइप किया हुआ, विधिवत पूर्वा रसीदी व राजस्व टिकट चिपका हुआ और तीन प्रतियों में प्रस्तुत किया जाना चाहिए। आपूर्तिकर्ता बिल में स्थायी खाता सं०/ जीएसटी सं०, जो सक्षम विभाग से निर्गत हो संलग्न करें, अन्यथा बिल पर विचार नहीं किया जाएगा। नगर निगम की सीमा के भीतर चुगी शुल्क भुगतान नहीं किये जाएंगे। भाग बिलिंग सख्त वर्जित है, यद्यपि आपूर्ति एक से अधिक बार की गयी हो तो भी अंतिम आपूर्ति के पश्चात ही बिल दिया जाना चाहिए। बिल का भुगतान माल/ भंडार की प्राप्ति, परीक्षण/ निरीक्षण/ चालन और आदेश के समतुल्य गुणवत्ता, मात्रा और विनिर्देशों के संबन्ध में संतोषजनक पाये जाने के पश्चात आपूर्तिकर्ता को भुगतान किया जायेगा।
4. **Bills and Payment:** The Order No., Order Date and Sl. No., Quantity & HSN Code of the article must be quoted in the bill. The supplier's bill should be prepared in ink or typed and submitted in triplicate, duly pre-receipted and affixed with revenue stamp. The supplier must furnish Permanent Account Number / GSTIN No. as allotted by the competent Department failing which the bill may not be entertained. No claim on account of payment of Octroi duty within the limit of Municipal Corporation shall be accepted. Part Billing is strictly prohibited. Even if supply is made in more than one lot bill should be raised only once after making full or final supply. Bills for the supply will be paid after the items are received, tested/ inspected/ commissioned and found satisfactory with regard to quality, quantity and specifications ordered for suppliers.
५. सभी क्षतिग्रस्त या अस्वीकृत माल अपनी लागत पर लौटाये जायेंगे और जोखिम एवं आकस्मिक व्यय पर वसूली योग्य खर्च किया जाएगा।
5. All damaged or unapproved goods shall be returned at your cost & risk and the incidental expenses incurred thereon shall be recoverable from any of your bills.
६. **बीमा के साथ सुपुर्दगी:** सुपुर्दगी की तारीख का सख्ती से पालन किया जाना चाहिए, असफल होने पर क्रय आदेश रद्द किया जा सकता है। जुर्माना क्रय आदेश के नियम एवं शर्तों के अनुरूप होगा। सामान सुरक्षित रूप से और सक्षमता से आपूर्तिकर्ता के जोखिम पर निर्गत किया जाना चाहिए और इस आदेश के सन्दर्भ में उद्धृत भराई लागत सभी पार्सल में रखा जाना चाहिए। स्थानीय कंपनियों से अनुरोध किया जाता है कि समान कि सुपुर्दगी हमारे भंडारण में किसी भी कार्य दिवस को ०३ बजे अपराहन से पूर्व दिया जाए।
6. **Delivery with Insurance:** The date of delivery should be strictly adhered to failing which the purchase order is liable to be cancelled. Penalty may be imposed as per P.O. terms & conditions. Goods should be securely, safely and adequately packed & dispatched at the risk of supplier and packing costs quoting this

order reference should be kept in all package. Local firms are requested to deliver the goods in our stores before 3.00 PM on any working day.

७. **नष्ट क्षतिपूर्ति व विलंब दंड:** जुमाना 0.5% प्रति सप्ताह या बिना वितरित माल की देर से वितरण और स्थापना और कमीशनिंग में देरी के लिए होगी। जुमाने की अधिकतम राशि, 10% की दर से ऑर्डर का मूल्य पर होगी।
7. **Liquidated Damages & Late Penalty:** The penalty shall be 0.5% per week or part of a week towards late delivery of undelivered goods and towards delay in installation and commissioning. The maximum amount of penalty shall be 10% of the order value.
८. **जमानत/ आश्चस्ति:** उपकरण की जमानत/ आश्चस्ति अवधि सफल स्थापना व चालू तिथि से निर्देशित अवधि या यदि निर्देशित न हो तो कम से कम मानक वारंटी/ गारंटी 01 साल होना चाहिए। यदि उपकरण के किसी भी हिस्से या पूरे उपकरण में जमानत/ आश्चस्ति अवधि के दौरान खराबी आई तो हमारे परिसर में ही इसका प्रतिस्थापन/ निःशुल्क मरम्मत करना होगा।
8. **Guarantee/ Warranty:** The equipment should be guaranteed/ under warranty for a specified period or if not specified, 01 year standard warranty/ guarantee from the date of successful installation as otherwise mentioned. In case any part or whole of the equipment is found to be defective during the guarantee period, then the same will have to be replaced/ repaired free of cost at our premises.
९. **स्थापना और चालन:** जहां भी स्थापना किया जाना आवश्यक है, उसी के अनुसार निर्धारित समय में क्रय आदेश रद्द किया जा सकता है/ क्रय आदेश के नियम एवं शर्तों के अनुरूप दंड लगाया जा सकता है। यदि क्रय आदेश केवल एक मशीन/ उपकरण के लिए है, को तुरंत सफलता से स्थापित और चालित किया जाना चाहिए लेकिन किसी भी परिस्थिति में पूर्ति के एक महीने बाद नहीं होना चाहिए। चालन में देरी १ महीने और जैसा की क्रय आदेश में उल्लेखित हों, नष्ट क्षतिपूर्ति क्रम संख्या ७ के अनुसार बिल/ दलाली से काटा जायेगा।
9. **Installation & Commissioning:** Wherever, installation is required to be done, the same should be done by the supplier as per schedule failing which purchase order is liable to cancelled/ penalty may be imposed as Purchase Order terms and conditions. In case the item ordered for is a machine/ equipment the same should be successfully installed and commissioned immediately but in no case later than one month of the supply or the same. For delay in commissioning beyond 1 month or otherwise mentioned in the P.O. liquidated damages as per Sl. No. 7 may be deducted from the Bill/ Agency Commission.
१०. **निरस्तीकरण:** संस्थान के पास क्रय आदेश को निरस्त करने का अधिकार है यदि आपूर्तिकर्ता वितरण की समय सीमा को पूरा करने में विफल रहता है और अगर देरी प्रतिकूल संस्थान के उपयोगकर्ता वैज्ञानिक द्वारा दर्ज की गयी हो या संस्थान के अनुसंधान व विकास कार्यक्रम को प्रभावित किया हो। आदेश रद्द करने के मामले में कोई मुआवजा नहीं दिया जायेगा।
10. **Cancellation:** The institute reserves the right to cancel the order if party fails to meet the delivery deadline and if is recorded by the user scientist that the late delivery has adversely affected the R&D Programme of the Institute. In case of cancellation of order, no compensation will be paid towards progress of order/ procurement.
११. **अप्रत्याशित घटना:** अप्रत्याशित घटना (**Force Majeure**) का अर्थ है कि जो घटना आपूर्तिकर्ता के नियंत्रण के परे हो, जिसमें आपूर्तिकर्ता की गलती या लापरवाही शामिल न हो। इस तरह की घटनाएँ यथा युद्ध या क्रांति, आग, बाढ़, महामारी, संगरोध प्रतिबंध और माल दुलाई प्रतिबंध इत्यादि जिसमें क्रेता की संप्रभुता या संविदात्मक कार्य सीमित नहीं है। यदि कोई **Force Majeure** की स्थिति उत्पन्न होती है, तो आपूर्तिकर्ता ऐसी परिस्थितियों के लिखित रूप में क्रेता को तुरंत सूचित करेगा और उसका कारण भी देगा। जब तक लिखित रूप में क्रेता द्वारा निर्देशित नहीं किया जाता है, आपूर्तिकर्ता अनुबंध के तहत अपने दायित्वों का पालन करना जारी रखेगा, जहां तक यथोचित व्यावहारिक है और प्रदर्शन के लिए सभी उचित वैकल्पिक साधनों की तलाश करेगा जो **Force Majeure** की घटना से नहीं रुक रहा होगा। इस खंड का आशय है कि अगर प्रदर्शन में देरी या अनुबंध के तहत अपने दायित्वों को निभाने में विफल होने का कारण अप्रत्याशित घटना (**Force Majeure**) है तो आपूर्तिकर्ता का कार्य निष्पादन प्रतिभूति (**performance security**) के जब्ती, नष्ट क्षतिपूर्ति, विलंबदंड, स्वतः करार समाप्ती और निरस्तीकरण लागू नहीं होगा।
11. **Force Majeure:** "Force Majeure" means an even beyond the control of the supplier and not involving the supplier's fault or negligence and not foreseeable. Such events may include, but are not limited to, acts of the purchaser either in its sovereign or contractual capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes. If a Force Majeure situation arises, the supplier shall promptly notify the purchaser in writing of such conditions and cause thereof. Unless otherwise directed by the purchaser in writing. The supplier shall continue to perform its obligations under the contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the force majeure event.

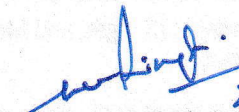
The supplier shall not be liable for forfeiture of its performance security, late penalty or liquidated damages or termination for default, if and to the extent that its delay in performance or other failure to perform its obligations under the contract is the result of an event of Force Majeure for purposes of this clause.

१२. **विवाचन:** इस अनुबंध से उत्पन्न सभी विवाद मध्यस्थता का आयोजन दिल्ली इंटरनेशनल आर्बिट्रेशन सेन्टर (डीआईएसी), दिल्ली उच्च न्यायालय, नई दिल्ली होगा।

12. **Arbitration:** Any difference/ dispute arising out of the agreement shall be referred to Delhi International Arbitration Centre (DIAC), Delhi High Court, New Delhi.

१३. **न्यायक्षेत्र:** आपूर्तिकर्ता और खरीददार के बीच यह अनुबंध भारत के कानून द्वारा शासित होगा और इस अनुबंध के अंतर्गत, यदि कोई विवाद हो तो उस पार्टी द्वारा धनबाद क्षेत्र स्थित सक्षम न्यायालय में ही दाखिल किया जायेगा।

13. **Jurisdiction:** This contract between supplier and buyer shall be governed by the Laws of India and dispute under this contract shall be lodged by parties to the competent jurisdiction, in Dhanbad, India only.


20.10.2023
Controller of Stores & Purchase
CSIR-CIMFR

SN	Technical Specifications
01	<p>Fixed Bed-Tubular Micro Reactor</p> <p>Fixed Bed-Tubular Micro Reactor is designed to operate in Down Flow mode. The Design conditions are 105 Barg pressure & Ambient to 550°C temperature.</p> <p>It consists of following module:</p> <ol style="list-style-type: none"> 1. Gas Feed Module 2. Pre Heating Module 3. Reactor Module 4. Product Handling Module 5. Valves, fittings and tubing 6. Control System 7. Structure
	<p>1. Gas Feed Module</p> <p>Gas feed module consists of five gas lines, Hydrogen (H₂), Carbon Monoxide (CO) gas, Carbon Dioxide (CO₂) gas, Nitrogen (N₂) gas, and Methane (CH₄) gas. Each is in-lined with BHU, Filter, Pressure Gauge, Ball Valve and Check Valve.</p> <p>Following are specifications of each gas line :</p> <p>1.1 Thermal Mass Flow controller</p> <ul style="list-style-type: none"> • Make : Brooks • Flow Range : 2-80 ml/min • Design pressure : 102 Barg • Maximum inlet pressure : 101 Barg • Maximum outlet pressure : 100 Barg • Calibration Gas : Hydrogen (H₂) gas • Contact part M.O.C. : SS 316 • Accuracy : +0.9% of S.P. (20-100% F.S.), +0.18% of F.S. (2-20% F.S.) • Inline pressure gauge range : 0-160 Barg (Make : Baumer) • Inline Manual Valve : Ball Valve (Make : Swagelok) • Inline Check Valve : 10 psi cracking pressure (Make : Swagelok) • Inline By-Pass Valve : Manual Ball valve (Make : Swagelok) • Inline Filter size : 07 micron (Make : Swagelok) • Qty : 01 No <p>1.2 Thermal Mass Flow controller</p> <ul style="list-style-type: none"> • Make : Brooks • Flow Range : 1-40 ml/min • Design pressure : 102 Barg • Maximum inlet pressure : 101 Barg • Maximum outlet pressure : 100 Barg • Calibration Gas : Carbon Monoxide (CO) gas • Contact part M.O.C. : SS 316 • Accuracy : +0.9% of S.P. (20-100% F.S.), +0.18% of F.S. (2-20% F.S.) • Inline pressure gauge range : 0-160 Barg (Make : Baumer) • Inline Manual Valve : Ball Valve (Make : Swagelok) • Inline Check Valve : 10 psi cracking pressure (Make : Swagelok) • Inline By-Pass Valve : Manual Ball valve (Make : Swagelok) • Inline Filter size : 07 micron (Make : Swagelok) • Qty : 01 No

1.3 Thermal Mass Flow controller

- Make : Brooks
- Flow Range : 1-20 ml/min
- Design pressure : 42 Barg
- Maximum inlet pressure : 41 Barg
- Maximum outlet pressure : 40 Barg
- Calibration Gas : Carbon Dioxide (CO₂) gas
- Contact part M.O.C. : SS 316
- Accuracy : +0.9% of S.P. (20-100% F.S.), +0.18% of F.S. (2-20% F.S.)
- Inline pressure gauge range : 0-160 Barg (Make : Baumer)
- Inline Manual Valve : Ball Valve (Make : Swagelok)
- Inline Check Valve : 10 psi cracking pressure (Make : Swagelok)
- Inline By-Pass Valve : Manual Ball valve and Needle Valve (Make : Swagelok)
- Inline Filter : 07 micron (Make : Swagelok)
- Qty : 01 No

(Note: Maximum Operating Pressure of Thermal Mass Flow Controller for CO₂ is 40 Barg only at ambient temperature.)

1.4 Thermal Mass Flow controller

- Make : Brooks
- Flow Range : 1-50 ml/min
- Design pressure : 102 Barg
- Maximum inlet pressure : 101 Barg
- Maximum outlet pressure : 100 Barg
- Calibration Gas : Nitrogen (N₂) gas
- Contact part M.O.C. : SS 316
- Accuracy : +0.9% of S.P. (20-100% F.S.), +0.18% of F.S. (2-20% F.S.)
- Inline pressure gauge range : 0-160 Barg (Make : Baumer)
- Inline Manual Valve : Ball Valve (Make : Swagelok)
- Inline Check Valve : 10 psi cracking pressure (Make : Swagelok)
- Inline By-Pass Valve : Manual Ball valve (Make : Swagelok)
- Inline Filter size : 07 micron (Make : Swagelok)
- Qty : 01 No

1.5 Thermal Mass Flow controller

- Make : Brooks
- Flow Range : 1-10 ml/min
- Design pressure : 102 Barg
- Maximum inlet pressure : 101 Barg
- Maximum outlet pressure : 100 Barg
- Calibration Gas : Methane (CH₄) gas
- Contact part M.O.C. : SS 316
- Accuracy : +0.9% of S.P. (20-100% F.S.), +0.18% of F.S. (2-20% F.S.)
- Inline pressure gauge range : 0-160 Barg (Make : Baumer)
- Inline Manual Valve : Ball Valve (Make : Swagelok)
- Inline Check Valve : 10 psi cracking pressure (Make : Swagelok)
- Inline By-Pass Valve : Manual Ball valve (Make : Swagelok)
- Inline Filter size : 07 micron (Make : Swagelok)
- Qty : 01 No

	<p>2. Pre Heating Module The pre-heating module consists of a pre-heater operational at 300 °C to heat the mixture from gas feed, and a heat traced line operational at 200 °C (Make : HTS Amptek)</p> <p>2.1 Pre-Heater with Static Mixer (For Gases)</p> <p>Specifications for Pre-Heater:</p> <ul style="list-style-type: none"> • Make : R L Solutions LLP • Type : Tube type closed end • Operating Temperature : Ambient to 300 °C • Heating Length : As per tube dimensions • End Connections : 1/4"OD • Qty : 01 No <p>2.2 Thermocouple</p> <ul style="list-style-type: none"> • Make : Watlow • Type : K
	<p>3. Reactor Module</p> <p>Reactor Section consists of a single reactor. Reactor is designed to operate in down flow mode. Thermocouple is used to measure the skin temperature of Reactor. Furnace heater is used to control the temperature of the reactor using PLC based PID. A pressure gauge (Make: Baumer), Pressure Relief Valve (Make: Swagelok), Pressure Transmitter (Make: Baumer), Rupture Disk (Make: BS&B) is installed at top of reactor.</p> <p>3.1 Reactor Tube</p> <ul style="list-style-type: none"> • Make : R L Solutions LLP • M.O.C : SS 316 • Dimension : Approx. ID 10 mm x 400 mm Heating Length • Design Pressure : 105 Barg • Operating pressure : 100 Barg • Volume : 10 mL • Design Temperature : 550 °C • Operating temperature : 500 °C • Heating media : Split type electric heating furnace • Temperature control : Skin Based • Temperature Sensing Points : Equidistant at 2 points inside the reactor • Qty : 01 No <p>3.2 Furnace</p> <ul style="list-style-type: none"> • Make : ATS,USA • Type : Split type electric heating • Zone : 02 zone • Heating Length : 400 mm • Total length : 450 mm • Design temp : 550 °C • Operating temp : 500 °C • Temperature control : PLC based PID • Qty : 01 No
	<p>4. Product Handling Section</p> <p>4.1 Condenser</p> <ul style="list-style-type: none"> • Make : R L Solutions LLP • M.O.C. : SS 316

	<ul style="list-style-type: none"> • Design Pressure : 105 Barg • Operating pressure : 100 Barg • Design Temperature : 0-20 °C • Operating temperature : 200 °C • Qty : 01 No <p>4.2 Gas Liquid Separator A manual level gauge will be installed in the gas liquid separator.</p> <ul style="list-style-type: none"> • Make : R L Solutions LLP • M.O.C. : SS 316 • Design Pressure : 105 Barg • Operating pressure : 100 Barg • Design Temperature : 250 °C • Operating temperature : 200 °C • Qty : 01 No <p>4.3 Back Pressure Regulator</p> <ul style="list-style-type: none"> • Make : Tescom • Operation : Manual • Capacity : Upto to 100 Barg • M.O.C. : SS 316 • End connection : 1/4" OD • Qty : 01 No <p>4.4 Chiller</p> <ul style="list-style-type: none"> • Make : JULABO, Germany • Operating range : 0-20°C • Qty : 01 No
	<p>5. Valves, Fittings and Tubing</p> <ul style="list-style-type: none"> • Valves & Fittings : Make – Swagelok (1/4" Tube OD) • Tubing : Make – Sandvik (1/4" Tube OD)
	<p>6. Gas cylinder with high-pressure regulator:</p> <ul style="list-style-type: none"> • Nitrogen, Hydrogen, Carbon monoxide, Carbon dioxide and Methane filled Cylinder (47 Lit. appx Water capacity). (Make: Swagelok / BOC / Chromgate) • Dual stage high pressure Gas regulators (SS 316 diaphragm) of reputed brand compatible to be connected with-above mentioned gas cylinders as well as regulators. • Proper Manifold at a straight distance of 10 m with suitable SS Tubings for the gas supply system will be provided for each gas cylinder • Operating Pressure: up to 70 Bar with heating arrangement up to 55°C (CO2 regulator with heating arrangement) • One number for each H2, CO, CO2, N2, CH4 cylinder.
	<p>7. Micro-processor based Control System Designed control section allows you to control and monitor the Process parameters such as Temperature, Level and flow in the Fixed-Bed Micro Reactor. It is incorporated with Controller Based PID.</p> <p>6.1 Control Panel</p> <ul style="list-style-type: none"> • Make : Rittal • Type : PLC Based PID (Make : Allen Bradley)

- Operation : SCADA
- MCBs/Switchgears for electric power: Siemens/GE/ABB/L&T
- Qty : 01 No

Over Temperature Safety:

PLC based PID temperature control system is provided with MCBs for over current protection. Alarm system with hooter to control unit provided.

Temperature Control:

Temperature measured by Thermocouples is displayed and controlled by PLC based PID.

Safety:

All heating modules are provided with individual MCB along with main MCB on control unit. High-Pressure and High-Temperature safety alarms with interlocking.

Provision to place PLC cabinet and control console at a straight / aerial distance of 3m (Make: Allen Bradley / Siemens / Mitsubishi)

6.2 SCADA Station

Designed SCADA station allows you to control, monitor and log the features of control panel.

SCADA is featured with:

Data Logging	All process parameters i.e. temperature, level & Flow is logged in SCADA and saved the data in its server.
On Line trending	Process parameters can be monitored in graphically for its current values of specified time frame.
Historical Trending	It is a feature to view the earlier process parameters in graphical trends.
Report Generation	It is a tool to generate the process parameters in tabular format either the current or past sessions
Recipe	It is a tool to operate the system in sequential manner for its given time frame.

PC Configuration:

Make (DELL, HP,) Intel® Core™ i7 (10th Generation Processor) or better Processor with suitable Graphics, 4 GB DDR4 or higher with one TB SSD, 24 inches, full HD monitor.

Technical Specifications of UPS:

- Make : Vertiv (Emerson) / Aplab / APC
- Capacity : 20 KVA
- Back up time : 1 hour for maximum load condition

Battery Limits & Utilities Requirements

All battery limit connections will be located at the process frame edge for connections by the client. It is assumed that the client secures all feeds on overpressure as stated below:

Utility Name	Operating range at battery limit
Feed gas	Pressure controlled via cylinders.
Electric Power	230 VAC, 50 Hz, Current - 30 Amps
Space	For Reactor system

8. Structure

Fixed-Bed Micro Reactor is designed to fix on skid mounted structure, made up of heavy duty aluminium strut profile.

Handwritten signature and date: 20.10.2023

**Controller of Stores & Purchase
CSIR-CIMFR**