

**PART B****TECHNICAL SPECIFICATIONS FOR 'LASER WELDING & CUTTING MACHINE'**

<b>AA. APPLICATION :</b>			
<b>Sl.No.</b>	<b>FEATURES /BHEL SPECIFICATION</b>	<b>OFFER BY BIDDER</b>	<b>DEVIATIONS</b>
AA.1	<p>The offered system shall be capable of doing the following</p> <ul style="list-style-type: none"> <li>• Laser cutting &amp; welding with at least 6 kW continuous wave laser power output</li> <li>• Laser welding of steel/stainless steel/nickel based superalloy</li> <li>• Laser hybrid welding by suitable coupling with conventional arc welding power source (GMAW/GTAW/Plasma).</li> <li>• Laser cutting of steel/stainless steel in single pass with smooth surface</li> </ul>		
<b>BB. MACHINE CONFIGURATION : [The scope of supply shall consist of the following]</b>			
<b>Sl.No.</b>	<b>FEATURES /BHEL SPECIFICATION</b>	<b>OFFER BY BIDDER</b>	<b>DEVIATIONS</b>
BB.1	A fiber coupled 6 kW disc LASER or fiber laser or hybrid laser with a beam parameter product of < 4 mm-mrad and have a minimum of two power tapping. The laser source shall be from reputed manufacturers like Trumpf or IPG Photonics or Laser Line or Coherent/Rofin-Sinar only		
BB.2.	The laser resonator shall have all necessary internal optics and cooling systems		
BB.4	A CNC table with a clear minimum of 1.0 m traverse in X axis, 1.0 m in Y axis and a minimum Z axis travel of 0.6 m along with a rotary positioner mounted on the table.		
BB.5	Required accessories for laser system like Servo stabilizer, isolation transformer, UPS suiting the machine with all accessories, chiller (Primary and/or Secondary, as required), etc. All the accessories to be quoted along with the machine.		
BB.6	Class 1 safety enclosure for laser operating areas covering the entire CNC workstation		

BB.7	Safety interlocks in at least three locations		
BB.8	Welding head, cutting head, laser with necessary optics		
BB.9	Laser viewing window from Laser Vision for safe viewing from outside		
BB.10	Operator console for operation		

CC. EQUIPMENT SPECIFICATION : LASER SYSTEM				
Sl.No.	FEATURES	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
CC.1	<b>Type</b>	Continuous wave Disc or fiber laser or hybrid laser (dual output) preferably with the capability to operate modulated/pulsed power mode		
CC.2.	<b>Mandatory maximum Power Output</b>	6000 W in continuous wave mode. At least 6000 W peak power output in pulsed mode of operation, if pulsing option available. The option of having modulated pulsed power output will be an added advantage. All the kind of pulsed power outputs shall be clearly mentioned along with the offer supported by technical literatures.		
CC.3.	<b>Beam Quality</b>	The beam parameter product to be 4 mm-mrad or better at 6000 W power output.		
CC.4.	<b>Laser Cooling System</b>	Internal cooling system with necessary deioniser and pump module for cooling the resonator, as required		
CC.5.	<b>Beam Switch</b>	Integrated beam switch with at least two channels		
CC.6.	<b>Optical Fiber</b>	<ul style="list-style-type: none"> <li>• Suitability to work different fiber core diameters like but not limited to 100, 200, 600 &amp; 1000 µm diameter process fiber with at least 10 m long cable</li> <li>• Two optical fibers of 200 µm core diameter to be supplied along with the machine</li> <li>• Necessary leak detector for detecting any leaks in the fiber</li> <li>• Optical fiber shall have QBH connector at both laser and processing head ends and should be suitable for working with Coherent FLO60 (S/N 2185) laser as well.</li> </ul>		

CC.7.	<b>Shutter</b>	Internal shutter with necessary beam dump for continuous firing before taken out to process fiber. The time duration of firing to the beam dump to be clearly mentioned along with the offer and preferably have more than 30 minutes.		
CC.8.	<b>Alignment laser</b>	Red/green laser for optical alignment		
CC.9.	<b>Air Purging</b>	The resonator shall have necessary air purging system (as required) with required connections		
CC.10.	<b>Base Frame</b>	<ul style="list-style-type: none"> <li>• Laser resonator shall be mounted on a frame (if required) with suitable Sunnex dampers to arrest vibrations</li> <li>• The frame shall have necessary locking arrangements for fixing the resonator</li> <li>• The frame shall be made of steel and painted to avoid any corrosion</li> </ul>		
<b>DD. EQUIPMENT SPECIFICATION: CNC GANTRY MOTION SYSTEM</b>			<b>[...contd.....]</b>	
<b>Sl.No.</b>	<b>FEATURES</b>	<b>BHEL SPECIFICATION</b>	<b>OFFER BY BIDDER</b>	<b>DEVIATIONS</b>

DD.1.	<b>Motion System</b>	<p>Four-axis motion system with simultaneous movement control for all axes. The motion details shall be of at least as given below</p> <ul style="list-style-type: none"> <li>• X-axis: The x-axis shall be on the r bridge with a clear minimum travel of 1.0 m with a minimum of <math>\pm 50 \mu\text{m}</math> accuracy and a minimum of <math>\pm 50 \mu\text{m}</math> repeatability and with necessary limit switch. The speed of movement shall be continuously adjustable with a maximum speed of at least upto 20 m/min.</li> <li>• Y-axis: The Y-axis shall be on the r bridge with a clear minimum travel of 1 m with a minimum of <math>\pm 50 \mu\text{m}</math> accuracy and a minimum of <math>\pm 50 \mu\text{m}</math> repeatability and with necessary limit switch. The speed of movement shall be continuously adjustable with a maximum speed of at least upto 20 m/min</li> <li>• Z-axis: The z-axis is mounted to the bridge/gantry with a minimum of 0.6 m travel with a minimum of <math>\pm 50 \mu\text{m}</math> accuracy and a minimum of <math>\pm 50 \mu\text{m}</math> repeatability and with necessary limit switch</li> <li>• Rotary-axis: A minimum of 12 inch 3-jaw chuck with a standard payload capacity of 100 kg. The maximum RPM or surface velocity for 12-inch diameter shall be specified.</li> </ul>		
DD.2.	<b>Cable Management</b>	<ul style="list-style-type: none"> <li>• Necessary cable drag tray preferably from igus.</li> <li>• The necessary covers and a management solution to protect fiber optic cable, all the air and water lines connecting processing heads, optics, etc.</li> </ul>		
DD.3.	<b>CNC Controls</b>	<p>CNC controls shall be from a reputed supplier like Fanuc/Fagor/Siemens/Parker/Beckhoff/Mitsubishi/Panasonic . The same shall be specified in the offer.</p>		

DD.4.	<b>Servo motors</b>	Required servo motors for axis movements shall be from a reputed supplier like Siemens/Mitsubishi/Yaskawa/Panasonic with necessary gearbox.		
DD.5.	<b>Construction</b>	<ul style="list-style-type: none"> <li>• 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/Dunlop dampers to avoid vibrations. Any other method to avoid vibrations shall be mentioned by the vendor.</li> <li>• Work table of size 1000 mm x 1000 mm minimum with suitable 'T' slots</li> <li>• Minimum load bearing capacity of the bed shall be 0.5 MT</li> </ul>		

DD.6	<b>Integration, Controls &amp; Programming</b>	<ul style="list-style-type: none"> <li>• Laser system and all the processing heads shall be integrated with the CNC.</li> <li>• All operations of the system shall be controllable through CNC.</li> <li>• 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</li> <li>• 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</li> <li>• A minimum of 6 additional Digital I/O ports to be provided for future applications</li> <li>• Common part programmes to be preloaded</li> <li>• Safety integration to be provided</li> <li>• Dual channel safety circuit for laser safety and operator safety</li> <li>• Necessary buttons to be provided on the front of the operator interface</li> <li>• Emergency Stop (E-Stop) buttons to be provided</li> <li>• Separate system reset button to be provided and specified</li> <li>• Separate laser enable/disable switch</li> </ul>		
<b>EE. EQUIPMENT SPECIFICATION : LASER CELL – LASER SAFETY ENCLOSURE- CLASS 1</b>				
<b>S.No.</b>	<b>FEATURES</b>	<b>BHEL SPECIFICATION</b>	<b>OFFER BY BIDDER</b>	<b>DEVIATIONS</b>

EE.1.	<b>Requirement</b>	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		
EE.2.	<b>Safety Features</b>	<ul style="list-style-type: none"> <li>• All necessary safety interlocks, guarding, as well as access panels for service/maintenance of the system</li> <li>• A laser safe viewing window from Laser Vision with all outer beadings of minimum dimensions 12" x 8" suiting the laser wavelength and can give at least L5 protection</li> </ul>		
EE.3.	<b>Construction</b>	<ul style="list-style-type: none"> <li>• Dual wall steel panels to assure Class 1 laser enclosure rating</li> <li>• The dimensions of the enclosure to be mentioned in the offer. The enclosure shall have adequate space for the operator to access all the sides of the table. The exact space planned to be mentioned in the offer.</li> <li>• Roll up or sideways motorised operator door for loading parts and programming access.</li> <li>• Make-up air vents on both sides of enclosure for optimum exhaust air flow through</li> <li>• All other openings to be properly sealed</li> <li>• Interior LED lighting with required environmental control system</li> <li>• Internal viewing camera for live viewing and a closed circuit with flat screen LED TV with minimum of 18" display</li> <li>• Ladders shall be provided where ever required.</li> </ul>		
FF.7.	<b>Essential Inclusions</b>	<ul style="list-style-type: none"> <li>• One optical fiber spare</li> <li>• Cover slides – 20 Nos</li> <li>• Nozzle kit of different nozzles (0.8 – 1.2 mm wires) – 2 Nos</li> <li>• Cleaning nozzles – 5 Nos</li> <li>• Power connector – 2 Nos</li> <li>• Helmet</li> </ul>		

FF. EQUIPMENT SPECIFICATION : PROCESSING HEADS				
S.No.	PARTICULARS	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS



<p>FF.1</p>	<p><b>Welding Head -</b></p>	<p>Welding head with necessary processing optics to focus the laser beam on to the workpiece only from from the laser system manufacturer or Precitec GmbH or Laser Mechanisms or High YAG or Raytools or any other supplier acceptable to BHEL with wobbling capability suiting the quoted laser. The make of the welding head should be clearly mentioned and shall meet the following</p> <ul style="list-style-type: none"> <li>• 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 combinations to be clearly mentioned</li> <li>• Wobbling parameters like frequency, distance, etc. to be mentioned along with the offer</li> <li>• Provision to supply shielding gas</li> <li>• Suitable protection cover slide</li> <li>• Provision of swivelling welding head. Details to be given</li> <li>• Provision for 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</li> <li>• Provision for LCD monitor to display the signal of the camera inside and outside of the machine work area</li> <li>• Water cooled optics</li> <li>• Necessary connections to provide cross jet</li> <li>• Metal bellows (wherever required) to protect the flexible hoses</li> <li>• Additional focusing optics of focal lengths 200 &amp; 300 (2 each) and two collimating lens of 150 mm focal length to be included in the offer</li> <li>• Cover slide with necessary IR coatings – 10 Nos.</li> <li>• Necessary alarm or feedback module to be included</li> </ul>		
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		<ul style="list-style-type: none"> <li>• The head shall have provision to accommodate Laser Weld Monitor and Seam Tracking System</li> <li>• Fiber end connection - QBH</li> </ul>		
FF.2	<b>Cutting Head</b>	<p>Cutting head with necessary processing optics to focus the laser beam on to the workpiece only from from the laser system manufacturer or Precitec GmbH or Laser Mechanisms or High YAG or Raytools or any other supplier acceptable to BHEL suiting the quoted laser. The make of the cutting head should be clearly mentioned and shall meet the following</p> <ul style="list-style-type: none"> <li>• Collimation length of 100 mm – 2 Nos.</li> <li>• Focusing length of 150 mm &amp; 200 mm – 2 each</li> <li>• Assist gas pressure – as required for thick plates cutting</li> <li>• Required autofocus sensor</li> <li>• Fiber interface – QBH type</li> </ul>		
<b>GG. ESSENTIAL ACCESSORIES</b>				
<b>Sl.No.</b>	<b>FEATURES</b>	<b>BHEL SPECIFICATION</b>	<b>OFFER BY BIDDER</b>	<b>DEVIATIONS</b>

GG.1.	<b>Chillers</b>	<p>The required chiller(s) (indoor type) as required for the quoted system to maintain the temperature in the resonator, processing heads, optics, etc. and shall meet the following specifications</p> <ul style="list-style-type: none"> <li>• 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</li> <li>• Chiller (s) shall have tanks &amp; pumps to meet the required capacity</li> <li>• The required flow rates to cool all the laser system, processing heads and optics. Flow rates and operating pressure to be mentioned.</li> <li>• Automatic feedback system to monitor the flow pressure/flow, temperature and water conductivity (if required) to be part of the supply</li> <li>• Shall have necessary safety interlock to avoid switching on of the laser if the water flow/level/temperature is erroneous/beyond acceptable limit</li> <li>• The required water quality in terms of conductivity, etc. to be mentioned in the offer</li> <li>• 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</li> <li>• Required damage protection system for all the hoses at critical locations to be part of the system</li> <li>• The required anti corrosive liquid to be supplied for trouble free operation for atleast 3 years</li> <li>• 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</li> </ul>		
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GG.2.	<b>Isolation Transformer, Servo Stabiliser &amp; UPS</b>	<ul style="list-style-type: none"> <li>• 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 &amp; accessories.</li> <li>• Bidder to furnish technical details of the offered Isolation Transformer and Servo Stabiliser with makes &amp; ratings and shall be sourced from REPUTED VENDORS.</li> <li>• The supply can be combination of both Isolation Transformer and Servo Stabiliser in one unit, serving the purpose.</li> <li>• The Isolation Transformer and Servo Stabiliser Units can be sourced from INDIA and also through the LOCAL REPRESENTATIVE, including essential spares.</li> <li>• UPS from a reputed supplier with a stand by capacity of at least 20 minutes at full load with all accessories</li> </ul>		
GG.3.	<b>Laser Safety Goggles</b>	<ul style="list-style-type: none"> <li>• 6 goggles from Laser Vision to protect the personnel with at least L7 protection for the quoted laser wavelength</li> <li>• Goggle cleaning liquid (3 bottles) to be included in the offer</li> </ul>		

GG.4.	<b>Spares &amp; Accessories</b>	<p>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</p> <ul style="list-style-type: none"> <li>• Necessary Spares for laser. Details to be provided</li> <li>• Hand held laser power meter with digital display preferably Pocket Monitor from M/s Primes for measurement of continuous wave laser power upto 10 kW</li> <li>• Optical fiber of core diameter 200 μm – 1 No.</li> <li>• Cover slides for processing heads – 15 Nos. each</li> <li>• Collimation lens for both heads heads – 2 each</li> <li>• Anti-corrosive additive for chiller water</li> <li>• A standard support and maintenance kit to be provided</li> <li>• Whatman lens cleaning tissue (25 packs) to be supplied</li> <li>• Legris hoses of the following dimensions                             <ul style="list-style-type: none"> <li>○ 10 x 8 mm – 20 m</li> <li>○ 8 x 6 mm – 20 m</li> <li>○ 6 x 4 mm – 20 m</li> <li>○ 4 x 2 mm – 20 m</li> </ul> </li> </ul>		
<b>HH. SCOPE OF SUPPLY</b>				
<b>SI.No.</b>	<b>FEATURES</b>	<b>BHEL SPECIFICATION</b>	<b>OFFER BY BIDDER</b>	<b>DEVIATIONS</b>
HH.1	Scope of Supply	Vendor should give the detailed scope of supply with numbers along with the offer		
<b>II. PRE DISPATCH INSPECTION</b>				
<b>SI.No.</b>	<b>FEATURES</b>	<b>BHEL SPECIFICATION</b>	<b>OFFER BY BIDDER</b>	<b>DEVIATIONS</b>
II.1				

	<p><b>Pre Dispatch Inspection (PDI)</b></p>	<p>The entire system shall have to be offered for pre dispatch inspection at vendor sites. Following shall be demonstrated during pre-dispatch inspection.</p> <ul style="list-style-type: none"> <li>• Functioning of the laser and all its accessories</li> <li>• Full power output of the laser with calibrated digital power meter</li> <li>• Beam quality of the laser and Focusing stability</li> <li>• CNC motion system demonstrating the maximum speed, positioning accuracy, limit switch, etc.</li> <li>• Safety interlocks and its functioning</li> <li>• Processing heads and its functioning</li> <li>• Autogenous welding trials to demonstrate the capability</li> <li>• Cutting trials to establish the maximum thickness possible</li> <li>• Light proofness of the cell</li> <li>• Airfare, board &amp; lodging for the BHEL Engineers who will be visiting supplier's works for pre-dispatch inspection and training, shall be borne by BHEL.</li> </ul>		
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**JJ. GENERAL POINTS :**

S.No.	PARTICULARS	BHEL SPECIFICATION	OFFER BY BIDDER	DEVIATIONS
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JJ.1.	<b>Electrical &amp; Electronics Systems</b>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Tropicalization: All electrical / electronic equipment shall be tropicalized.</li> <li>• Control circuit voltage shall not exceed 24V DC</li> <li>• All electrical components in the cabinets should be mounted on DIN Rail</li> <li>• Vendor should ensure the proper earthing for the machine.</li> <li>• All electrical &amp; electronic control cabinets &amp; panels should be vermin and dust proof. All Electric enclosures shall have IP 54 protection</li> </ul>		
JJ.2	<b>Machine Foundation</b>	<ul style="list-style-type: none"> <li>• The required machine foundation, if any to be clearly mentioned within 15 days of the receipt of the PO from BHEL.</li> </ul>		
JJ.3.	<b>Machine Spares</b>	<ul style="list-style-type: none"> <li>• List of spares with itemized break-up of mechanical, hydraulic, pneumatic, electrical and electronic spares used in the machine for 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:</li> </ul>		
		<p><b>Electrical / Electronic / PLC Spares:</b> All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch, Power Module &amp; Control Cards, etc.</p>		

		<ul style="list-style-type: none"> <li>• 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 &amp; suppliers to enable BHEL to procure these in advance, if required</li> </ul>		
		<ul style="list-style-type: none"> <li>• Vendor to confirm that complete list of spares for machine and accessories (including laser), along with item part no / specification / type / model, and name &amp; address of the spare supplier shall be furnished along with documentation shall be provided with the machine</li> </ul>		



JJ.4.	<b>Documentation</b>	<p>The following documents in English language should be supplied along with the machine:</p> <p style="text-align: center;"><b>Hard Copies - 3 Sets</b>                      <b>Vendor to confirm</b> <b>In hard disk/USB - 1 Set</b></p> <ol style="list-style-type: none"><li>1. Operating manuals of Machine &amp; its PLC System (if provided)</li><li>2. Programming manuals of Machine &amp; its PLC System (if provided)</li><li>3. Operating manuals of Machine &amp; its CNC System (if provided)</li><li>4. Programming manuals of Machine &amp; its CNC System (if provided)</li><li>5. Maintenance and spare part manuals with all drawings of machine assemblies / subassemblies with parts list</li><li>6. Manual shall contain all instructions for machine installation and processing trials in sequence.</li><li>7. Detailed circuit and fault diagnostic software, detailed circuit diagram of the equipment (Laser, Chillers, processing heads, safety interlocks, water circuits), maintenance and service manuals</li><li>8. All Electrical circuit diagrams with bill of materials</li><li>9. Pneumatic circuit diagrams with bill of materials</li><li>10. Maintenance &amp; Interface manuals for Machine Control System</li><li>11. Preventive Maintenance check list for Electrical and Mechanical System</li><li>12. Trouble shooting chart for Main and all sub systems</li><li>13. Complete PCB Schematics indicating check points for Electronic controls.</li><li>14. Complete list of Bought out items with make and model number.</li><li>15. Catalogues, O&amp;M manuals for all bought out items used in the machine.</li><li>16. Operating Manuals, Maintenance Manuals &amp; Catalogues for all supplied Accessories.</li></ol>		
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		<p>17. Detailed specification of all rubber items / hydraulic / lubrication fittings</p> <p>18. PLC program print-outs with comments in English</p> <p>19. PLC program and data on CD, Flash Memory Card.</p> <p>20. 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</p> <p>21. Complete list of Alarm log, Error code, error messages &amp; remedies and on line fault diagnostics to be provided by the vendor.</p> <p>22. Complete list of spares for machine, along with item part no /specification / type / model and make &amp; address of the sub-vendor.</p> <p>23. Part drawings of sub systems installed in machine</p>		
JJ.5.	<b>Prove out at BHEL Works</b>	<ul style="list-style-type: none"> <li>• After the machine erection and energizing at BHEL works, all systems of the machine have to be operated and demonstrated in proper working condition.</li> <li>• System shall be demonstrated for autogenous welding, hand held welding and cutting.</li> </ul>		

JJ.6	<b>Commissioning</b>	<ul style="list-style-type: none"> <li>• Supplier to take full responsibility for 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.</li> <li>• Supplier shall do the necessary wiring connection for laser hybrid welding with the GMAW power source provided by BHEL.</li> <li>• Service requirement like power, air &amp; water shall be provided by BHEL at only one point to be indicated by Vendor in their foundation/layout drawings.</li> <li>• All tests, as mentioned (Machine Acceptance) shall form part of the commissioning activity.</li> <li>• Suitable calibration, as required to be carried out by the vendor after installation of the machine. Required instruments are to be carried by the supplier for calibration. Calibration reports are to be submitted for repeatability and accuracy. Details of the calibration method that shall be followed to be mentioned in the offer.</li> <li>• Commissioning spares, required for commissioning of the machine shall be supplied free of cost</li> <li>• Test Mandrels, Instruments and other necessary equipment including Laser equipment, if required, to carry out all above activities should be brought by the Vendor.</li> </ul>		
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<p>JJ.7</p>	<p><b>Training</b></p>	<ul style="list-style-type: none"> <li>• The supplier shall train at least TWO or THREE BHEL Engineers in Operation and Maintenance (Mechanical, Electrical/ Electronics and Programming) of the Machine for sufficient working days (vendor to specify) at supplier’s works after the pre-dispatch inspection.</li> <li>• 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 Five working days</li> <li>• The training shall include specialized coaching in             <ul style="list-style-type: none"> <li>○ Safety</li> <li>○ Operation of the machine</li> <li>○ PC based System</li> <li>○ Operation &amp; programming</li> <li>○ Trouble-Shooting</li> <li>○ Software Application</li> <li>○ All special features of the machine</li> <li>○ Electrical / Mechanical / Electronics systems</li> </ul> </li> <li>• Competent, English speaking experts shall be arranged by the vendor during training for satisfactory &amp; effective training of BHEL personnel</li> </ul>		
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JJ.8	<b>Thermal Stability for Ambient Conditions &amp; Environmental Performance of the Machine</b>	<ul style="list-style-type: none"> <li>• The machine shall be suitable for an ambient temperature of + 50° C and relative humidity of 93 % respectively, but both do not occur simultaneously.</li> <li>• The vendor should ensure trouble free operation of the machine with Thermal Stability of the complete machine and accuracy requirements, keeping in view of ambient conditions as mentioned above.</li> <li>• The machine, including attachments and accessories, should be suitable for continuous operation on three shifts a day.</li> <li>• Paint of the machine should be oil / coolant resistant and should not peel off</li> <li>• Maximum noise level shall be 85 dB(A) at normal load condition</li> </ul>		
JJ.9	<b>Painting</b>	Painting of entire Machine / Electrical Panels: <ul style="list-style-type: none"> <li>• RAL 6011 Apple Green (Polyurethane Paint)</li> <li>• Heat resistant paint on the inside of the machine in the weld/cut zone</li> </ul>		
JJ.10	<b>Machine Packing</b>	Sea worthy & rigid packing for all items of complete machine, 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		
JJ.11	<b>Warranty</b>	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 same shall be confirmed by the bidder.		
JJ.12	<b>Bought-Out Items</b>	<ul style="list-style-type: none"> <li>• The Bought-Out Items - like Motors, ICs, Relays, Contactors, Switches, Electronic Elements, etc., used in the Power source &amp; torch shall be of Internationally Reputed Manufacturers only.</li> </ul>		

JJ.13	<b>General</b>	The vendor to give the following details <ul style="list-style-type: none"><li>• Machine Model No.</li><li>• Total connected load (KVA):</li><li>• Total required air volume in cu.m/min</li><li>• Floor area required (Length, Width, Height) for complete machine &amp; accessories</li><li>• Total weight of the machine (approx.)</li><li>• The general arrangement drawing showing the machine &amp; associated systems with salient dimensions shall be submitted along with the offer. The drawing should be clear and legible</li></ul>		
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