



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 7421/7360/7833 Fax :431 257 6826 Email : vkarna@bhel.in : ajayasalkar@bhel.in : vijayak@bhel.in Web : www.bhel.com
NOTICE INVITING TENDER	

TWO PART BID	Enquiry Number:	Enquiry Date:	Due date for submission of quotation:
Tender to be submitted in two parts	2601800025	05.07.2018	30.07.2018

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.

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.

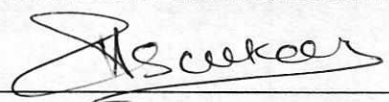
Item	Description	Qty.	(Indigenous Vendors) Matl. Will be Delivered to
10	Procurement of Laser Hybrid Welding machine For Tube To Fin Welding as per the technical specification, BHEL commercial terms & conditions applicable (to be downloaded from web site www.bhel.com and https://eprocure.gov.in)	01 No.	FOR, BHEL, Stores, High Pressure Boiler Plant, Trichirappali - 620014

Important points to be taken care during submission of offer

1. Material shall be delivered to (By indigenous vendors): As stated above.
2. By foreign vendors: CFR /CPT- Chennai Seaport / Airport
3. Delivery required 32 Weeks (Including PDI) from the date purchase order.
4. Erection & Commissioning period required 6 Weeks from the date of intimation by BHEL to vendor for deputation of their Engineers for E&C.
5. EMD for this Tender will be (INR): 2,00,000.00.
6. Compliance Forms. TRY/IMP/01 & TRY/IND/01A to be filled and enclosed along with the offer failing which, the offer will not be considered for evaluation.
7. All updates, amendments, corrigenda, etc., (if any), for each tender will be posted only on the above websites from time to time, as and when required, until each tender is opened. There will be no publication of such updates, amendments, corrigenda, etc., through newspapers or any other media.

BHEL's General guidelines / instructions (Refer MM / CE / GENL /001 – EMD) including bank guarantee formats and list of consortium banks, commercial Terms check list and Integrity Pact can be downloaded from BHEL web site <http://www.bhel.com> or from Central Public Procurement Portal website <https://eprocure.gov.in> under Enquiry reference "2601800025".

Note: this is not an E-tender, hence Vendors are requested to ensure that the offer is reaching physically at our office before 14:00 Hrs. on the date of tender opening.

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 
--	--

AJAY V. ASALKAR
Sr. MANAGER
MM / Capital Equipment
BHEL, Tiruchirappalli - 620 014

PART A**QUALIFYING CRITERIA FOR THE SUPPLY OF
'LASER/LASER HYBRID WELDING MACHINE FOR TUBE TO
FIN WELDING FOR PANEL FABRICATION'****SECTION – I**

The BIDDER is expected to give complete details against each clause in the table given below and wherever necessary, an additional sheet may be attached (giving clear reference number) to cover the required details.

S. No.	PARTICULARS	VENDOR'S RESPONSE
1.0	Number of Years of Experience of the BIDDER (Original Equipment Supplier) in the field of design, manufacture and supply of 'LASER/LASER HYBRID WELDING AUTOMATION' for R&D/Production OR Number of years of experience in the design, manufacture and supply of panel welding machine with GMAW process	
2.0	YEAR of LAUNCH of the MODEL (Laser & GMAW power source) quoted against this ENQUIRY	
3.0	Number of 'Laser/ Laser Hybrid Welding Machine' OR Number of GMAW based panel welding machine supplied, till date for continuous production	
4.0	Details on International Standards followed in Design and Testing of the System quoted	
5.0	Details on SERVICE-AFTER-SALES Set-Up in India including the Addresses of Agents / Service Centres in India, to be furnished compulsorily.	
6.0	BIDDER to indicate the Country of Origin for the supply of laser, CNC/PLC controls, welding torch, GMAW power source, Fixtures, accessories like chiller, compressor. The details to be indicated clearly.	

SECTION – II

The BIDDER has to compulsorily meet the following requirements to get qualified for submitting an offer for the 'Laser/Laser Hybrid Welding Machine for Tube to Fin Welding for Panel Fabrication'

S. No.	REQUIREMENTS	VENDOR'S COMMENTS
7.0	The BIDDER shall have a minimum of THREE Years of Continuous Experience in the Design, Manufacture & Supply of High power (≥ 5 kW) laser/laser hybrid welding system for continuous production	

LASER HYBRID WELDING SYSTEM FOR PANEL FABRICATION

	OR at least FIVE years of continuous experience in the Design, Manufacture & Supply of Panel welding machine	
8.0	The BIDDER should have supplied at least one 'Laser/laser hybrid welding machine suitable for autogenous/hybrid welding with a laser power output of 5 kW or above for continuous production to Customers in India or abroad. Details of the customers shall be provided along with the machine details and the application for which the machine is supplied. Also, indicate the number of such machines sold in India along with the details of applications. OR The bidder should have supplied at least one panel welding machine with multi torch GMAW process for welding panels with multiple tubes and fins of length 20000 mm or above with total width of 1500 mm or above. Details of the customers shall be provided along with the machine details and the application for which the machine is supplied. Also, indicate the number of such machines sold in India along with the details of applications.	
9.0	Reference of the Customer and Performance Certificate with full contact details of CONTACT PERSON, who are the End Users of the MODEL (given under Clause No.8.0) of 'Laser/laser hybrid welding machine or Panel welding machine' as applicable	
10.0	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 – III

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

S.No.	REQUIREMENTS	VENDOR's COMPLIANCE
11.0	The BIDDER shall submit the offer in TWO PARTS - Technical [with PART A & PART B] & Commercial and Price Bid.	

LASER HYBRID WELDING SYSTEM FOR PANEL FABRICATION

12.0	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 just 'CONFIRMED' or 'COMPLIES' or 'YES' or 'NO-DEVIATION' or similar words in the technical comparative statement may lead to disqualification of the Technical Offer.	
-------------	--	--

S.No.	REQUIREMENTS	VENDOR'S COMPLIANCE
13.0	The BIDDER shall assure a continuous support for SPARES and SERVICE for TEN Years, from the date of commissioning of the equipment at BHEL Works.	
14.0	The Technical Offer shall be supported by Product Catalogue and Data Sheets in ORIGINAL and complete technical details / literature on the QUOTED MODELS of Laser, GMAW power source, CNC/PLCs, Laser hybrid welding head, fin feeding mechanism, tube roller mechanism, accessories, etc.	
15.0	The Commercial Offer (given with the Technical Offer) shall contain the Scope of Supply and the Un-Priced Part of the Price-Bid, for confirmation for the scope of supply.	
16.0	Earlier performance & field experience (service support) with BHEL (if any) will be a reckoning factor for the technical qualification of the OFFER.	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
1.0	PURPOSE	Continuous laser/laser hybrid welding of Super critical / Sub Critical High Pressure Power Boiler Membrane Wall Panels formed by welding of seamless tubes with intermediate flats. The offered system shall be a special purpose machine consisting of automatic laser hybrid welding system with all the accessories and capable of doing the following: • Laser/laser hybrid welding from one side to achieve full penetration in tube to fin assembly made of exotic materials like T/91 with tube ODs 38.1 mm, 41.2 mm, 42.4 mm & 44.5 mm and fin dimensions of 12.7 (W) x 6 -8 (T) mm in single pass at a welding speed of above 2.5 m/min for every tube to fin welding in both forward and reverse direction • A system comprising of at least six welding torches capable of welding at six locations across the width of the panel with a laser power of 8 kW supplied to each torch • Mechanism to control the torches together and also independently • Necessary mechanism for fin straightening before going to the feeding mechanism • Necessary feeding mechanism to feed the tube and fin in assembled condition to the welding station • A system for tack welding multiple tube to fins before feeding to the welding station • Laser/laser hybrid welding of tube to fin assembly with multiple tubes and fins for making panels of length 24 m and width 2.4 m (max.) • Necessary preheating system (preferably induction based) for preheating the panels upto 350 °C	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
		<i>Bidder to clearly mention the design with suitable sketches/ photographs to support their concept. Bidder, if desires may visit BHEL, Trichy with prior appointment before submitting the offer for seeing the present concept of panel welding with GMAW process.</i>	
2.0	JOB SPECIFICATION		
2.1	Tube Outside Diameter	38.1mm / 41.2 mm/ 42.4 mm/ 44.5mm / 63.5 mm	
2.2	Tube Wall Thickness	2.3 mm to 10.6 mm	
2.3	Tube Material		
2.3.1	a) Carbon Steel	SA192, SA210A1, SA210C, etc.	
2.3.2	b) Alloy Steel	SA213T11, SA213T22, SA213T91, SA213T92, etc.	
2.4	Fin Material		
2.4.1	a) Carbon Steel	ASTM A 576	
2.4.2	b) Alloy Steel	ASTM A 387Gr.12, ASTM A 387Gr.22, ASTM A 387 Gr. 91, ASTM A 387 Gr. 92 etc.	
2.5	Fin Width	9 mm to 110 mm	
2.6	Fin Thickness	5 mm to 12 mm	
2.7	Fin Coil Weight	Max: 2000 kg	
2.8	Fin Coil Diameter (OD)	Min: 1000 mm / Max: 1500 mm	
2.9	Fin Coil Diameter (ID)	Min:450 mm / Max: 700 mm	
2.10	Panel Length (Welded Portion)	Minimum: 4000 mm Maximum : 25000 mm	
2.11	Panel Width	Upto 2500 mm	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
2.12	Panel Tolerances	Tolerance on Width: +0mm /- 3mm Bow: Not allowed	
	WELDING LINE		
3.0	WELDING STATION		
3.1	Type	CNC/ PLC Controlled Push-Through (moving tube) Stationary Welding Machine	
3.2	Weld Process	Laser/ Laser - GMAW Hybrid welding	
3.3	Welding Wire Diameter	0.8 - 1.2 mm Solid Wire	
3.4	Construction	Rigid Closed Frame	
3.5	Number of Torches	8 Nos of laser hybrid welding torch. Six installed in the machine and two spare	
3.6	Torch Arrangement	6 Torches for top side welding. CNC control for lateral and vertical movement of torches	
3.7	Machine Design	Machine design to ensure formation of panels without kink, bow and twist, in addition to a perfect defect-free welding.	
3.8	Panel Welding	Simultaneous Welding with six torches only from top side of the panel in both forward and reverse directions	
3.9	Selection of Torches for welding in a group	Welding with any or all 6 Torches at a time by operator selection	
3.10	Welding Speed (Variable Range)	500 to 6000 mm/min.	
3.10 a	Conveyor Speed	500 to 10000 mm/min	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
3.11	Continuous Welding without interruptions	Welding shall progress without interruptions while welding a 24 m long panel when welding with all 6 Torches simultaneously. Note: A maximum of 2 interruptions for torch cleaning purpose only are allowable	
3.12	Drive	Inverter Controlled AC Drive conveyor system	
3.13	Upper Form Roller Shafts and Lower Form Roller Shafts	Screw Rod and Locking Arrangement with Gear-Box and Motor. Suitable arrangement to vary effective height so that adjustment for different diameter of tubes is possible. Hydraulically operated pressing rollers for fins and tubes with automatic control and mechanically pre-setting provisions. Suitable arrangement to vary effective height so that adjustment for different diameter of tubes is possible. Machine shall have working/maintenance accessible area not less than 800 mm wherever required. Bidder to explain the complete construction.	
3.14	Form Rollers and Distance Rings	Shall be suitable for both tube-end and fin-end panels.	
3.15	Fin Bar Guiding Arrangement	Electrically Operated, vertically adjustable pre-set system to position fins at tube centre to suit various tube diameters. System to be rigid and sturdy. Bidder to provide details.	
3.16	Fin Bar Pressing Rolls	Automatic control with pre-setting provisions to suit various tube diameters. Bidder to provide details.	
3.17	Fin & Tube Clamping Device	Side Pressing Unit with hydraulically operated pressing rollers for fins or tubes with automatic control and mechanically pre-setting provisions.	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
3.18	Preheating System	• A suitable preheating preferably induction type for preheating the entire assembly just before feeding to the welding zone • Preheating system should be provided at both sides (in feeder and out feeder sides) • The maximum temperature shall be 350°C • Automatic external control • Bidder to specify the following for the induction preheating system ○ Output capacity in terms of kW ○ Duty cycle ○ Output frequency ○ Range of output control – preferably 0 -100% ○ Oscillator ○ Cooling method ○ Timer setting suitable for the requirement ○ Kind of protection with interlocking mechanisms to prevent over heating/ over current, etc. ○ Type of temperature control	
3.19	Arc Blow Prevention & Return Current Collecting Arrangement	Welding return current collectors (for grounding) are to be provided at suitable locations and machine frame to be constructed with separate high capacity collectors to withstand high current flow and to avoid over heating of collectors and to avoid current flow through rollers & other machine supporting systems. Current carrying capacity to be specified. Bidder to explain the arrangement for Arc Blow prevention to ensure smooth & stable arc when all torches are working.	
3.20	Service Platform over the Machine	To locate lasers (if possible), GMAW welding power sources, wire feeders, 15 kg spool coil holders, 300 kg Jumbo coil holder. Details of	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
		equipment that shall be placed above the service platform to be mentioned clearly. Hydraulic power pack, Chillers for hydraulic system and torches, etc. shall be placed near the machine conveyor floor level and shall have easy approach for maintenance. A layout showing the location of the equipment to be given along with the offer	
3.21	Tube loading rack	A separate rack to be provided for loading of tubes around 35 nos. in one partition and 35 nos. in second partition .	
3.22	Roller construction for feeding the tube and pressurizing the tubes	Sufficient number of rows of rollers across the width & length of the panel are to be arranged, (Minimum 5 set of top pressing rollers with 2 nos. of fin pressing units and 2 nos. of side pressing rollers) in order to avoid welding heat related problems of like bow / twist generation during welding and insufficient pressure related problems in the horizontal or vertical directions.	
3.23	Weld Quality	Machine Design to ensure perfect weld quality (in single stroke) without any defects like Weld Skip- Off, Off-Line, Burn- Through, Under-Cuts, Lack of Fusion or Penetration, Weld Porosity. Weld Quality inspection visually as per Annexure-I. Bidder to confirm.	
3.24	Weld Quality	Complete weld penetration across the thickness of the fin to be ensured. Bidder to confirm.	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
3.25	Machine Elements	Welding components / equipment arrangement are to be of rigid and solid design, self-guiding/holding type and user friendly to avoid welding related problems (due to fragile arrangement of wire feeders, guides & controllers, torch assembly & positioning, devices with respect to feeding rollers, etc.). The torch vertical up & down and lateral adjustment to be integrated with the seam tracker through CNC and the details to be provided by the bidder.	
4.0	WELDING EQUIPMENT		
4.1.	LASER EQUIPMENT WITH OPTICAL FIBERS		
4.1.1	Laser Equipment – 6 Nos.	Fiber coupled 8000 W disc or fiber laser with a beam quality 8 mm-mrad or better and have a minimum of two power tapping. The laser source shall be from reputed manufacturers like Trumpf or Rofin/Coherent or IPG Photonics or Laser Line only	
4.1.2.	Type	Six Disc or fiber lasers with the capability to operate in both continuous wave and pulsed mode from reputed manufacturers like Trumpf or Rofin/Coherent or IPG Photonics or Laser Line only	
4.1.3.	Power Output of each laser and Mode of Operation	8000 W in continuous wave mode. At least 8000 W peak power output in pulsed mode of operation. The option of having modulated pulsed power output will be an added advantage. All the kind of pulsed power output shall be clearly mentioned. The minimum stable operating laser power in CW and pulsed mode to be mentioned clearly	
4.1.4.	Beam Quality	The raw beam quality to be at least 8 mm-mrad or better at 8000 W power output.	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
4.1.5.	Laser Cooling System	Internal cooling system with necessary deioniser and pump module for cooling the resonator, as required	
4.1.6.	Beam Switch	Integrated beam switch with at least two channels	
4.1.7.	Optical fiber - 12 Nos.	- Compatible optical fiber to achieve a spot size of 200-300 μm with a minimum focal length of the focal lens for the laser at 200 mm. - Optical fiber shall be of sufficient length for connecting the laser and the welding head and for free movement across the width of the panels (2.4 m) - The core diameter of the optical fiber and the length of the fiber offered to be clearly mentioned - Required fiber protection sheath/cover to be provided for all the optical fibers - Required optical coupler to be supplied - Necessary leak detector for detecting any leaks in the fiber to be included - Safety interlocks in case of any fiber damage to cut off the laser power to be included - Safety features to avoid back reflections damaging the resonator to be included in the optical circuit	
4.1.8.	Shutter	Internal shutter (mechanical or digital as per the fabrication of the laser) with necessary beam dump to be included	
4.1.9.	Alignment laser	Red/green laser for optical alignment for every power tapping. Laser safety class of the alignment laser to be mentioned	
4.1.10.	Air Purging	The resonator shall have necessary air purging system with required connections, if required	
4.1.11.	Base Frame	Laser resonators shall be mounted on individual base frames (if required) with suitable Sunnex dampers to	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
		arrest vibrations. The lasers shall be having a wheel base (if possible) for easy movements • The frames shall have necessary locking arrangements for fixing the resonator • The frames shall be made of steel and painted to avoid any corrosion • The base frames, if required shall be supplied along with the machine • If no base frame required, wheel base shall be provided for resonators with necessary locking arrangement.	
4.2. PULSED GMAW POWER SOURCE WITH WIRE FEEDER – 6 Nos.			
4.2.1	Type	GMAW power source shall be IGBT or MOSFET based inverter controlled and capable of delivering constant current and pulsed current in DCEP mode. Waveform controlled deep penetration welding power source is preferable. Quoted model of the power source to be specified clearly	
4.2.2	Make	The GMAW power source shall be from reputed suppliers like Fronius or Panasonic or OTC Daihen or Kemppi or EWM or Lincoln Electric	
4.2.3	Current Rating	350 A @ 100 % duty cycle	
4.2.4	Operating range for welding current	30-400 A with stepless variation and continuously adjustable	
4.2.5	Open circuit voltage	Bidder to specify the open circuit voltage	
4.2.6	Digital control	Welding power source shall have digital control/ display/ Setting features. Type of digital control shall be clearly mentioned. Remote control should be available for easy operation.	
4.2.7	Insulation	Class 'H' or Class 'F' shall be provided to suit tropical working conditions	

SI. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
4.2.8	Machine protection	IP 23 – Degree of protection	
4.2.9	Machine cooling	The Power source shall feature a forced air cooling system that ensures adequate cooling of the components while preventing dust and metal particles from being drawn in.	
4.2.10	Functional / Elemental Design Protection/ operator safety	• Inbuilt protection for the IGBT/Power source against Thermal / Overload / Short-Circuit / Single or Two Phase Power Input Conditions. • All PCBs shall be sprayed with mould coating to prevent damage from dust and grinding particles. • Machine Design to ensure proper earthing for the machine and its peripherals. • Protection against electric shock from input supply for ensuring operator safety.	
4.2.11	Electromagnetic Interference (EMI) Suppression	• Power source shall be equipped with a suitable Filter Network connected to the input Power Line, to prevent propagation of EMI / HF noise either into or out of the Power source. • All metal enclosures and internal shields shall prevent radiated EMI.	
4.2.12	Welding Current Cable	Current cable with a suitable cross sectional area of for the intended hybrid welding application and sufficient length for connecting the power source to the welding torch	
4.2.13.	Wire Feeding System	Wire feeder for feeding wires of diameters 0.8 mm, 1.0 mm, 1.2 mm. The required rollers and liners for all the diameters, gas supply fittings, air blast fittings, coolant connections, etc. to be supplied along with machine. Bidder to specify the following • Operating voltage • Maximum wire feed rate for different wire diameters	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
		- Type & details of coolant connections - Type & details of gas fittings - Type & details of air blast fittings (if required)	
4.2.14	Welding Wire Coil Holders	Capacity to hold and feed 15 kg. Spools	
4.2.15	Welding Wire Drum Holders	Capacity to hold 300 kg. Jumbo Coil packs	
4.2.16	Torches: Wire feeder and Jumbo coil packs mounting position	Wire feeders and Jumbo coil packs for torches shall be on the Service Platform	
4.2.17	Wire feeding conduits	The wire feed conduits for feeding of the wire from the Drum Packs to wire feeder inlet shall have a suspending/support arrangement that ensures the conduits are routed in smooth curves aiding uninterrupted wire flow. Entrance nozzle area shall be provided with automatic pneumatic purge cleaning system for removal of peeled off coating from wire for preventing clogging of wire conduits	
4.3.	LASER HYBRID WELDING TORCH		
4.3.1	Laser hybrid welding torch – 8 Nos. (6 installed in the machine and 2 as spare)	Laser hybrid welding torch suiting the laser model, preferably compact type from internationally reputed suppliers like Fronius or ESAB or Cloos or Highyag or IPG or Precitec or Reis and shall meet the following The torch can work upto a laser power of upto 10 kW of laser power and MIG welding current of up to 350 A @ 100 % duty cycle	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
		• Capable of carrying out welding at high speed upto 10 m/min in both forward and reverse directions • Synchronised laser focusing with GMAW arc • The required connections for integrating with the laser, MIG power source through main control system • Provision for supply of different shielding gases like Ar/He/CO₂/N₂/O₂ • The torch shall be water cooled • Required water cooling connections with protected hoses (as necessary) for continuous operation to be provided. Details to be mentioned • Cover slides for protecting the focus lens from spatters and fumes. • Cross jet/air knife for protecting the optics from damage • Provision for feeding different type of wires of different diameters ranging from 0.8-1.2 mm. The required contact tips to be supplied with the machine. The required contact tip handling tool to be supplied along with the machine. • Suitable mechanism for trouble free feeding of filler wires • The required holding systems (pneumatic or mechanical) to fix the welding torch sturdy for continuous operation • An inline sensing system for taking care of positioning, variation in fit up, etc. to be quoted as an option • Torch cables to be provided with protective sheathing that is fire proof • Torch mounting guide to be provided for welding 2.5 m wide panel	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
		Easily mountable/detachable nozzle cup for GMAW torch	
4.3.2	Weld Torch movement and positioning	It should be possible to move and locate the Welding Torch Carriages at any desired position on the horizontal Guide Beam. Movement should be motorized on LM guides with ball screws rods for accurate positioning and repeatability	
4.3.3	Stroke adjustment of Welding Torch	Up/Down Stroke adjustment shall be motorized. BIDDER to specify the stroke length.	
4.3.4	Weld Arc Shielding Gas	Machine mounted arc shield for Pulsed GMAW	
4.3.5	Mixed Gas Flow Rate	10 – 40 lpm / torch	
4.3.6	Inlet Pressure	1.5 to 5 Bar	
4.3.7	Gas circuit - Accessories	Gas Manifold with 8 x 8 cylinders arrangement for Argon and 2 x 2 CO ₂ preheater with required gas mixing unit (preferably from M/s WITT) for the required flow rates as mentioned above, Gas Solenoid Valves, Gas Flow-Meters, flow sensors, Gas-Regulators with pressure gauges for inlet/outlet pressure indication, safety relief valves with hoses and end connections, are to be provided with machine tripping logics arrangement.	
4.4	SEAM TRACKING SYSTEM		
4.4.1.	Laser seam tracking system – 6 Nos.	- Optical triangulation using structured laser illumination based seam tracking system for positioning the welding torch at desired location and to trace the desired welding path - The seam tracking system shall be capable of adjusting the torch at a speed > 25 m/min. The exact speed of adjustment to be clearly mentioned	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
		• The system shall be suitably integrated for welding in both forward and reverse directions. • Option to work offline without seam tracking, if required • Bidder to specify the following ○ Kind of detector ○ Stand-off distance ○ Depth of field ○ Field of view for close plane and far plane ○ Average depth resolution ○ Average lateral resolution ○ Sampling rate ○ Laser safety class ○ Dimensions and weight of the tracker	
4.5	CHILLER & COMPRESSOR FOR LASER AND PROCESSING HEADS		
4.5.1	Chillers	The required chiller(s) as required for the quoted system to maintain the temperature in the resonator, processing heads, optics, etc. and shall meet the following specifications • The primary and secondary chiller (if required) should be from a reputed manufacturer recommended by the laser system manufacturer. Make of chiller to be mentioned • Chiller (s) shall have tanks pumps to meet the required capacity • The required flow rates to cool all the laser system, processing heads and optics. Flow rates and operating pressure to be mentioned. • Automatic feedback system to monitor the flow pressure/flow, temperature and water conductivity (if required) to be part of the supply	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
		• Shall have necessary safety interlock to avoid switching on of the laser if the water flow/level/temperature is erroneous • The required water quality in terms of conductivity, etc. to be mentioned in the offer • All the connections (tubes/hoses and connectors) shall be of required dimensions to suit the flow rates and pressures. The tubes and connectors shall be from Legris or internationally reputed brands only • Required damage protection system for all the hoses at critical locations to be part of the system • The required anti corrosive liquid to be supplied for trouble free operation for atleast 3 years • Any construction support required from BHEL side for water connections such as pipes, fittings, etc. that is to be made ready before commissioning to be specified in advance	
4.5.2	Air Compressor and Dryers	A suitable air compressor with refrigerator dryer for supply of compressed air for Laser and processing head of quality recommended by the LASER manufacturer and shall meet the following specifications • The compressor shall be from an internationally reputed manufacturer recommended by the supplier of the laser system quoted in the system. Make to be mentioned in the offer • The compressor shall be able to supply air at pressure and flow rates atleast 30% above the requirements for operation of all the system and accessories • A tank with suitable capacity shall be part of the supply • The system shall include dryers with required pre filter, moisture separator, carbon filter and fine filter to supply	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
		clean dry air to the system and shall be compatible with the supplied air compressor The dew point temperature to be mentioned in the offer Purity of the air at the outlet of the dryer should be mentioned	
4.6.	LASER POWER METER		
4.6.1.	Laser power meter	- Laser power meter preferably from M/s Primes for measurement of laser power upto 10 kW - The power meter shall be hand held with the digital display - The calibration certificate to be provided	
5.0	FUME EXTRACTION SYSTEM		
5.1	Fume extraction System	A very effective fume extraction system to be provided to suck the entire fumes being generated during welding with all 6 torches in the welding zone.	
5.2	Fume extraction System	Fume extraction system with roof level ducting suitable for handling minimum 10000 CMH air flow rate with static pressure around 250 mm WC pressure (average). The fume extraction system shall be high efficient, silent and compact package system with blower integrated within the filtration unit.	
5.3	Details of Fume extraction system	Entire system including Smoke/Dust filter unit, Blowers and its with accessories shall be of Nederman/Donaldson/Kemper/GEA/Denco Happel/ Plymovent or other reputed makes acceptable to BHEL	
5.4	Details of Fume extraction system	Fumes extraction system: Provided with VFD for optimum suction of fumes	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
		- Filters shall be Pleated cartridge type PTFE treated/laminated for handling fumes/fine particles, around 99 % at 0.1 to 0.4 μm with 10 m^2(around) with automatic cleaning/purging system - Extraction air hoods + connecting air ducts in galvanized sheet steel fabricated construction complete with its flanges, flange packing / gaskets - Sound proof enclosures shall be provided for noise level less 75dBA at 1 meter Automatic On/Off system based on welding On/Off operation – Provision to be incorporated in the control panel	
5.5	Details of Fume extraction system	Bidder to explain the complete fume extraction system provided on the machine with Make, Type, Capacity, Hood design and its location etc. Bidder to also provide details such as suction pressure, Flow rate, Filter cartridge type, purging/cleaning system, ducting and hood arrangement.	
6.0	IN-FEED , OUT-FEED CONVEYORS & RETURN CONVEYORS		
6.1	Conveyor Design	- Should be suitable for welding in both forward and reverse directions at the identical speed. - Made of Wear Resistant but Smooth (not to make impressions on the tubes of the panels) Steel Rollers. - Position of Idler & Motorized Rollers are to be so designed such that the Panels of all Dimensions (within the range specified) are handled smoothly. - BIDDER to specify the details on the arrangement of Drive and Idler Rollers	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
6.2	Conveyor Width	Suitable for making Panels upto a width of 2500 mm	
6.3	In-feed Conveyor	To be suitable for welding 25000 mm long and 2500 mm wide panels.	
6.4	Out-feed Conveyor	To be suitable for welding 25000 mm long and 2500 mm wide panels.	
6.5	Pass-On Stand or Return Conveyor	Provided with all motorized Steel Rollers Stand, suitable for transporting sub-panels / full panels (with width upto 2500 mm) through the full traverse length of the In-Feed Conveyor, Out-Feed Conveyor and the Machine Frame Width.	
6.6	Conveyor Speed of Infeed / Out feed / Return conveyor	500 to 10000 mm/min (synchronized to the Welding Speed in Automatic Mode) – Otherwise selectable for Manual Operations, even when the welding operation is not in progress or stopped. Variable frequency drive shall be used for speed control with suitable geared motor.	
6.7	Cross Conveyors	1. Cross Conveyors to be provided to shift sub- panel / mini-panels from the Out-Feed Conveyor to the pass-on conveyor after welding, and again from pass-on conveyor to the In-feed Conveyor for further buildup of panel. Variable frequency drive shall be used for speed control with suitable geared motor.	
		2. Cross Conveyors shall be of Lift and Shift type conveying system. Rigid guiding arrangement of lifting and shifting conveyor system to be provided.	
		3. Lift evenly throughout the length and width of the panel irrespective of its position on the lifting supports. The supports and lifting mechanism has to be very rigid.	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
		4. Each Cross Conveyor Unit shall be made of minimum six numbers of cross-transferring arm assemblies. Bidder to specify the no. of cross conveyor arms.	
6.8	Stoppers & Aligning system	Stoppers and Aligning system shall be provided in the infeed and out feed conveyors for aligning and positioning of tubes/formed mini panels together for welding sub-assemblies and final assembly welding for full panel fabrication of 2500 mm width.	
6.9	Noise Level Control	By providing non-metallic linings in the various tube conveyors in the system	
6.10	Mini Panel Storage Rack	Mini Panel Storage Rack shall be provided for temporary storing of mini panels after formation and to be brought back to the machine later during matching pass welding. Ladders shall be provided where ever required.	
7.0	INTEGRATED TUBE & FIN FEEDING ARRANGEMENT		
7.1	Tube Feeding System	Bidder to explain the arrangement of Tube feeding arrangement from the sloping rack to the panel tacking unit. The tubes have to be automatically lowered on to the scalloped bar of panel tacking unit, one by one from the sloping rack.	
7.2	Fin Storage and Feeding System	Bidder to explain the arrangement of feeding the fins in between the tubes in panel tacking unit. The fin feeding to be done automatically.	
7.3	Panel Tacking table	Bidder to explain the construction of Panel tacking table, having a fixture for arranging the tubes & fins including automatic feeding of tubes & fins to the Panel tacking table. The table to be suitable for a sub-panel of 5 tubes and 6 fins of 25000 mm length.	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
7.4	Tack Welding Fixture	The tack welding fixture shall have a Pneumatic clamping unit, which clamps the tubes and fins firmly in the fixture, (maintaining the pitch distance between tubes) for tack welding at the start of the panel for about 5 to 10 mm (up to 50 mm length). Bidder to explain the construction of Panel tack welding fixture.		
7.5	Tack Welding	Tack welding shall be done by MIG / SMAW welding. The Welding power source is under BHEL scope.		
7.6	Transport of Tack Welded Panel to Machine In-Feed Table	The tack welded sub-panel to be shifted from the panel tacking table to the machine In-feed table by means of Cross Transport Conveyor. Bidder to explain the construction.		
7.7	Control Unit for the above	Controls for Automatic tube & fin feeding and clamping, transport of tack welded sub panel to the In-feed table to be provided. Bidder to confirm the controls provided.		
8.0	FIN WIDTH CORRECTING UNIT WITH SHOT BLASTING			
8.1	JOB DESCRIPTION			
8.1.1	Fin Width	9 mm to 110 mm	Vendor to Confirm	
8.1.2	Fin Thickness	5 mm to 12 mm	Vendor to Confirm	
8.1.3	Fin Length (Cut length)	Minimum Length : 4000 mm Maximum length : 25000 mm	Vendor to Confirm	
8.1.4	Fin Material	Carbon Steel: ASTM A 576 Tensile Strength: 390 MPa Alloy Steel: a) ASTM A 387Gr.12 (TS: 450 to 585MPa) b) ASTM A 387Gr.22 (TS: 515 to 690 MPa)	Vendor to Confirm	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
		c) ASTM A 387 Gr.91 (TS: 585 to 760 MPa) d) ASTM A 387 Gr. 92 (TS: 620 to 770 MPa)		
8.1.5	Fin Coil Weight	Max: 2000 kg	Vendor to Confirm	
8.1.6	Fin Coil OD	Min: 1000mm / Max: 1500mm	Vendor to Confirm	
8.1.7	Fin Coil ID	Min:450mm / Max: 700mm	Vendor to Confirm	
8.2	PRODUCTIVITY	Max. 6m/min	Vendor to Confirm	
8.3	MACHINE CONFIGURATION: The machine shall have the following elements / Components:			
8.3.1	Coiled Fin Mounting Arrangement		Vendor to Confirm	
8.3.2	De-Coiling Unit		Vendor to Confirm	
8.3.3	Fin Butt Welding Bench		Vendor to Confirm	
8.3.4	Fin Shot Blasting Station		Vendor to Confirm	
8.3.5	Fin Width Correction Unit		Vendor to Confirm	
8.3.6	Fin Horizontal Straightening Unit		Vendor to Confirm	
8.3.7	Fin Vertical Straightening Unit		Vendor to Confirm	
8.3.8	Fin Length Measuring Unit		Vendor to Confirm	
8.3.9	Hydraulic Fin Cut-Off / Shearing Unit.		Vendor to Confirm	
8.3.10	Fin Transfer Unit		Vendor to Confirm	
8.3.11	Fins storage rack		Vendor to Confirm	
8.3.12	Control Panel		Vendor to Confirm	
8.4	COILED FIN MOUNTING ARRANGEMENT & DE-COILING UNIT			
8.4.1	Coil Loading	Manual loading with the help of crane.	Vendor to Confirm	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
8.4.2	Fin Coil Maximum OD	1500mm	Vendor to Confirm	
8.4.3	Fin Coil Minimum ID	450mm	Vendor to Confirm	
8.4.4	Width of coil mounting arrangement - Maximum	200mm	Vendor to Confirm	
8.4.5	Coil Weight - Maximum	2000 Kgs. (maximum)	Vendor to Confirm	
8.4.6	Coil Clamping arrangement	Mechanical Jaws – Four jaws – Self Centering type	Vendor to provide details	
8.4.7	Device to prevent free uncoiling	Friction Brake (with adjuster)	Vendor to provide details	
8.4.8	Uncoiling and Fin feeding	By pinch rolls in the fin calibrating m/c.	Vendor to provide details	
8.4.9	Fin Coil end Sensing	Suitable Mechanical type Sensor or any other sensing device for stopping the machine automatically once the fin comes to an end in the de-coiling unit.	Vendor to provide details	
8.5	FIN BUTT WELDING BENCH			
8.5.1	To be of simple and compact design to weld the leading end with trailing end of fin			
8.5.2	Clamping	Manually operated clamps for clamping the ends of fins and aligning.	Vendor to Confirm	
8.5.3	Welding Process	MIG / MAG / SMAW Welding Power Source is under BHEL scope.	Vendor to Confirm	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
8.5.4	Construction	During fin feeding, the weld bench shall be retracted from the fin feeding line. Weld bench may be mounted on slides or by wheels.	Vendor to provide details	
8.6	FIN SHOT BLASTING STATION			
8.6.1	The proposed machine shall be capable of cleaning the oil film, grease, rust, scales, protective film coats etc. from the surface of the fins.			
8.6.2	The design of the machine shall be such that the equipment is compact in size with ease of maintenance.		Vendor to Confirm	
8.6.3	The chamber size shall be of suitable size for the job envelope and effective cleaning of the surfaces.		Vendor to Confirm	
8.6.4	The shot-blasting operation should be carried out automatically by blast wheels directed at suitable angles towards the fin (as per Sl no- 8.1) for complete cleaning.		Vendor to provide details	
8.6.5	The blasting chamber shall have access doors and chamber door for maintenance purposes.		Vendor to Confirm	
8.6.6	The machine shall have suitable inlet with scrubbers for fin in- feed, intermediate supports for fin inside the chamber and outlet with scrubbers for fin out-feed for cleaning. Suitable guide units for the fin to be provided at the inlet and outlet points and the guide units shall be adjustable to accommodate varying width of fins.		Vendor to Confirm	
8.6.7	The blasting chamber shall be constructed of thick plates with suitable abrasive resistant lining with suitable stiffeners inside the chamber to ensure minimum wear of chamber.		Vendor to Confirm	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
8.6.8	The blasting chamber shall be leak-proof with proper sealing elements for the openings so that no dust / shots leaks out of chamber during operation.		Vendor to Confirm
8.6.9	Type	Push-Through Type	Vendor to Confirm
8.6.10	Location	Inline and between Fin Butt-Welding Bench & Width correction unit	Vendor to Confirm
8.6.11	Cleaning Standards	SA2½ (Sweden) equivalent	Vendor to Confirm
8.6.12	Shots – Quantity, Mix, Selection & Specification	Around 500 kg/filling, Mix of Shots of specification SS 850 & SS 600 as per IS 4606-1983	Vendor to Confirm
8.6.13	Filter Cleaning	Automatic and Pulse Jet Cleaning	Vendor to Confirm
8.6.14	Purging of shots	Purging to be done for 10 to 15 seconds after the shot blasting is completed to purge out residual shots in the system.	
8.6.15	Dust Collection	In designated Dust Collecting Bins.	Vendor to Confirm
8.6.16	Dust Extraction – Outlet Air Quality	Dust Emission Maximum @ 5mg/Nm ³ [for particle size 10 micron & above]	Vendor to Confirm
8.6.17	Number of Blasting Wheels		Vendor to Specify
8.6.18	Blasting wheel shall be direct drive type. Vendor to provide the details		Vendor to Specify
8.6.19	Blasting speed		Vendor to Specify
8.6.20	Integral Shot Recovery & Recycling System		Vendor to Confirm
8.6.21	Location	Normal Shop-Floor Area	Vendor to Confirm

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
8.6.22	Dust Separation	Through a system containing cyclonic separators, ducts connecting blasting chamber & dust extraction unit, dust collectors and exhaust fan		
8.6.23	Shots Leakage	Leak proof arrangement to be provided	Vendor to Confirm	
8.6.24	Control	Manual & Automatic Start / Stop with indicating alarm for shots level low	Vendor to Confirm	
8.6.25	Noise Level	Not exceeding 85 dBA	Vendor to Confirm	
8.6.26	Air booster	Suitable air booster to be provided. For pneumatic air supply refer clause 16.1	Vendor to Confirm	
8.7	FIN WIDTH CORRECTION UNIT BY COLD ROLLING			
8.7.1	Purpose: Continuous width correction of Fins to be done by COLD ROLLING by means of rollers and straightening in horizontal and vertical directions.		Vendor to Confirm	
8.7.2	Fin Bar Straightening & Width correcting Unit by Rolling shall consist of :		Vendor to Confirm	
	Supporting & In feed Guide Rollers		Vendor to Confirm	
	Vertically straightening unit, Mechanically Adjustable		Vendor to Confirm	
	Horizontally straightening unit, Mechanically Adjustable		Vendor to Confirm	
	Fin width correcting unit with top & bottom support rollers		Vendor to Confirm	
	Motorized, Hardened, Calibrating Rollers, Mechanically adjustable to the needed Fin-Width, with Mechanical Width Indicators.		Vendor to Confirm	
8.7.3	Total No. of Width Correcting Roller Stages (In how many stages the width correction is done)		Vendor to Specify	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
8.7.4	No. of Width Correcting Rollers per Stage (How many rollers are there in each stage)		Vendor to Specify	
8.7.5	Width correction Capacity	Suitable for the Material as per Clause 8.1.4	Vendor to Confirm	
8.7.6	Width of Fins used	9 mm to 110 mm	Vendor to Confirm	
8.7.7	Fin thickness	5 mm to 12 mm	Vendor to Confirm	
8.7.8	Width Correction required up to	1.5 mm	Vendor to Confirm	
8.7.9	Tolerance on Width	± 0.05 mm	Vendor to Confirm	
8.7.10	Fin Feeding Speed	Range : 1.0 to 6.0m/min	Vendor to Confirm	
8.7.11	Lubrication	Greasing points have to be provided in convenient locations for easy grease filling in the unit.	Vendor to Confirm	
8.8	FIN FEEDING SYSTEM & FIN STORAGE RACK			
8.8.1	Automatic fin bar pulling of the fin from the Decoiler Unit and through rollers of the fin width correction unit / other units.		Vendor to provide details of the feeding system	
8.8.2	The fin storage rack on the out feed side has to be rigid by design.		Vendor to Confirm	
8.8.3	The width of the fin storage rack on the out feed side shall have enough width to store atleast 50 fins of 12.7 mm width.		Vendor to Specify	
8.8.4	The automatic outfeed conveying system to be provided. Details such as drives provided, means of conveying etc. to be provided about the outfeeding system.		Vendor to Specify	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
8.8.5	The system to shift the corrected fins from outfeed conveyor to the fin storage rack to be explained.		Vendor to Specify	
8.8.6	The outfeed conveying system and fin storage rack to handle fins with maximum length of 25000 mm and minimum length of 4000 mm		Vendor to Confirm	
8.9	HYDRAULIC CUT OFF UNIT & FIN LENGTH MEASURING DEVICE			
8.9.1	Purpose : To cut the fin to the pre-programmed length after Fin width correction & Straightening			
8.9.2	Cutting	Hydraulic Shear	Vendor to Confirm	
8.9.3	Length Measuring Devices	Online Automatic Length measurement before the shearing unit to be provided.	Vendor to Confirm	
8.9.4	Length range	Programmed length after Width correction & straightening. Range : 1000 mm to 25000 mm	Vendor to Confirm	
8.9.5	Length display	The actual length to be continuously displayed by the side of the programmed length on the control panel screen.	Vendor to Confirm	
8.9.6	No. of Fins to be cut	Programmed no. of fins to be cut and actual no. of fins cut to be displayed on the control panel screen.	Vendor to Confirm	
8.9.7	Accuracy on Length of Fin	± 10 mm in 25000 mm	Vendor to Confirm	
8.9.8	Interlock	Automatic Fin travel stop and restart when Fin is Cut	Vendor to Confirm	
8.9.9	Interlock	Automatic fin travel start after the fin is transferred to fin storage rack.	Vendor to Confirm	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
8.10	FIN PULL CONVEYOR		
8.10.1	Automatic fin bar pulling system for transferring the fins(all sizes) from the fin storage rack to panel tacking unit and positioning the fins in between the tubes.	Vendor to provide details of the feeding system	
8.11	OPERATION AND CONTROL SYSTEM FOR FIN WIDTH CORRECTION SYSTEM		
8.11.1	Control shall be PLC based.	Vendor to Specify	
8.11.2	Separate operator's panel for Fin width correcting & shot blasting station, having complete machine control system with suitable TFT colour display preferably touch screen of required configuration shall be provided for convenient and efficient operation. All switches should be within reach of operator. All displays/indications should also be conveniently placed. The control panel shall be standalone type with a cable length of minimum 15000 mm.	Vendor to provide details	
8.11.3	Control panel shall have the following digital display for pre- setting and control: a) Start / Stop of Machine b) Length of the fin c) Width of the fin d) No. of fins (Qty) e) Speed of fin feeding	Vendor to Confirm	
8.11.4	Actual values are to be displayed on the control panel screen by the side of the pre-set values during operation of the following: a) Length of the fin b) Width of the fin c) No. of fins (Qty)	Vendor to Confirm	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
	d) Speed of fin feeding		
9.0	OPERATION AND CONTROL SYSTEM FOR THE PANEL WELDING STATION		
9.1	OPERATOR'S CONTROL PANEL:		
9.1.1	Control shall be PC based CNC & PLC control.	Vendor to Specify	
9.1.2	Operator's Panel having complete machine control system with suitable display unit of required configuration shall be provided for convenient and efficient operation. It should be operated in separate control room. It should have provision for control from remote mode and field mode for easy operation and setting of the panel (job). All switches should be within reach of operator. All displays/indications should also be conveniently placed (Layout showing complete details should be submitted with the offer)	Vendor to Confirm	
9.1.3	Operator control panel shall have separator monitor to see the welding system operation and panel welding. Suitable camera should be installed in various location of machine to see the welding bead, wire feeding system and conveyor mechanism. Details of camera and system should be specified along with the offer.	Vendor to Specify	
9.2	PC based CNC & PLC SYSTEM & FEATURES		
9.2.1	Make : Fanuc / Siemens / Mitsubishi	Vendor to provide details	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
9.2.2	Model (suitable and latest version)	Vendor to specify	
9.2.3	Details of Standard features	Vendor to specify	
9.2.4	Details of optional features, recommended by vendor.	Vendor to specify	
9.2.5	The system should have full alphanumeric keyboard, display of suitable size, RS232C serial interfaces, parallel interface for printer, compact disc drive unit for data input/output, hard disk of sufficient capacity, pre-installed system software and other associated / required softwares, etc. (Details shall be furnished by the Vendor in the TECHNICAL OFFER)	Vendor to Confirm	
9.2.6	TFT monitors to be provided for display. Bidder to specify the size of the monitors.	Vendor to Specify	
9.2.7	Display type and size	Vendor to Specify	
9.2.8	Dell New Inspiron 15 5570 laptop with pre-loaded software for CNC & PLC for maintenance to be supplied with the machine. The details of the required configuration are given below • 8th generation Intel core i7-8550U processor (8MB cache, upto 4 GHz) • Windows 10 operating system with complete MS office • Memory – 16 GB, DDR4, 2400MHz • 2TB 5400 RPM Hard Drive • Video card – AMD Radeon 530 Graphics with 4G GDDR5 graphics memory • 15.6" FHD (1920 x 1080) Anti-glare LED-Backlit Display • English backlit keyboard • Tray load DVD drive • 802.11ac + Bluetooth 4.1, Dual Band 2.4 & 5 GHz, 1 x 1 • 42WHr,3-cell integrated battery	Vendor to Specify	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
	- Necessary ports for USB 3.1 Gen 1 Type – C with power delivery and video, 2 USB 3.1 Gen 1, 1 USB2.0, 1 HDMI 1.4b, 1 Noble lock, 1 3-in-1 SD media card reader - Kaspersky antivirus with 2 years' subscription			
9.3	MACHINE OPERATIONAL CONTROLS			
9.3.1	Welding Process Control	Independent Process Controllers	Vendor to Confirm	
9.3.2	The Controls shall be Hinged with swiveling arrangement	Located in a convenient position for the operator (180 ° Swivel)	Vendor to Confirm	
9.3.3	Remote Control on Both Sides of Welding Machine	For Welding Torches Operations: - Torch Left / Right Torch Up / Down Wire Feed – Jogging control (inching)	Vendor to Confirm	
9.4	CONTROL FEATURES SHALL INCLUDE THE FOLLOWING:			
9.4.1	Start / Stop of Panel movement	Auto / Semi Auto / Manual START/STOP of welding according to panel movement.	Vendor to Confirm	
9.4.2	Panel movement trip logic	If panel movement stops or slows down, welding should be stopped. Similarly panel movement should STOP if welding is interrupted.	Vendor to Confirm	

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
9.4.3	Interlocks	All necessary interlocks such as burn through, weld seam tracking, safety defeat, welding wire feed indication and alarm for change over, etc. to be provided. Bidder to list down all the interlocks provided in the machine.	Vendor to Specify	
9.4.4	Separate controls of Different Units	Tube Shot Blast Unit Control / Fin width correcting unit control / Laser/ Welding Power Source Controls / preheating system/Wire Feed Controls / Panel Movement Controls etc. /Seam tracker (if possible) to be provided.	Vendor to Confirm	
9.4.5	Movements control	Operation of Torches / Upper Rolls / Fin Pressing Rolls / In-Feed, Out- Feed and Return Conveyor Control / Emergency Stop etc.	Vendor to Confirm	
9.4.6	Displays	Controller shall be provided with Digital Ammeters & Voltmeters for display of preset & real time weld parameters, digital display of Welding speed, wire feed rate, Gas flow etc. Bidder to enlist all displays on the control panel.	Vendor to Specify	
9.4.7	Locking	Provision for setting & locking of welding parameters	Vendor to Confirm	
10.0	DIAGNOSTIC SYSTEMS			
10.1	FAULT DIAGNOSTIC SYSTEM:			

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
10.1.1	Fault diagnostic system should be provided to show the faults on the display and detailed cause, and remedy for the faults related to mechanical and electrical maintenance.	Vendor to confirm	
10.1.2	Help guide should be provided to use both diagnostic systems	Vendor to confirm	
10.2	TELE-DIAGNOSTIC SERVICE (OPTIONAL)		
10.2.1	Tele-diagnostic service should be provided through International telephone lines along with required Hardware / Software package for the supplied PC based PLC system for remote diagnosis and correction of the problems in PC based PLC System of the machine. The tele-diagnostic service shall be provided free of charge for the guarantee period. BHEL will provide the necessary telephone line near the machine. GSM connection not acceptable.	Vendor to confirm	
10.2.2	The Vendor shall inform terms and conditions for the service after guarantee period. Subsequently, it should be possible to use other platforms, such as Internet or telephone line, subject to their availability in future.	Vendor to confirm	
11.0	MACHINE CONSTRUCTION AT WELDING ZONE		
11.1	Machine frame shall be designed in such a manner to have easy access for the operators to view the weld bead in all 6 Torches and make adjustments online. Adequate wide space to be provided for the operator to go and stand and observe without much effort or inconvenience. The standing space to be suitably designed.	Bidder to give details of the arrangement with dimensions of machine frame in the welding zone.	
12.0	TOOLINGS		

Sl. No.	PARTICULARS	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
12.1	Complete set of toolings to be offered for the following sizes to weld a 2.5 m wide full panel – Bidder to offer and confirm. 1. Tube Dia. 38.1mm x Pitch 50.8mm – 1 Set 2. Tube Dia. 41.3 mm x Pitch 54 mm – 1 set 3. Tube Dia. 42.4 mm x Pitch 55.1 mm – 1 set 4. Tube Dia. 44.5 mm x Pitch 57.2 mm – 1 set 5. Tube Dia. 63.5mm x Pitch 76.2 mm - 1 Set		
12.2	Tooling drawings for the complete sets of Toolings ordered shall be submitted with the documentation		
12.3	One set of all types & sizes of tools required for maintenance of the equipment to be supplied with equipment. List of the same shall be enclosed in the technical offer.	Vendor to confirm & furnish details	

Sl. No.	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
13.0	HYDRAULICS		
13.1	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.	Vendor to Furnish Details	
13.2	Pumps, valves, accessories, etc. shall be of Bosch-Rexroth /Eaton-Vickers / Parker. (Details to be submitted).	Vendor to confirm & furnish details	
13.3	Each pump should have an independent motor. Tandem pumps shall be avoided. Pump shall have stand by pump and motor. All the pumps, manifolds, valve shall not be placed directly on the tanks and shall have proper oil collecting plates. Wherever possible flexible hoses are to be avoided with pipe fittings. Power pack shall have secondary containment.	Vendor to confirm	
13.4	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/Pall.	Vendor to confirm & furnish details	
13.5	The flexible hoses used in the system shall be of Gates / Aeroquip / Parker.	Vendor to specify	
13.6	Failure indication for oil level, temperature, pressure, filter clogging should be provided	Vendor to confirm & furnish details	
13.7	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.	Vendor to specify	

Sl. No.	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
13.8	Refrigerated Cooling system of sufficient capacity to maintain complete Hydraulic System at a temperature not exceeding 50 deg. C irrespective of the ambient conditions.	Vendor to confirm & furnish details
13.9	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	Vendor to furnish details
13.10	Maximum Operating Pressure of hydraulic system	Vendor to specify
13.11	Main Pump flow in lpm and Motor Power in kW	Vendor to specify
13.12	Reservoir capacity (in litres)	Vendor to specify
13.13	All oil pipelines shall be of seamless steel and should undergo pickling process.	Vendor to confirm
13.14	Pressure measuring minimess check points (preferably with 1/4" BSP stud end) to be provided, wherever required for quick pressure measuring and pressure setting while trouble shooting. One set of handheld minimess pressure gauge (glycerine filled) of suitable range with micro bore standard hose (around 1.5 m length) also has to be supplied along with the power pack.	Vendor to confirm
13.15	All hydraulic cylinders used in the machine should be standard cylinders have standard bore and rod sizes. The piston rod shall be hard chrome plated. Latest wear resistant standard size, seals and O rings of Hunger/Hallite/Parker/James Walker/Merkel/ Simrit/ Busak & Shamban (Trelleborg) only Shall be used. Cylinder shall be provided with cushioning. Make of hydraulic cylinder: Parker/Rexroth/ Milwaukee/Atos only	Vendor to furnish details

Sl. No.	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
13.16	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.	Vendor to furnish details	
13.17	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.	Vendor to confirm	
13.18	The oil to be used shall be of standard ISO Viscosity Grades – 46 / 68. Vendor shall indicate equivalent Indian make oil.	Vendor to specify	
13.19	The maximum pressure of the system should preferably not to exceed 310 bar	Vendor to specify	
13.20	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.	Vendor to specify	
13.21	The pipelines to be painted with standard colours as per the colour coding accepted internationally for hydraulic systems.	Vendor to furnish details	
13.22	All hydraulic pipelines, hoses and electrical control cables to be neatly laid out with proper clamps and flexible hose conveyors wherever required.	Vendor to confirm	
13.23	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.	Vendor to confirm	
13.24	Hydraulic oil will be supplied by BHEL during commissioning at BHEL works. Vendor to provide the oil during pre-dispatch inspection.	Vendor to confirm	
14.0	COOLING SYSTEM		

Sl. No.	SPECIFICATION / DESCRIPTION			BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
14.1	Chiller Unit for Cooling of Sub- Systems	Suitable Capacity Refrigerant Chilling Units are to be provided for the cooling of Power Transformers, Hydraulic Power Pack Oil etc. Make: Werner Finley / Rite-Temp/Daikin make only. Bidder to give Complete technical Details on these Chilling Units	Vendor to Specify	
14.2	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	Vendor to Confirm	
15.0	LUBRICATION :			
15.1	Machine lubrication: Automatic centralized lubrication system with timer control and suitable metering cartridges to be supplied.		Vendor to confirm	
15.2	All greasing points to be provided at convenient location for the operators to fill grease periodically.		Vendor to confirm	
15.3	First filling of Lubrication Oil to be supplied by the supplier. Indian equivalent shall be mentioned.		Vendor to specify	
15.4	First filling of Grease should be supplied by vendor. Indian equivalent shall be mentioned.		Vendor to specify	
16.0	PNEUMATIC SYSTEM:			
16.1	The pneumatic operated elements of the machine shall work efficiently with BHEL compressed air supply at a pressure of 4.5 to 5 k/cm ² in ¾" pipe line.		Vendor to confirm	
16.2	Bidder to specify the total air volume required for efficient operation of the complete machine.		Bidder to confirm	

Sl. No.	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
16.3	Refrigerated Air Drier to be provided to eliminate moisture content from the compressed air at the designed flow and pressure rating.	Bidder to confirm	
16.4	BHEL will provide compressed air at only one point near / on the machine. Vendor shall provide suitable filter-regulator-lubrication (FRL) unit and in addition a hand wheel valve at this point	Vendor to confirm	
16.5	Hydraulic, Pneumatic & 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.	Vendor to confirm	
16.6	Pneumatic components shall be of FESTO /SMC/REXROTH/PARKER make.	Vendor to Specify	
17.0	ELECTRICAL & ELECTRONICS SYSTEMS		
17.1	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 Vendor. All cables, connections, circuit breakers etc. required for connecting BHEL's power supply to the machine shall be in the scope of vendor.	Vendor to confirm	
17.2	Tropicalization: All electrical / electronic equipment shall be tropicalized.	Vendor to confirm	
17.3	Control circuit voltage shall not exceed 24V DC	Vendor to confirm	
17.4	All electrical components in the cabinets should be mounted on DIN Rail	Vendor to confirm	
17.5	All electrical and electronic panels including operator's panel should be provided with fluorescent lamps for sufficient illumination and power receptacles of 220 V, 5/15 A AC. All adapters /receptacles should have compatibility with Indian equivalents.	Vendor to confirm	

Sl. No.	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
17.6	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.	Vendor to confirm	
17.7	Vendor should ensure the proper earthing for the machine and its peripherals.	Vendor to confirm	
17.8	Cables shall be routed through totally enclosed cable trays. There shall not be cable trenches.	Vendor to Confirm	
17.9	All electrical & electronic control cabinets & panels should be vermin and dust proof. All Electric enclosures shall have IP 54 protection	Vendor to confirm	
17.10	Motors and drives shall be of Fanuc / Siemens / Allen Bradley / ABB / Indramat / SEW / Mitsubishi conforming to IS / IEC Standards (Vendor should indicate make and type in the offer)	Vendor to confirm	
17.11	All electrical items shall be of from SEW / ROCKWELL / Allen Bradley / Telemecanique / Delta / Siemens/ Mitsubishi / Fanuc.	Vendor to Confirm	
17.12	All the motor control variable frequency drives should have input and output chokes with brake resistor.	Vendor to confirm	
17.13	All indication lamps should be provided with LED Indication Lamp.	Vendor to confirm	
17.14	All components/devices/terminals are to be incorporated with numbered ferrules.	Vendor to Confirm	
17.15	External wiring from / to control panel, control desk, external motors, etc. shall be by means of screened multi-core cables.	Vendor to Confirm	

Sl. No.	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
17.16	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.	Vendor to Confirm	
17.17	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. All field elements shall have easy accessibility for maintenance. Suitable sensors shall be used for water flow, airflow, oil flow, pressure, gas flow for feed back to the system.	Vendor to Confirm	
17.18	Air Conditioners with Dehumidifiers of suitable capacity to be provided for all Electrical / Electronic Panels / Cabinets including Operator's Panel considering specified ambient conditions (ambient temperature of +50°C and relative humidity of 93 %) Make: Rittal / Warner & Finley. Detailed specifications to be submitted.	Vendor to Specify	
17.19	Vendor to specify total power consumption in KW at Maximum load	Vendor to Specify	
18.0	MACHINE LIGHTS		
18.1	Machine Spot Lights and suitable fluorescent light or metal halide lamps to be provided for sufficient illumination in the welding zone.	Vendor to Confirm	
18.2	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to Confirm	
19.0	MACHINE FOUNDATION:		

Sl. No.	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
19.1	Vendor 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, foundation loadings, etc. required for foundation design shall be submitted by the Vendor within three months after getting BHEL's approval.	Vendor to Confirm
19.2	BHEL shall design and construct complete foundation for the machine as per the Vendor's recommendation	Vendor to Confirm
19.3	Complete anchoring system including fixators, levelling shoes required for anchoring system should be supplied by vendor.	Vendor to Specify
20.0	MACHINE SPARES:	
20.1	List of spares with itemized break-up of mechanical, hydraulic, pneumatic, electrical and electronic spares used in the machine (including laser & GMAW power source) in sufficient quantity as per recommendation of Vendor for 2 years of trouble free operation on three shifts continuous running basis shall be furnished by vendor 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)	Vendor to Confirm
20.2	Mechanical, Hydraulic, Pneumatic Spares: Following spares shall be supplied along with the machine: - Hydraulic valves- 1 no in each type - Pneumatic valves- 1 no in each type - Seal kit – Two set of seal kit for all cylinder - Bearing- 1 no in each type - LM bearing/guide- 1 set in each type - Oil filter element- 2 nos in each type	Vendor to Confirm

Sl. No.	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
	- Hydraulic hose- 2 nos in each type - Sprocket – 2 nos in each type - Chain links (connecting link and offset links) – 5 sets in each size - Pressure Switches, Transducers, Flow Switches – 1 no in each type Vendor to provide the list of other recommended spares as per clause no 20.1	
20.3	Electrical / Electronic / PLC 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, Servo Motors for Feed Drives, Power Module & Control Cards for Main Drive as well as Feed Drives etc.	Vendor to Confirm
20.4	Welding Consumable spares such as cover slides, connectors, flexible hoses, hose covers, etc. for laser hybrid welding head, Contact tips, Gas nozzles, Tip adapters, Other torch spares for at least 12 months' continuous operation shall be provided.	
20.5	Spare laser hybrid welding torches (2 Nos.), lasers, GMAW power source, Torch cables and Wire feed conduits, Wire feed rollers may also be offered for 12 months.	
20.6	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 vendor 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	Vendor to Confirm

Sl. No.	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
20.7	Vendor to confirm that complete list of spares for machine and accessories (including lasers & welding power source), 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	Vendor to Confirm	
20.8	A set of Service Tools for dismantling and assembling of machine components such as roller sets etc. may be quoted.	Vendor to Confirm	
21.0	DOCUMENTATION:		
21.1	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.	Vendor to Confirm	
21.2	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.	Vendor to Confirm	
21.3	The following documents in English language should be supplied along with the machine: Hard Copies - 3 Sets Vendor to confirm In CD form - 1 Set - GA Drawing of the complete Panel Welding station. - GA Drawing of Individual Mechanisms - GA & Sub-Assembly Drawings for sub-systems for maintenance purpose. - Operating manuals of Machine & its PLC System - Programming manuals of Machine & its PLC System - Operating manuals of Machine & its CNC System - Programming manuals of Machine & its CNC System		

Sl. No.	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
	8. Maintenance and spare part manuals with all drawings of machine assemblies / subassemblies with parts list 9. All Electrical circuit diagrams with bill of materials 10. Hydraulic circuit diagrams with bill of materials 11. Pneumatic circuit diagrams with bill of materials 12. Maintenance & Interface manuals for Machine Control System 13. Preventive Maintenance check list for Electrical and Mechanical System 14. Trouble shooting chart for Main and all sub systems 15. Complete PCB Schematics indicating check points for Electronic controls. 16. Complete list of Bought out items with make and model number. 17. Catalogues, O&M manuals for all bought out items used in the machine. 18. Operating Manuals, Maintenance Manuals & Catalogues for all supplied Accessories. 19. Detailed specification of all rubber items / hydraulic / lubrication fittings 20. PLC program print-outs with comments in English 18. PLC program and data on CD, Flash Memory Card. 19. 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. 20. Complete list of Alarm log, Error code, error messages & remedies and on line fault diagnostics to be provided by the vendor. 21. Complete list of spares for machine, along with item part no /specification / type / model and make & address of the sub-vendor. 22. Part drawings of sub systems installed in machine	
22.0	MACHINE INSPECTION & ACCEPTANCE:	
22.1	PRE-DISPATCH INSPECTION AT SUPPLIER'S WORKS:	

Sl. No.	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
22.1.1	Complete Panel Welding station with all sub-systems and accessories shall be assembled and offered for inspection by BHEL Engineers at supplier's works	Vendor to Confirm
22.1.2	All systems of the machine have to be operated and demonstrated to the BHEL Engineers in proper working condition.	
22.1.3	Two full panels of 12000 mm length / 2500 mm width to be welded and shown. The Tubes and fins along with the welding consumables have to be arranged by the supplier. All the other consumables have to be arranged by supplier. Welding wire shall be either in 25 kg spools or Jumbo packs.	Vendor to Confirm
22.1.4	The Weld quality shall be tested as per Annexure-I and as per Clause 3.21 & 3.22.	Vendor to Confirm
22.2	PROVE-OUT AND ACCEPTANCE AT BHEL WORKS:	
22.2.1	After the machine erection and energizing at BHEL works, all systems of the machine have to be operated and demonstrated in proper working condition.	Vendor to Confirm
22.2.2	25000 mm long and 2500 mm wide panels shall be welded and proved out with 15 Kg spools & 300 Kg Jumbo Coils with wire specification ER90S-B9 – 1.2mm Solid wire in T91 panels at welding speed ≥ 2500 mm/min.	Vendor to Confirm
22.2.3	All consumables related to the welding machine shall be in vendor's scope. All filler materials, tubes and fins will be supplied by BHEL.	Vendor to Confirm
22.2.4	The welding shall be smooth and without interruptions as specified under clause 3.11.	Vendor to Confirm
22.2.5	The machine shall be accepted after trouble free welding of panels for SIX consecutive shifts. Weld quality test shall be done as per Clause 3.21 & 3.22	Vendor to Confirm
23.0	TRAINING:	

Sl. No.	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
23.1	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.	Vendor to Confirm
23.2	Airfare, board & lodging for the BHEL Engineers who will be visiting supplier's works for pre-dispatch inspection and training, shall be borne by BHEL.	Vendor to note
23.3	The Supplier shall impart training to BHEL's Machine Operators and Maintenance crew in Operation and Maintenance (Mechanical, Electrical/ Electronics and PLC System) during commissioning of the Machine at BHEL works for at least FIFTEEN working days.	Vendor to Confirm
23.4	The training shall include specialized coaching in i) Safety ii) Operation of the machine iii) PC based System & Operation, iv) Trouble-Shooting, v) Software Application vi) All special features of the machine vii) Electrical / Mechanical / Electronics systems	Vendor to Confirm
23.5	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel	Vendor to Confirm
24.0	ERECTION & COMMISSIONING	

Sl. No.	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
24.1	Supplier to take full responsibility for Supervision of the erection and for startup, 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. Commissioning Engineers who will be deputed to BHEL shall be English speaking or English interpreters have to be arranged by the supplier for the entire duration from start of erection till the machines are commissioned and handed over to BHEL with complete training.	Vendor to Confirm	
24.2	Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by Vendor in their foundation/layout drawings. Other requirements like crane and personnel shall also be provided by BHEL.	Vendor to Confirm	
24.3	All tests, as mentioned (Machine Acceptance) shall form part of the commissioning activity.	Vendor to Confirm	
24.4	Laser calibration for CNC axis are to be carried out by the vendor after installation of the machine. Necessary backlash and pitch error compensation values in the CNC system after calibration are to be provided. Required instruments are to be carried by the supplier for calibration. Calibration reports are to be submitted for repeatability and accuracy of each axis.	Vendor to Confirm	
24.5	Commissioning spares, required for commissioning of the machine shall be supplied free of cost	Vendor to Confirm	
24.6	Test Mandrels, Instruments and other necessary equipment including Laser equipment, if required, to carry out all above activities should be brought by the Vendor.	Vendor to Confirm	

Sl. No.	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
24.7	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 vendor. For this purpose, the Vendor should supply sufficient quantity of touch-up paint of various colours of paint used.	Vendor to Confirm
25.0	IN-BUILT SAFETY ARRANGEMENTS	
25.1	Laser Safety Enclosure	
	• A class 1 safety enclosure with double stage protection with full steel cover and hanging flexible laser shields suiting the laser wavelength (if feasible) to confine the scattered laser radiation to the enclosure • LED lighting with VGA based CCTV camera and LCD screen with 17" monitor viewing arrangement for monitoring the welding process • Two laser viewing windows from Laser Vision of dimensions 18" x 18" suiting the laser wavelength with L5 protection and with damage protection mechanism positioned at suitable places of the enclosure. Damage protection mechanism can be glass shields on both to protect both inside and outside surfaces of the laser viewing window with steel covering opening for mounting • Safety interlocks at multiple locations to cut off the laser power in case of defeat • Required guarding and access panels shall be provided and the details to be mentioned clearly	
25.2	Following safety features in addition to other standard safety features should be provided on the machine:	

Sl. No.	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
25.3	Panel Welding Machine shall have Safety Guards / Sliding Doors for protection against the welding arc / splash / flashing for the Machine Operators. Safety Doors to have visible glasses for clear vision also. Bidder to submit details on this arrangement offered.	Vendor to specify	
25.4	A detailed list of all alarms / indications provided on machine should be submitted by the Vendor.	Vendor to Specify	
25.5	Suitable safety enclosure to be provided with glass windows for the fin width correction machine.	Vendor to Confirm	
25.6	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.	Vendor to Confirm	
25.7	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.	Vendor to Specify	
25.8	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.	Vendor to Confirm	
25.9	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations and suitably guarded.	Vendor to Confirm	
25.10	Emergency Switches should be provided at suitable locations as per International Norms.	Vendor to Confirm	
25.11	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.	Vendor to Confirm	

Sl. No.	SPECIFICATION / DESCRIPTION	BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
26.0	THERMAL STABILITY FOR AMBIENT CONDITIONS & ENVIRONMENTAL PERFORMANCE OF THE MACHINE:	
26.1	The machine shall be suitable for an ambient temperature of +50 deg. C and relative humidity of 93% respectively, but both do not occur simultaneously.	Vendor to Confirm
26.2	The vendor 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.	Vendor to Confirm
26.3	The machine, including attachments and accessories, should be suitable for continuous operation on three shifts a day.	Vendor to Confirm
26.4	If any safety / environmental protection enclosure is required it shall be built in the machine by the vendor.	Vendor to Confirm
26.5	Paint of the machine should be oil / coolant resistant and should not peel off	Vendor to Confirm
26.6	Maximum noise level shall be 85 dB(A) at normal load condition.	Vendor to Confirm
27.0	PAINTING:	
27.1	Painting of entire Machine / Electrical Panels: RAL 6011 Apple Green (Polyurethane Paint) Heat resistant paint on the inside of the machine in the welding zone.	Vendor to Confirm
28.0	MACHINE PACKING:	
28.1	Sea worthy & rigid packing for all items of complete machine, PLC 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	Vendor to Confirm
29.0	WARRANTY:	

Sl. No.	SPECIFICATION / DESCRIPTION		BIDDER'S OFFER WITH CONFIRMATION & COMPLETE TECHNICAL DETAILS
29.1	For 24 months from the date of commissioning OR 30 months from the date of dispatch whichever is earlier.	Vendor to Confirm	
30.0	GENERAL:		
30.1	Machine Model No.	Vendor to Specify	
30.2	Total connected load (KVA):	Vendor to Specify	
30.3	Total air volume in cu.m/min	Vendor to Specify	
30.4	Floor area required (Length, Width, Height) for complete machine & accessories	Vendor to Specify	
30.5	Total weight of the machine (approx.)	Vendor to Specify	
30.6	The general arrangement drawing showing the machine & associated systems with salient dimensions shall be submitted along with the offer. The drawing should be clear and legible	Vendor to provide compulsorily	
31.0	OPTIONAL ACCESSORIES or SUPPORTING SYSTEMS		
31.1	Weld Quality Scanner	A suitable hand held or machine mounted instrument with recording / live indicating facility to check the quality of weldment in the panel, after the welding operation. Bidder to provide details if such a system is optionally offered.	
31.2	Sensor to detect distance	Sensor for automatic detection of contact tip to work distance. Bidder to provide details if such a system is optionally offered.	

ENCLOSURE: ANNEXURE – 1: Visual inspection of Weld quality

VISUAL INSPECTION OF TUBULAR PANELS

The tubular products shall be visually inspected at appropriate stages and accepted based on the Acceptance standards detailed in below:

ACCEPTANCE CRITERIA

Characteristics	Acceptance norms
-----------------	------------------

- | | |
|------------------------------|-----------------|
| a) Cracks, Voids & Skips | } Not permitted |
| b) Burnthrough | |
| c) Lack of Fusion | |
| d) Lack of penetration | |
| e) Oxide/metallic inclusions | |
| f) Overlaps | |
| g) Underflushing | |
| h) Root porosity | |
| i) Wrinkles & Deformities | |
| j) Poor restart | |

1. Surface mismatch Not to exceed $1/4 t$ where "t" is the tube thickness

2. Undercut (on pressure retaining materials) Not to exceed 0.4mm

3. Porosity (for fillet welds) Pores up to & including 1.6 mm diameter, provided it does not occur at a start or stop. 4 or more pores (cluster or inline) are not permitted if they are separated by less than 1.6mm or less than the major dimension of the largest indication in that group. For other pores, acceptance shall be as per TABLE 1.

4. Reinforcement Not to exceed 3 mm

5. Tool marks Not permitted. To be ground to have a smooth transition

6. Concavity of the fillet weld Permissible, provided it does not encroach on the required weld thickness

7. Arc strikes Not permitted. Stray arc areas shall be examined with LPI or MPI after grinding followed by thickness measurement

8. Spatter To be removed. Isolated spatter may be permitted

9. Bore passage Freedom from foreign materials

TABLE 1 - Porosity acceptance level

TYPE	SIZE in mm	No. of pores permitted in 150 mm length
SMALL	0.8	10
MEDIUM	1.2	5
LARGE	1.6	3
ASSORTED	-	LARGE – 1No.) MEDIUM – 2 Nos.) TOTAL – 7 Nos. SMALL – 4 Nos.)

Characteristics	Acceptance norms
Cracks, Voids & Skips Burn through Lack of Fusion & Chill Bar melts Lack of penetration Slag/flux/oxide/metallic inclusions Overlaps Under flushing Root porosity Wrinkles & Deformities Poor restart	Not permitted
Surface mismatch	Not to exceed $1/4 t$ where "t" is the tube thickness
Undercut (on pressure retaining materials)	Not to exceed 0.4mm
Porosity (for fillet welds)	Pores up to & including 1.6 mm diameter, provided it does not occur at a start or stop. 4 or more pores (cluster or inline) are not permitted. If they are separated by less than 1.6mm or less than the major dimension of the largest indication in that group. For other pores, acceptance shall be as per TABLE 1.
Reinforcement	Not to exceed 3 mm.
Tool marks	Not permitted. To be ground to have a smooth transition
Concavity of the fillet weld	Permissible, provided it does not encroach on the required weld thickness
Arc strikes	Not permitted. Stray arc areas shall be <i>cleaned thoroughly and further</i> examined with LPI or MPI after grinding followed by thickness measurement
Spatter	To be removed. Isolated spatter may be permitted
Bore passage	Freedom from foreign materials