An ISO 9001 Company

Bharat Heavy Electricals Limited

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

ENQUIRY	Phone: +91 431 257 79 38 Fax : +91 431 252 07 19 Email : tvenkat@bheltry.co.in Web : www.bhel.com

	Enquiry Number:	**Enquiry Date:**	**Due date for submission of quotation:**
	2620800059	**11.07.2008**	**14.08.2008**
You are requested to quote the Enquiry number date and due date in all your correspondences. This is only a request for quotation and not an order			

Item	**Description**	**Quantity**	**Delivery (Item required at BHEL on)**
10	Friction Stir Welding Machine as per the technical specification & commercial conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)	1 No.	30.10.2009

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 "2620800059".

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 Equipment / MM

PART A

QUALIFYING CRITERIA FOR THE SUPPLY OF FRICTION STIR WELDING MACHINE

SECTION – I

The BIDDER / VENDOR has to compulsorily meet the following requirements to get Qualified for submitting an offer for **Friction Stir Welding machine**

S. No.	**REQUIREMENTS**	**Vendor's RESPONSE**
1	The BIDDER shall have a minimum of THREE Years of Continuous Experience in the field of Design, manufacture and supply of FRICTION STIR WELDING machines.	
2	Only those vendors, who have supplied, and commissioned at least one such machine for similar applications in the past five years (on the date of opening of Tender) and such machine is presently working satisfactorily for more than one year after commissioning (on the date of opening of Tender), should quote. However, if such machine (s) has/ had been supplied to BHEL, then such machine should be presently working satisfactorily for more than six months after its commissioning and acceptance (on the date of opening of Tender).	
2.1	The vendor should submit the following information where similar machines have been supplied, for qualification of their offer.	
2.2	Name and postal address of the customer / company where similar machine is installed.	
2.3	Name and designation of the contact person of the customer.	
2.4	Phone, FAX no. and email address of the contact person of the customer.	
2.5	Month and Year of commissioning	
2.6	Application for which the machine is supplied.	
2.7	One Performance certificate from the customers regarding satisfactory performance of machine supplied to them. The certificate should be current and on the letterhead of the Customer. It should contain information regarding model / Size of machine, year of commissioning and performance of M/c.	
3.0	BHEL reserves the right to verify the information provided by vendor. In case the information provided by vendor is found to be false/ incorrect, the offer shall be rejected.	

SECTION – I I

The BIDDER 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
4	Profile of the Company bringing-out the years of Experience of the BIDDER in the field of design, manufacture, integration and supply of **Friction Stir Welding machine**	
5	Number of **Friction Stir Welding machines** supplied, installed and commissioned till date for **similar applications** (with details on machine type / model, configuration, customer and quantity)	
6	YEAR of supply of latest, **Friction Stir Welding machine** for welding applications and the Technical Specifications of the Machine supplied [Details to be furnished]	
7	Details on the Firm's Registration and the FINANCIAL STRENGTH of the COMPANY (Balance Sheet for the last **3** years) shall be submitted with the TECHNICAL OFFER	
8	Details on International Standards / Design Process Codes followed in Design and Manufacture of the Equipment.	
9	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	
10	Any Additional Data to supplement the manufacturing capability of the BIDDER for the subject equipment	

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SECTION – III

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

S. No.	REQUIREMENTS	VENDOR's RESPONSE
11	The BIDDER / VENDOR shall submit the offer in TWO PARTS-Technical [with PART A & PART B] & Commercial and Price Bid.	
12	The Technical Offer shall be supported by Product Catalogues and description.	
13	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 [without any supporting technical write-ups, photos and datasheets] may lead to disqualification of the Technical Offer.	
14	The BIDDER / VENDOR shall assure a continuous support for the supply of SPARES and SERVICE for TEN Years, from the date of commissioning of equipment at BHEL Works.	
15	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, tooling, attachments, auxiliary parts, spares, consumables, etc. with the main and basic equipment, to meet the technical specification requirements.	
16	Soft copy if any, giving the salient features of the proposed machine with all sub-systems and auxiliaries, and /or showing live-demo of an existing and working machine of similar configuration and capacity may be provided.	
17	BIDDER has to indicate the Country of Origin for the supply of equipment.	
18	The reference List of Customers shall be accompanied with (Phone Number and E-Mail ID) of the CONTACT PERSON for cross reference by BHEL	
19	In case of preliminary qualification of the offer, on technical grounds, the BIDDER may be called for a detailed technical discussion on the original technical offer at BHEL Works, with a sufficient notice period.	

PART – B
Technical specifications of Friction Stir Welding machine

Sl. No.	PARTICULARS	SPECIFICATION DESCRIPTION	BIDDER's OFFER (WITH COMPLETE TECHNICAL DETAILS)
1,0	General description of Friction Stir welding machine and Purpose of the machine	a) Friction stir welding machine capable of making Tee joints made of aluminium and its alloys for manufacturing of Blanking Plate and Palm assembly (annexure-1) in a production unit b) Machine with precision movements of table and tool during welding. Vendor to specify the type of machine (like CNC etc.) c) Built in system for programming of welding parameters and data acquisition system for recording of process parameters d) Should have provision for using retractable pin tool and also monolithic tools for welding e) Suitable fixtures for holding the job	
1.1	Scope of supply	FSW machine with the following features a. Capability to weld with monolithic tool and retractable pin tool b. Ability to weld with and without tool tilting mode c. Job holding fixtures for welding of the complete range of products in annex-1 d. FSW tools for welding of Al & aluminum alloys of palm and plate assembly for 2 years e. Technology of welding with sequencing and without holes left in the job and full penetration of the joint f. Spares for 2 years operation g. Demo of the welding of complete product (blanking plate & palm assembly) at vendors works and BHEL, Rudrapur	

		h. Manuals i. Training of the personnel j. Parameter data acquisition system and display k. Controls for sequential programming of the welding l. Precision Movement system for guiding the job, tool setting and welding m. Remote Viewing system for welding as an optional system	
2.0	PRODUCTIVITY	The FSW machine should have adequate production capacity of 4 Palm assemblies of maximum size (Each having three palms of 25 mm thickness and blanking plate of 20 mm thickness made of aluminium plate) in a shift of eight hours	.
3.0	JOB DETAILS	a) The job to be welded is blanking plate and Palm assembly with Tee joints having the specifications indicated in the annex 1. This assembly forms a part of the busbar used for electric power transmission. b) The number of Palms per assembly may vary from one to three depending on the design requirement. c) Material to be used are aluminum & its alloys (1050 & 3003 series) up to 25 mm maximum thickness and sizes as indicated in annex 1 d) Full penetration weld for the entire cross section (E X B as per drawing in annex 1) of palm should be ensured. e) The gap between the Tee joints (palms) is 80mm minimum	
3.1	Welding technology and FSW tools	a) Vendor should specify the welding technique to be adopted for achieving the full penetration as indicated in annex – 1. b) The vendor should provide the technology including the sequence for welding and ensure that no hole is left in the job c) The technology shall ensure minimum number of start and stop during the welding. d) Vendor should suggest the type of tool to be used for welding	.

		of palm and blanking plate assembly along with retractable tool assembly and quote for the FSW tool. Vendor to give FSW tools for two years of operation. To be included in the quotation as a separate item.	
4.0	MACHINE CONFIGURATION	Machine shall have the following basic features a. Robust construction with easy access for job and tool mounting and dismantling, inspection, machine setting, welding etc b. Adequate number axis movement (X, Y, Z, tool tilt for tool setting etc) - Vendor to specify. c. Should facilitate the use of retractable pin and monolithic tools. d The machine should operate with and without tool tilting modes. f. Necessary fixtures for quick clamping & release of the components should be included for the entire range of products as per annex-1. g Operator Control Desk / HMI (HMI should be kept away from the weld area) Vendor to specify the type and location of pendent i. Main Electrical Panel with Panel cooling (with CE Marking and with IP54 Protection) j. Machine shall be TROPICALISED in basic design and construction	
5.0	**MACHINE REQUIREMENTS : Machine must have robust systems with adequate capacity to provide smooth movements in various axes with necessary interlocks for enabling good quality welds to be achieved in blanking plate in the palm assembly as given in Annex-1. Vendor should specify various types of interlocks provided in the system.**		
5.1	Movements X axis (Welding direction) a.Guidance system &	a. Vendor to specify the type (such as linear bearing guide with hardened rails ,etc.,) capacity, etc.	

	Drive b.Control mode c.Stroke d.Speed e.Force	 b. Closed loop Position control & Adaptive control for force c. To be specified by the vendor d. To be specified by the vendor e. To be specified by the vendor	
5.2	Yaxis(Lateral direction to welding) a.Guidance system and drive b.Control mode c. Stroke d. Speed e. Force	 a. Vendor to specify the type (such as linear bearing guide with hardened rails, etc.,) , capacity, etc. b Closed loop position control with adaptive control for force c. To be specified by the vendor d. To be specified by the vendor e. To be specified by the vendor	
5.3	Z axis(Tool Axis) a.Guidance system and drive b..Control mode c. Stroke d.Speed e. Force	 a. Precision linear bearing with hardened and ground rails b. Closed loop position control with adaptive control for force. c. To be specified by the vendor taking into consideration the dimensions of the spindle, tool and fixture for mounting and clamping the job d. To be specified by the vendor e. To be specified by the vendor	
5.4	Provision for tilting the tool a.Drive and locking b.Angle indicator	± 0 to 5 deg. tilt to be provided. The machine should be capable of operating in the following modes i. With tilting of tool ii. Without tilting of the tool a. To be specified by the vendor b. Vendor to specify the type	

5.5	Main spindle a. Spindle Speed b.Torque c. Power d. Tool holder configuration	a.To be specified by the vendor (Infinitely variable & in two steps) b.To be specified by the vendor c. To be specified by the vendor d. To be specified by the vendor	
5.6	Working table & envelope	a. Suitable table with necessary T slots for holding the fixture, job & test plates, b. maximum weight of the job that can be loaded, working envelope of the table. To be specified by the vendor	
6.0	**WELDING CONTROLLERS**		
6.1	Controls	a. Operator control panel and separate pendent for setting and control of parameters should be provided. The equipment shall have control features for programming of the individual axes for tool setting, welding, sequencing of operations, interlocking, troubleshooting, etc. Control system of preferably Siemens make to be used. b.The machine and welding parameters should be programmable. c. The programmed parameters and actual parameters should be displayed during welding. Vendor to specify the number of programmes that can be stored	
6.2	Display & Recording of Process Parameters	Machine to have the appropriate facility for Real Time Display, Recording and Retrieval of the following Process Parameters :- Force, Torque, Travel speed, Position	

		by means of 'state of art' REAL TIME DISPLAY on the screen and storage and retrieval of recorded data off the screen for atleast 100 sets of weld data at any time for reference. Provision for communication to PC and printing of data including tables or graphs.	
6.3	Electrical Power Input	a. The electrical power input shall be 415 ± 10 % V, 50 ± 2 % Hz, 3 Phase AC supply. b. BHEL provide this supply at one point only and the vendor has to take care of all other electrical distribution network required for the FSW Station.	
6.4	Power Requirement	Vendor has to indicate the total power requirement (including that for all the accessories and attachments) in kVA with the offer.	
7.0	**MACHINE CONSTRUCTION**		
7.1	Ambient Atmospheric Conditions	a. The FSW Machine with all Sub-Systems shall be suitable for operation in an ambient temperature of 5 to 50°C and with a Relative Humidity of 90% (both higher values do not occur simultaneously). b. The ENTIRE EQUIPMENT shall be TROPICALISED in Design and CONSTRUCTION.	
7.2	Machine Operation	The Basic Machine with all the Sub-Systems, Accessories and Attachments are to be designed for working in two shifts (8 hour shift) a day and all the 365 Days in a year, with the vendor recommended PREVENTIVE MAINTENANCNE MEASURES.	
7.3	Machine Maintenance	The machine configuration and component arrangement should have easy accessibility, higher rigidity, self-aligning /fitting, locking & piloting arrangement to ensure a 'maintenance free' concept.	
7.4	Electrical Wiring	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 b. External wiring from / to control panel, control desk, external motors etc shall be by means of screened multi-core cables	

7.5	Painting	a. The heavier machine parts are to be shot blasted for surface preparation prior to painting. b. One coat of Primer with 25 μ of DFT (Dry Film Thickness) and 48 hours of compulsory curing after painting. c. Two coats of Enamel Paint (Colour – Apple Green) each with 25 μ of DFT and intermittent curing of minimum 16 hours.	
7.6	Safety Guards	FSW Machine to have adequate Safety Guards and interlocks. Bidder to submit details on these arrangements .	
8,0	**MACHINE SPARES**		
8.1	OPERATING SPARE PARTS	The vendor shall provide a LIST of complete set of essential spare parts / items / components incorporated in the FSW Machine and other Sub-Systems / Accessories / Attachments and shall QUOTE the Unit Price for each item with the OFFER,	
9	**MACHINE INSPECTION & ACCEPTANCE**		
9.1	Machine Performance Testing and Acceptance	The FSW and Accessories shall be tested for its performance prove-out as per BHEL Specifications, at the Vendor's Works prior to dispatch. a) Satisfactory welding should be demonstrated on minimum of three assemblies each for the smallest and the biggest sizes of the assemblies - as per annexure –1. b) The sample welded joints should pass through the macro section test and satisfy the requirements of millivolt drop test where the difference between parent metal and weld metal value shall not exceed 10%. Vendor should demonstrate the full penetration welding as indicated in Sl.no. 3.0 d	
10..0	Installation & commissioning	To be carried out at BHEL, Rudhrapur , India.	
10.1	Mechanical Erection	Erection of the Equipment will be done by BHEL under the supervision of VENDOR'S SERVICE ENGINEERS and as per the guidelines furnished in the Erection Manual given by the Vendor	

10.2	Commissioning	Commissioning of the Equipment and demonstration of smooth functioning of all the Sub-Systems and their full range capabilities (at BHEL Works) shall be the RESPONSIBILITY of the Vendor.	
10.3	Performance Prove-Out	After the successful commissioning of the machine and sub-systems, the Vendor shall establish the Machine's Capability and the Production Rate from the Machine, as given under the Clause Sl.No. 2.0. Satisfactory welding should be demonstrated on minimum of three assemblies each for the smallest and the biggest sizes of the assemblies - as per annexure –1. **at BHEL. Rudrapur**	
11.0	TRAINING	a. The Vendor shall train four BHEL Engineers in the Operation, Trouble Shooting and Maintenance of the FSW Machine at the Vendor's Works for a minimum period of five Working Days, after the INSPECTION of the Equipment. b. The Vendor's Service Engineer/Application Engineer shall train BHEL personnel in the Operation, Trouble Shooting and Maintenance of the FSW Machine at BHEL Works for a minimum period of 5 Working Days, after the SUCCESSFUL COMMISSIONING of the Equipment, at BHEL Works.	
12.0	TECHNCIAL OFFER	The Technical Offer shall contain the following : a. Complete Scope of Supply, including Main Equipment, fixtures, All Accessories and Attachments, FSW and other tools etc. b. List of Operating Spares, Foundation / Anchoring details c. Erection, Commissioning and Performance Prove-Out Details. d. Complete description of all systems & sub-systems forming part of the FSW 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	
13.0	Optional items	a. Provision for remote viewing of the welding under progress to be provided through a video camera and a separate display monitor	

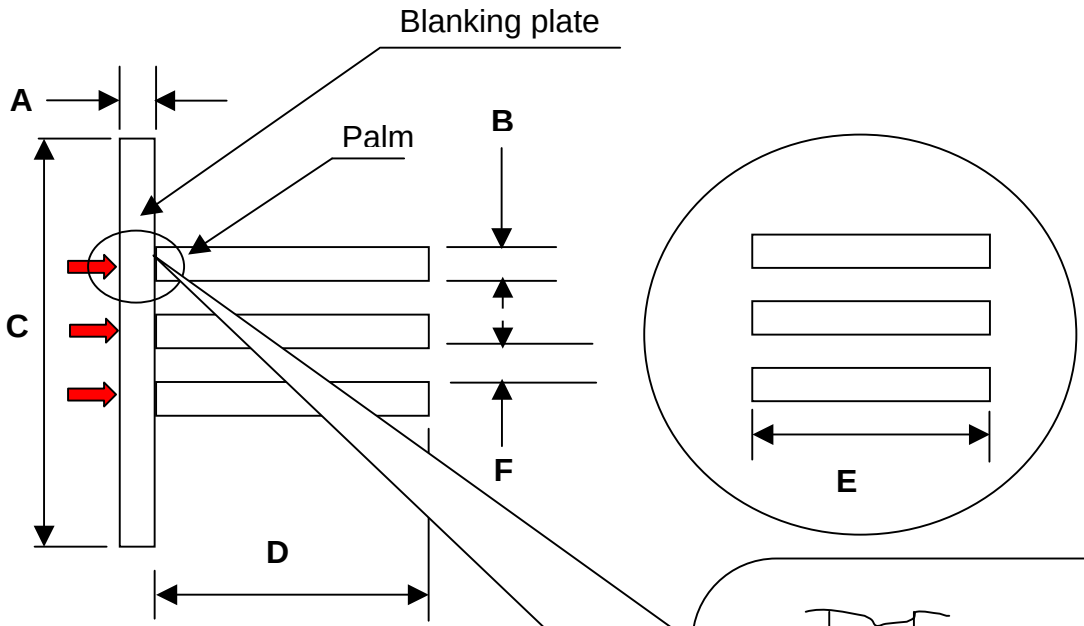
		monitor	
14.0	Documentation	Three sets of following documents (3 Hard copies) in English language should be supplied along with the machine	
14.1	Maintenance operation manual	• Operating manuals of Machine & control systems with machine specifications, detailed operating instructions for machine operation, setting of machine parameters, precautions, and machine safety details. • Programming Manuals of Machine & control system necessary drawings	
14.2	Maintenance and trouble shooting manuals	• Detailed Maintenance manual of machine with all drawings of machine assemblies/sub-assemblies/parts, Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list also • Maintenance, Interface & commissioning manuals for systems like CNC etc, spindle & feed drives • Manufacturing drawings for all supplied tool holders, adapters, sleeves, fixtures etc. • Catalogues, O&M Manuals of all bought out items including drawings, wherever applicable. • Detailed specification of all wear items and hydraulic / lube fittings • PLC program printouts with comments in English. • PLC program on CD, NC data & PLC data on CD • Complete back up of hard disk on CD and clear written Instructions to take back up and reloading of a new hard disk. • The vendor shall submit complete Master List of parts used in the machine. • One additional set of all the above documentation on CD	

14.3	Total weight of the Machine & Sub-Systems	To be specified by the vendor	
15.0	PERFORMANCE GUARANTEE	The Performance of the Total Equipment and/or the Components / Sub-Assemblies / Bought-Out-Items shall be guaranteed for a minimum period of twelve months from the date of commissioning at BHEL Works.	
16.0	Service after sales	Charges for annual service contract to be quoted as optional.	

ANNEX -1

DETAILS OF COMPONENTS FOR FRICTION STIR WELDING

BLANKING PLATE AND PALM ASSEMBLY

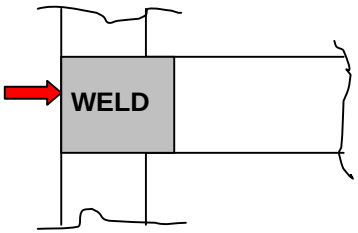


Detail		Range of value
A	=	12.7 to 20mm
B	=	20 – 25mm
C	=	Diameter 175 to 850mm
D	=	150 to 350mm (Height of the Palm)
E	=	150 to 500mm (Length of the Palm)
F	=	80mm min (Space between Palm)

The number of Palms may vary from one to three depending on the design requirement.

Indicates location of friction stir weld

Quantity = 2500 number of welds/ Year
As shown in figure X



Full penetration weld for the entire cross section (E X B) of palm

Figure X

Material specification

IS 19501 (Near equivalent AA1050)

IS 31000 (Near equivalent AA 3003)