Bharat Heavy Electricals Limited

(High Pressure Boiler Plant**)**
Tiruchirappalli – 620014, TAMIL NADU, INDIA
An ISO 9001 Company
CAPITAL EQUIPMENT / MATERIALS MANAGEMENT

ENQUIRY	Phone: +91 431 257 76 83 Fax : +91 431 252 07 19 Email : ramado@bheltry.co.in Web : www.bhel.com

	Enquiry Number:	**Enquiry Date:**	**Due date for submission of quotation:**
	2720800017	**22.10.2008**	**25.11.2008**

You are requested to quote the Enquiry number date and due date in all your correspondences. This is only a request for quotation and not an order

Item	**Description**	**Quantity**	**Delivery (Item required at BHEL on)**
10	2 Ton Electric Furnace – Single Bogie Car Bottom as per the technical specification & commercial conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)	1 No.	30.06.2009

Note: Offer should be
Foreign Bidders: CFR Mumbai Port

Indigenous Vendors:
FOR, BHEL, Stores
Industrial Valves Plant
433, Industrial Complex
Goindwal – 143 423
District: Tarn Taran (Punjab), India

BHEL commercial terms & conditions with Price Bid and Bank Guarantee formats along with technical specifications can be downloaded from BHEL web site http://www.bhel.com or from the Government tender website http://tenders.gov.in (public sector units > Bharat Heavy Electricals Limited page) under Enquiry reference "2720800017".

Tenders should reach us before 14:00 hours on the due date Tenders will be opened at 14:30 hours on the due date Tenders would be opened in presence of the tenderers who have submitted their offers and who may like to be present	Yours faithfully, For **BHARAT HEAVY ELECTRICALS LIMITED** Sr.Manager / MM / Capital Equipment

PART A

2 Ton Electric Furnace - Single Bogie Car Bottom

SECTION – I : QUALIFYING CRITERIA

The BIDDER has to compulsorily meet the following requirements to get qualified for considering the technical offer for the ELECTRIC FURNACE

S. No.	PARTICULARS	VENDOR's RESPONSE
1	Only those vendors (OEMs), who have supplied and commissioned at least 1. **One Car Bottom Electric Furnace of 150 KW or more and** 2. **Loading capacity of 2 tons or more** in the past ten years (on the date of opening of Tender) and such equipment is presently working satisfactorily for more than one year after commissioning (on the date of opening of Tender) should quote. However, if such equipment had already been supplied to BHEL, then that equipment should be presently working satisfactorily for more than six months after its commissioning and acceptance (on the date of opening of Tender).	
The vendor should submit following information where similar equipment has been supplied for qualification of their offer.		
1.1	Name and postal address of the customer or company where similar equipment is installed.	
1.2	Name and designation of the contact person of the customer.	
1.3	Phone, FAX no and email address of the contact person of the customer.	
1.4	Month and Year of commissioning of the equipment.	
1.5	Application for which the equipment is supplied	
1.6	One Performance certificate from the customer regarding satisfactory performance of equipment supplied to them. For obtaining the performance certificate from the customer, a suggestive format is provided in **SECTION - IV**.	
2.0	BHEL reserves the right to verify the information provided by vendor. In case the information provided by vendor is found to be false/ incorrect, the offer shall be rejected.	

SECTION – I I

The BIDDER / VENDOR is requested to provide the following information:

S. No.	PARTICULARS	VENDOR's RESPONSE
3.0	The BIDDER/VENDOR to furnish Reference List of Customers, with full address, details of contact person, where SUCH ELECTRIC FURNACES have been supplied in the past.	
4.0	Specify details of SUCH ELECTRIC FURNACES supplied to other units of BHEL, if any. (Year of commissioning, Power in KW, Furnace bogie size, Loading capacity etc.)	
5.0	Details on SERVICE-AFTER-SALES Set-Up in India including the Address of Agents / Service Centers in South India.	
6.0	Any Additional Data to supplement the manufacturing capability of the BIDDER for the subject equipment.	

SECTION – III

The BIDDER to note:

S. No.	PARTICULARS	VENDOR'S RESPONSE
7.0	The BIDDER / VENDOR shall submit the offer in TWO PARTS. 1. Technical Offer [with PART A & PART B] and Commercial offer. 2. Price Bid.	
8.0	The Offer shall contain a comparative statement of Technical **Specifications demanded by BHEL** and **Offer Details submitted by the Bidder**, against each clause. A just 'CONFIRMED' or 'COMPLIED' or 'YES' or 'NO-DEVIATION' or similar words in the technical comparative statement may lead to disqualification of the Technical Offer.	
9.0	The Technical Offer shall be supported by Product Catalogue and Data Sheets in ORIGINAL and complete technical details of 'Bought-Out-Items' with copies of Product Catalogue and Selection Criteria	
10.0	The Commercial Offer (given with the Technical Offer) shall contain the Scope of Supply and the Un-Priced Part of the Price-Bid, for confirmation	

SAN PSG GCS KPL

RDR AVC NRM

SECTION – IV

The performance certificate should be produced **on Customer's Letter Head.**

PERFORMANCE CERTIFICATE

1. Supplier of the equipment		
2. Make & Model of the Equipment		
3. Month & Year of Commissioning		
4. Application for which Equipment is used		
5	Furnace power in KW Loading Capacity In Tons Bogie size L x B	
6. Performance of the Equipment (**Strike off** whichever is **not applicable**)		Best in the market Satisfactory Good Average Not Satisfactory
7. Any Other remarks		
Date:		Signature & Seal of the Authority Issuing the Performance Certificate

SAN PSG GCS KPL

RDR AVC NRM

PART B

Technical Specification of 2 Ton Electric Furnace - Single Bogie Car Bottom

S.No.	FEATURES	PARAMETERS / DESCRIPTION	BIDDER'S OFFER [With Technical Details]
1.0	**Scope Of Supply**	Design of Furnace, Manufacture, Inspection, Supply, Erection & Commissioning, Performance Prove-Out, Documentation and Performance Guarantee as per BHEL Specification.	
2.0	**FURNACE CONFIGURATION**		
2.1	**Furnace Type**	Electrically Operated Car Bottom (Bogie Hearth) Furnace. Heating element strips shall be employed for heat generation.	
2.2	**Application**	To carry-out stress relieving of forged and cast steel valve bodies after welding and part processing	
2.3	**Loading Capacity**	2 Metric Tons (maximum)	
2.4	**Job Material**	Castings / Forgings of Carbon Steel, Alloy Steel with Weld Over-Lays and Hard Facings.	
2.5	**Job Details**	The jobs loaded in the furnace will be Valve Bodies of Gate Valves, Globe Valves, Stop Valves, etc. Valve size ranges from 2" to 24 ". Large valves will be loaded as individual pieces. Small valves will be loaded as a batch in crates. The maximum weight of charge will not exceed 2 tons in any case.	
2.6	**Job Handling**	1. Loading and unloading of the job will be done always when the Bogie is outside the Furnace. 2. EOT Crane of BHEL will be used for loading and unloading of the job. When batch of small jobs in steel crates are loaded, there is every probability that concentric loading may occur on the bogie hearth.	

S.No.	FEATURES	PARAMETERS / DESCRIPTION	BIDDER'S OFFER [With Technical Details]
3.0	**FURNACE CONSTRUCTIONAL FEATURES**		
3.1	**Furnace usage**	The usage of furnace shall extend up to 120 Hrs continuously with repeated heating/soaking/cooling.	
3.2	**Furnace temperature**	Vendor to specify the maximum temperature, this furnace can generate.	
3.2.1	**Charge Temperature**	The maximum charge temperature shall be 780 °C. The furnace should be capable of maintaining this temperature as soaking temperature throughout the soaking period.	
3.3	**Rate of Heating**	The maximum rate of heating shall be 100^{o} C/hr, beyond 350°C. The rate of heating shall be adjustable steplessly.	
3.3.1	**Rate of Cooling**	The maximum rate of cooling shall be 50^{o} C/hr. The rate of cooling shall be adjustable steplessly.	
3.4	**Soaking Time**	10 Hours (maximum)	
3.5	**Uniform Soaking temperature**	The charge temperature must be uniform during soaking. The maximum variation allowed is $\pm$ 10 °C	
3.6	**Power Rating**	BIDDER to specify the power rating of the furnace in kW. Bidder should submit design calculation sheet for the power rating specified above.	
3.7	**Heating Chamber Dimensions**	Effective loading area on the bogie shall be 2.0 M x 2.0 M, with a clear height of 2.0 M from the bogie surface. Vendor to specify the Chamber dimensions to suit the effective loading area of bogie.	
3.8	**Furnace Bogie**	The furnace shall be provided with a Single Bogie. Bogie shall have drive mechanism for the forward and reverse movement of the Bogie on rails. Rails will be grouted flush with the floor level in the shop.	

S.No.	FEATURES	PARAMETERS / DESCRIPTION	BIDDER'S OFFER [With Technical Details]
3.9	**Bogie Construction**	**1.** The bogie shall be driven by motorized drive mechanism through a suitable reduction gearbox. Bidder to specify travel speed of the bogie. **2.** The drive mechanism and gearbox are to be located on the side of the furnace for ease of maintenance. **3.** Drive transmission from gearbox to car bottom bogie shall be of Rack & pinion type. **4.** Provision shall also be made to move the bogie manually (using other vehicle) during power failure. BIDDER has to provide details on this offered arrangement. **5.** Rails for bogie movement, to specification CR 80, IS 3443, with center to center distance 1676 mm (BG), will be provided by BHEL **6.** Bogie shall be provided with refractory hearth suitable to withstand the job load and maximum furnace temperature. **7.** Provision shall be included in the design to provide sand sealing between the furnace shell and on both sides of the bogie. **8.** The bogie shall be designed in such a way that perfect matching between the bogie refractory and furnace hearth refractory is ensured / maintained, in order to minimize the heat loss. **9.** The bogie shall have top layer lined with IS 8 quality firebricks backed by lightweight firebricks of suitable thickness. **10.** The loading surface of the bogie shall be provided with suitable cast iron job supports to prevent damage of refractory while loading the job. BIDDER has to furnish technical details of bogie from the design point of view, to meet the above listed requirements.	

S.No.	FEATURES	PARAMETERS / DESCRIPTION	BIDDER'S OFFER [With Technical Details]
3.10	**Furnace Door Construction**	a. A vertical Sliding Door shall be on the front side of the furnace chamber. b. Structural design to take care of strength and anti-buckling quality features of the Furnace Door under high temperatures. c. Opening & Closing of Door shall be motorized with suitable sprocket-chain drive mechanism, gear reduction and counter balance. d. Pneumatic door locking arrangement along with mechanical locking arrangement to minimize the heat loss when the furnace is in operation. e. Provision should be made on the door for sand sealing at the roof and bottom in the bogie in closed position of the door f. The Door shall be provided with facilities for manual operation in case of power failure or failure of the motorised system. Vendor to furnish Details of the door drive system, sand sealing and door-locking mechanism.	
3.11	**Furnace Wall Insulation**	a. The wall insulation shall be of ceramic fibre blanket or modules of suitable density and thickness to maintain the charge (job) temperature at 780°C. b. Ceramic fibre blanket or modules of suitable density and thickness shall be used for the sliding door and for all sides of the furnace for insulation purpose. c. The maximum skin temperature should not exceed 80^{o}C d. The supplier should submit the heat balance calculation for proof of achieving the skin temperature as per BHEL specification.	

S.No.	FEATURES	PARAMETERS / DESCRIPTION	BIDDER'S OFFER [With Technical Details]
3.11	**Furnace Wall Insulation**	e. Wall insulation design with ceramic fiber blankets / modules shall be submitted along with offer. f. The interfacing surfaces of the furnace shell and the bogie shall have shaped hard refractory bricks (IS 8) suitably arranged and matched to minimize the heat loss from the furnace.	
3.12	**Furnace Shell**	a. The bottom side shall have bogie and the front side shall have a vertical Sliding Door. b. Except bottom and front sides, all other sides of the furnace chamber shall be permanently closed. c. The furnace shell shall be built using at least 10 mm thick mild steel plates. d. Proper reinforcements using rolled sections of suitable dimensions shall be introduced to provide a rigid and sturdy construction. e. The furnace shall be rigid enough to withstand distortions due to thermal & mechanical stresses, to house the insulation and refractory brick work, to hold other related structures and components and shall have a prolonged life span.	

S.No.	FEATURES	PARAMETERS / DESCRIPTION	BIDDER'S OFFER [With Technical Details]
3.13	**Heating Elements**	1. Material: KANTHAL A-1 STRIPS and the dimensions are to be designed by the supplier to suit the furnace specification. 2. The thickness of the heating element shall be min 2 mm. The terminal strip shall be KANTHAL A-1 and shall have thickness of 6 mm. 3. Heating Elements supporting system shall be suitable for strip-corrugated elements for freely radiating style / similar arrangement. 4. Test Certificates for Kanthal A-1 Strips is to be furnished by the supplier, with the documentation for the Furnace. 5. The heating elements shall be arranged or supported on the sidewalls / rear wall of the furnace. Heating elements shall not be located on the doors and roof. 6. The number of refractory blocks supporting the heating elements shall be kept at a minimum and the complete arrangement drawings shall be submitted to BHEL for approval prior to taking up the manufacture. (Heating element pitch and spacing between heating elements shall be designed in such a way to avoid deflection, arcing and short-circuiting.) 7. The heating elements holding arrangement should be rigid enough, ease of maintenance and avoid sagging of the elements in due course of furnace operation. The rigidity of the supports has to be ensured from the furnace wall.	
3.13.1	**Temperature Control Zones**	The furnace shall have Two temperature control zones.	
3.14	**Ventilation**	BIDDER has to suggest / recommend a suitable ventilation arrangement for the inner chamber of furnace, for an effective and	

		optimum working cycle.	
S.No.	**FEATURES**	**PARAMETERS / DESCRIPTION**	**BIDDER'S OFFER** [With Technical Details]
3.15	**Circulating Fan**	1. One circulating fan to be provided to maintain uniformity of temperature of job and furnace. 2. The material of construction of the circulating fan system shall be suitable for the maximum furnace operating temperature. 3. Water chiller and chilled water circulation system, of adequate capacity, to be provided for the bearings & shaft of the circulating fan. 4. Baffle arrangement shall be provided to have uniform circulation inside furnace. 5. Alarm provision to be made to indicate failure of chilled water circulation system and / or circulating fan failure. 6. The Vendor to furnish the following details. a. Power rating of the circulating fan b. Material of construction of the fan c. Chiller d. Arrangement of fan e. Arrangement & capacity of water circulation system for fan bearings and shaft	
3.16	**Painting**	1. The furnace shall be painted with rust preventive coat, one coat of Zinc Chromate Primer and two coats of Heat Resistant Aluminum Paint, with suitable Dry Film Thickness (DFT) and curing time. Furnace Door Counter Weights are to be painted with yellow and black zebra strips. 2. The final coat of finish painting shall be done at BHEL Works, before handing over the Furnace after the successful	

		commissioning and performance prove-out.	
S.No.	**FEATURES**	**PARAMETERS / DESCRIPTION**	**BIDDER'S OFFER** [With Technical Details]
4.0	**PROGRAMMABLE TEMPERATURE CONTROLLER**		
4.1	**Type**	Shall be of multi-programmed Programmer of (up to) eight ramp / dwell combinations.	
4.2	**Make**	Eurotherm, Model: 2404P4	
4.3	**Range**	0 – 1200 °C	
4.4	**Input to the Programmable controller**	Universal type	
4.5	**Output from the Programmable Controller**	4 mA to 20 mA	
4.6	**Display**	Digital Display	
4.7	**Power Supply**	230±10% V, 50 Hz Single Phase AC Supply	
5.0	**POWER CONTROLLER**		
5.1	**Type**	The Controller shall be of Thyristor type, suitably designed for automatic heat-treatment cycles, without any manual intervention.	
5.2	**Capacity**	The capacity of the Thyristor Pack shall be suitable for the KW rating of the furnace.	
5.3	**Controller Unit**	1. The furnace temperature shall be controlled by Thyristor Controller through Programmable Controller in auto / manual mode. 2. The Power control shall be through a system consisting of Thyristorised Power Pack and Control Cards, inclusive of suitable fan cooling arrangement.	

		3. The power controller shall be of EUROTHERM / JELTRON make.	
S.No.	**FEATURES**	**PARAMETERS / DESCRIPTION**	**BIDDER'S OFFER** [With Technical Details]
5.4	**Control Panel**	1. Two control panels shall be provided. 2. One panel to house the Programmable temperature Controller, Temperature recorder, Safety Controller. 3. Second panel to house Power controller, Fuses, Indicating lamps, Digital ammeter and voltmeter, auto/manual selector, input/output terminals, starters for all drives, over-load relays, On/Off controller.	
5.5	**Display**	Provision for monitoring the electrical parameters like current for each phase, voltage, kWh. etc. through a suitable Display Unit.	
6.0	**TEMPERATURE RECORDER**		
6.1	**Make / Type**	16 Channels (min.) CHINO LAXSONS make, Hybrid Temperature Recorder, microprocessor based, with digital display-with Ethernet and with a recording chart of width 250 mm. Vendor to specify model no.	
6.2	**Range**	0 - 1200°C	
6.3	**Scale Width**	250 mm	
6.4	**Power Supply**	230±10% V, 50 Hz Single Phase AC Supply	
6.5	**Backup Power Supply**	Suitable U P S (uninterrupted power supply) provision shall be made to operate the Temperature Recorder for one hour, in case of electrical power failure.	
7.0	**SAFETY CONTROLLER**		
7.1	**Make**	MASIBUS / RADIX	
7.2	**Range**	0 - 1200°C	
7.3	**Input to the Controller**	K-Type Thermocouple	
7.4	**Output from**	Relay type, Relay rating 2 Amps 230V AC	

	Controller		
7.5	**Power Supply**	230±10% V, 50 Hz Single Phase AC Supply	
S.No.	**FEATURES**	**PARAMETERS / DESCRIPTION**	**BIDDER'S OFFER** [With Technical Details]
8.0	**THERMOCOUPLE**		
8.1	Type	K – Type thermocouple	
8.2	**Number of Thermocouple**	a. 1 No. Duplex and 1 No. Simplex type thermocouple for each furnace zone for connecting to the Programme Controller, Temperature Recorder and – Safety Controller.(total 4 Nos.) b. Additional 4 Nos. of K-type, 4000 mm long, 6.0 mm OD, and mineral insulated, inconel sheathed thermocouple for job temperature measurements. c. Additional provisions shall be made on both sidewalls of the furnace to insert thermo couples for measurement during furnace qualification / calibration exercise.	
9.0	**GENERAL POINTS**		
9.1	**Input Power Supply**	1. The furnace shall be suitable for an input supply through a 415 ± 10% V, 50 ± 3% Hz. 3 Phase AC, 3 - Wire System. 2. BHEL will provide the input power supply at one point only and further tappings (for sub-systems) are to be managed by the Supplier, through suitable step-down transformers and proper internal wiring. 3. Supplier has also to specify the means & mode of giving power supply to the heating elements.	
9.2	**Pneumatic air supply**	BHEL will supply air at 60 – 70 psi at one point. Distribution from BHEL terminal point, including filter – regulator shall be in the scope of Vendor.	
9.3	**Ambient Conditions**	The control elements shall meet all the specified requirements while working in an ambient temperature of maximum 50 ° C and 90 % of relative humidity.	

9.4	**Make of Motors**	Motors shall be of M/s Siemens / KEC / ABB / BBL makes. Single phasing preventers shall be incorporated for all the motors.	
S.No.	**FEATURES**	**PARAMETERS / DESCRIPTION**	**BIDDER'S OFFER** [With Technical Details]
9.5	**Control Elements**	The electrical switch and control elements shall be of Siemens / L&T / GEC Alsthom / Telemechanique make.	
9.6	**Gear Boxes**	The gearboxes are to be of Greaves / Radicon / Elecon / Shanthi Gears make only and necessary Test and Guarantee Certificate are to be submitted.	
9.7	**Remote Control Unit**	Remote Control Pendant (hand held type) shall be provided for bogie and front sliding door operations.	
9.8	**Cabling Code**	All wires, cables, instrument tappings, etc. shall be terminated at components / devices / terminals using suitable number ferrules.	
9.9	**Inter-Connecting Cables**	Required length of Power and Control (Copper) Cables to inter-connect the Power Controller and Terminals, Field Instruments, Motors etc. with Panel shall be Supplied.—Compensating cables shall be routed through separate cable trays.	
9.10	**Safety Systems**	Necessary safety interlocks incorporated for the safe operation of the furnace shall be elaborated in the offer.	
10.0	**SPARES**		
10.1	**OPERATING SPARE PARTS**	**1)** The Vendor shall recommend and submit list of spares required for the machine for two years of trouble free operation on three shifts /day basis. a) **Mechanical** and b) **Electrical & electronic** spares. c) **Other** spares. The list shall generally include the following items. **a) Mechanical:** Vendor to recommend a list. **b) Electrical &Electronic Spares:** Thyristor Controller 1 Set	

		Thyristors 1 Set Limit switches 2 Nos. Semiconductor fuses 1 Set Programmable Temp. Controller 1 No. Safety Controller 1 No. Power supply card for recorder 1 No. Input card for recorder 1 No. Recorder Motors 1 No. of each type **c) Other** spares: Heating Elements (KANTHAL A-1 STRIPS) and Refractory Blocks supporting Heating Elements-- 25% of Furnace requirement Cr/Al Thermocouples Duplex ----4 Nos Cr/Al Thermocouples Simplex ---2 Nos Ribbon cassette for recorder ----5 Nos. 250mm wide recorder chart paper rolls ----25 Nos. **d)** Un-priced list of spares with quantities, specified at **a,b&c** above, should be submitted with the technical offer. **e)** Unit Price of each item figuring in **d** shall be submitted with the price bid.	
10.2	**COMMISSIONING SPARES**	The supplier shall arrange commissioning spares required for commissioning of the Furnace.	

S.No.	**FEATURES**	**PARAMETERS / DESCRIPTION**	**BIDDER'S OFFER** [With Technical Details]
11.0	**FURNACE INSPECTION & ACCEPTANCE**		
11.1	**Inspection at Supplier's Works**	1. The supplier has to offer for inspection to BHEL Officials, all the furnace components (structures, insulation material, refractory bricks, etc.), mechanical sub-assemblies, heating elements, accessories & attachments forming part of the electrical and control systems, spares, anchoring & supporting materials, etc., which are in individual despatchable consignments. 2. Items like Temperature Program Controller, Temperature Recorder, Safety Controller, Thermo-Couples, etc, shall be tallied with the Test Certificates of the OEM.	
11.2	**Acceptance at BHEL Works**	1. The Furnace in total will be accepted only after performance prove-out as per BHEL Specifications. 2. During prove out minimum three heat-treatment cycles of Stress relieving, shall be run and proved out.	
12.0	**ERECTION & COMMISSIONING**		

12.1	**Erection**	1. Erection of Complete furnace and its auxiliaries – is under supplier's scope. 2. Civil foundation Works will be BHEL scope. Foundation details to be submitted by the vendor. 3. BHEL will provide electricity, water and crane for handling and lifting of furnace components / materials at erection site (free of cost). However, welding machines, accessories and consumables will be under the scope of supplier for erection and commissioning.	
S.No.	**FEATURES**	**PARAMETERS / DESCRIPTION**	**BIDDER'S OFFER** [With Technical Details]
12.2	**Commissioning and performance prove out**	1. Commissioning of the Equipment and all the Sub-Systems for Smooth Functioning shall be the RESPONSIBILITY of the Supplier. 2. During commissioning, the below mentioned performance checks shall be carried out on the furnace with charge (job), at BHEL Works: a. Rate of heating checks at: 50°C/hr. and 100°C/hr. b. Maximum charge (job) temperature: 780 °C c. Uniformity of temperature in Soaking: ±10°C d. Maximum soaking time: 10 Hours. e. Three Heat Treatment cycles between 600 to 780 deg C.	
13.0	**FURNACE DOCUMENTATION**		

13.1	**O & M Manuals**	a. Totally three hard Copies of the Operation & Maintenance Manual and one copy in CD form (SOFT COPY) to be submitted. b. One Hard Copy of O & M Manual of the Furnace shall be submitted during INSPECTION at Supplier's Works. c. The following documents mentioned under **Clause No. 13.2** shall form part of the Operation & Maintenance Manual	
S.No.	**FEATURES**	**PARAMETERS / DESCRIPTION**	**BIDDER'S OFFER** [With Technical Details]

13.2	**Documents and Technical Details**	1. GA Drawing of the Furnace in Total. 2. GA Drawing of Individual Mechanisms / Sub-Systems / Sub - Assemblies. 3. Sub-Assembly Drawings (without dimensions) for sub-systems for maintenance purpose. 4. Electrical Wiring Drawings – Power & Control Circuits 5. Pneumatic Circuit Diagram (if any) 6. Complete Printed Circuit Board Schematics indicating check points (Test Points) for Electronic Controls 7. Specifications / Ratings of All Bought-Out-Items 8. Trouble Shooting Chart for Main and all Sub-Systems 9. Drawings of all the refractory components with specifications. 10. Test certificates of Kanthal heating elements. 11. Total Weight of the furnace including structures, lining & insulation, mechanical sub-systems, etc. 12. Total connected load in KW.	
14.0	**TRAINING**	The Supplier's Service Engineer shall train BHEL Staff in the Operation, Trouble Shooting and Maintenance of the Furnace for a minimum period of 6 Working Days, after the SUCCESSFUL COMMISSIONING of the furnace, at BHEL Works, free of cost.	
S.No.	**FEATURES**	**PARAMETERS / DESCRIPTION**	**BIDDER'S OFFER** [With Technical Details]

15.0	**TECHNICAL OFFER**	The Technical Offer shall contain the following: a. Complete Scope of Supply, including Main Equipment, Safety systems, All Accessories and Attachments, etc. b. List of Operating Spares, Commissioning Spares, Foundation / Anchoring Materials c. Complete description of all systems & sub-systems forming part of the Furnace. d. A schematic diagram showing the layout of the furnace & associated systems with salient dimensions e. The technical write-up on the operating sequence of the furnace with broad outline of various operations involved	
16.0	**PERFORMANCE GUARANTEE**	The Performance of the Furnace in total with its Components / Sub-Assemblies and Bought-Out-Items, should be guaranteed for a minimum period of 24 months from the date of performance acceptance at BHEL Works.	