INDIAN INSTITUTE OF TECHNOLOGY KANPUR

Department of Chemical Engineering

Enquiry No. IITK/ChE/NV/2016-2017/1 Date 5/02/16

Sub: Quotations invited for GAS-LIQUID REACTOR SYSTEM

TECHNICAL SPECIFICATIONs

A Gas-Liquid Reactor System is required for the study of gas-liquid (water) reactions at high pressure. The study uses two different gases delivered from gas cylinders, along with the test liquid (water) to be simultaneously injected into a high pressure tubular reactor, using high pressure liquid pumps. Reactor should have the provision to restrict the drain of reactants along with gas-liquid mixture. The reactor should have provision for injection and recovery of particulates below 200 microns. After reactor section the system should have all the features as narrated under product separation and recovery. The system should consist of all sections mentioned here under. **The system should be supplied as complete system ready for use housing all the sections in one structure/panel.**

1) **High Pressure High Temperature Reactor**

   MOC-: Inconel 600
   Reactor: ID-37 mm preferable OD -42-43 mm length: 345 mm approx
   Reactor Volume-:370ml
   Heating console-: Two zone split Heating system with independent temperature control module.
   Temperature control-: PID based Auto tuning type.
   Maximum Operating Pressure-:30 Bar
   Design should consider provision for recycle of product stream back to reactor in fully controlled atmosphere along with relevant valves and pumps
   Process Condition requirement-: 30 Bar & 400 Deg C (Controllable min. to max.)
   Reactor should have all safety provisions like safety rupture disc, Pressure Gauge, Pressure Transmitter, vent valve, pressure safety valve, necessary flanges, thermowell.

2) **Gas Feed Details**

   All gas feed lines shall have BH union, ball valve, Moisture traps, filter, isolation valve, pressure gauge, Forward Pressure Regulator, NRV, Restriction Orifice.
   No. of Gases-:
   Air/Oxygen-: 1-100 SCCM
   Nitrogen-: 1-100 SCCM
   Independent control for both the gases by Bronkost MFC and monitoring .
   Flow rate accuracy –: ± 1% FS
   High pressure Double stage complete SS Regulators with High pressure Hose.
   All gas lines would be of SS 316 polished from inside & outside up to reactor.

3) **Liquid Feed Details**

Feed Tank-:4000ml capacity with available provision for Nitrogen purging, suitable feed port/ valve, safety valve, vent valve, drain port with suitable valve and level indicator.
MOC SS316
Pump-: Dedicated High Pressure pump flow 0-5 ml/min with accurate flow control of +/- 2% of set value.
Liquid feed assembly should have necessary NRVs up to Reactor.

4) <u>Product Separation and Recovery details.</u>

There should be proper provision for:
Recovery of final product liquid only with proper chilling/cooling/ condensing devices.
Controlled recirculation of excess test sample.
Recirculation of test sample in case of undesirable results.
Maintenance of Controlled atmosphere and pressure throughout the reaction.
Separation of Media and atmosphere and provision for minimum level control of media.
Direct Mixture of test samples and gas feed before reaction and by pass for the same.
Final product should be collected in 4000ml capacity pot with available provision for suitable safety valve, drain port, vent valve, sampling port with suitable valve. MOC SS316.
All connections/ lines MOC SS 316.

Note:

1. Vendors will provide P & ID diagrams for their proposed system, in the absence of which bids will not be considered.

2. Vendors should have at least 15 successful installations of such systems. Please provide contact addresses.

The sealed quotations (separately for technical and price bidding) should be addressed to Prof. Nishith Verma, ChE and sent to the following address latest by 19th Feb 2016.

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