An ISO 9001 Company

# Bharat Heavy Electricals Limited

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

| **ENQUIRY**<br><br>**NOTICE INVITING TENDER** | Phone: +91 431 257 70 49<br>Fax : +91 431 252 07 19<br>Email : csguna@bheltry.co.in<br>Web : www.bhel.com |
|---|---|

| **TWO PART BID**<br><br>Tender to be submitted in two parts. | **Enquiry Number:**<br><br>**2620900234** | **Enquiry Date:**<br><br>**23.10.2009** | **Due date for submission of quotation:**<br><br>**24.11.2009** |
|---|---|---|---|

You are requested to quote the Enquiry number date and due date in all your correspondence. This is only a request for quotation and not an order.
Please note that under any circumstances both delayed offer and late offers will not be considered. Hence vendors are requested to ensure that the offer is reaching physically our office before 14.00 hrs on the Date of tender opening.

| Item | Description | Quantity |
|---|---|---|
| 10 | **Flash Butt Welding Machine** as per the technical specification, general guidelines instructions & commercial conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in) | **1 No** |

**Important points to be taken care during submission of offer**

1. **Delivery required 10 months from the date of purchase order.**
2. **Grace period of 2 months beyond the above delivery period will be considered.**
3. **Checklist to be filled and enclosed along with the offer failing which, the offer will not be considered for evaluation.**

**BHEL's General guidelines / instructions (refer MM/CE/GT/001) including bank guarantee formats and list of consortium banks, commercial terms check-list 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 "2620900234".**

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

## PART A

## QUALIFYING CRITERIA FOR THE SUPPLY OF FLASH BUTT WELDING MACHINE

## SECTION – I

The BIDDER is expected to give complete details against each clause in the table given below, with additional sheets those may be attached (giving clear reference number) to furnish and cover the requisite details / documents.

| S. No. | PARTICULARS | VENDOR's RESPONSE |
|---|---|---|
| 1 | VENDOR to provide the Profile of their Company | |
| 2 | The Bidder / Vendor (OEM) shall have a minimum of TEN Years of Continuous Experience in the field of Design, Manufacture and Supply of FLASH BUTT WELDING MACHINES. | |
| 3 | List of customers to whom FLASH BUTT WELDING MACHINES were supplied, installed and commissioned till date, highlighting the customers who are in the field of Power Utility Boilers manufacturing (of High Pressure Ratings). The sizes of machines supplied may be furnished. | |
| 4 | Details on SERVICE-AFTER-SALES Set-Up in India including the Addresses of Agents / Service Centres in India. | |
| 5 | Any Additional Data to supplement the manufacturing capability of the BIDDER for the subject equipment. | |

## SECTION – II

The BIDDER / VENDOR has to compulsorily meet the following requirements to get qualified for submitting an offer for the Flash Butt Welding Machine.

| S. No. | REQUIREMENTS | VENDOR's RESPONSE |
|---|---|---|
| **1** | Only those vendors (OEMs) should quote, who have supplied and commissioned at least ONE FLASH BUTT WELDING MACHINE of 100KVA (50% duty cycle) or more and suitable for welding a cross sectional area in steel of 1500 sq mm and above in the past Ten years (on the date of opening of Tender) and such machine should presently be working satisfactorily for more than one year after commissioning (on the date of opening of Tender),. However, if such equipment has been supplied to BHEL, then the same must be currently working satisfactorily for not less than six months (as on date of Tender Opening) from the date of commissioning and acceptance. | |
| | The vendor should submit following information where similar machine has been supplied: | |
| 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 | |
| **2** | Along with the Technical offer, the Vendor should submit the Performance certificate from the customer for the satisfactory performance of the equipment supplied as per clause 1.0 above.<br>(For obtaining the Performance certificate, a suggestive format is provided in **SECTION – IV**) | |
| **3** | Offers of only those vendors who meet the above Qualifying Criteria will be considered for further evaluation. | |
| **4** | 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. | |
| **5** | DELIVERY - The bidder shall quote the best possible delivery. However the delivery period shall not exceed 10 months from the date of Purchase Order. A grace period of 2 months in addition is provided. The additional grace period will attract loading, which is explained in the commercial terms of the enquiry.<br>The delivery period is reckoned from the date of purchase order to date of despatch from the vendor works. | |

## SECTION – III

The BIDDER / VENDOR has to comply with the following, for accepting the Technical Offer for scrutiny by the Purchaser:

| S. No. | REQUIREMENTS | VENDOR's COMPLIANCE |
|---|---|---|
| 1 | The BIDDER / VENDOR shall submit the offer in TWO PARTS-Technical **[with PART A & PART B]** & Commercial and Price Bid. | |
| 2 | The offer shall contain a comparative statement of Technical Specifications given by BHEL and the offered details submitted by the Bidder, against each clause.<br>Merely stating 'CONFIRMED' or 'COMPLIES' or 'YES' or 'NO-DEVIATION' or similar words wherever 'Vendor to Specify' details in the technical comparative statement may lead to disqualification of the Technical Offer. | |
| 3 | The Technical Offer shall be supported by product Catalogues & Data Sheets and also technical details of Bought-Out-Items with copies of Product Catalogue to the extent possible. | |
| 4 | 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 of the inclusion of all the accessories, toolings, attachments, auxiliary parts, spares, consumables, etc. with the main and basic equipment, to meet the technical specification requirements. | |
| 5 | BIDDER has to indicate the Country of Origin for the supply of equipment. | |

**SECTION – IV**

## PERFORMANCE CERTIFICATE

(On Customer's Letter Head)

1. Supplier of the machine :

2. Make & Model of the Equipment :

3. Month & Year of Commissioning :

4. Application for which machine is used :

5. Sizes of Jobs Performed in the machine
   a. Tube diameter :
   b. Tube thickness (maximum) :
   c. Tube material :

6. Performance of the Machine : Satisfactory / Good / Average / Not Satisfactory
   (Strike off whichever is not applicable)

7. After Sales Service : Satisfactory / Good / Average / Not Satisfactory

8. Any other remarks :

Date:

Signature & Seal of the Authority
Issuing the Performance Certificate

## PART B

## TECHNICAL SPECIFICATION FOR FLASH BUTT WELDING MACHINE

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| **1.0** | **APPLICATION** | a. The Flash Butt Welding Machine is to be used for the butt-welding of tube ends, which form part of the Tubular Coils [as shown in **ANNEXURE –1**] used in High Pressure Boilers.<br><br>b. The Flash Butt Welding Machine shall have a built-in system for Process Control. | |
| **2.0** | **PRODUCTIVITY** | The FBW machine is expected to produce 240 Weld Joints of Tubes with OD 38.1mm x Thick 5.3mm diameter tube of Carbon Steel Material - in a shift of eight hours. | |
| **3.0** | **JOB DETAILS** | Only Seamless Steel Tubes | |
| 3.1 | Tube Outer Diameter | 31.8mm, 38.1mm, 44.5mm, 51.0mm | |
| 3.2 | Tube Wall Thickness, mm | Thickness Range: 2.0 mm to 10.0 mm | |
| 3.3 | Tube Material | Carbon Steel : SA192, SA210A1, SA210C | |
| 3.4 | Weld Surface Area | Around 1500 sq.mm [Tube Cross-Sectional Face Area] | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| **4.0** | **MACHINE CONFIGURATION** | Machine shall have the following as the basic elements or components:<br>a. Machine Frame<br>b. Moving and Fixed Platens<br>c. Moving and Fixed Jaws with Job Holding Die Mounting Facility<br>d. Independent Hydraulic Power-Pack and Cylinders for Clamping jobs<br>e. Closed-Circuit Oil Chiller for controlling Oil Temperature in Hydraulic Power-Pack<br>f. Closed-Circuit Water Chiller for cooling Transformer Windings, Job Clamping Dies, etc.<br>g. Clamping Die Upset Mechanism<br>h. Off-Set Locking Arrangement<br>i. Job Aligning Die with Inserts<br>j. Pre-heating, Flashing & Upsetting for Weld Joining Mechanism<br>k. Operator Control Desk / HMI (HMI should be kept away from the weld flashing area)<br>l. Main Electrical Panel with Panel cooling A/C unit (with IP54 Protection).<br>m. Machine shall be TROPICALISED in basic design and construction.<br>n. Manual slag removal weld dressing tool at Weld Butt Joint<br>o. Attachments & Accessories to enhance quality and productivity.<br>p. Weld parameters data logging & recording facility. | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| **5.0** | **BUTT WELDING OPERATION** | | |
| 5.1 | Welding Process | Flash Butt - **AC** Resistance Welding | |
| 5.2 | Power Rating / Capacity | Bidder to specify the rating of the FBW Machine offered [Not lower than 100kVA@ 50% Duty Cycle] | |
| 5.3 | Power Rating Calculation | Bidder to specify the Sizing of Transformer rating for maximum cross-sectional area and provide the Calculations from which the rating is derived. | |
| 5.4 | Upset Force | Bidder to specify the design value of Upset Force for the FBW Machine offered<br>[Not lower than 12 Tonnes] | |
| 5.5 | Clamping Force | Bidder to specify the design value of Clamping Force for the FBW Machine offered<br>[Not lower than 18 Tonnes] | |
| 5.6 | Tube Clamping mechanism | Machine to have HORIZONTAL tube clamping mechanism. The clamping mechanism should be such that it should be possible to load the coil (as shown in Annexure-1) on the machine and position the joints conveniently. When one joint is complete, it should be possible to shift the coil manually on the machine bed to position the next joint for welding without having to lift the coil by crane.<br>The dimensions to be maintained for convenient working by the operator are given in Annexure-2. An indicative sketch of the clamping mechanism has to be enclosed with the offer. | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| **5.7** | **TUBE ALIGNMENT FACILITY:** | | |
| 5.7.1 | Mechanical Adjustment | Machine to have suitable mechanical adjustment in the fixed platen for aligning both the tubes to an extent of minimum 10 mm in the horizontal and vertical directions. | |
| 5.7.2 | Hand wheel arrangement | A mechanical hand wheel arrangement to be provided, conveniently positioned, in the front of the machine, for making fine adjustments, to ensure perfect alignment, perfect tube contact. | |
| 5.7.3 | Locking arrangement | A locking arrangement has to be provided for this, such that the setting does not get disturbed for the consecutive joints and also during welding operation. | |
| 5.7.4 | Graduations | Graduations to be provided on the hand wheel for making accurate movement of the fixed plated. | |
| 5.7.5 | **IMPORTANT NOTE** | The mechanism shall ensure that no operator intervention is required to adjust clamps for tube alignment in between consecutive joints upto continuous welding of 50 joints. | |
| 5.7.6 | Tolerance | The Tolerance on misalignment in tube to tube axis alignment between the two tubes shall be within ± 0.1mm after welding of 50 Joints. | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 5.8 | Tube Clamping Length | 150 mm or less. Bidder to provide the clamping length | |
| 5.9 | Tube Clamping | Only by Power Hydraulics. | |
| 5.10 | Tube Clamping Dies & Inserts | Each set consisting of a pair of Clamping dies and inserts for both leftside and rightside clamping. Bidder to specify and quote for the entire range of tube diameters mentioned under Clause 3.1<br><br>One Clamping die set to be suitable for all the three tube diameters viz. 31.8mm, 38.1mm, 44.5mm with inserts for all tube diameters –2 Sets<br><br>Second Clamping die set to be suitable for tube diameter 51mm with inserts - 2 Sets | |
| 5.11 | Tube Centre Height from the ground | **1200mm**. Bidder to specify the tube centre height. | |
| 5.12 | Weld Joint Dressing | Manual tong type slag removal tool with trimming tool inserts for all tube diameters under Clause 3.1**- 2 Nos** This is for external cleaning of flash butt-welded joint immediately after welding and/or annealing operation. Bidder to provide a sketch or catalog of the tool. The weld projection can be 3 to 4mm over the tube surface. (3 to 4mm on outer radius of the tube) | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| **5.13** | **ANNEALING OF WELDED JOINT** | | |
| 5.13.1 | Annealing of Flash Butt Welded Joint | Machine to have facility for annealing of flash butt-welded joint (post weld heat-treatment), immediately after welding as a supplementary process may be quoted as optional accessory.<br>Bidder to describe the system and process by which annealing is done. | |
| 5.13.2 | Annealing – Process Control | Bidder to specify the method and system offered for the pre-programming of annealing cycle and for the control of the annealing temperature. | |
| 5.13.3 | Temperature Indicator | One portable, hand held, non-contact, Infrared sensing type, temperature indicator with digital display and having measurement range of 20 deg C to 1000 deg C with accuracy of ±0.5 deg C. Make and Model to be specified by the bidder. | |
| **5.14** | **PARAMETERS MONITORING & DATA LOGGING** | | |
| 5.14.1 | Monitoring of Process parameters through Digital Display. | a. Facility for monitoring the four main process parameters – Secondary Voltage, Current, Platen Movement, Force – from the Machine Control Panel during the Welding Operation and display of parameters in tabular format.<br>b. Bidder to give details on the sensors & specification of associated system | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 5.14.2 | Process Control and Instrumentation | To have facility for pre-programming, feedback control and recording of<br>a. Number of Pre-Flash<br>b. Number of Pre-Heat Cycles<br>c. Flashing Length and<br>d. Upsetting Length | |
| 5.14.3 | Pre-Flashing Parameters | Bidder to indicate the means of setting of Pre-Heat Current and ON-Time [Pre-Flashing] parameters through PC / PLC based system. | |
| 5.14.4 | Flashing Control | Shall be Linear and Parabolic (depending upon the job / tube material) | |
| 5.14.5 | Upsetting Stage | To have facility for Current Cut-Off Time Control and Upsetting Torque Control | |
| 5.14.6 | Travel Speed | Independent forward and reverse speed control during preheating stage.<br>Bidder to indicate Speed Ranges | |
| 5.14.7 | Traverse Mechanism | Tube movement for pre-heating, flashing & upsetting and forward & reverse motions shall be through AC Servo Motor with Servo Drive Control or Servo Hydraulic | |

| S.No. | PARTICULARS | SPECIFICATION / DESCRIPTION | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| **5.15** | **Data Logging – Real Time Display & Recording of Process Parameters** | Machine to have the appropriate facility for Real Time Display, Recording and Retrieval of the following Process Parameters such as:<br>1. Initial die opening<br>2. Secondary voltage setting<br>3. Preheat current<br>4. Preheat on & off time<br>5. No. of Pre heat cycles<br>6. Flashing current<br>7. Flashing distance/time<br>8. Upset current<br>9. Upset current ON time<br>10. Upset force<br>11. Upset distance<br>12. Total Flashing Length<br>13. Total Upset Length<br>by means of 'state of art' REAL TIME DISPLAY on the screen and recall of previous records off the screen, at any time for reference. Bidder to specify any other parameters that can be logged | |
| 5.15.1 | Data logging system | Bidder to indicate the system used for data logging | |
| 5.15.2 | Data logging equipment | The computer shall be of latest model or Industrial PC.<br>The computer to be programmed such that it directly boots into the data logging system only without the access to other functions of the computer for protection from virus entry. The access to all the other features of the computer shall be locked with login entry only through administrator. | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| **6.0** | **ELECTRICAL AND ELECTRONIC DEVICES AND CONTROLS** | | |
| 6.1 | **INPUT POWER SUPPLY:**<br>415V with a voltage fluctuation of +/- 10%, 50HZ with a fluctuation of +/-3%, 3 Phase AC (3 wire system without neutral) power supply will be provided by BHEL at a single point near the machine, as per layout recommended by Bidder. Hence design & supply of all cables, connections, circuit breakers etc. suitably required for connecting BHEL's power supply to the machine shall be in the scope of Bidder. | Bidder to Confirm | |
| 6.2 | Bidder to specify the type and capacity of the power source with details about power transformer and associated controls. Make of the transformer to be indicated. | Bidder to Specify | |
| 6.3 | All Current carrying conductors and cables should be of copper. | Bidder to Confirm | |
| 6.4 | Primary Voltage Control | Bidder to Specify | |
| 6.5 | Transformer Secondary Voltage Tap setting to be provided on the front side of the machine such that the operator can vary the setting from the front and the secondary Voltage Digital display to be provided on the front side of the machine for easy visibility to the operator. | Bidder to Confirm. | |
| 6.6 | Ranges of Welding Current for various tubes listed under Clause 3.1 to be provided. | Bidder to Specify | |
| 6.7 | All feedback systems & field sensors, limit switches, proximity switches, pressure switches, temperature controllers, should be for heavy duty application and wired up with flexible PVC insulated screened cables running in conduits and converging to common terminal block. Terminal blocks shall be of reputed make acceptable to BHEL. | Bidder to Confirm | IKK to check |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 6.8 | External wiring from/to control panel, control desk, external motors etc shall be by means of screened multi-core cables. | Bidder to Confirm | |
| 6.9 | All field elements shall have easy accessibility for maintenance. | Bidder to Confirm | |
| 6.10 | All electrical / electronic equipment shall be tropicalized. | Bidder to Confirm. | |
| 6.11 | All electrical components in the cabinets should be mounted on DIN Rail | Bidder to Confirm. | |
| 6.12 | All electrical and electronic panels including operator's panel should be provided with fluorescent lamps for sufficient illumination and power receptacles of 220Volts, 5/15 Amp AC. All adapters /receptacles should have compatibility with Indian equivalents. | Bidder to Confirm. | |
| 6.13 | All cables moving with traversing axes should be installed in caterpillar / Drag chain. Additionally, all the cable trays required for laying of cables should be included in the offer. | Bidder to Confirm. | |
| 6.14 | Details of the protection system provided to avoid short-circuiting of secondary side of welding transformer. | Bidder to Specify | |
| 6.15 | Bidder should ensure the proper earthing for the machine and its peripherals. | Bidder to Confirm. | |
| 6.16 | All electrical & electronic control cabinets & panels should be vermin and dust proof. All Electric enclosures shall have IP 54 protection. | Bidder to Confirm. | |
| 6.17 | Motors and drives shall be of Fanuc / Siemens / Allen Bradley / ABB / Indramat / SEW or any other reputed makes acceptable to BHEL conforming to IS / IEC Standards. (Bidder should indicate make and type in the offer) | Bidder to Specify | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 6.18 | Air Conditioners with Dehumidifiers of suitable capacity to be provided for all Electrical / Electronic Panels / Cabinets including Operator's Panel considering specified ambient conditions.<br>**Make:** Rittal / Warner & Finley or any other reputed make acceptable to BHEL.<br>Detailed specifications to be submitted. | Bidder to Specify | |
| 6.19 | Control Circuit Voltage shall not exceed 24V DC. | Bidder to Confirm. | |
| 6.20 | The total tentative power requirement (including that for all the accessories and attachments) in kVA to be indicated. | Bidder to Specify | |
| 6.21 | Foot switch controls shall be provided for starting the cycle of welding. | Bidder to Confirm | |
| 6.22 | The foot switch control shall be positioned in front on the ground vertically below the joint position such that it can be operated with operator facing the joint. | Bidder to Confirm | |
| **7.0** | **PURGE GAS SYSTEM** | | |
| 7.1 | In-built facility to regulate the pressure of air / inert gas, to the required level from the input pressure (3 to 5 kg/sq.cm) for minimizing the flash inside the tube during welding. | Bidder to Confirm | |
| 7.2 | The pressure regulator/ knob with suitable pressure gauge, to be provided on front side of the machine, convenient for the operator to adjust the input pressure. | Bidder to Confirm | |
| 7.3 | Bidder to quote for 1 pair of gas connection caps for each tube diameter as mentioned under clause 3.1 | Bidder to Confirm | |
| 7.4 | An air / gas pressure switch to be provided to have an interlock with welding circuit, to avoid failure. | Bidder to Confirm | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| **8.0** | **PNEUMATICS (if any)** | | |
| 8.1 | Details of Elements forming part of the pneumatic circuitry to be provided. | Bidder to Specify | |
| 8.2 | The pneumatic operated elements of the machine shall work efficiently with BHEL compressed air supply at a pressure of 4.5 to 5 kg/cm2.<br>If higher air pressure is required for efficient operation of the machine, Bidder shall furnish the information for Air Compressor of suitable capacity. | Bidder to Confirm | |
| 8.3 | BHEL will provide compressed air at only one point near / on the machine. Bidder shall provide suitable filter-regulator-lubrication (FRL) unit at this point and in addition a hand wheel valve. | Bidder to Confirm | |
| 8.4 | Pneumatic piping should be preferably metallic except places where flexible piping is essential. All the pipes required for the same shall be included in the standard scope of the machine. | Bidder to Confirm | |
| 8.5 | Pneumatic components shall be of FESTO / NORGREN make or equivalent reputed make acceptable to BHEL. | Bidder to Specify | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| **9.0** | **HYDRAULICS** | | |
| 9.1 | Bidder to provide details on Rating / Specification and Selection of Hydraulic Power-Pack with Cylinders for application like tube clamping and other hydraulic applications in the machine. | Bidder to Furnish Details | |
| 9.2 | The System should be centralized, modular / stacked valve construction having minimum number of pipes / pipe joints and located at suitable location with easy accessibility of components for maintenance. | Bidder to Furnish Details | |
| 9.3 | Pumps, valves, accessories etc shall be of Bosch-Rexroth / Vickers or equivalent reputed make acceptable to BHEL. (Details to be submitted). The seals used in cylinders shall be of Merkel / Parker / Bushak + Shamban / Hunger / Simrit make. | Bidder to confirm & furnish details | |
| 9.4 | Each pump should have an independent motor. Tandem pumps shall be avoided. | Bidder to confirm | |
| 9.5 | Suitable filtration system should be provided with Duplex / standby filter units. It is preferable to use re-usable type of filter elements in the system. The filter unit shall be of Hydac / Parker / Rexroth or equivalent reputed make acceptable to BHEL. (Details to be submitted). | Bidder to confirm & furnish details | |
| 9.6 | The flexible hoses used in the system shall be of Gates / Aeroquip / Parker or any other reputed make acceptable to BHEL. | Bidder to specify | |
| 9.7 | Failure indication for oil level, temperature, pressure, filter clogging should be provided | Bidder to confirm & furnish details | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 9.8 | Automatic shut off provision during hose failures, chiller failure, low oil level etc. Pump unloading feature during idle running to be provided for energy conservation. Details should be submitted. | Bidder to specify | |
| 9.9 | Cooling system of sufficient capacity to maintain complete Hydraulic System at a temperature not exceeding 50 deg C irrespective of the ambient conditions. | Bidder to confirm & furnish details | |
| 9.10 | It should be possible to replace hydraulic elements like valves, manifolds etc without disturbing the associated pipelines. The positioning of hydraulic elements should allow easy maintenance | Bidder to furnish details | |
| 9.11 | Maximum Operating Pressure of hydraulic system | Bidder to specify | |
| 9.12 | Main Pump flow in lpm and Motor Power in kW | Bidder to specify | |
| 9.13 | Reservoir capacity (in litres) | Bidder to specify | |
| 9.14 | All oil pipelines shall be of seamless steel and should undergo pickling process. | Bidder to confirm | |
| 9.15 | One hand held minimess pressure gauge of suitable range with minimess hose (1.0 to 1.5m length) to be supplied along with the power pack. Check points to be provided in the system. | Bidder to confirm | |
| 9.16 | All cylinders used in the machine should have standard bore and rod sizes. The piston rod shall be hard chrome plated. | Bidder to furnish details | |
| 9.17 | The Power pack should be designed taking into account the energy efficiency (Hi-low pump system, proper unloading during idling, etc.). The motor used for pumps shall be energy efficient ones. | Bidder to furnish details | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 9.18 | All the pipe / hose end fittings shall be of standard weld nipple with O-ring seating type (DIN 3865 or equivalent). No ferrule joints are to be used in the hydraulic system. All threaded connections shall be of metric sizes | Bidder to confirm | |
| 9.19 | The oil to be used shall be of standard ISO Viscosity Grades – 32 / 46 / 68 | Bidder to specify | |
| 9.20 | The maximum pressure of the system should preferably not to exceed 310 bar | Bidder to specify | |
| 9.21 | The control voltages for all the Solenoids of the valves shall be of 24-V DC and all solenoid operated DC valves should have manual over-ride provision and light indicating solenoids. | Bidder to specify | |
| 9.22 | The pipelines to be painted with standard colours as per the colour coding accepted internationally for hydraulic systems. | Bidder to furnish details | |
| 9.23 | All hydraulic pipelines, hoses and electrical control cables to be neatly laid out with proper clamps and flexible hose conveyors wherever required. | Bidder to confirm | |
| 9.24 | Suitable leakage oil collection metallic tray to be provided wherever required. | Bidder to confirm | |
| 9.25 | All the components in the hydraulic power pack shall be provided with identification numbers, as per the hydraulic circuit and should be pasted with metallic identification number plates. | Bidder to confirm | |
| 9.26 | Hydraulic oil will be supplied by BHEL during commissioning at BHEL works.<br>Bidder to provide the oil during pre-dispatch inspection. | Bidder to confirm | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 9.27 | All the hydraulic elements in the circuitry shall have easy access during the maintenance of machine. | Bidder to Confirm | |
| **10.0** | **CHILLING UNIT:** | | |
| 10.1 | Suitable Capacity Refrigerant type Chilling Units are to be provided for the cooling of Power Transformers, Tube Clamping Dies, Hydraulic Power Pack Oil etc. Bidder to give complete Technical Details on these Chilling Units. Preferably the chilling units for Power Transformers and Tube Clamping dies may be separate from the Hydraulic Oil chilling unit. | Bidder to furnish details | |
| 10.2 | Suitable flow sensors are to be provided to have an interlock with welding circuit, to avoid failure of flow of cooling medium | Bidder to Confirm | |
| **11.0** | **LUBRICATION :** | | |
| 11.1 | Machine lubrication: Automatic centralized lubrication system with timer control and suitable metering cartridges to be supplied. | Bidder to Confirm | |
| 11.2 | First filling of Lubrication Oil to be supplied by the supplier. Indian equivalent shall be mentioned | Bidder to Confirm | |
| 11.3 | First filling of Grease should be supplied by Bidder. Indian equivalent shall be mentioned. | Bidder to Confirm | |
| 11.4 | Lubricating oil piping should be preferably metallic except places where flexible piping is essential. All the pipes required for the same shall be included in the standard scope of the machine. | Bidder to Confirm | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| **12.0** | **MACHINE SPARES:** | | |
| 12.1 | Itemized break-up of mechanical, hydraulic, electrical and electronic spares used in the machine in sufficient quantity as per recommendation of Bidder for 2 years of trouble free operation on three shifts continuous running basis shall be furnished by Bidder along with offer. The list is to include following, in addition to other recommended spares: **(Unit Price for each item of spare shall be offered)** | Bidder to confirm | |
| 12.2 | **Mechanical & Hydraulic Spares:** All types of Pumps, Valves, Pressure Switches, Transducers, Flow Switches, Filters, Seals, O-rings and Hydraulic Hoses etc. Mechanical wearing components due to linear movement and rotation etc | Bidder to confirm | |
| 12.3 | **Electrical / Electronic Spares:** All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch, Encoders, Spares for PLC I/O Card, Digital to Analogue Card, HMI, Display Unit, Servo Motors for Feed Drives, Power Module & Control Cards for Main Drive as well as Feed Drives, Field Sensors (such as Encoders, Optical Sensors, Proximity Switch, Limit Switch) etc. | Bidder to confirm | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 12.4 | All types of spares for total machine and accessories shall be available for at least ten years after supply of the machine. If machine or control is likely to become obsolete in this period, the Bidder should inform BHEL sufficiently in advance and provide drawings of parts / details of spares & suppliers to enable BHEL to procure these in advance, if required | Bidder to confirm | |
| 12.5 | Bidder to confirm that complete list of spares for machine and accessories, along with item part no / specification / type / model, and name & address of the spare supplier shall be furnished along with documentation to be supplied with the machine | Bidder to confirm | |
| **13.0** | **DOCUMENTATION:** | | |
| 13.1 | GA drawings, Machine detailed constructional drawings with dimensions, Civil Foundation layout drawings, Hydraulic / Pneumatic / Electrical / Electronic circuits with BOM, are to be submitted within 45 days from the date of ordering (in case of an order) for approval by BHEL. | Bidder to confirm | |
| 13.2 | Tooling drawings for the ordered tooling are to be submitted within 60 days from the date of placing order, for BHEL approval before manufacturing, in case of an order. | Bidder to Confirm | |

| S.No. | SPECIFICATION / DESCRIPTION | Bidder's Offer with Complete Technical Details |
|---|---|---|
| 13.3 | The following documents in English language should be supplied along with the machine:<br>**Hard Copies - 3 Sets**<br>**In CD form - 1 Set Bidder to confirm**<br><br>1. Operating manuals of Machine & its PLC System<br>2. Programming manuals of Machine<br>3. Complete PLC Programming manuals<br>4. Maintenance manuals with all drawings of machine assemblies / sub-assemblies with parts list<br>5. Electrical circuit diagrams and components with bill of materials<br>6. Hydraulic circuit diagrams and components with bill of materials<br>7. Pneumatic circuit diagrams and components with bill of materials<br>8. Maintenance & Interface manuals for Machine Control System<br>9. Preventive Maintenance check list for Electrical and Mechanical System<br>10. Manufacturing drawings for all toolings, ordered along with the machine, including Tool Holders, Spindle Mounting details, Adapters etc.<br>11. Catalogues, O&M manuals for all bought out items used in the machine.<br>12. Operating Manuals, Maintenance Manuals & Catalogues for all supplied Accessories.<br>13. Detailed specification of all rubber items / hydraulic / lubrication fittings<br>14. PLC program print-outs with comments in English<br>15. PLC program and data on CD, Flash Memory Card.<br>16. Complete back up of hard disk on GHOST CD and clear written Instructions (3 copies) to take back up and reloading of a new hard disk.<br>17. Complete list of Alarm log, Error code, error messages & remedies and on line fault diagnostics to be provided by the Bidder.<br>18. Complete list of spares for machine, along with item part no / specification / type / model and make & address of the sub-Bidder. | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 13.4 | Tooling drawings for the ordered tooling are to be submitted within 60 days from the date of placing order, for BHEL approval before manufacturing, in case of an order. | Bidder to Confirm | |
| **14.0** | **MACHINE INSPECTION & ACCEPTANCE** | | |
| **14.1** | **AT SUPPLIER'S WORKS:** | | |
| 14.1.1 | Machine shall be offered for inspection by BHEL engineers at Supplier's works | Bidder to Confirm | |
| 14.1.2 | 240 joints/ per machine/Shift of Size & specification:<br>Φ 38.1 x 5.30 mm SA 210 GR-A1 to be welded at Supplier's works as inspection trials. Tubes for inspection trials shall be supplied by BHEL.<br><br>A few tubes will be given for establishing parameters prior to inspection trials. The tubes will be certified / identified by BHEL. | Bidder to Confirm | |
| **14.1.3** | **Test Procedure for acceptance of the machine** | | |
| 14.1.3a | The weld parameters for the above size including Number of Pre Flash, Number of preheat cycles, Flashing length, Upsetting length, Purging air pressure, Moving platen forward & reverse speed shall be established by the Supplier. | Bidder to Confirm | |
| 14.1.3b | The testing of weld joints shall be carried out as per the procedure given in Annexure 2.<br>The Stress relieving (Clause 2.5 of Annexure 2) is to be done at 610 ± 10 deg C for 15 minutes in a furnace. All arrangements are to be made by the Supplier. Welding and testing shall be done in the presence of BHEL Engineers. | Bidder to Confirm | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 14.1.3c | 240 joints of the above size will be welded continuously in one shift ( 8 hours ) with the set established parameters. | Bidder to Confirm | |
| 14.1.4d | Flash removal of all joints shall be done after welding. | Bidder to Confirm | |
| 14.1.3e | All joints shall be visually inspected. | Bidder to Confirm | |
| 14.1.3f | One joint for every 30 joints welded will be taken as the testing sample for mechanical testing. Last two joints will also be taken as testing samples. Accordingly $1^{st}$, $30^{th}$, $60^{th}$, $90^{th}$, $120^{th}$, $150^{th}$, $180^{th}$, $210^{th}$, $239^{th}$, $240^{th}$ joint will be taken for mechanical testing. These Joints shall be identified by stamping. | Bidder to Confirm | |
| 14.1.3g | Welding of 240 Joints, identification of Test Joints and testing shall be done in presence of BHEL Engineers. | Bidder to Confirm | |
| 14.1.3h | All joints shall be subjected to 75% ball test. (of Nominal tube ID). | Bidder to Confirm | |
| 14.1.3i | These 10 joints shall be subjected to testing as per Annexure-2 of technical specification. The specimens for bend test shall be stress relieved at 610 ± 10°C for 15 minutes in a furnace. Acceptance of macro and bend tests is specified in relevant clause of Annexure-2. All requirements for heat treatment and testing to be arranged by the supplier. | Bidder to Confirm | |
| 14.1.3j | The four main process parameters Voltage, Current, Platen movement & Force recorded in the machine monitoring system for 10 consecutive joints shall not deviate by 10 %. | Bidder to Confirm | |
| 14.1.3k | All the parameters during welding of 240 joints shall be logged through the data logger. | Bidder to Confirm | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 14.1.3l | Acceptance of the machine for dispatch to BHEL will be based on satisfactory results in all of the above tests. | Bidder to Confirm | |
| 14.1.3 m | Tests shall be conducted by the supplier at their works and at their cost in the presence of BHEL Engineers. | Bidder to Confirm | |
| 14.1.3n | All welded joints are to be returned to BHEL. | Bidder to Confirm | |
| **14.2** | **AT BHEL WORKS:** | | |
| 14.2.1 | The weld parameters including Number of Pre Flash, Number of preheat cycles, Flashing length, Upsetting length, Purging air pressure, Moving platen forward & reverse speed shall be established by the Supplier at BHEL works after installation, for sizes given below:<br><br>OD 38.1mm x 5.3 mm / SA 210 GR-A1<br>OD 44.5 mm x 4.5mm / SA 210 GR-A1<br><br>The test samples will be provided by BHEL. | Bidder to Confirm | |
| 14.2.2 | WPS shall be qualified for the machine for the sizes given above as per ASME Section IX after stress relieving of weld joints at 610 ± 10 degC for 15 minutes in a furnace that is connected to a temperature recorder and has a time temperature graph. Heat treatment and testing for WPS qualification shall be done by BHEL. | Bidder to Confirm | |
| 14.2.3 | 240 joints/ per machine/Shift (8 Hours) of OD 38.1mm x 5.30 mm - SA 210 GR-A1 to be welded at BHEL works with the established parameters as above and productivity has to be proved out for TWO continuous shifts.<br>Tubes for productivity trials shall be supplied by BHEL. | Bidder to Confirm | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 14.2.4 | The four main process parameters Voltage, Current, Platen movement & Force recorded in the machine monitoring system for 10 consecutive joints shall not deviate by 10 %. | Bidder to Confirm | |
| 14.2.5 | All the parameters during welding of 240 joints shall be logged through the data logger in two shifts. | Bidder to Confirm | |
| 14.2.6 | Acceptance & Commissioning of the machine BHEL will be based on satisfactory results in all of the above tests. | Bidder to Confirm | |
| **15.0** | **TRAINING:** | | |
| 15.1 | The supplier shall train TWO BHEL Engineers in Operation and Maintenance (Mechanical, Electrical/ Electronics and Programming) of the Machine for FIVE working days at supplier's works after the pre-dispatch inspection. | Bidder to confirm | |
| 15.2 | Bidder to clearly mention whether the training is offered free of cost or chargeable.<br>If chargeable, the Bidder has to quote on manday basis. | Bidder to Specify | |
| 15.3 | Travel charges, board & lodging for the BHEL Engineers who will be visiting supplier's works for pre-dispatch inspection and training, shall be borne by BHEL. | Bidder to note | |
| 15.4 | The Supplier shall impart training to BHEL's Machine Operators and Maintenance crew in Operation and Maintenance (Mechanical, Electrical/ Electronics and PLC based control System) during commissioning of the Machine at BHEL works for 10 working days. | Bidder to confirm | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 15.5 | The training shall include specialized coaching in<br>i) Safety<br>ii) Operation of the machine<br>iii) PC based System & Operation,<br>iv) Trouble-Shooting,<br>v) Software Application<br>vi) All special features of the machine<br>vii) Electrical / Mechanical / Electronics systems | Bidder to Confirm | |
| 15.6 | Competent, English speaking experts shall be arranged by the Bidder during training for satisfactory & effective training of BHEL personnel | Bidder to Confirm | |
| **16.0** | **MACHINE FOUNDATION:** | | |
| 16.1 | Bidder shall submit the preliminary layout drawing for getting BHEL's approval within one month from the date of Letter of Intent (LOI). Complete details like static and dynamic loads etc required for foundation design shall be submitted by the Bidder within three months after getting BHEL's approval. | Bidder to confirm | |
| 16.2 | BHEL shall design and construct complete foundation for the machine as per the Bidder's recommendation | Bidder to confirm | |
| **17.0** | **MACHINE LEVELLING & ANCHORING SYSTEM** | | |
| 17.1 | Complete anchoring system including foundation bolts, anchoring materials, fixators, levelling shoes etc should be supplied | Bidder to specify | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| **18.0** | **ERECTION & COMMISSIONING** | | |
| 18.1 | Supplier to take full responsibility for Supervision of the erection and for start up, testing and commissioning of machine, its controls and accessories. Supplier shall send suitable qualified Engineers for supervision of Erection and Commissioning of the machine at BHEL works. | Bidder to Confirm | |
| 18.2 | Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by Bidder in their foundation/layout drawings. Other requirements like crane and helping personnel shall also be provided by BHEL. | Bidder to Confirm | |
| 18.3 | Successful proving of BHEL components by the Bidder shall be considered as part of commissioning. All tests, as mentioned (Machine Acceptance) shall form part of the commissioning activity. | Bidder to Confirm | |
| 18.4 | Commissioning spares, required for commissioning of the machine shall be supplied free of cost | Bidder to Confirm | |
| 18.5 | Test Mandrels, Instruments and other necessary equipment, to carry out all above activities should be brought by the Bidder. | Bidder to confirm | |
| 18.6 | Portion, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection should be repainted and merged with the original surrounding paint by the Bidder. For this purpose, the Bidder should supply sufficient quantity of touch-up paint of various colours of paint used. | Bidder to Confirm | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 18.7 | General schedule of Erection and Commissioning shall be submitted with the offer. | Bidder to Confirm | |
| 18.8 | Charges, duration, terms & conditions for E&C should be furnished in detail separately by Bidder along with offer. | Bidder to Confirm | |
| 18.9 | Portion, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection should be repainted and merged with the original surrounding paint by the Bidder. For this purpose, the Bidder shall supply sufficient quantity of touch-up paint of various colours of paint used. | Bidder to confirm | |
| 18.10 | The Bidder shall bring special tools and equipment required for erection of the machine. Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc. for operation and maintenance of the machine should be supplied. List of such tools should be submitted with offer | Bidder to confirm | |
| **19.0** | **IN-BUILT SAFETY ARRANGEMENTS** | | |
| 19.1 | Following safety features in addition to other standard safety features should be provided on the machine: | Bidder to confirm | |
| 19.2 | A detailed list of all alarms / indications provided on machine should be submitted by the Bidder. | Bidder to specify | |
| 19.3 | All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hindrance to machine operator's movement for effective use of machine. | Bidder to Confirm | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 19.4 | Machine should have adequate and reliable safety interlocks / devices to avoid damage to the machine, work piece and the operator due to the malfunctioning or mistakes. | Bidder to specify | |
| 19.5 | Machine functions should be continuously monitored and alarm / warning indications through lights/ alarm number with messages (on the display and operator panels) should be available. | Bidder to Confirm | |
| 19.6 | All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations and suitably guarded. | Bidder to Confirm | |
| 19.7 | Emergency Switches should be provided at suitable locations as per International Norms. | Bidder to Confirm | |
| 19.8 | All lubricated parts like Bed, guide ways shall have provision for collecting the used Lubrication oil from machine guide ways and preventing them from spilling over on to the ground. | Bidder to Confirm | |
| **20.0** | **THERMAL STABILITY FOR AMBIENT CONDITIONS & ENVIRONMENTAL PERFORMANCE OF THE MACHINE:** | | |
| 20.1 | The machine shall be suitable for an ambient temperature of +45 deg C and relative humidity of 90 % respectively, but both do not occur simultaneously. | Bidder to confirm | |
| 20.2 | The Bidder should ensure trouble free operation of the machine with Thermal Stability of the complete machine and accuracy requirements of BHEL components, keeping in view of ambient conditions as mentioned above. | Bidder to confirm | |

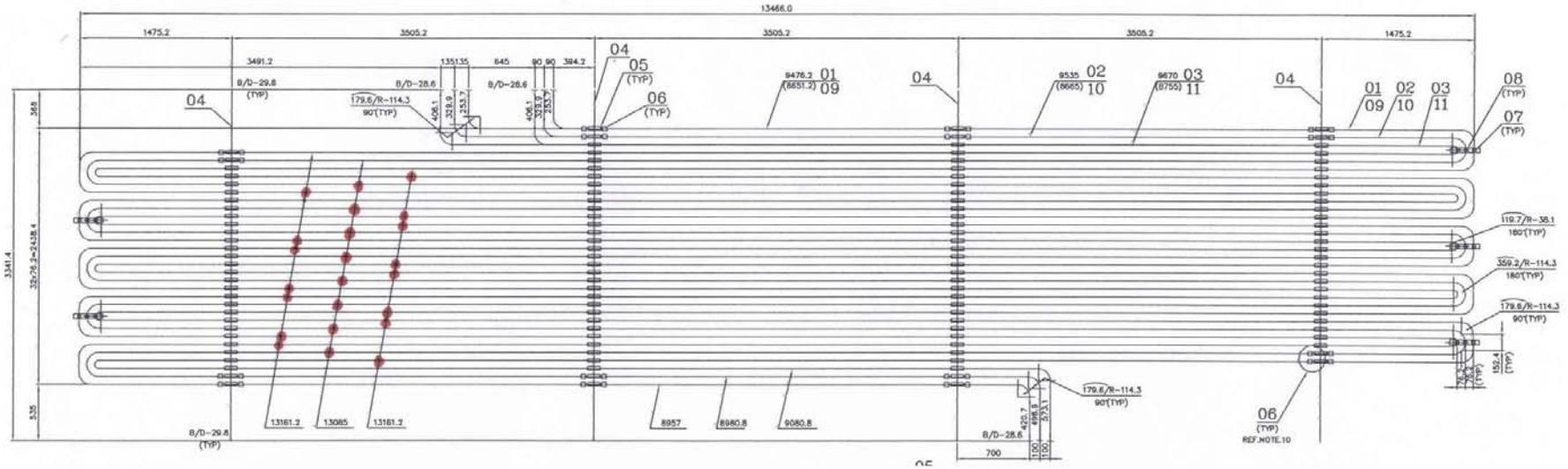
| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| 20.3 | The machine, including attachments and accessories, should be suitable for 24 hrs. Continuous operation to its full capacity for 24 hour a day and 7 days a week throughout the year. | Bidder to Confirm | |
| 20.4 | If any safety / environmental protection enclosure is required it shall be built in the machine by the Bidder. | Bidder to confirm | |
| 20.5 | Paint of the machine should be oil / coolant resistant and should not peel off | Bidder to confirm | |
| 20.6 | The Machine should conform to following factors related to environment:<br>Maximum noise level shall be 85 dB(A) at normal load condition, 1meter away from the machine with correction factor for back ground noise. This will be measured as per international standards like DIN 45635-16. Supplier to demonstrate compliance to noise level, if asked for. | Bidder to Confirm | |
| **21.0** | **PAINTING:** | | |
| 21.1 | Painting of Machine / Electrical Panels:<br><br>a. One coat of Primer<br>b. Two coats of Polyurethane Paint<br>**c. Colour - RAL-6011 (Reseda Green)** | Bidder to Confirm | |
| **22.0** | **GUARANTEE:** | | |
| 22.1 | Performance Guarantee to be given for 12 months from the date of commissioning OR 18 months from the date of dispatch whichever is earlier. | Bidder to confirm | |

| S.No. | SPECIFICATION / DESCRIPTION | | Bidder's Offer with Complete Technical Details |
|---|---|---|---|
| **23.0** | **MACHINE PACKING:** | | |
| 23.1 | Sea worthy & rigid packing for all items of complete machine, PLC System, Data logger system, all accessories and other supplied items to avoid any damage/loss in transit. When machine is dispatched in containers, all small loose items shall be suitably packed in boxes | Bidder to confirm | |
| **24.0** | **GENERAL:** | | |
| 24.1 | Machine Model No. | Bidder to specify | |
| 24.2 | Total connected load (KVA): | Bidder to specify | |
| 24.3 | Floor area required (Length, Width, Height) for complete machine & accessories | Bidder to specify | |
| 24.4 | Total weight of the machine | Bidder to specify | |
| 24.5 | The machine configuration and element arrangement should have easy accessibility, high rigidity, and good maintainability | Bidder to confirm | |
| **25.0** | **The Technical Offer shall contain the following :**<br>a) Point by Point confirmation / details wherever called for to be provided.<br>b) Complete Scope of Supply, including Main Equipment, All Accessories and Attachments, etc.<br>c) List of Operating Spares<br>d) Anchoring Materials<br>e) Performance Prove-Out Details.<br>f) Complete description of all systems & sub-systems forming part of the FBW Machine.<br>g) A General Arrangement drawing showing the layout of the machine & associated systems with salient dimensions. The drawing should be clear and legible. | | |

**ENCLOSURES : 1) ANNEXURE – 1 : TYPICAL COIL WELDED IN FLASH BUTT WELDING MACHINE**
**2) ANNEXURE – 2 : TESTING OF FLASH BUTT WELDS**

# COIL WELDING IN FLASH BUTT WELDING STATION

**ANNEXURE - I**




● POSTION OF FLASH BUTT WELDS

**TYPICAL COIL CONFIGURATION**

**Sketch No. CABS-3-06-01**

**BHEL, Tiruchirappalli**

BHARAT HEAVY ELECTRICALS LIMITED

TIRUCHIRAPPALLI 620014

**ANNEXURE - 2**

# TESTING OF FLASH BUTT WELDS

## 1.0 SCOPE

1.1 This procedure details out the requirements for selection, testing and acceptance of FLASH BUTT welded joints (For pre-production qualification).

## 2.0 SELECTION

2.1 Three Test welds/shift (one each at the beginning, middle and end) shall be taken up for testing.

2.1.1 When production shifts are consecutive, a test at the end of the shift can be considered as the test for the beginning of the next shift.

2.2 The entire circumference of each test weld shall be cut along the axis of the tube into an even number of strips of sufficient length. The width of the strips shall be maintained as below:

Width (minimum) = t + D/4 for tube OD 51 mm & below and t + D/8 for tube OD greater than 51 mm, where "t" is the tube wall thickness and D is the outside diameter of the tube.

Width (maximum) = 38 mm

2.3 One edge of one strip from each test weld shall be polished to a 600 grit finish with the final grinding parallel to the long axis of the strip. The polished surface shall be macro examined at 5X magnification. No incomplete fusion or other open flaws on the polished surface are acceptable. Defects occuring on the base metal not associated with the weld may be ignored.

2.4 Half of the strips from each test weld shall be prepared as Root bend specimens and the remaining half shall be prepared as face bend specimens.

2.5 The bend specimen shall be subjected to the recommended Post Weld Heat Treatment (Stress relieving).

2.6 The specimen shall be dressed flush on both sides, corners rounded smoothly and visually examined for complete fusion and absence of other open flaws.

## 3.0 TESTING AND ACCEPTANCE

3.1 The specimen shall be bent through 180 degrees over a former having diameter as given below:

| Material Specification | Former Diameter |
|---|---|
| SA 192, SA 210 GR- A1 | 4 times Tube Wall Thickness |
| SA 210 GR – C | 6 times Tube Wall thickness |

3.2 In the event of any change in the tube size, weld parameters/machine settings or welding operator during the shift, new specimens will be selected as explained in Cl. 2.0.

3.3 The test welds shall be considered acceptable if the sum of lengths of linear indications (voids, lack of adhesion, flat spots or cold shuts) revealed in bend test of the individual strips do not exceed 5% of sum of weld lengths tested.

3.4 Failure in the HAZ is not acceptable.

3.5 Non-metallic inclusions larger than 1.5 mm in length or diameter are not acceptable.