Government of India  
Bhabha Atomic Research Centre  
Materials Processing Division  

Ref: MPD/HTMDS/FA3/BP/20/  
Date: 22/07/2020

Quotations are invited for the following minor fabrication job:

<table>
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<th>S. No.</th>
<th>Description</th>
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<td>1.</td>
<td>Design, fabrication &amp; supply of laboratory-scale controlled atmosphere muffle type box Furnace with continuous operating temperature of 1600 °C as per given specifications (Annexure-1).</td>
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Note:

1. The reference no. given above and due date 04/09/2020 should be clearly mentioned on the sealed envelope. Please superscribe the envelope with the words “Quotation: not to be opened”.

2. Quotation shall be complete in all respect with the regard to price, validity etc. and must reach the undersigned by the due date 04/09/2020 (Time: 17:00 Hrs). It is advised to send the quotation by Speed-post service of India Post, as private courier services are not permitted inside BARC premises.

3. Quotation should be sent to the following address:

Bhaskar Paul  
Scientific Officer-F  
High Temperature Materials Development Section  
Materials Processing & Corrosion Engineering Division  
Bhabha Atomic Research Centre  
Trombay, Mumbai – 400085

4. The fabricated item is to be delivered to North Gate, BARC.

5. The offer shall be valid for 60 days from the date of opening and, in case of placement of the work order, shall remain firm till the completion of the work.

6. Quotation should be submitted in printed/ typed form on your letter head. Your VAT/ Sales Tax/GST Registration Number registered with local ST authority/ CST authority, PAN Number of the firm, Service Tax Registration Number, etc. should be clearly mentioned. Computer generated letter heads are to be construed as invalid and rejected.

7. Taxes etc., if applicable, should be indicated separately.

Yours sincerely

(Bhaskar Paul)
Annexure-1

Detailed specifications for laboratory-scale controlled atmosphere muffle type box Furnace for pack cementation experiments with continuous operating temperature of 1600 °C:

1. **Heating element:** Suitable MoSi₂ type to ensure continuous operation of the furnace at 1600 °C. It should be easy to replace the heater.

2. **Chamber Structure:** Furnace should be double walled, water cooled, made out of Mild steel along with appropriate leak proof gaskets.

3. **Effective hot zone:** 150 mm (W) X 150 mm (H) X 150 mm (D)

4. **Max. Design temperature:** 1650 °C.

5. **Continuous Operating temperature Range:** 1600 °C (Programmable).

6. **Temperature Uniformity:** +/- 1 °C, from 400 °C to 1600 °C.

7. **Flow controller:** Two numbers of reputed make flow controllers with suitable arrangement for mixing two gases in the inlet side.

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10. **Power requirement:** 415V / 3 phase / 24 A/AC pump

11. **Maximum power:** 3.8 KW

12. **Temperature controller:** Temperature control through PID programmer with temperature indicator. Suitable power panel, as per the specifications given below, should be provided. Temperature indicator should be provided to indicate temperature within ±1°C. One thermocouple to be located in the middle (inside) of the furnace and other thermocouple should be placed near the heating elements.

13. **Heating rate:** 0-10 °C/min. It should be possible to operate at single set point as well as in 15 segment temperature profile.

14. **Insulation:** The furnace insulation should be good to ensure that the furnace surface/skin temperature to be less than 50°C.

15. **Power Controller:**

   - 3-Phase angle controlled Thyristor drive with current feed back
   - Load capacity will be three times of actual load
   - Manually controlled power pot for regulation the Power
   - Thyristor power drive with automatic voltage/current control
   - Power modules having in output semiconductor fuse
   - Alarms: gross fault alarms, over current alarm, load failure alarm

16. **Indications on panel:** a) Ammeters and Voltmeters for input/output, b) mains indicator c) output indicator.

17. **Control switches:** mains on/off, out put on/off, push button (with contactor).

18. **Safety Features:** The furnace should be equipped with input and output fuses; safety non indicating controller, soft start & stop facility, thermocouple broken indication. Other safety features which should be incorporated are:
• **Power Cables**: Stranded Cu conductor (upto and including 2.5 sq mm), multicore, XLPE insulated, extruded PVC inner sheathed, steelwire/strip armoured and FRLS PVC outer sheathed cable, as per IS:7098 (Part I).

• **Earthling**: Earthing of Furnace and its Electrical panel shall be done by connecting it to two independent nearest earth pits.

• **Alarm Communication**: In the event of fault condition viz., over temperature audiovisual alarm communication, system comprising hooter and indicating lamps will activate.

• **Door Closer Interlock**: Provision should be made to prevent heater power to the furnace unless the door is shut.

• **Over Temperature protection**: There should be a provision to protect the furnace to reach over temperature. The furnace should be automatically switch off the heater power with indicator light and alarm sound. All the heaters will be fixed with overload protection to protect the thyristor and furnace.

19. **Acceptance criteria**: The furnace will be checked for its ability to leak proof by filling argon gas in the chamber for 24 hours. A firebrick piece of the dimension 60 mm diameter and 150 mm height would be placed in the furnace, heated to 1600 °C and soaked for 24 hrs at 1600 °C. The heating element should not break. Temperature uniformity would also be checked.

20. **Spare/consumables**: Following consumables and spares should be provided with the furnace:

   1. Alumina crucibles (L=100 mm; dia=50mm): 25 Numbers
   2. Alumina Oxide Powder, Purity: 99.8%, Particle Size: Less than 1 Micron: 50 Kg
   3. Sheathed Thermocouple (K type): 5 numbers
   4. Reputed make tool kit comprising of all types of spanners and screw drivers
   5. High temperature cement: 20 Kg