



Bharat Heavy Electricals Limited

(High Pressure Boiler Plant)

Tiruchirappalli – 620014, TAMIL NADU, INDIA

CAPITAL PURCHASE / MATERIALS MANAGEMENT / MANUFACTURING

An ISO 9001
Company

ENQUIRY	Phone: +91 431 257 79 38 Fax : +91 431 252 07 19 Email : tvenkat@bheltry.co.in Web : www.bhel.com
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	Enquiry Number: 2620700036	Enquiry Date: 23.07.2007	Due date for submission of quotation: 10.09.2007
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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 Schedule
10	Flash Butt Welding Machine with Process Monitoring Facility for Coil formation as per the technical specification & commercial conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)	2 Nos.	30.04.2008

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 “2620700036”.

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 Manager / Capital Purchase / MM / Manufacturing
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PART A**SECTION – I: QUALIFYING CRITERIA**

The BIDDER / VENDOR (OEM) has to meet the following requirements to get qualified for submitting an offer for **FLASH BUTT WELDING MACHINE**.

S. No.	REQUIREMENTS	VENDOR's COMMENTS
1	The Bidder / Vendor (OEM) shall have a minimum of FIVE Years of Continuous Experience in the field of Design, Manufacture and Supply of FLASH BUTT WELDING MACHINE	
2	Only those vendors (OEMs) should quote, who have supplied and commissioned at least ONE FLASH BUTT WELDING MACHINE of 150KVA (50% duty cycle) or above 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 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.	
2.1	Performance certificate from the customers regarding satisfactory performance of such equipment supplied to them in attached format should to be enclosed along with technical offer.	
2.2	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 – II

The BIDDER/ VENDOR (OEM) is requested to furnish the following information:

S. No.	PARTICULARS	VENDOR's RESPONSE
3	Profile of the Company bringing-out the years of Experience of the BIDDER in the field of design, manufacture and supply of 'FLASH BUTT WELDING STATIONS'	
4	Number of 'FLASH BUTT WELDING STATIONS' supplied, installed and commissioned till date (with details on equipment type / model, configuration, customer and quantity)	
5	Details on International Standards / Design Process Codes followed in Design and Manufacture of the Equipment.	
6	Details on SERVICE-AFTER-SALES Set-Up in India including the Addresses of Agents / Service Centers in India. Competency & Experience of the Local Service Agency are to be provided.	
7	Any Additional Data to supplement the manufacturing capability of the BIDDER for the subject equipment.	

SECTION – III

The BIDDER/ VENDOR (OEM) to note the following:

S.No.	REQUIREMENTS	VENDOR's COMPLIANCE
8	The BIDDER / VENDOR (OEM) shall submit the offer in TWO PARTS -Technical [with PART A & PART B] & Commercial and Price Bid.	
9	The Technical Offer shall be supported by Product Catalogues & description.	
10	The Offer shall contain a comparative statement of Technical Specifications given by BHEL and the Offer Details submitted by the Bidder, against each clause. A mere 'CONFIRMED' or 'COMPLIES' or 'YES' or 'NO-DEVIATION' or similar words in the technical comparative statement against clauses where details have been sought may lead to disqualification of the Technical Offer.	
11	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.	
12	BIDDER / VENDOR (OEM) has to indicate the Country of Origin for the supply of equipment.	

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 :

- 5. Jobs Performed in the machine :

- 6. Capacity (KVA @ 50% duty cycle):

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

- 7. Any other remarks:

Date:

Signature & Seal of the Authority
Issuing the Performance Certificate

PART B**TECHNICAL SPECIFICATION FOR FLASH BUTT WELDING STATION**

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] coming in High Pressure Boilers. b. The FBW Machine shall have a built-in system for Process Control.	
2.0	PRODUCTIVITY	The FBW machine is expected to have a production capacity of 200 Weld Joints (for 44.5 mm 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, mm	31.8, 38.1, 44.5, 51.0, 54.0, 57.0, 60.3, 63.5mm	
3.2	Tube Wall Thickness, mm	Thickness Range: 2.0 mm to 10.0 mm	
3.3	Tube Material	a. Carbon Steel: SA192, SA210A1, SA210C b. Alloy Steel: SA209T1, SA213T11, SA213T22	
3.4	Weld Surface Area	Around 2200 sq. mm. [Tube Cross-Sectional Face Area]	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
4.0	MACHINE CONFIGURATION	<p>Machine shall have the following as the basic elements or components:</p> <ul style="list-style-type: none"> a. Machine Frame b. Moving and Fixed Platens c. Moving and Fixed Jaws with Job Holding Die Mounting Facility d. Independent Hydraulic Power-Pack and Cylinders for Clamping jobs e. Closed-Circuit Oil Chiller for controlling Oil Temperature in Hydraulic Power-Pack f. Closed-Circuit Water Chiller for cooling Transformer Windings, Job Clamping Dies, etc. g. Clamping Die Upset Mechanism h. Off-Set Locking Arrangement i. Job Aligning Die with Inserts j. Manual slag removal weld dressing tool at Weld Butt Joint k. Pre-heating, Flashing & Upsetting for Weld Joining Mechanism l. Operator Control Desk / HMI (HMI should be kept away from the weld flashing area) m. Main Electrical Panel with Panel cooling A/C unit (with IP54 Protection). n. Machine shall be TROPICALISED in basic design and construction. o. Attachments & Accessories to enhance quality and productivity. 	

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 150 kVA @ 50% Duty Cycle]	
5.3	Upset Force	Bidder to specify the design value of Upset Force for the FBW Machine offered [Not lower than 12 Tonnes]	
5.4	Clamping Force	Bidder to specify the design value of Clamping Force for the FBW Machine offered [Not lower than 18 Tonnes]	
5.5	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-I) 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 to carryout the above operation. An indicative sketch of the clamping mechanism has to be enclosed with the offer.	
5.6	Tube Alignment Facility	Machine to have suitable mechanical adjustment in the fixed platen for aligning both the tubes prior to butt welding, to an extent of minimum 10 mm in the horizontal and vertical directions	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
5.7	Tube Clamping & Alignment	To have provision for vertical and horizontal movement to suit off-set setting and then locking to ensure a perfect tube contact, right weld joint alignment for welding and to avoid disturbance during the welding operation. Joystick control to be provided for aligning the tubes.	
5.8	Tube Clamping Length	Bidder to Specify the minimum Tube Clamping Length [BHEL desires to have a maximum of 150 mm only for clamping]	
5.9	Tube Clamping Means	Only by Power Hydraulics.	
5.10	Tube Clamping Dies & Inserts	Tube Clamping Dies / Inserts - 2 Sets (Each set consisting of a pair of Clamping dies and inserts for both leftside and rightside clamping) Vendor to specify and quote for the entire range of tube diameters mentioned under Clause 3.1	
5.11	Weld Joint Dressing	Manual tong type slag removal tool for external cleaning of flash butt-welded joint immediately after welding and/or annealing operation. Vendor 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) Trimming tool inserts may be quoted for all tube diameters mentioned under Clause 3.1	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
6.0	ELECTRICAL AND ELECTRONIC DEVICES AND CONTROLS		
6.1	Power Source	Bidder to specify the type and capacity of the powersource with details about power transformer and associated controls	
6.2	Primary Voltage Control	Vendor to specify	
6.3	Current Range	Bidder to indicate Welding Current ranges for various tubes listed under Clause SI. No. 3.0	
6.4	Process Control and Instrumentation	To have facility for pre-programming, feedback control and recording of a. Number of Pre-Flash b. Number of Pre-Heat Cycles c. Flashing Length and d. Upsetting Length	
6.5	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.	
6.6	Flashing Control	Shall be Linear and Parabolic (depending upon the job / tube material)	
6.7	Upsetting Stage	To have facility for Current Cut-Off Time Control and Upsetting Torque Control	
6.8	Travel Speed	Independent forward and reverse speed control during preheating stage. Bidder to indicate Speed Ranges	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
6.9	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	
6.10	Electric Motors	All Electric Motors shall be of any of the following makes: SIEMENS / ABB / makes conforming to IEC Standards	
6.11	Monitoring of Process parameters	<p>a. Facility for monitoring the four main process parameters - Voltage, Current, Platen Movement, Force - from the Machine Control Panel during the Welding Operation and display of parameters in tabular format.</p> <p>b. Bidder to give details on the sensors & specification of associated system</p>	
6.12	Display & Recording of Process Parameters	<p>Machine to have the appropriate facility for Real Time Display, Recording and Retrieval of the following Process Parameters such as:</p> <ol style="list-style-type: none"> 1) Total Weld Time 2) Maximum Upset Force 3) Stroke for Maximum Upset Force 4) Total Pre-Heat Time 5) Total Flash Time 6) Number of Short-Circuit Flash 7) Stroke for First Contact 	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
6.12 Contd.	Display & Recording of Process Parameters	8) Pre-Heat Distance Measurement 9) Mean Current during Flashing 10) Mean Force during Pre-Heating 11) Maximum Pre-Heating 12) Mean Current for Pre-Heating 13) Total Pre-Flash Time 14) Total Flashing Length 15) Total Upset Length, etc. 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.	
6.13	Short Circuit Protection	Bidder to furnish details on the protection system provided to avoid short-circuiting of secondary side of welding transformer.	
6.14	Electrical Power Input	a. The electrical power input shall be 415V with voltage fluctuation of $\pm 10\%$ and 50Hz with fluctuation of $\pm 2\%$, Three Phase AC supply through a Three Wire System (4 th Wire for Protective Earthing). No neutral conductor. b. BHEL will provide this supply at one point only and the supplier has to take care of all other electrical distribution network required for the FBW Station.	
6.15	Control Voltage	Control Circuit Voltage shall not exceed 110 V.	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
6.16	Power Requirement	Bidder has to indicate the total tentative power requirement (including that for all the accessories and attachments) in kVA with the offer.	
6.17	Foot Switch controls	Foot switch controls shall be provided for starting the cycle of welding.	
7.0	OPTIONAL ITEM		
7.1	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. Vendor to describe the system and process by which annealing is done.	
7.2	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, with an integral Time-Temperature Graph Indicator cum Recorder for the flash butt welded joint.	
8.0	MACHINE CONSTRUCTION		
8.1	Ambient Atmospheric Conditions	<p>a. The FBW Machine with all Sub-Systems shall be suitable for operation in an ambient temperature of 25 to 50°C and with a Relative Humidity of 90% (both higher values do not occur simultaneously).</p> <p>b. The entire equipment shall be TROPICALISED in Design and Construction.</p>	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
8.2	Machine Operation	The Basic Machine with all the Sub-Systems, Accessories and Attachments are to be designed for working in three shifts (8 hour shift) a day and all the 365 days in a year, with the supplier recommended preventive maintenance measures.	
8.3	Machine Maintenance	The machine configuration and element arrangement should have easy accessibility, high rigidity, and good maintainability	
8.4	Electrical Wiring	<p>a. All electrical motors, limit switches etc, on the machine shall be wired using PVC sheathed cable running in conduits and converging to common terminal block</p> <p>b. External wiring from/to control panel, control desk, external motors etc shall be by means of screened multi-core cables</p>	
8.5	Purging Gas Feeding Arrangement	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.	
8.6	Gas Connection Caps	Vendor to quote for 1 pair of gas connection caps for each tube diameter as mentioned under clause 3.1	
8.7	Interlock System for Gas Supply	An air / gas pressure switch to be provided to have an interlock with welding circuit, to avoid failure	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
8.8	Hydraulic Power Pack- Selection Criteria	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.	
8.9	Hydraulic Circuits	<ul style="list-style-type: none"> a. Hydraulics, forming part of the machine and associated equipment, shall be connected by reinforced synthetic rubber hoses of reputed makes and / or steel tubes of sufficient capacity. b. Hydraulic Circuit to originate from a common point on the Machine and provided with suitable oil filters, control valves and elements of reputed makes. c. All the hydraulic elements in the circuitry shall have easy access during the maintenance of machine. 	
8.10	Hydraulic Power Pack- Protection Controls & Make	To have suitable means and measures for Temperature Control, High & Low Pressure Control, Oil Level Sensing, etc. All the Hydraulic Pumps & Valves shall be of Vickers or Bosch-Rexroth make.	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
8.11	Chiller Unit for Cooling of Sub-Systems	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	
8.12	Interlock System for Chilling Units – Coolant Flow	Suitable flow sensors are to be provided to have an interlock with welding circuit, to avoid failure of flow of cooling medium	
8.13	Pneumatic Circuits (if any)	<ul style="list-style-type: none"> a. Purpose b. Pneumatics forming part of the machine and associated equipment shall be connected by nylon reinforced synthetic rubber and / or steel tubes. b. Pneumatic Circuit to originate from a common point on the Machine and provided with a suitable Filter / Regulator /Lubricator Unit and in addition a hand wheel valve. c. Bidder to give details on Elements forming part of the pneumatic circuitry. d. The pneumatic systems should be suitable for operation on BHEL shop air pressure of maximum 60 psi. 	
8.14	Safety Guards	FBW Machine to have Safety Hoods for protection of operator against the flashing. Bidder to submit details on this arrangement.	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
8.15	Painting	a. One coat of Primer with 25 μ of DFT (Dry Film Thickness) b. Two coats of Enamel Paint, each with 25 μ of DFT c. Colour - RAL-6011 (Reseda Green)	
9.0	MACHINE SPARES		
9.1	SPARES	Bidder has to quote for the following items with the OFFER: a. The Supplier shall LIST DOWN with the OFFER, the complete set of replaceable parts / items / components coming in the FBW Machine and other Sub-Systems / Accessories / Attachments and shall QUOTE the Unit Price for each item. b. Mechanical wearing components due to linear movement and rotation, etc. [Each 4 Nos] c. Spares for Hydraulics Power-Pack viz., 'O' rings, Sealing Rings, Hydraulic Valve 'O' rings, etc. [Each 4 Nos] d. Electrical & Electronic Items: PCB & PLC I/O Card, Digital to Analogue Card, CPU Card, HMI, Field Sensors (such as Encoders, Optical Sensors, Proximity Switch, Limit Switch), Display Unit, etc. [Each 4 Nos]	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
10.0	MACHINE DOCUMENTATION		
10.1	O & M Manuals	<ul style="list-style-type: none"> a. Three Copies of the Operation & Maintenance Manuals in English to be given in Hard Bound Paper Copies with three One copies in CD form. b. One Hard Copy of O & M Manual shall be submitted at the time of INSPECTION of the FBW Machine by BHEL Officials, at the Supplier's Works. c. The following documents and details [given under the Clause 10.2] shall form part of the Operation & Maintenance Manual 	
10.2	Documents and Technical Details	<ul style="list-style-type: none"> a. GA Drawing of the FBW Station. b. GA Drawing of Individual Mechanisms. c. Sub-Assembly Drawings (without dimensions) for sub-systems for maintenance purpose d. Electrical Wiring Drawings – Power & Control Circuits. e. Pneumatic/Hydraulic Circuit Diagram f. PLC Ladder Diagrams (Soft Copy) with Flash Memory Card. g. PLC Ladder Diagrams (Hard Copy) h. Complete Printed Circuit Board Schematics indicating check points (Test Points) for Electronic Controls i. Alarm Log, Error Code, Error Messages & Remedies and On-Line Fault Diagnostics to be provided. 	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
10.2	Documents and Technical Details	j. PLC Programming Tool: On-Line Troubleshooting, Software Modification, Upload and Down-load of Programs. k. Specifications/Ratings of Bought-Out-Items l. Guarantee for all Bought-Out-Items by Vendor m. Trouble Shooting Chart for Main and all Sub-Systems n. Machine related PC Details – Machine Operating Softwares, File Handling, Display Recording. CD Read and Write unit, Serial and USB Ports to be ensured. o. UPS is required for minimum 30 minutes back up time for PC data. p. Total weight of the Machine & Sub-Systems.	
11.0	MACHINE INSPECTION & ACCEPTANCE		
11.1	Machine Performance Testing and Acceptance	The FBW and Accessories shall be tested for its performance prove-out as per BHEL Technical Specifications, at the Supplier's Works prior to despatch. a. Welding trials have to be done with a minimum of 15 tube samples (each with Carbon Steel and Alloy Steel material) – tube sizes selected will be based on a mutually agreeable criterion. These tube joints shall also be subjected to post weld heat treatment in the machine itself. b. The sample welded joints should pass through the bend test and satisfy the requirements of BHEL QUALITY Document for TESTING OF FLASH BUTT WELDS as given in ANNEXURE-2.-	

S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
11.1 Contd.	Machine Performance Testing and Acceptance	c) Monitoring of Process Parameters by the Computer in the FBW Machine for 10 consecutive weld joints, shall not deviate by 10%	
12.0	ERECTION & COMMISSIONING		
12.1	Mechanical Erection	Erection of the Equipment will be done by BHEL under the supervision of SUPPLIER'S SERVICE ENGINEERS and as per the guidelines furnished in the Erection Manual given by the Supplier	
12.2	Machine Commissioning	Commissioning of the Equipment and Smooth Functioning of all the Sub-Systems (at BHEL Works) shall be the RESPONSIBILITY of the Supplier.	
12.3	Performance Prove-Out	After the successful commissioning of the machine and sub-systems, the Supplier's COMMISSIONING ENGINEER and the APPLICATION ENGINEER have to establish the Performance Prove –Out for the Machine's Capability and the Production Rate from the Machine, as given under the Specification Clause 2.0	
13.0	TRAINING		
		a. The Supplier shall train BHEL Engineers in the Operation, Trouble Shooting and Maintenance of the FBW Machine at the Supplier's Works for a period of 10 Working Days. Vendor to quote on Man-day basis.	

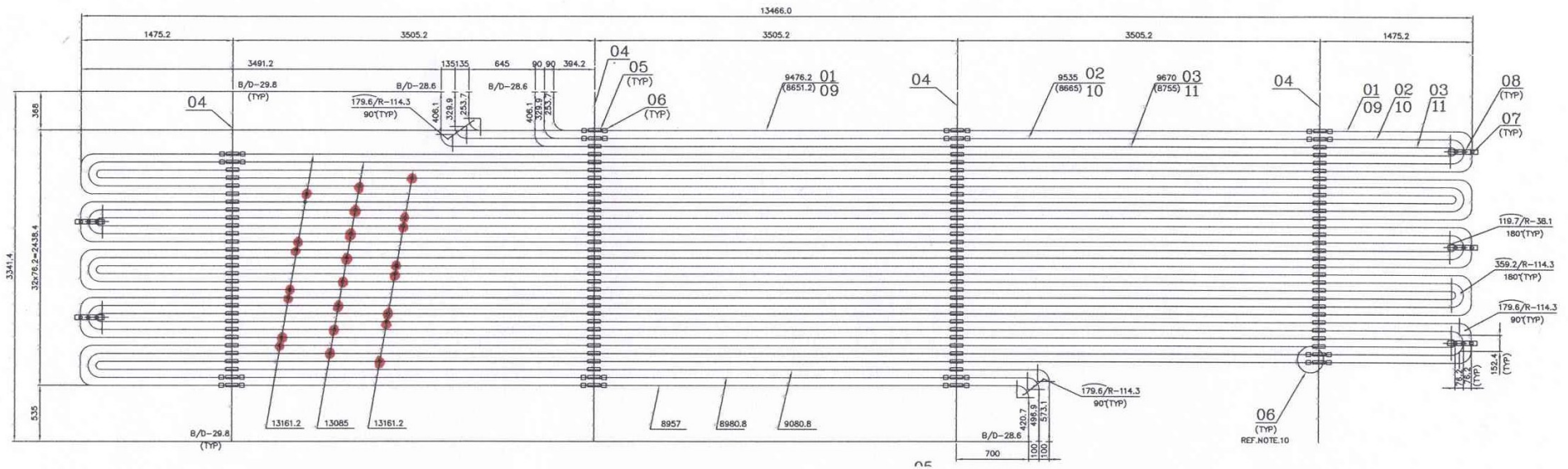
S.No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH COMPLETE TECHNICAL DETAILS
13.0 Contd.	TRAINING	b. The Supplier's Service Engineer / Application Engineer shall train BHEL Engineers in the Operation, Trouble Shooting and Maintenance of the FBW Machine at BHEL Works for a minimum period of 10 Working Days, after the SUCCESSFUL COMMISSIONING of the Equipment, at BHEL Works.	
14.0	TECHNICAL OFFER	The Technical Offer shall contain the following : a. Complete Scope of Supply, including Main Equipment, All Accessories and Attachments, etc. b. List of Operating Spares, Anchoring Materials c. Erection, Commissioning and Performance Prove-Out Details. d. Complete description of all systems & sub-systems forming part of the FBW Station e. A schematic diagram showing the layout of the machine & associated systems with salient dimensions f. The operating sequence of the machine with broad outline of various operations involved	
15.0	PERFORMANCE GUARANTEE	The Performance of the Equipment shall be guaranteed for a minimum period of twenty-four months from the date of Commissioning at BHEL Works.	

ENCLOSURE :

- 1) ANNEXURE – 1 : TYPICAL TUBULAR COIL ASSEMBLY DRAWING
- 2) ANNEXURE – 2 : BHEL QUALITY ASSURANCE DOCUMENT

COIL WELDING IN FLASH BUTT WELDING STATION

ANNEXURE - I



● POSTION OF FLASH BUTT WELDS

TYPICAL COIL CONFIGURATION

Sketch No. CABS-1-06-01

BHEL, Tiruchirappalli

ANNEXURE - 2

BHARAT HEAVY ELECTRICALS LIMITED TIRUCHIRAPPALLI

TESTING OF FLASH BUTT WELDS

0 SCOPE

- 1.1 This procedure details out the requirements for selection, testing and acceptance of FLASH BUTT welded joints.

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 occurring 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.
- 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 90 degrees over a former having diameter 3 times the tube wall thickness.

ANNEXURE - 2

- 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.

4.0 RETESTS

- 4.1 If a test weld fails to satisfy Cl. 3.3, 3.4 & 3.5, two additional test welds shall be tested.
 - 4.1.1 Production welding can be proceeded after welding the pre-production test piece with the concurrence of QC only. In case production is continued and if the pre-production test piece fails to meet the requirements, the first two welds of the product made after the welding of the test weld shall be subjected to the bend tests. If both the weld pass the tests then the lot is accepted. In case any one of the sample test weld fails, the entire lot of welds represented by the test weld shall be quarantined. The causes of the failures shall be analysed by Shop and WTC and satisfactory test results shall be obtained. The deviation from these parameters shall be analysed. The quarantined lot shall be cut and rewelded. The welding shall be continued after satisfactory results are obtained with the modified parameters.
- 4.2 If an intermittent test weld fails, 2 welds each immediately before and after the failed test weld should be taken up for testing and tested for compliance. If any test weld fails, the entire lot of welds represented by the test weld shall be cut and rewelded.

5.0 RECORDS

- 5.1 The records of pre-production tests done shall be maintained.