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Form for Inviting Quotations

Reference No. MEE/11-12/281/CSIR/KSRS /XX11

Date: 22-12-2014

Subject: Supply of TEST SET-UP FOR IN-SITU DYNAMIC CHARACTERIZATION OF SOLAR ABSORBER ELEMENT IN VACUUM ENVIRONMENT

Project No: MEE/11-12/281/CSIR/KSRS

Due Date: 14 -01-2015

Dear Sir,

1. Quotations are invited in **duplicate** for the supply of **Test Setup for in-situ dynamic characterization of solar absorber element in vacuum environment** and Specification of which are shown in overleaf.
2. The Quotations **duly sealed and super scribed on the envelope** with the reference No. and due date, should be addressed to the undersigned to reach him on or before the due date stipulated above.
3. The Quotations should be valid for sixty days from the due date and the period of delivery required should also be clearly indicated.
4. If the item is under DGS&D Rate Contract, Rate Contract Number and the price must be mentioned. It may also please be indicated whether the supply can be made direct to us at the Rate Contract price. If so, please send copy of the R. C. (Please note that we are not Direct Demanding Officers).
5. Relevant literature pertaining to the items quoted with full specifications (and drawing, if any) should be sent along with the Quotations, wherever applicable. Samples if called for should be submitted free of charges, and collected back at the supplier's expenses.
6. **Local Firms:** Quotations should be free delivery to this Institute, if Quotations are for Ex-Godown delivery charges should be indicated separately.
7. **Firms outside Madras:** Quotations should be F.O.B. Madras. If F.O.B. consignor station, freight charges by passenger train / lorry transport must be indicated.. If Ex-Godown, packing, forwarding and freight charges must be indicated. The following set of documents is required in all cases: a. complete set of Clean Bill of Lading / Airway Bill / Air or surface Parcel Receipt, showing that the goods have been shipped and freight prepaid. b. Insurance Policies / Certificates in duplicate covering Marine Insurance as per Institute Cargo Clauses (All risks) and perils as per Institute Strikes, Riots and Civil Commotion Clauses, War risks as per Institute, Clauses. Cover for CIF value plus 10 percent.
8. The rate of Sales / General Taxes and the percentage of such other taxes legally leviable and intended to be claimed should be distinctly shown along with the price quoted. Where this is not done, no claim for Sales / General Taxes will be admitted at any stage and on any ground whatsoever. **The taxes leviable should take into consideration that we are entitled to have Concessional Sales Tax applicable to non-Government Educational Institutions run with no profit motive for which a concessional. Sales Tax Certificate will be issued at the time of final settlement of the bill.**
9. Goods should be supplied carriage paid and insured.
10. Goods shall not be supplied without an official supply order.
11. **Payment:** Every attempt will be made to make payment within 30 days from the date of receipt of bill / acceptance of goods, whichever is later.

Quotation can be sent addressing:

“Dr.K.Srinivas Reddy
Professor
#204, Heat Transfer and Thermal Power Laboratory
Department of Mechanical Engineering
Indian Institute of Technology, Madras- 600 036”

TEST SET-UP FOR IN-SITU DYNAMIC CHARACTERIZATION OF SOLAR ABSORBER ELEMENT IN VACUUM ENVIRONMENT

PREAMBLE

In Concentrated Solar Power [CSP] Technology based on Parabolic Collector a 4 metre long Solar Photoreciever Tube is deployed for collection of Solar Radiation. This Tube transfers the radiation from Sun to Heat in the Working Fluid passing through the Photoreciever Tube.

The tube is coated with a High Temperature stable Solar Selective Coating which has high absorbance in the solar spectrum and low emittance in the Infrared region. The coated tube is placed in a glass envelope with a vacuum environment to reduce convective losses.

In order to characterize the Thermal characteristics of the tube an elaborate test set –up is envisaged to completely characterize the Tube for its performance when incorporated in a CSP Plant in the Solar Field.

The Test set-up consists of precisely controlled heating of the tube and continuously recording the various parameters like Temperature, Voltage and Current of the heaters etc. in PLC-HMI based Automation System.

This document describes the complete scope of supply and specifications of the Test Set-up required.

Scope of Supply and Technical Specifications

1. Ceramic Isolated Heaters

A Encapsulated Heater with proper Ceramic Isolation and uniform Heating Facility in Tube length of 4060 mm. The Heaters should be single phase 230 Volt operated and capable of reaching a steady state temperature of 450 C. A Heating capacity of 5 KWatt is envisaged for this Temperature.

Heater should be designed to provide uniform Heating throughout the length of the Tube taking into consideration the end loses.

The Heaters are required to be inserted for every Test Cycle in the Photoreciever Tube and should rugged to undertake the above handling. Proper fixture to be provided for placement of Heater in the Tube for Uniform Heating.

2. Six Thermocouples and Temperature Scanner

Six Thermocouples place at the following Locations:

Thermocouple 1 [TC1]: Placed at the left surface [internally] of the Photoreciever Tube

Thermocouple 2 [TC2]: Placed at the centre surface [internally] of the Photoreciever Tube

Thermocouple 3 [TC3]: Placed at the right surface [internally] of the Photoreciever Tube

Thermocouple 4 [TC4]: Placed at the centre surface [internally] of the Photoreciever Tube

Thermocouple 5 [TC5]: Placed for Measurement of Ambient Temperature

Thermocouple 6 [TC6]: Placed at the Outer Glass Envelope for Measurement of Glass Tube Temperature

Please see schematic of the Set-up indicating the placement of Thermocouples. The thermocouple TC2 will be used as a Control Thermocouple for the PID control along with the Heater Control Power Supply.

All Thermocouples should be K-type, Mineral Insulated with SS Sleeve and with proper end OMEGA connectors. The Thermocouples should be designed for placement at above locations without any modification, each time the experiment is conducted.

All Thermocouples need to be calibrated and should be supplied along with calibration certificate.

3. Heater Power Supply

A High Precision Constant Voltage Power Supply with continuous Precise Voltage Control from 0-230 Volts ripple free DC with digital Voltage and Current Display. Provision should be made for remote output [preferable 0-10 Volts] for Data acquisition and control(DAS).

The Heater Power Supply should be capable of both Manual Control of Voltage from a 10 turn potentiometer [local front panel control] as well as remote control using control output from a PID controller specified in Section (4) below

4. Closed Loop Temperature PID Control

A neuro fuzzy logic based PID controller should be provided with remote settable set value and a control output in 0-10 Volt range. This PID control output should be able to control the Heater power Supply in the remote mode to achieve steady state feedback values of Voltage Applied and current drawn by the Heater to maintain a specific set temperature from 0- 450 C.

Facility to be provided for Data Acquisition for Voltage and Current in order to find the actual Heat Loss.

5. AUTOMATION

The complete Test set up should be completely Automated using a PLC-HMI configuration consisting of:

- Digital Inputs and Outputs for Switching ON/OFF the various subsystems and Interlocks.
- Analogue Inputs and Outputs [0-10 Volts/4-20 mA] for various Temperature Inputs, Voltage and Current of Heater Power Supply etc.
- An HMI with 12"[min.] Colour LCD Touch Screen for Visualization and Data Acquisition
- Typical Test cycle Recipe programming, storage and Recall Facility
- Trends capture and display for all parameters
- Alarm Management for safety interlocks and deviation/overshoot of parameters
- Remote Connection through Internet for Maintenance and Trouble shooting

Summary of specification

1)Ceramic Isolated heaters	<ul style="list-style-type: none"> ➤ Single Phase 230V ➤ Capacity : 5KW (capable to reach Temp 450 C)
2)Thermocouples	<ul style="list-style-type: none"> ➤ Quantity : 6 Nos (TC1 - TC6) ➤ Type : K type insulated with SS sleeve & end OMEGA connector ➤ With Calibration Certificate
3)Heater power supply	<ul style="list-style-type: none"> ➤ Range : 0-230 V ➤ Remote O/p :0-10 V for DAS ➤ Control : Both Manual & Remote control(from PID)
4)Closed Loop Temperature PID Control	<ul style="list-style-type: none"> ➤ A Neuro fuzzy logic based PID control with remote settable set value. ➤ Control O/p: 0-10V (should be able to control Heater Power supply) ➤ DAS : Provision Voltage & Current to be displayed
5)Automation	<ul style="list-style-type: none"> ➤ Digital I/P &O/P : Switching ON/OFF subsystem ➤ Analogue I/P &O/P : 0-10 Volts / 4-20 mA for Temperature ,Voltage & current of Heater power supply. ➤ HMI with 12" color LCD touch screen ➤ Programming ,Storage and recall facility ➤ Remote connection through internet

*Refer page 1 & 2 for specification details

Diagrammatic representation of setup

