


|   |   | BHARAT HEAVY ELECTRICALS LIMITED                                      |         |            |         |  | Enquiry No. :      |  |
|--|---|---|---------|------------|---------|--|--------------------|--|
|  |   | PIPLANI BHOPAL 462022 (M.P.) INDIA                                    |         |            |         |  | Due Date :         |  |
|  |   | CONTACT PERSON'S NAME/DESIGN./PHONE NO./E-MAIL (FROM PURCHASE DEPTT.) |         |            |         |  | Supplier Qtn. No.: |  |
|  |   |   |         |            |         |  | Date :             |  |
| SPECIFICATION CUM COMPLIANCE CERTIFICATE OF '200 kW ROTOR INDUCTION BRAZING MACHINE'   |   |   |         |            |         |  |                    |  |
| NOTE:-   |   |   |         |            |         |  |                    |  |
| 1. Vendor must submit complete information against clause no.13(i.e. Qualifying Conditions). The offer meeting this clause would only be processed.  |   |   |         |            |         |  |                    |  |
| 2. The "Offered" Column and where applicable, the "Deviations" & "Remarks" Column of this format shall be filled in by the Vendor and submitted along with the offer. Inadequate / incomplete, ambiguous, or unsustainable information against any of the clauses of the specifications/requirements shall be treated as non-compliance. |   |   |         |            |         |  |                    |  |
| 3. The offer and all documents enclosed with offer should be in English language only.   |   |   |         |            |         |  |                    |  |
| NAME & ADDRESS OF THE SUPPLIER :   |   |   |         |            |         |  |                    |  |
| TELEPHONE NOS.:  |   |   |         |            |         |  |                    |  |
| FAX NOS.:  |   |   |         |            |         |  |                    |  |
| E-MAIL ADDRESS :   |   |   |         |            |         |  |                    |  |
| SCOPE: SUPPLY, ERECTION & COMMISSIONING OF ' 200 KW ROTOR INDUCTION BRAZING MACHINE ' WITH SPECIFICATIONS AS BELOW   |   |   |         |            |         |  |                    |  |
| SNO  | DESCRIPTION FOR BHEL REQUIREMENT  | SPECIFIED / TO BE CONFIRMED BY  | OFFERED | DEVIATIONS | REMARKS |  |                    |  |
| 1.0  | PURPOSE   |   |         |            |         |  |                    |  |
| 1.1  | The equipment is required for induction brazing of short circuit rings (made up of heavy copper section bars ) with rotor bars of (rotors of) electrical motors for squirrel cage motors. | Vendor to confirm   |         |            |         |  |                    |  |

|       |   |     |                   |  |  |  |
|-------|---|-----|-------------------|--|--|--|
| 1.2.1 | <b>Job details:-</b><br>cross- section – 6000 mm2<br>Max thickness – 60 mm<br>Max diameter - 800 mm<br>Min thickness – 20 mm<br>Material – electrical quality copper of high purity<br>Max weight coming on table :5000 Kg<br>Max weight of Copper SC ring – 200 Kg      d) Brazing Flux – Rustam 6610  | Max | Vendor to confirm |  |  |  |
| 1.2.2 | Brazing Material - Rustam- A or equivalent<br>Brazing filler Material - LAG 2p/ LAG 5 p   |     | Vendor to confirm |  |  |  |
| 2     | <b>SPECIFICATION:</b>   |     |                   |  |  |  |
| 2.1   | <b>MACHINE CONFIGURATION:</b>   |     |                   |  |  |  |
| 2.1.1 | The machine should have the following major components suitably interconnected. It should be a machine with - IGBT based power source, - fibre optic pyrometer, - programmable temperature controller with all controls & accessories.<br>- It should also have a Table to handle rotor during brazing.<br>- It should have power conversion efficiency of 93 %.<br>- The machine configuration will be vertical axis of table. for vertical keeping of the wound rotor.<br>- Brazing temp.of 850 °C to be reached in 10 minutes-<br>Brazing filler material –LAG2p/LAG5p- Flux – Rustam –A or equivalent |     | Vendor to Confirm |  |  |  |
| 2.1.2 | a) Transistorised Frequency Converter   |     | Vendor to Confirm |  |  |  |
| 2.1.3 | b) Compensator circuit  |     | Vendor to Confirm |  |  |  |
| 2.1.4 | c) Digital microprocessor based control system with LCD display of various parameters   |     | Vendor to Confirm |  |  |  |
| 2.1.5 | d) Water cooling System   |     | Vendor to Confirm |  |  |  |

|              |  |  |  |  |  |
|--------------|--|--|--|--|--|
| <b>2.1.6</b> | e) Fixture mounted output HHT Transformer including flexible cables                                      | Vendor to Confirm                                    |  |  |  |
| <b>2.1.7</b> | f) 4 nos. Inductors (to cover different diameter range)  | Vendor to Confirm                                    |  |  |  |
| <b>2.1.8</b> | g) The system should have auto tuning feature for maximum power transfer to the load                     | Vendor to Confirm                                    |  |  |  |
|              |  |  |  |  |  |
| <b>2.2</b>   | <b>Transistorised Frequency Converter:</b>   |  |  |  |  |
| 2.2.1        | Max output power for continuous operation - 200 kW   | Vendor to confirm                                    |  |  |  |
| 2.2.2        | Max. output power for Intermittent duty- 320 kW  | Vendor to confirm                                    |  |  |  |
| 2.2.3        | Output frequency, 10-25 kHz  | Vendor to confirm                                    |  |  |  |
| 2.2.4        | Power regulation range 10-100 %  | Vendor to confirm                                    |  |  |  |
| 2.2.5        | Efficiency 90% or better   | Vendor to Confirm                                    |  |  |  |
| 2.2.6        | Power factor: 0.9 or better  | Vendor to Specify                                    |  |  |  |
| 2.2.7        | The converter to have auto Turning features with load matching capacitors                                | Vendor to Confirm                                    |  |  |  |
| 2.2.8        | The converter shall be protected from short-circuit and no-load conditions (Details should be furnished) | Vendor to Confirm                                    |  |  |  |
| 2.2.8        | Input supply voltage   | 415 VAC +/- 10 %, 50 Hz +/- 3 %, 3 phase, no neutral |  |  |  |
| 2.2.9        | Working Height from floor  | Vendor to specify                                    |  |  |  |
| 2.2.10       | Overall Dimensions   | Vendor to specify                                    |  |  |  |

|            |  |                   |  |  |  |
|------------|--|-------------------|--|--|--|
| 2.2.11     | Overall Dimensions of the Control Cabinet  | Vendor to specify |  |  |  |
| 2.2.12     | Moulded Case Circuit Breaker and adequate protection for IGBT to be provided   | Vendor to Confirm |  |  |  |
|            |  |                   |  |  |  |
| <b>2.3</b> | <b>Controller &amp; Output Transformer :-</b>  | Vendor to confirm |  |  |  |
| 2.3.1      | Integral Solid State Digital Microprocessor based controller (Complete details should be provided)   | Vendor to Confirm |  |  |  |
| 2.3.2      | Method of Power Control in auto/manual mode.In auto mode the power to be controlled using set temprature in the controller and in manual mode through potetiometer set by the operator.      | Vendor to specify |  |  |  |
| 2.3.3      | Output power, voltage, frequency; and input voltage & current to be displayed on a LCD display unit also any fault ,alarm or interlock to be displayed on this screen..(Details to be given) | Vendor to Specify |  |  |  |
| 2.3.5      | Provision of remote control of power through a separate control desk.  | Vendor to Confirm |  |  |  |
| 2.3.7      | Protective thermal switches and inter locking to prevent operation of the power supply without adequate / normal cooling water flow. (Details should be furnished)                           | Vendor to confirm |  |  |  |
| 2.3.8      | Diagonostic features to provide visual indication of overload / abnormal operating conditions of the equipment and internal fault conditions. (Details should be furnished)                  | Vendor to confirm |  |  |  |
| 2.3.9      | Output transformer shall be light in weight (Weight of Output Transformer )  | Vendor to Specify |  |  |  |
| 2.3.10     | Water flow switch for Output Transformer & Inductor should be provided   | Vendor to confirm |  |  |  |
| 2.3.11     | Adequately rated interconnecting cable should be provided between the Frequency Converter Output and the output Transformer  | Vendor to Confirm |  |  |  |
| <b>2.4</b> | <b>Water cooling system :-</b>   |                   |  |  |  |

|            |  |                         |  |  |  |
|------------|--|-------------------------|--|--|--|
| 2.4.1      | Water Chiller Unit with hermetically sealed compressor, Heat Exchanger, Fan etc (Details of chiller unit should be furnished. Compressor shall be with non-CFC refrigerant)  | Vendor to Confirm       |  |  |  |
| 2.4.2      | Water input to chilling unit will be at ambient temp as top-up water. Return water from inductor coil will be at a higher temperature. (Complete details of the Water Cooling System should be furnished)  | Vendor to Confirm       |  |  |  |
| 2.4.3      | Cooling Capacity of Chillier: (Min 75000 Kcal/Hr)  | Vendor to confirm       |  |  |  |
| 2.4.4      | Stainless Steel water tank with High Pressure Pump for water circulation   | Vendor to Confirm       |  |  |  |
| 2.4.5      | Tank should be provided with inlet for top-up water controlled by a float switch   | Vendor to Confirm       |  |  |  |
| 2.4.6      | Cooling Water Flow   | Vendor to specify       |  |  |  |
| 2.4.7      | Cooling Water Pressure   | Vendor to specify       |  |  |  |
| 2.4.8      | Cooling Water Temperature  | 30 deg. Centigrade max. |  |  |  |
| 2.4.9      | System should be complete with instrumentation, cables, interconnecting pipes, fittings, valves etc  | Vendor to Confirm       |  |  |  |
|            |  |                         |  |  |  |
|            |  |                         |  |  |  |
|            |  |                         |  |  |  |
| <b>2.5</b> | <b>Inductor :</b>  |                         |  |  |  |
|            | Inductor should be made from copper hollow sections for circulation of cooling water inside. The design should be robust and of adequate section thickness for long life, suitable for the heavy amount of current drawn and for continuous duty application. Actual shape/ dwg to be made as per requirement after the placement of P.O. BHEL will specify a particular Job. (Vendor to provide dimensioned drawing and details subsequently for approval). | Vendor to confirm       |  |  |  |

|              |   |                   |  |  |  |  |  |
|--------------|---|-------------------|--|--|--|--|--|
| <b>2.6</b>   | <b>Construction</b>   |                   |  |  |  |  |  |
| <b>2.6.1</b> | <b>Mechanical Unit</b>  |                   |  |  |  |  |  |
|              | This consists of a fixture and a suitable table to carry out the brazing operation. The arrangement should be suitable for single shot brazing . It should have arrangement for clamping of the rotor on the table. It should have suitable arrangement for supporting the SC ring and rotor on the table.  |                   |  |  |  |  |  |
|              | All necessary clamps for doing one no of job should be provided.  |                   |  |  |  |  |  |
| <b>2.6.2</b> | <b>Temperature controller(Eurotherm make)</b>   |                   |  |  |  |  |  |
|              | The programmable temperature controller include two fibre optic sensors with optic fibre cable 2.5 metres long for feedback information about the process. One sensor monitors the temperature on the short circuit ring and regulates the output power from the frequency converter, not to exceed the preset temperature level. The second sensor monitors the temperature in the bars and will stop the process when the correct temperature is reached. By using this system, it will ensure that the temperature is correct ( no overheating in short circuit ring) and to assure good quality brazed joint.A temperature display system is to be provided. Temperature gradient should be controllable. |                   |  |  |  |  |  |
| <b>2.7</b>   | <b>ELECTRICAL SYSTEM:</b>   |                   |  |  |  |  |  |
| 2.7.1        | 415V +/- 10%, 50Hz +/-3 %, 3 Phase AC (3 wire system without Neutral) Power Supply Source will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All types of cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine/control cabinets, shall be the responsibility of vendor. Requirement of grounding/earthing should be furnished by vendor.   | Vendor to confirm |  |  |  |  |  |
| 2.7.2        | <b>Tropicalisation:</b> All electrical / electronic equipment shall be tropicalized   | Vendor to confirm |  |  |  |  |  |

|       |   |                   |  |  |  |
|-------|---|-------------------|--|--|--|
| 2.7.3 | All power & control cabinets should be dust proof   | Vendor to confirm |  |  |  |
| 2.7.4 | Vendor should ensure the proper earthing for the machine and its peripherals.   | Vendor to confirm |  |  |  |
| 2.8   | <b>SAFETY ARRANGEMENTS:</b>   |                   |  |  |  |
| 2.8.1 | Following safety features, in addition to other standard safety features should be provided on the machine:   |                   |  |  |  |
| 2.8.2 | Machine should have adequate and reliable safety interlocks / devices to avoid damage to the machine, workpiece and the operator due to the malfunctioning or mistakes. Machine functions should be continuously monitored and alarm / warning indications through lights/ alarm number with message display should be available.                       | Vendor to confirm |  |  |  |
| 2.8.3 | All the pipes, cables etc. on the machine should be well supported and protected.   | Vendor to confirm |  |  |  |
| 2.8.4 | All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations.   | Vendor to confirm |  |  |  |
| 2.8.5 | Emergency Switches at suitable locations as per International safety norms are to be provided.  | Vendor to confirm |  |  |  |
| 2.8.6 | Protective standard should be specified   | Vendor to Specify |  |  |  |
| 2.9   | <b>AMBIENT CONDITIONS &amp; THERMAL STABILITY :</b>   |                   |  |  |  |
| 2.9.1 | Total machine and all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies.<br>Power Supply:<br>Voltage: 415 V - 10%, +10%<br>Frequency: 50 Hz, +3%, - 3%<br>No. of phases = 3<br>Ambient Conditions: Temperature = 5 to 50 degree celsius<br>Relative Humidity = 95% max. | Vendor to confirm |  |  |  |

|              |   |                   |  |  |  |
|--------------|---|-------------------|--|--|--|
| <b>2.9.2</b> | Weather conditions are tropical, Atmosphere may be dust laden during some part of the year. Machine shall be kept in the normal shop floor condition. Max. temperature variation is up to 25 deg Celsius in 24 hours.<br>(Details of provisions on the machine for the same are required) | Vendor to confirm |  |  |  |
| <b>3</b>     | <b>Fluid Circulation System : Details should be Submitted by the Vendor</b>   |                   |  |  |  |
| <b>3.1</b>   | The System should be centralised. Tanks shall preferably be located at floor level  | Vendor to confirm |  |  |  |
| <b>3.2</b>   | Make: Reputed manufacturer. (Details to be submitted)   | Vendor to Specify |  |  |  |
| <b>3.3</b>   | Filtration System,  | Vendor to Specify |  |  |  |
| <b>3.4</b>   | Failure indication  | Vendor to Specify |  |  |  |
| <b>3.5</b>   | Automatic shut off provision, Details to be submitted.  | Vendor to Specify |  |  |  |
| <b>3.6</b>   | Refrigerated type cooling and electric heating (Electric heating only if required) system of sufficient capacity to maintain complete   | Vendor to Specify |  |  |  |
| <b>3.7</b>   | Pump capacity ( <b>flow / pressure</b> )  | Vendor to Specify |  |  |  |
| <b>3.8</b>   | Each pump should have an independent motor. Tandem pumps should not be used   | Vendor to Specify |  |  |  |
| <b>3.9</b>   | <b>First filling of all required Oils &amp; Grease etc.</b> , to be supplied by vendor. Indigenous (Indian) source or Indian equivalent and   | Vendor to confirm |  |  |  |
| <b>4</b>     | <b>SPARES:</b>  |                   |  |  |  |



|            |   |                   |  |  |  |
|------------|---|-------------------|--|--|--|
| <b>4.1</b> | A list of recommended spares for 2 years normal working to be quoted with relevant details. Itemised breakup of electrical spares, chilling unit spares, spare dust filters, and electronic spares including control boards, displays etc and spares for hydraulic/ fluid circulation items to be used on the machine in sufficient quantity for 2 years of trouble free operation on three shifts continuous running basis should be offered by vendor.<br>(Unit Price of each item of spare should be offered in the price bid) | Vendor to Specify |  |  |  |
| <b>4.2</b> | A list of commissioning spares should be furnished  | Vendor to Specify |  |  |  |
| <b>5</b>   | <b>DOCUMENTATION :</b><br>Four sets of following documents (Hard copies) in English   | Vendor to confirm |  |  |  |
| <b>5.1</b> | Operation & Maintenance Manual  | Vendor to confirm |  |  |  |
| <b>5.2</b> | Electrical & Electronic Drawings  | Vendor to confirm |  |  |  |
| <b>5.3</b> | Manufacturing drawings for all supplied Inductors.  | Vendor to confirm |  |  |  |
| <b>5.4</b> | Catalogues, O&M Manuals of all bought out items including drawings, wherever applicable.  | Vendor to confirm |  |  |  |
| <b>5.5</b> | One additional set of all the above documentation on CD ROM, wherever possible.   | Vendor to confirm |  |  |  |
| <b>6</b>   | <b>Foundation</b>   |                   |  |  |  |
| <b>6.1</b> | Supplier to design the foundation and give the drawings for execution of the foundation. All Anchoring and levelling material should be supplied by supplier.   | Vendor to confirm |  |  |  |

|             |   |  |  |  |                   |  |  |
|-------------|---|--|--|--|-------------------|--|--|
| <b>7</b>    | <b>TRAINING:</b>  |  |  |  |                   |  |  |
| <b>7.1</b>  | 3 days duration training should be imparted to BHEL personnel in the following areas after erection and commissioning.<br>(a) Operation of the machine including safety aspects<br>(b) Electrical, Electronic & Mechanical maintenance of the machine & accessories |  |  |  | Vendor to confirm |  |  |
| <b>8</b>    | <b>PRE-DISPATCH INSPECTION:</b>   |  |  |  |                   |  |  |
| <b>8.1</b>  | Machine shall be inspected before dispatch for workmanship, completeness and suitability of operation. One trial job shall be done at supplier's works  |  |  |  | Vendor to confirm |  |  |
| <b>9</b>    | <b>GUARANTEE:</b>   |  |  |  |                   |  |  |
| <b>9.1</b>  | The equipment should be guaranteed for a period of 12 months from date of commissioning or 18 months from the date of dispatch whichever <b>later</b> .   |  |  |  | Vendor to confirm |  |  |
| <b>10</b>   | <b>COMMISSIONING &amp; PROVEOUT:</b>  |  |  |  |                   |  |  |
| <b>10.1</b> | The equipment shall be commissioned by the vendor at BHEL works   |  |  |  | Vendor to confirm |  |  |
| <b>10.2</b> | Jobs for the proveout at BHEL works shall be provided by BHEL. Vendor shall be fully responsible for prove-out of components as well as process to the full satisfaction of BHEL.   |  |  |  | Vendor to confirm |  |  |
| <b>11</b>   | <b>PACKING:</b>   |  |  |  |                   |  |  |
| <b>11.1</b> | Sea worthy (in case of imported goods) & rigid packing for all items of complete machine, all Accessories and other supplied items to avoid any damage/loss in transit, should be provided.   |  |  |  | Vendor to confirm |  |  |
| <b>12</b>   | <b>GENERAL : The vendor should submit the following</b>   |  |  |  |                   |  |  |
| <b>12.1</b> | Machine Model   |  |  |  | Vendor to specify |  |  |

|             |  |  |                   |  |  |
|-------------|--|--|-------------------|--|--|
| <b>12.2</b> | Total connected load (KVA):  |  | Vendor to specify |  |  |
| <b>12.3</b> | Floor area required (Length, Width, Height) for complete machine & accessories   |  | Vendor to specify |  |  |
| <b>12.4</b> | Total weight of the machine  |  | Vendor to specify |  |  |
| <b>12.5</b> | Vendor to submit, along with offer, the reference list of customers where similar machines have been supplied mentioning the   |  | Vendor to specify |  |  |
| <b>12.6</b> | Detailed catalogues , photographs of the m/c and accessories should be submitted with the offer.   |  | Vendor to specify |  |  |
|             |  |  |                   |  |  |
| <b>13</b>   | <b>QUALIFYING CONDITIONS :</b>   |  |                   |  |  |
| <b>13.1</b> | Only those vendors, who have supplied and commissioned at least one 200 kW or higher rating IGBT Transistor based Induction Brazing machine for similar applications in the past ten years and such machine is presently working satisfactorily for more than one year (more than six months if supplied to BHEL) after commissioning, should quote. The following information is to be submitted by the vendor about the companies where similar machines have been supplied. This is required from all the vendors for qualification of their offer. |  | Vendor to confirm |  |  |
| <b>13.2</b> | 1. Name of the customer / company where similar machine is installed. (Copy of Purchase Order should be furnished)   |  | Vendor to confirm |  |  |
| <b>13.3</b> | 2. Complete postal address of the customer.  |  | Vendor to confirm |  |  |
| <b>13.4</b> | 3. Year of commissioning. (Copy of Commissioning Report should be furnished)   |  | Vendor to confirm |  |  |
| <b>13.5</b> | 4. Application for which the machine is supplied   |  | Vendor to confirm |  |  |
| <b>13.6</b> | 5. Name and designation of the contact person of the customer.   |  | Vendor to confirm |  |  |
| <b>13.7</b> | 6. Phone, FAX no. and email address of the contact person of the customer.   |  | Vendor to confirm |  |  |

|              |   |                   |  |  |  |
|--------------|---|-------------------|--|--|--|
| <b>13.8</b>  | 7. Performance certificate from the customers, on their letter head, regarding satisfactory performance of machine supplied to them | Vendor to confirm |  |  |  |
| <b>14</b>    | <b>Scope of Supply</b>  |                   |  |  |  |
|              | <b>Description</b>  | <b>Quantity</b>   |  |  |  |
| <b>14.1</b>  | Microprocessor controlled frequency converter with 10 m cable and 1 no. timer   | 1 No              |  |  |  |
| <b>14.2</b>  | Control Panel including temerature and pressure controls, optical sensors   | 1 No              |  |  |  |
| <b>14.3</b>  | Inductor coil   | 4 nos             |  |  |  |
| <b>14.4</b>  | HHT with proper fixturing for various adjustments   |                   |  |  |  |
| <b>14.5</b>  | Pyrometers  | 2 Nos             |  |  |  |
| <b>14.6</b>  | Machine Table suitable to carry out brazing oeration with option to carry out segmental heating                                     | 1 set             |  |  |  |
| <b>14.7</b>  | Interconnecting cables & pipes  | 1 set             |  |  |  |
| <b>14.8</b>  | Water chiller with pipes & fittings   | 1 set             |  |  |  |
| <b>14.9</b>  | Set of Fuses including high speed fuses   | 1 set             |  |  |  |
| <b>14.10</b> | Dust Filter set   | 2 sets            |  |  |  |
| <b>14.11</b> | Documents(Manuals as per pt. 5 of this spec) with circuit diagram   | 4 sets            |  |  |  |
|              |   |                   |  |  |  |