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TELEGRAMS : BARC-MUMBAI, CHEMBUR.  
फेक्स संख्या : ९१-२२-२५५० ५१५१  
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भारत सरकार  
GOVERNMENT OF INDIA  
भाभा परमाणु अनुसंधान केन्द्र  
BHABHA ATOMIC RESEARCH CENTRE

## URANIUM EXTRACTION DIVISION

Ref: UED/Pl.13/21/21195

Date: 24/12/2021

**TENDER No: BARC/UED/KM/21128**

**DUE DATE: 03/01/2022**

### **Tender enquiry**

**Sub: Design, fabrication, supply and installation of High density Rich slag metal melting system for MTR waste treatment.**

Dear Sir / Madam,

Quotations are invited on behalf of Head, UED in sealed envelope for **Design, fabrication, supply and installation of High density Rich slag metal melting system for MTR waste treatment.**

**1. Scope of work:**

Design, manufacture, supply, installation, commissioning, of high density rich slag melting system.

Process Parameters :

1. Density of waste material : 11.5gm/cc
2. Batch size – 25kg
3. Dimension of the slag block : 10mm to 80mm
4. Melting temperature : 1400DegC
5. Maximum Design temperature of the system : 1600 DegC
6. Material of the crucible : Graphite.
7. Mode of heating : Induction Heating
8. Crucible dimension: 120mm OD and 160mm Height.

9. Power requirement : 50kW with Auto tune frequency
10. Detailed specification of the heating system will be given in the technical specification below.
11. Time of Operation : Continuous operation for 5hrs.
12. Vacuum system : Double stage Rotary vacuum pump of suitable capacity.
13. Vacuum required :  $10^{-3}$ Torr
14. Enclosure for the charge : Quartz chamber.
15. Sensors : Necessary temperature sensors, pressure gauge and Vacuum gauge have to be provided as given in the detailed technical specification below.

#### Technical Specification of Heating system

1. Mode of Heating : Induction Heating system.
  - 1.1. Power Supply: The furnace heating coil should operate at unity power factor, i.e. maximum power transfer frequency. The electrical supply should auto tune as per the load material, distance of the crucible from the coil, susceptor material etc. The frequency of operation should be in the medium range.
  - 1.2. Quartz Chamber: The quartz chamber dimensions 300mm OD and length 900mm, Wall thickness of 5mm. The chamber has to be sealed to hold vacuum. It should also be suitable for Argon purging. The quartz chamber should be placed inside the coil. No external metal chamber for the coil is needed.
  - 1.3. Ports/ inserts: The chamber should have provisions / ports for induction power feed through, vacuum pumping port, gas inlet and outlet port, pyrometer, immersion thermocouple and pressure relief.
  - 1.4. Immersion thermocouple: This device should be provided in the system for measurement of temperature of molten metal. B type thermocouple duplex type has to be provided for contact type measurement.
  - 1.5. Pyrometer: Two colour on-line pyrometer of 350oC to 1800oC. The accuracy of measurement should be 0.3% with a resolution of 0.1°C Emissivity should be adjustable from 0.1 to 1. Response time should be 10ms or better. The sensor heads should be unaffected by electromagnetic interferences. LCD display for the temperature indication and parameter setting should be provided.
  - 1.6. Mounting Frame: The furnace chamber will be mounted on a suitable & sturdy framework made out of MS rectangular channels (powder coated) in such a way to establish convenience of operation.
  - 1.7. Induction heating coil: The coil should be made of copper with insulation and coating of suitable material to withstand high temperature. The coil should be water cooled. The coil should not be damaged due to heat of the crucible. The coil should be easily to replace without disturbing the vacuum chamber.

#### Technical Specification of Vacuum pump

2. Vacuum System.
  - 2.1. Double stage rotary vacuum pump of suitable capacity and a Pirani gauge should be provided. Necessary process connection should be available on the chamber.
  - 2.2. Pirani Gauge : One pirani gauge heads should be provided to independently monitor the roughing and backing pressure in the range of 0.5 to 0.001 mbar through a selector switch.

### 3. SAFETY DEVICES:

3.1 A water flow switch in the water circulation line of the unit should be provided. The switch will protect the diffusion pump in case of water supply failure/low pressure by switching off the diffusion pump heater.

3.2 A Thermostat switch should be fitted to the water cooling coils of the diffusion pump to protect from excessive heating by switching off the heater.

3.3 Over Load protection devices for the vacuum pump motor and diffusion pump should be provided.

### 4. MOUNTING FRAME:

All the above components should be housed in an aesthetic MS frame with a front panel for mounting gauges and ON /OFF switch for vacuum pump. The unit should be mounted on four sturdy castor wheels with locking arrangement for mobility and easy maneuverability.

### 5. Technical Specification of Electrical Panel.

The electrical panel should be made of CRC sheet and the panel should have undergone 7 tank process. The panel should be powder coated and oven dried. The panel should have lighting and exhaust sufficient enough to maintain the ambient temperature inside the panel. All the wiring should be as per approved drawings and all the wires should have ferrules. Panel fabrication should start only after approval of all the drawings of the panel (i.e. GA, assemble drawing, power and control circuit drawings). 3 copies of the as built drawings should be submitted at the time of hand over of the furnace.

- 5.1. Input Supply: 3 $\phi$ , 415 V, 50 Hz input supply.
- 5.2. Panel: The electrical power and control panel should have proper exhaust and space for easy maintenance.
- 5.3. IGBT based inverter control has to be provided.
- 5.4. Load – 50kW (induction heating)
- 5.5. Input power for the panel is 3Ph, 415V AC
- 5.6. Incoming power supply should be connected to an MCCB housed inside the panel.
- 5.7. Frequency should be in Auto tune mode for resonance. Also provision to change the frequency should be available.
- 5.8. Digital frequency indicator should give the frequency of output.
- 5.9. Panel should have DC current and voltage indication.
- 5.10. Digital temperature controller for Pyrometer input of 4-20mA.
- 5.11. Digital temperature controller for B type thermocouple.
- 5.12. Digital temperature controller for safety (with universal input).
- 5.13. Spare digital temperature controller should be supplied by the vendor (fully configured)
- 5.14. Heating start and stop indication should be provided on the panel. Panel should have indication of 3ph power supply.
- 5.15. Various interlocks Overload, Temperature, pressure, cooling water have to be incorporated for safe operation of the furnace.
- 5.16. The inverter should be designed with all safety design like overload, voltage surge Snubber, and component temperature.

- 5.17. The panel should be easy to maintain with sufficient space for handling all the components. The panel should have lighting and exhaust.
- 5.18. The panel should be designed to be compatible with the existing heating coil as well as the new heating coil to be installed by the vendor.
- 5.19. Water-cooled high frequency output transformer (HFT) should be reliable and compact.
- 5.20. Cable: The length of the connecting power cable running between the furnace and control panel should be as per the requirement at the site.
- 5.21. Safety Features: The unit should be fitted with safety indicators like: i) Water Fail ii) Over Heat iii) Over Current.
- 5.22. Fall in Induction coil assembly insulation resistance: In the event of fall in induction coil assembly insulation resistance below 5 K ohms an audio alarm should come up.

## 6. Drawing and approvals

All the prefabrication drawing should be submitted to user department for approval before starting the actual fabrication. Details of all bought out items should be made available to the user department before placing the purchase order.

### Fabrication, erection & commissioning

The fabricator must agree and provide sufficient facilities for stage-wise inspection of the fabricated items by the purchaser's representative and arrange for final demonstration of the induction melting unit at rated capacity. The fabricator shall install, commission & demonstrate the satisfactory performance of the vacuum induction furnace at user's site after delivery.

### Documentation & Manuals

1. Party should maintain records for all inspection and tests done by purchaser. The format for recording the tests, inspection, reports etc. should be submitted for approval.
2. Three sets of as built mechanical, electrical & instrumentation drawing should be submitted after completion of project.
3. Three copies of operation manual & drawing for all the bought out items should be after completion of project. Three sets of instruction, operating and trouble-shooting manuals in English should be supplied along with the equipment.

All quotations must be accompanied by the following information / documents

1. Complete technical details of the equipment being offered along with the basic sketch of the conceptual equipment indicating approximate dimensions.
2. The bidder should specify the details of the vacuum system e.g. make, model no., vacuum pumps capacity, accessories etc.
3. List of customers to whom similar equipments have been supplied especially to Govt. organizations.
4. Facilities available for fabrication, testing, demonstration etc.

Quotations submitted without the above details are not likely to be considered for the evaluation. The purchaser shall have the right to visit and evaluate fabrication facilities of the supplier and his sub contractors.

General Conditions:

1. Prompt after sales service during and after guarantee period has to be provided by supplier.
2. Anything else not specifically mentioned here but necessary for smooth, safe and trouble free operation will be in vendor's scope and should be indicated in the offer.
3. Any minor modifications during the manufacture or commissioning for smooth and trouble free operation of the equipment shall be done free of charge.
4. Supplier should also have flexible approach to accommodate any minor changes for betterment of the system.

BARC Scope:

Free water and electricity will be made available at nearby area during commissioning

Vendor should note that, if they succeed to get the order, during erection and commissioning the installation personnel would be required to have their Police Verification Certificates (PVC) to enter inside BARC premises.

**2. QUANTITY:**

Total job is as tabulated below:

| Sr. No | Description   | Quantity |
|--------|---|----------|
| 1.     | <b>Design, fabrication, supply and installation of High density Rich slag metal melting system for MTR waste treatment.</b> | 01 set.  |

3. **PRICE:** Offered should be including the entire scope of work (Fabrication, supply, taxes, packing and forwarding, transportation). Max possible break up price should be given in the offer.
4. **TESTING:** The system will be tested twice for operation at desired temperature.  
Maximum temperature attainment with dummy charge should be successfully demonstrated. All the safety interlocks mentioned in the technical specification above should be demonstrated. The heating system should deliver the desired wattage, it should heat the crucible to the desired temperature in desired time.
5. **WARRANTY:** 12 months from the date of commissioning.
6. **VALIDITY:** Price should be valid throughout the contract period.
7. **COMPLETION PERIOD:** The job is to be completed within **4 weeks** from the date of receipt of the order any delay which is liable to the contractor is liable for penalty @ 0.5% per week (5% maximum) to be imposed on the contractor.
8. **INCOME TAX:** Income Tax @2% and surcharge on tax as applicable shall be deducted from vendor's bill.

9. **SAFETY:** Party should follow all the safety procedure while working inside BARC. During the execution of the work order party will be responsible for all safety precautions to be maintained in the work area. The party should arrange all the safety appliances. As per BARC security norms, the contractor shall have to obtain in the police verification Certificate (PVC) to work inside BARC for all the persons to be employed for this work and be comply with all security regulations strictly. **Any injury/damage caused to the contractor's work force during execution of the job for any reason whatsoever shall be the liability of the contractor only. The vendor will be only responsible for any labor related dispute.**

10. **PAYMENT:** 100% including taxes after receipt of the unit at our site, final acceptance of the total job and submission of the following documents:

1. Delivery Challan.
2. Advance Stamped Receipt.
3. Original Bill.
4. Guarantee certificate
5. Job completion certificate.
6. GST certificate.

11. **TERMS AND CONDITIONS:**

*Note: [Reference: (2/Misc-9/Lgl/2001/92 dated April 30, 2001, BARC]*

- a. Confidentiality: No party shall disclose any information to any third party concerning the matters under this contract generally. In particular, any information identified as "Propriety" in nature by the disclosing party shall be kept strictly confidential by the receiving party and shall not be disclosed to any third party without the prior written consent of the original disclosing party.
- b. "Restricted information" categories under Section 18 of the Atomic Energy Act, 1962 and "Official Secrets" under Section 5 of the Official Secrets Act, 1923:

**Any contravention of the above –mentioned provisions by any contractor, sub-contractor, consultant, adviser or the employees of a contractor will invite penal consequences under the aforesaid legislation.**

- c. Prohibition against use of BARC's name without permission for publicity purposes:The contractor or sub-contractor, consultant, adviser or the employees engaged by the contractor shall not use BARC's name for any publicity purpose through any public media like Press, Radio, TV or Internet without the prior written approval of BARC.

**Party should write clearly the Tender No. and due date on the top of envelope. Quotation should be submitted on printed letter head. Party should mention their PAN/GST No. on top of quotation. Quotations should be sent by Speed post only.**

Thanking you,

Yours faithfully,

**(P. Kalpana Mitra)**  
**UED, BARC**  
**(For and On Behalf of President of India)**