



An ISO 9001
Company

Bharat Heavy Electricals Limited

(High Pressure Boiler Plant)

Tiruchirappalli – 620014, TAMIL NADU, INDIA

CAPITAL EQUIPMENT / MATERIALS MANAGEMENT

ENQUIRY

NOTICE INVITING TENDER

Phone: +91 431 257 76 53

Email : skaruna@bheltry.co.in

spsy@bheltry.co.in

Web : www.bhel.com

TWO PART BID	Enquiry Number:	Enquiry Date:	Due date for submission of quotation:
Tender to be submitted in two Parts	2601700035	03.07.2017	27.07.2017

You are requested to quote the Enquiry number date and due date in all your correspondence. This is only a request for quotation and not an order.

Please note that under any circumstances both delayed offer and late offers will not be considered. Hence vendors are requested to ensure that the offer should reach physically on or before 14.00 Hrs(IST) on the Date of tender opening. Tenders received after 14.00Hrs (IST) will not be considered for evaluation.

Item	Description	Quantity	(Indigenous Vendors) Matl. Will be Delivered to
10	Laser Welding And Cladding System as per the technical specification & commercial conditions applicable(To be downloaded from web site www.bhel.com or http://tenders.gov.in)	1.00 Set.	FOR, BHEL,Stores, High Pressure Boiler Plant, Trichirappalli - 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 Chennai Seaport / Airport
- 3) Delivery required 6 months(including PDI) from the date of purchase order.
- 4) Erection & Commissioning period required 5 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.
- 8) Integrity Pact applicable. Format attached. It should be duly signed and sealed and to be sent with offer.

BHEL's General guidelines / instructions (refer MM / CE / GENL / GENL / 001 - EMD) including bank guarantee formats and list of consortium banks, commercial terms check-list can be downloaded from BHEL web site <http://www.bhel.com> or from the Government tender website <http://tenders.gov.in> (public sector units > Bharat Heavy Electricals Limited page) under Enquiry reference .

Tenders should be submitted before 14.00Hrs (IST) 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

DGM / Capital Equipment / MM

S.PARTHASARATHY
MANAGER
CAPITAL EQUIPMENT / MM
BHEL, TRICHY-620014.

PART A**QUALIFYING CRITERIA FOR THE SUPPLY OF 'LASER WELDING & CLADDING SYSTEM WITH FIBER COUPLED LASER'****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 WELDING AND CLADDING MACHINE' for R&D/Production	
2.0	YEAR of LAUNCH of the MODEL (Laser) quoted against this ENQUIRY	
3.0	Number of 'Laser Welding/Cladding Machine' supplied, till date in the QUOTED MODEL	
4.0	Details on International Standards followed in Design and Testing of the System quoted	
5.0	Comprehensive Details on Performance Testing of the laser in terms of beam quality, focusability, etc. carried out at the Factory, to be furnished with the Technical Offer. The same may be shown during the pre-dispatch inspection at site	
6.0	Details on SERVICE-AFTER-SALES Set-Up in India including the Addresses of Agents / Service Centres in India, to be furnished compulsorily.	
7.0	BIDDER to indicate the Country of Origin for the supply of welding machines.	

SECTION – II

The BIDDER has to compulsorily meet the following requirements to get qualified for submitting an offer for the 'Laser Welding & Cladding System with Fiber Coupled Laser'

S. No.	REQUIREMENTS	VENDOR's COMMENTS
8.0	The BIDDER shall have a minimum of FIVE Years of Continuous Experience in the Design, Manufacture & Supply of High power ($\geq 6\text{kW}$) laser welding system	

S. No.	REQUIREMENTS	VENDOR's COMMENTS
9.0	The BIDDER should have supplied atleast one 'Laser welding/cladding machine suitable for welding and cladding with a laser power output of 6 kW or above to Customers in India. Also, indicate the number of such machines sold in India.	
10.0	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.10.0) of 'Laser Welding / Cladding Machine'. Performance Certificate in Original need to be submitted or the Certificate in the a scanned copy mode may be sent through E-mail directly to BHEL, by the VENDOR's Customer. For obtaining the Performance Certificate, a suggestive format is provided in the ANNEXURE - A .	
11.0	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
12.0	The BIDDER shall submit the offer in TWO PARTS - Technical [with PART A & PART B] & Commercial and Price Bid.	
13.0	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.	
14.0	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.	

S.No.	REQUIREMENTS	VENDOR's COMPLIANCE
15.0	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, CNC/Robot, processing heads, accessories, etc.	
16.0	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.	
17.0	Earlier performance & field experience (service support) with BHEL (if any) will be a reckoning factor for the technical qualification of the OFFER.	

ANNEXURE - A**Suggestive Format of PERFORMANCE CERTIFICATE:**

The Performance of the VENDOR's EQUIPMENT should be certified by the customer on **Customer's Letter Head** and submitted along with the TECHNICAL OFFER.

PERFORMANCE CERTIFICATE

1.0	Brief Description of the LASER WELDING / CLADDING STATION / AUTOMATED WELDING WORK CENTRE for which the Performance Certificate is sought / furnished (with Manufacturer's name)	
2.0	Make & Model Number of the Machine	
3.0	Month & Year of Commissioning	
4.0	Application for which The Machine is used	
5.0	Machine Details	
5.1	Number of Laser Welding Heads	
5.2	Size of jobs handled in the Welding Station.	
5.3	Specification of Materials welded in the subject work-station	
5.4	Details on the Welding Power sources used	
5.5	Details on the PLC / Control Units employed.	
6.0	Performance of the Machine by way of Productivity and Availability (Please tick the appropriate option)	Satisfactory Not Satisfactory
7.0	Service After Sales support rendered by the VENDOR / OEM (Please tick the appropriate option)	Satisfactory Not Satisfactory
8.0	Other Remarks (if any)	
Date:		Signature & Seal of the Authority Issuing the Performance Certificate

PART B**TECHNICAL SPECIFICATIONS FOR 'LASER CLADDING AND WELDING SYSTEM'**

AA. APPLICATION :			
Sl.No.	FEATURES /BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
AA.1	The offered system shall be a special purpose machine consisting of CNC and robot integrated laser system with all necessary accessories and capable of doing the following • Laser welding of atleast 10 mm thick nickel based superalloy at a speed of 1 m/min • Laser welding of steels and stainless steels of atleast 10 mm thickness at a speed of 1 m/min • Laser welding of aluminium and its alloys of atleast 8 mm thickness at a speed of 1 m/min • Laser cladding of external surfaces in flat, curved and symmetrical components • Internal deep bore cladding of tubes/pipes with internal diameter of minimum 40 mm & above for a minimum depth of 500 mm and above • Laser hardening of external surfaces • Software capable of generating 3D paths for laser additive manufacturing • Laser hybrid welding by suitable coupling with conventional arc welding power source (GMAW/GTAW/Plasma)		
BB. MACHINE CONFIGURATION : [The scope of supply shall consist of the following]			
Sl.No.	FEATURES /BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
BB.1	A fiber coupled 6kW disc or fiber laser with a beam quality 8mm-mrad or better and have a minimum of two power tapping. The laser source shall be from reputed manufacturers like Trumpf or Rofin/Cohrent or IPG Photonics or Laser Line only		
BB.2.	The laser resonator shall have all necessary internal optics and cooling systems		

PART-B: LASER CLADDING & WELDING SYSTEM

BB.3	6 axes robot with minimum 30 kg payload capacity		
BB.4	A CNC table with a minimum of 1.5 m traverse in X axis, 2.5 m in Y axis and a minimum Z axis travel of 0.8 m along with a rotary positioner mounted on the table.		

BB. MACHINE CONFIGURATION : [The scope of supply shall consist of the following]				
SI.No.	FEATURES /BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS	
BB.5	Required accessories for laser system like Servo stabilizer suiting the machine with all accessories, chiller (Primary and/or Secondary, as required), dust collector, air compressor, air dryers to maintain required dew point temperature, etc. All the accessories to be quoted separately along with the machine.			
BB.6	Class 1 safety enclosure for laser operating areas covering both CNC and robot			
BB.7	Safety interlocks at multiple locations			
BB.8	Welding head, cladding head, hardening head with necessary optics for various beam shapes from circular to rectangular			
BB.9	Laser viewing window at two locations			
BB.10	Operator console for overall operation			
BB.11	BHEL provided electrical power input supply is through a 415±10% V, 50 ±2 Hz, 3 Phase AC Supply , 4 wire system (4 th wire for earthing)			
BB.12	The system shall be totally tropicalized to work in an environment with maximum temperature upto 48 Deg. C and relative humidity at 85%, but both do not occur simultaneously.			
CC. EQUIPMENT SPECIFICATION : LASER SYSTEM				
SI.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
CC.1	Type	Disc or fiber laser 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		

CC.2.	Maximum Power Output and Mode of Operation	6000 W in continuous wave mode. Atleast 6000 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		
CC.3.	Beam Quality	The raw beam quality to be atleast 8 mm-mrad or better at 6000 W power output.		
CC.4.	Laser Cooling System	Internal cooling system with necessary deioniser and pump module for cooling the resonator, as required		
CC. EQUIPMENT SPECIFICATION : LASER SYSTEM				
Sl.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
CC.5.	Beam Switch	Integrated beam switch with atleast two channels		
CC.6.	Optical fiber	• 200 µm diameter process fiber with minimum 10 m long cable – 2 Nos. • 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 from damaging the resonator to be included in the optical circuit		
CC.7.	Shutter	Internal shutter with necessary beam dump		
CC.8.	Alignment laser	Red/green laser for optical alignment. Laser safety class of the alignment laser to be mentioned		
CC.9.	Air Purging	The resonator shall have necessary air purging system with required connections, as required		

[...contd.....]

PART-B: LASER CLADDING & WELDING SYSTEM

CC.10.	Base Frame	• Laser resonator shall be mounted on a frame (if required) with suitable Sunnex dampers to arrest vibrations. • The frame shall have necessary locking arrangements for fixing the resonator • The frame shall be made of steel and painted to avoid any corrosion • If the base frame is required, the same shall be supplied along with the machine		
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DD. EQUIPMENT SPECIFICATION: CNC GANTRY MOTION SYSTEM			
SI.No.	FEATURES	BHEL SPECIFICATION	[....contd.....]
	OFFER BY BIDDER	DEVIATIONS	
DD.1.	Motion System	Four-axis motion system. The motion details shall be of at least as given below - X-axis: The x-axis shall be on the r bridge with a minimum travel of 1.5 m with a minimum of $\pm 40\mu\text{m}$ accuracy and a minimum of $\pm 15\mu\text{m}$ repeatability. The speed of movement shall be continuously adjustable with a maximum speed of atleast upto 10 m/min - Y-axis: The x-axis shall be on the r bridge with a minimum travel of 2.5 m with a minimum of $\pm 40\mu\text{m}$ accuracy and a minimum of $\pm 15\mu\text{m}$ repeatability. The speed of movement shall be continuously adjustable with a maximum speed of atleast upto 10 m/min - X & Y axis minimum travel length can be interchangeable according to the design of the system - Z-axis: The z-axis is mounted to the bridge/gantry with a minimum of 0.8 m travel with a minimum of $\pm 40\mu\text{m}$ accuracy and a minimum of $\pm 15\mu\text{m}$ repeatability - Rotary-axis: A minimum of 12 inch 3-jaw chuck. The maximum RPM or surface velocity for 12 inch diameter shall be clearly specified	
DD.2	Cable Management	The necessary covers and a management solution to protect fiber optic cable, all the air and water lines connecting processing heads, optics, etc.	
DD.3	CNC Controls	CNC controls shall be from a reputed supplier like Fanuc or Fagor or Siemens only. The same shall be specified in the offer.	
DD.4	Servo motors	Required servo motors for axis movements shall be from an internationally reputed supplier	

SI.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
DD.5	Construction	The entire gantry system shall be built on a strong steel base to ensure rigidity. The base shall be mounted on the concrete floor with Sunnex dampers to avoid vibrations. Any other method to avoid vibrations shall be mentioned by the vendor.		
DD.6	Integration, Controls & Programming	• Laser system and all the processing heads shall be integrated with the CNC. • All operations of the system shall be controllable through CNC. • Electronic control of the parameters such as laser parameters (laser power, laser programmes, emission modulation, power ramping, etc.), process gas flow rate, shutter open/close, change of operational mode, etc. All such parameters that can be electronically controlled to be specified and listed clearly • Separate M codes for individual control of every function to be provided and clearly indicated with the offer. A minimum of 6 free M codes to be provided for future requirement. The number of available free M codes to be mentioned clearly in the offer • A minimum of 6 additional Digital I/O ports to be provided for future applications • Common part programmes to be preloaded • Safety integration to be provided • Dual channel safety circuit for laser safety and operator safety • Necessary buttons to be provided on the front of the operator interface • Emergency Stop (E-Stop) button to be provided • Separate system reset button to be provided and specified • Separate laser enable/disable switch		
EE. EQUIPMENT SPECIFICATION : 6 AXIS ROBOT				
SI.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS

EE.1	Type	6 axis floor mounted industrial robot mechanics with articulated kinematics.		
EE.2	Make	The robot shall be from reputed suppliers like Kuka or ABB or Fanuc or Reis only		
EE.3	Capacity	The robot shall have a minimum of 30 kg payload capacity. The robot should be able to hold and manipulate the processing heads offered with the machine without affecting the accuracy and repeatability.		
EE.4	Accuracy	Minimum 50 µm positional accuracy and repeatability		
EE.5	Reach	Reach of the robot should be at least 2 m. The exact reach of the robot shall be mentioned		
EE.6	Axes movement	• 3-phase servomotor controlled six degrees of freedom • Protection against overload • Main axis to be lubricated to ensure trouble free operation for atleast 20,000 hours • Absolute position sensing system shall be required		
EE.7	Two Axis Work piece Positioner	• A suitable positioner with necessary slots for clamping of fixtures and workpiece • A minimum of 400 kg capacity • Rotation and tilting of work clamping fixtures relative to the robot's position • Fully interpolated integration of the rotary and tilt axes as the 7th and 8th NC axes. Motion to be fully synchronised with the robot		
EE.8	Operator Console	• Remote operation pendant with sufficient cable lengths of atleast 10 m		
EE.9	Energy Supply Requirements	• Pneumatic connection • Purge gas connection • Digital user interface as an option		

EE. EQUIPMENT SPECIFICATION : 6 AXIS ROBOT...contd....				
Sl.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
EE.10	Software and Programming	- Simple and direct programming at the robot with inline-forms - Programming language which allows a flexible program structure, freely selectable programs/variable names, etc. - Software packages necessary for laser, arc welding and cladding - Options for remote control of laser, arc and other machines - Additive manufacturing software for Robot – 6 Axis to be provided with the system * Generation of 3D surface tool paths * Data transmission in .dwg, .dxf format - Atleast 4 additional digital I/O ports to be provided for future additions - User interface with Microsoft Windows - Ethernet connectivity for remote diagnostics to be provided		
EE.11	Safety Functions	- Software axes range monitoring in failsafe technology - Evaluation of actual position in failsafe technology - Cyclic monitoring of the reference position - Cyclic brake test - Connection to an external safety logic circuit - Upto ten monitored and freely definable axis specific or Cartesian areas - Inputs and outputs of redundant configuration - Crash sensor for the head		

EE. EQUIPMENT SPECIFICATION : 6 AXIS ROBOT			[...contd.....]	
Sl.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
EE.12	Integration & Control	- Integration of robot into main laser cell system panel - Integration of laser, process equipment and cell safety - Safety integration - Dual channel safety circuit for laser safety and operator safety - Emergency Stop (E-Stop) button - System reset button - Laser Enable/Disable switch - Cell operation mode select switch - Electronic control of process parameters - The necessary covers and a management solution to protect fiber optic cable, all the air and water lines connecting processing heads, optics, etc.		
FF. EQUIPMENT SPECIFICATION : LASER CELL – LASER SAFETY ENCLOSURE- CLASS 1				
S.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
FF.1.	Requirement	A Class 1 enclosure made of steel of required gauges to contain the scattered laser radiation within the cell and shall have to cover the entire laser operation area containing both gantry robot system.		
FF.2.	Safety Features	- All necessary safety interlocks, guarding, as well as access panels for service/maintenance of the system - A two laser safe viewing window from Laser Vision with all outer beadings of minimum dimensions 12” x 8” suiting the laser wavelength and can give atleast L5 protection		

FF. EQUIPMENT SPECIFICATION : LASER CELL – LASER SAFETY ENCLOSURE- CLASS 1 [...contd.....]				
S.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
FF.3.	Construction	- Dual wall steel panels to assure Class 1 laser enclosure rating - The dimensions of the enclosure to be mentioned in the offer - Roll up or sideways motorised operator door for loading parts and programming access. - Make-up air vents on both sides of enclosure for optimum exhaust air flow through - All other openings to be properly sealed - Interior LED lighting - Internal viewing camera for live viewing and a closed circuit with flat screen LED TV with minimum of 15” display		
GG. EQUIPMENT SPECIFICATION : PROCESSING HEADS				
S.No.	PARTICULARS	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
GG.1	Welding Head - 2 Nos.	Welding head with necessary processing optics to focus the laser beam on to the workpiece only from Precitec GmbH or from the laser system manufacturer suiting the quoted laser. The make of the welding head should be clearly mentioned and shall meet the following - Suitable collimating and focusing optics to focus the laser beam to a spot size in the range of 200 – 500 µm. The collimating and focusing lens combination to be clearly mentioned - Collimation 0° with defocusing and camera observation - A camera attachment with cross-hairs adjustable with control, camera power cable and BNC video cable of suitable length for positioning of the laser w.r.t the work-piece - LCD monitor to display the signal of the camera inside and outside of the machine work area		

GG. EQUIPMENT SPECIFICATION : PROCESSING HEADS [...contd.....]				
S.No.	PARTICULARS	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
GG.1 contd...	Welding Head - 2 Nos.	• Water cooled optics • Necessary connections to provide cross jet • Metal bellows (wherever required) to protect the flexible hoses • Additional focusing optics of focal lengths 150, 200, 300 and 500 mm to be included in the offer • Cover slide with necessary IR coatings • Necessary alarm or feedback module to be included		
GG.2	External/OD Cladding Nozzle – 1 No.	Coaxial cladding head only from Precitec GmbH or ILT Fraunhofer or from the laser system supplier suiting the quoted laser. The make of the cladding head to be clearly mentioned and shall meet the following specifications • A minimum of 2-10 mm powder focus • XY centering adjustment • A suitable camera arrangement with display for positioning of the laser beam • Suitable collimating, focusing and beam shaping optics for round or square beams to be included. The range of focal spot sizes for both round and square shapes to be clearly mentioned. • Optics required for different focal spot sizes in both round and square shapes to be clearly mentioned and quoted separately. • The required optical arrangement for line beam optics to be included and quoted separately for each dimensions of the line beam • Necessary cover slides with IR coating • Water cooling for optics • Attachments for supplying shielding gas • Connections to provide cross jet • Metal bellow to protect the flexible hoses		

GG. EQUIPMENT SPECIFICATION : PROCESSING HEADS [....contd.....]				
S.No.	PARTICULARS	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
GG.3	Internal/ID Cladding Nozzle with powder deposition – 1 No.	An ID cladding nozzle from a reputed manufacturer suiting the quoted laser. The make of the cladding head to be clearly mentioned and shall meet the following specifications • Shall be suitable for ID cladding in bores of diameter from 40 mm and above • The construction shall be rigid and sturdy for error free deep bore cladding • The arm/rod for attaching the cladding head shall be made of stainless steel or any other corrosion resistant material to avoid any rust formation • Required focusing nozzle for focusing powder and the laser shall be included • The minimum length of the clad area inside the bore shall be 500 mm for ID of 40 mm. • The minimum length of the clad area shall be more than 500 mm for ID ≥ 40 mm. The possible length of internal bore cladding for different diameters to be clearly mentioned • The maximum operating laser power shall be 3000 W or more • Maximum clad thickness possible in single pass to be mentioned clearly • All necessary electrical connections to be included • Suitable powder feeding mechanism/arrangement to be included • Optics required for achieving different focal spot sizes to be clearly mentioned and quoted separately • Option of using beam shaping optics to be clearly mentioned and required optics to be quoted separately • Arrangements for water cooling of the optics • All the cables, water hoses, etc. to be suitably protected to avoid any damage during or after cladding • Suitable monitoring system to be provided and details should be clearly mentioned in the offer		

GG. EQUIPMENT SPECIFICATION : PROCESSING HEADS [....contd.....]				
S.No.	PARTICULARS	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
GG.4	Internal/ID cladding nozzle with dual option of powder and wire deposition – 1 No.	An ID cladding nozzle from a reputed manufacturer with dual option of powder feeding and wire feeding for cladding deep bores. The make of cladding head is to be mentioned clearly and shall meet the following specifications • Shall be capable of operation at a laser power of at least 3000 W or above. The maximum laser power upto which it can be operated to be clearly specified • The minimum length of the clad area inside the bore shall be 1000 mm for ID of 76.2 mm. The possible length for internal bore cladding for different diameters to be clearly mentioned • The supporting system should be rugged and made of good quality material to withstand operating conditions • The cladding head should have capabilities to use both powders and wires as consumables. • The required wire feeder and other accessories to be part of the system • The grain size for the powder and the maximum wire diameter that can be used with the head to be clearly indicated • Options for adding hot wire addition to be part of the offer and should be quoted separately • Maximum possible clad height (typical) with both powder and with different wire diameters to be mentioned		

GG. EQUIPMENT SPECIFICATION : PROCESSING HEADS [....contd.....]				
S.No.	PARTICULARS	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
GG.5	Laser Hardening Optics	Laser hardening head/optics with required attachments for carrying out laser hardening of different materials. The make of hardening head to be mentioned clearly and shall meet the following specifications • The head should have necessary mechanism to vary the output beam dimensions in situ to achieve different beam widths with the same head • Different out beam spot dimensions to be clearly mentioned and to be quoted as options • Hardening optics should be able to work at full laser power of 6000 W		
GG.6	Powder Feeder	A twin powder feeder from a reputed manufacturer like GTV or Sulzer only capable of supplying powder for laser cladding/build up and shall meet the following specifications • Dual container setup with two containers and the hopper shall be of 5 litres capacity • Fully integrated with laser and motion system • The display shall be from reputed manufacturer and shall have touch screen display • PLC shall be from reputed supplier like Siemens or any other reputed supplier and to mentioned clearly • Provision for supervision of input and output pressure of gas • Proportional valves for carrier gas and shielding gas • Hosing and high precision powder stream splitter to be part of the system • Service and maintenance display mode option to be available		

GG.7	Laser Weld Monitoring (LWM)	A suitable system for monitoring the laser welding process from a reputed supplier and shall meet the following specifications • The make of the LWM to be mentioned in the offer • The system should be capable of monitoring the plasma, back reflection and temperature through suitable detectors • The sampling rate shall be atleast 40 kHz • The system should be suitable for monitoring both keyhole and conduction mode welding • The system should work with both CW and pulsed mode of operation • The LWM should be suitable for fiber, disc, diode and CO2 lasers • All the capabilities of the system to be mentioned clearly in the offer		
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HH. ESSENTIAL ACCESSORIES				
Sl.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
HH.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 • 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		
HH. ESSENTIAL ACCESSORIES [...contd.....]				

Sl.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
HH.2	Dust Collection System	The dust filtration system with a minimum of 4000 CFM or above suiting the dimensions of the laser cell with filters and fire extinguisher and shall meet the following specifications • Multiple cartridge down dust flow collector • A top mount motor with suitably rated fan system. The capacity of the fan and motor should be mentioned clearly • Reverse pulse filter cleaning system • A nano based fiber filters with best in class efficiency • Inline spark arrestor to be mounted on inlet of unit • An exhaust silencer to be provided • Suitably grounded filters • Integrated fire extinguisher system/explosion panel • Secondary explosion damper to be provided		
HH.3	Air Compressor and Pneumatic Lines	A suitable air compressor for supply of compressed air to various pneumatic actuators, solenoid valves, purging, cross jet, etc. 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 a capacity of atleast 1000 L shall be part of the supply • The hoses shall be from an internationally reputed supplier like Legris. The make should be mentioned • The hoses and connections to all the system shall be of dimensions to meet the pressure and flow rate requirements • The hoses shall be protected from damage at critical locations. • Any construction support required from BHEL side for air connections such as pipes, fittings, etc. that is to be made ready before commissioning to be specified in the offer		

HH. ESSENTIAL ACCESSORIES [....contd.....]			
Sl.No.	FEATURES	BHEL SPECIFICATION	
HH.4	Dryers	The system shall include dryers with required pre filter, moisture separator, carbon filter and fine filter to supply clean dry air to the system and shall meet the following specifications	
		• The dryer(s) to 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	
HH.5	Servo Stabiliser	The required 3 phase servo stabiliser to supply spike free electrical power to the systems shall be part of the offer. The make of the servo stabiliser to be mentioned in the offer.	
HH.6.	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	
HH.7	Isolation Transformer & Servo Stabiliser	• The offer shall compulsorily include one set of Isolation Transformer and Servo Stabiliser of suitable rating (not less than 60 kVA rating) to meet the total requirements of the welding station & accessories. • Bidder to furnish technical details of the offered Isolation Transformer and Servo Stabiliser with makes & ratings and shall be sourced from REPUTED VENDORS. • The supply can be combination of both Isolation Transformer and Servo Stabiliser in one unit, serving the purpose. • The Isolation Transformer and Servo Stabiliser Units can be sourced from INDIA and also through the LOCAL REPRESENTATIVE, including essential spares.	

II. SAFETY ACCESSORIES				
SI.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
II.1	Goggles	6 goggles from Laser Vision to protect the personnel with atleast L7 protection for the quoted laser wavelength - Goggle cleaning liquid (3 bottles) to be included in the offer		
JJ. SPARES				
SI.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
JJ.1.	Spares	All necessary spares and consumables for trouble free operation of the system of three years to be supplied along with the machine. The spares shall include but not limited to the following - Spares for laser - An optical fiber - Cover slides for processing heads - Focal lens for welding in all focal lengths mentioned before - Anti-corrosive additive for chiller water - A standard support and maintenance kit to be provided - Lens cleaning liquid and Whatman lens cleaning tissue to be supplied		
KK. PRE DISPATCH INSPECTION				
SI.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS

KK.1	Pre Dispatch Inspection (PDI)	The entire system shall have to be offered for pre dispatch inspection at vendor sites. Following shall be demonstrated during pre-dispatch inspection. • Functioning of the laser and all its accessories • Full power output of the laser with calibrated digital power meter • Beam quality of the laser and Focusing stability • CNC motion system demonstrating the maximum speed, positioning accuracy, limit switch, etc. • Robot motion system demonstrating the reach, speed, positioning accuracy, etc. • Safety interlocks and its functioning • Processing heads and its functioning		
KK. PRE DISPATCH INSPECTION [...contd.....]				
SI.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
KK.1 (contd.)	Pre dispatch inspection	The entire system shall have to be offered for pre dispatch inspection at vendor site. Following shall be demonstrated during pre-dispatch inspection. • Welding trials to demonstrate the capability • Cladding trials (external and internal) to demonstrate the specification match with different spot sizes • Hardening trials with different spot sizes • Light proofness of the cell • Functioning of dust collector		
LL. INSTALLATION AND COMMISSIONING :				
S.No.	PARTICULARS	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
LL.1	No. of Copies	2 (Two) sets containing manuals of Laser, CNC, Robot, Chiller, Dust Collector, Welding Head, Cladding Heads (External & Internal), Hardening Head		
LL.2	Language	English		

LL.3	Manual Details :	- Detailed user instruction manual, operation/Instruction manual, troubleshooting manual, CDRom tutorials for the laser and all the accessories to be supplied - Detailed circuit and fault diagnostic software, detailed circuit diagram of the equipment (Laser, Robot, Chillers, processing heads, safety interlocks, water circuits), maintenance and service manuals - Manual shall contain all instructions for machine installation and processing trials in sequence. - Manual to give details on PCBs [Printed Circuit Board] like tapping voltages, main electronic elements' specifications and ratings, etc. - Manual to give other details like trouble shooting chart, parameters selection for welding & cladding various base metals, etc. - Master List of Parts & Spares used in the machine with Make, Model, Rating, etc.		
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MM. GENERAL POINTS :				
S.No.	PARTICULARS	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
MM.1	Commissioning	- Installation, Erection and commissioning should be carried out by the supplier at WRI - Prove out trails in welding, - It is the responsibility of the supplier to integrate all the systems and ensure the functionality - Supplier should intimate their requirements for erection and commissioning along with offer.		
MM.2	Training	- The Supplier's SERVICE ENGINEER shall give training in the Operation and Maintenance of the Machine for BHEL Staff, after the successful commissioning of the entire system - Detailed training on part programming with both CNC and robot to be provided at both customer site and at BHEL		

PART-B: LASER CLADDING & WELDING SYSTEM

MM.3	Warranty	The system shall have warranty for a minimum of 36 months from the date of commissioning at WRI/BHEL. Warranty of individual components shall be atleast 36 months from the date of commissioning at WRI/BHEL and the warranty for individual component shall be mentioned clearly		
MM.4	Bought-Out Items	• The Bought-Out Items - like Motors, ICs, Relays, Contactors, Switches, Electronic Elements, etc., used in the Power source & torch shall be of Internationally Reputed Manufacturers only.		