

 <b>BHARAT HEAVY ELECTRICAL LIMITED</b> <b>UNIT'S ADDRESS:</b> <b>CONTACT PERSON'S NAME/DESIGN./PHONE NO./E-MAIL (FROM PURCHASE DEPTT.)</b>		<b>Enquiry No. :</b> <b>Due Date :</b> <b>Supplier Qtn. No.:</b> <b>Date :</b>			
<p align="center"><b>SPECIFICATION CUM COMPLIANCE CERTIFICATE OF CNC VERTICAL BORER.</b></p>					
<p><b>NOTE:-</b></p> <p>1. Vendor (OEM) must submit complete information against clause no. 26 (Qualifying condition). The offer meeting this clause would only be processed (OEM : Original Equipment Manufacturer).</p> <p>2. The vendor(OEM) should fill the "Offered" Column in compliance to specified requirements and also "Deviations" Column, where there is deviation from the requirement. Duly filled specification cum compliance certificate should be submitted along with the offer. Inadequate, incomplete, ambiguous or unsustainable information against any of the clauses of the specifications/requirements shall be treated as non-compliance.</p> <p>3. The offer and all documents enclosed with offer should be in English language only.</p>					
<b>NAME &amp; ADDRESS OF THE SUPPLIER :</b>					
<b>TELEPHONE NOS.:</b>					
<b>FAX NOS.:</b>					
<b>E-MAIL ADDRESS :</b>					
<b>SCOPE: SUPPLY, ERECTION &amp; COMMISSIONING OF CNC VERTICAL BORER COMPLYING WITH SPECIFICATIONS AS BELOW:</b>					
SNO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATIONS	REMARKS
<b>1   PURPOSE &amp; WORKPIECE MATERIAL</b>					
1.1	Purpose: This machine is required for carrying out rough & finish machining operations on casings and other components of Steam Turbines demanding high accuracies & surface finish. The machine shall be used for all types of turning, grooving, boring operations on diameters & faces including threading operations.	Vendor to note & accept			
1.2	Work Piece Material: are forgings / castings of High Alloy Steels, Nimonic Steel, Stainless Steel, Inconel, Cast Iron and similar other materials which are generally used in power producing equipments having hardness 150 to 500 BHN.	Vendor to note & accept			

<b>2 SPECIFICATIONS: (Minimum requirements)</b>				
<b>2.1 MACHINE CONFIGURATION</b>				
2.1.1	Double Column CNC Vertical Borer with single Ram	Vendor to offer		
<b>2.2 CAPACITY &amp; SIZE</b>				
2.2.1	Maximum Height for Turning & Facing	4000 mm or more		
2.2.2	Maximum Turning Diameter	5000 mm or more		
2.2.3	Max weight admitted on table	80000 Kg or more		
2.2.4	Maximum Swing Diameter	4500 mm or more		
2.2.5	Minimum Boring Diameter (using standard turning tool holder & tool clamped on the ram)	550mm or less		
<b>2.3 TABLE</b>				
2.3.1	Table Diameter	4000 mm		
2.3.2	Load Capacity	80000Kg or more		
2.3.3	Table Speed ( Infinitely Variable )	Min. 0.5rpm or less, Max. 75rpm or more		
2.3.3.1	Speed Ranges	Vendor to inform		
2.3.4	Power of Main Drive ( S1 - Continuous Rating ) AC. Minimum	125 kw or more		
2.3.5	Motor & Drive Make: FANUC ai or SIEMENS 1PH series motor with matching drive	Vendor to inform		
2.3.6	Encoder: FANUC/SIEMENS/HEIDENHAIN rotary encoders for direct reading of actual rpm	Vendor to confirm		
2.3.7	No. of Jaws/Vices (With Force Multiplier Mechanism)	4		
2.3.8	Maximum External Clamping Diameter	Vendor to inform		
2.3.9	Minimum External Clamping Diameter	Vendor to inform		
2.3.10	Maximum Internal Clamping Diameter	Vendor to inform		
2.3.11	Minimum Internal Clamping Diameter	Vendor to inform		
2.3.12	Clamping Force of each Jaw.	Vendor to inform		
2.3.13	Positions and Dimensions of the Jaws on Table. Chucking Capacity Diagram should be submitted.	Vendor to inform & submit		
2.3.14	Type of Force Multiplier Mechanism used in Jaws.	Vendor to inform & submit		
2.3.15	Maximum permissible Cutting Force	Vendor to inform		
2.3.16	Maximum permissible Torque	Vendor to inform		
2.3.17	RPM at which Max. Torque is available.	Vendor to inform		
2.3.18	Table Torque - Speed diagram should be submitted.	Vendor to submit		
2.3.19	Types of Bearings for the Table (including main Hydrostatic Bearing)	Vendor to inform		
2.3.20	Size of T - slots, their position and accuracy. Drawing of Table showing details of the T - slots etc. should be submitted.	Vendor to submit		

2.3.21	Two perpendicular accurate Slots should be provided on the table to use for alignment purposes.	Vendor to confirm			
2.3.22	Table Loading Diagram should be submitted (Load v / s Distance from Table Center) for uniform as well as for eccentric loading.	Vendor to submit			
2.3.23	Diameter, Depth and Accuracy of Center Bore on Table Top Surface.	Vendor to inform			
2.3.24	Single piece construction of machine table	Vendor to confirm			
<b>2.4 CROSS RAIL</b>					
2.4.1	Vertical Travel.	2500 mm			
2.4.2	Vertical Traverse Rate.	0-1000 mm/min			
2.4.3	Positions of cross rail should be infinitely variable/Continuous	Vendor to inform			
2.4.4	Distance between each Position/Step ( to be mutually agreed with vendor)	Vendor to inform			
2.4.7	Maximum Height of Cross Rail bottom from Table Top	4250 mm			
2.4.8	Minimum Height of Cross Rail bottom from Table Top	Vendor to inform			
2.4.9	W-axis is a complete NC axis Movement of Cross Rail Through NC Program as well as manually by Push Buttons rail positioning is accomplished through a ball screw on each column (with AC servomotor and gear box)	Vendor to offer			
2.4.10	Machine Reference Point should be at Ram Reference Point and it should be updated automatically with movement of Cross Rail	Vendor to confirm			
2.4.11	Details of crossrail movement/positioning/locking mechanism	Vendor to confirm			
<b>2.5 TOOL HEAD and RAM</b>					
2.5.1	No. of Columns	2			
2.5.2	No. of Rams	1			
2.5.3	Cross - Section of Ram (It should be rigid enough for troublefree machining with maximum projection of ram and also suitable for specified minimum bore dia)	400mm x 400mm			
2.5.4	Provision for Thread Cutting	Vendor to inform			
2.5.5	Clamping / Mounting Mechanism of Turning Tool Holders/Attachments on ram.	Vendor to submit			
2.5.6	Clamping Force Available for clamping of Turning Tool Holders/Attachments.	Vendor to inform			
2.5.7	Mounting of Turning Tool Holders and Attachments should be automatic through Program as well as manually through push buttons.	Vendor to confirm			

<b>2.6</b>	<b>MAIN TRAVERSES</b>					
2.6.1	Vertical Travel of Ram (Z-Axis) For maximum turning/facing height of 4000mm. (If offered turning height S.No. 2.2.1 is more than 4000 mm, Ram travel should also be increased by half value of increase in turning height above 4000 mm)	Minimum 2500mm				
2.6.2	Horizontal Travel of Ram ( +ve X-Axis )	2650 mm				
2.6.3	Horizontal Travel of Ram beyond Center of the Table ( -ve X-Axis ) : Minimum 1000mm	Vendor to inform				
2.6.4	Maximum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to inform				
2.6.5	Minimum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to inform				
<b>2.7</b>	<b>MACHINE GUIDEWAYS</b>					
2.7.1	Width of Cross Rail guideways	Vendor to inform				
2.7.2	Width of column guideways	Vendor to inform				
2.7.3	X & Z guide ways should be hydrostatic with pump per pocket design (Details should be submitted)	Vendor to confirm				
2.7.31	Rotary guide ways for the table should be Hydrostatic. Detail along with minimum & maximum dia. of hydrostatic bearing should be submitted.	Vendor to offer				
2.7.4	Hardness of guideways	Vendor to inform				
2.7.5	<u>Metallic Telescopic Covers</u> : Waterproof Telescopic Covers of rust resistant steel should be provided with pads/wipers on both left and right sides of tool head on the crossrail and also above & below the crossrail on both columns covering the guide ways. Joints of telescopic covers should be sealed to avoid mixing of coolant & hydrostatic oil . The movement of telescopic covers should be troublefree and requiring minimum maintenance.	Vendor to offer				

<b>2.8 FEEDS AND DRIVE SYSTEM</b>				
2.8.1 Cutting feed in X & Z Axes ( Infinitely Variable )				
2.8.2 Rapid feed in X & Z Axes	0.5 - 5000mm/min or more Min. 5000mm/min			
2.8.3 Feed motors & drives: FANUC ai or SIEMENS 1FT/1FK series AC servo motors with matching AC servo drives	Vendor to offer			
2.8.4 Maximum cutting force permissible on Ram & at what extension	Vendor to inform			
2.8.5 Maximum permissible Cutting Force at Maximum Ram extension	Vendor to inform			
2.8.6 Permissible Cutting Force v / s Ram Projection - Diagram should be submitted.	Vendor to submit			
2.8.7 Feed back system for X, Z axes: Heidenhain linear scales (Details to be submitted)	Vendor to offer			
2.8.8 Details of backlash free movement mechanism in X & Z axes should be submitted.	Vendor to submit			
2.8.9 Mechanism for locking X & Z axis	Vendor to inform			
<b>2.9 CONSTRUCTION</b>				
2.9.1 Vendor to furnish details of material, hardness & constructional details, including explanatory drawings, of various components/ assemblies like Column, Cross Rail, Ram head, Table, Guideways/slides, Feed Transmission system, Ram, Hydraulic and Lubrication system, Feedback system etc .of the machine.	Vendor to submit			
2.9.2 Video images on CD / hard copy explaining the technical features / Literature with photographs, drawings explaining the technical features should be enclosed with the offer.	Vendor to submit			
<b>2.10 OPERATOR'S PLATFORM</b>				
2.10.1 It should be independent motorised type, movable / adjustable in vertical and horizontal directions. It should be able to reach almost to center of the Table in horizontal direction. Interlocks should be provided for its horizontal / downward movement against rotating Table and against the job ( rotating or stationary ) to avoid collision / accident. A 15 Amp. Plug Point with ON/ OFF switch is also to be provided on the Platform.	Vendor to offer			
2.10.2 Horizontal movement of complete Platform.	Vendor to inform			
2.10.3 Vertical movement of complete Platform to cover total turning height.	Vendor to inform			
2.10.4 Height of Platform Railing.	Vendor to inform			
2.10.5 Weight Capacity of the Platform.	Vendor to inform			
2.10.6 Minimum Position of Platform from Shop Floor.	Vendor to inform			

2.11	OPERATION AND CONTROL SYSTEM				
2.11.1	OPERATOR'S PANEL :				
	Swiveling type operator's panel having complete CNC and machine control system with all displays of required configuration shall be provided and suitably located on operator's platform for convenient, efficient & safe operation of the machine. All switches, keys & display should be within reach of operator of average height (5' 5") for easy & safe operation. All displays/indications should also be conveniently placed accordingly. A protection cover made of steel sheet or equivalent should be provided above the operator's panel.			Vendor to offer	
2.11.2	CNC SYSTEM & FEATURES				
2.11.2.1	Make : Fanuc / Siemens.			Siemens or Fanuc	
2.11.2.2	Type : PC based latest version			PC based latest version	
2.11.2.3	The system should have full alphanumeric keyboard, TFT colour display (10.4" or larger), Machine Control Panel (MCP), RS232C serial interface, USB port for data input/output, network ready, graphic simulation and on-screen PLC Ladder display. All PLC input/output modules should be of FANUC/SIEMENS make. (Latest hardware & software versions, as available at the time of delivery, should be supplied).			Vendor to offer and submit details	
2.11.2.4	Details of optional features, recommended by vendor. (Including features required for Prove-Out Components)			Vendor to offer and submit details	
2.11.2.5	Details of other optional features:			Vendor to offer and confirm	
2.12.2.5.1	Axes Interpolation: Linear, Circular, Cylindrical, Helical, Spline			Vendor to confirm	
2.12.2.5.2	Max Number of simultaneous interpolation: 3			Vendor to confirm	
2.12.2.5.3	Part Program Storage: 2 MB or more			Vendor to confirm	
2.12.2.5.4	Technology Cycles: Geometry Calculation, standard Drilling, Tapping, Milling cycles.			Vendor to confirm	
2.12.2.5.5	Graphics simulation (Static and dynamic) of Part Programs and Machining process.			Vendor to confirm	
2.12.2.5.6	Co-ordinate Transformation: Datum shift, rotation, mirror image, scaling factor.			Vendor to confirm	

2.12.2.5.7	Pitch Error compensation (As applicable)	Vendor to confirm			
2.12.2.5.8	Backlash error compensation (As applicable)	Vendor to confirm			
2.12.2.5.9	Zero Offset for all axes	Vendor to confirm			
2.12.2.5.10	Feed override switch 0-120% for all axis	Vendor to confirm			
2.12.2.5.11	Spindle speed override switch 70-120%	Vendor to confirm			
2.12.2.6	Provision for safe shut down of CNC Control in case of Power Failure	Vendor to confirm			
<b>2.11.3</b>	<b>MANUAL CONTROL:</b>				
2.11.3.1	Complete manual operation of machine should be possible through Machine Control Panel (MCP). The MCP should have Spindle & Feed override switches, +/- Jog keys for individual axis, Start/Stop keys for Cycle, Spindle & Feed and additional keys/switches for auxiliary functions. Diagram of complete operator pendant with full details of all the switches/keys should be submitted.	Vendor to confirm. Layout of panel showing requisite switches to be submitted.			
<b>2.11.4</b>	<b>HAND HELD UNIT:</b>				
2.11.4.1	Hand Held unit, alongwith sufficient length of interfacing cable is to be offered for handwheel (MPG) operation of individual axis in jog & increment mode and provision for spindle inch in c.w & c.c.w directions	Vendor to offer & details to be submitted.			
<b>2.11.5</b>	<b>NOTE BOOK PC (I/O DEVICE):</b>				
2.11.5.1	Note Book PC (Internationally reputed make and latest model) with Windows operating system is to be supplied for bi-directional transfer of program and data between the offered unit and supplied CNC system. The notebook must contain all application softwares for the supplied CNC, PLC and Drives systems along with required interfaces and cables.	Vendor to offer with details.			
<b>2.12</b>	<b>UPS FOR CNC SYSTEM: (Only in case of PC based CNC systems)</b>				
2.12.1	UPS of 15 minutes for CNC system with inbuilt cooling and charge status display is to be supplied only in case of PC based CNC systems.	Vendor to offer & details to be submitted.			
<b>2.13</b>	<b>MACHINE LIGHTS</b>				
2.13.1	Machine Lights for sufficient illumination of complete working area including operator's panel & area below crossrail for clear visibility.	Vendor to offer			
2.13.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to offer			

2.13.3	Lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to offer			
2.13.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to offer			
2.13.5	Flashing/Rotary type light indicating end of cutting, program stop, alarm etc. at a easily visible & suitable place.	Vendor to offer			
<b>2.14</b>	<b>REFRIGERATION UNITS / AIR CONDITIONERS</b>				
2.14.1	Door mounted Air Conditioners with Dehumidifiers of reputed international make who have after-sales spares support in India or of Indian make like Advance/ Werner Finley/ Rittal for all Electrical/ Electronic Panels/ Cabinets including Operator's Panel (One no.of sufficient capacity for each cabinet/ panel considering continuous operation at ambient temperature of 50°C). The blow of cool air from the air conditioners shall not fall directly on the electronic circuits/ modules. ACs must be incorporated with electrical/ refrigeration interlocks.	Vendor to offer and confirm			
2.14.2	ACs unit must be mounted on the movable pendent with well-supported universal-head bolt. Two sets of cut-out labels are mandatory to be supplied with the units. The electrical connection of the AC unit must be with male-female connector, easily disconnected from the AC unit side. There has to be a MCCB to isolate the AC unit from the electrical panel.				
2.14.3	Oil Chiller units of reputed international make who have after-sales spares support in India or of Indian make like Advance/ Werner Finley/ Rittal/ Gem in package should have minimum 50% standby with multiple refrigeration circuits having energy-efficient HFC-based Hermetically-sealed Rotary/ Scroll/ Reciprocating Compressors with independent refrigeration circuits having SS-brazed Plate-type Heat Exchanger, Air-cooled Condenser, Thermostatic Expansion Valve, HP/ LP Switch, Oil Flow/ Anti Freeze Cut-out, etc. The units must have In-line Multistage Gear Pumps (with 100% standby), SS Storage Tank, Valves, NRVs, Filters, Automatic Microprocessor-based Controller with LCD Display, Safety Interlocks, etc. in one complete package. The unit must operate continuously with equal-run-time of Compressor at ambient temperature of 50°C.	Vendor to offer and confirm			



2.14.4	For precise air/ oil temperature with energy-efficient operation, latest state-of-the-art technology features like constab pressure control, variable speed control of fan-motor, hot-gas bypass control, etc. needs to be incorporated in the above Unit (s).				
2.14.5	Unit (s) must be designed to work in extremely harsh industrial environment and needs protection from heat, dust, fumes, corrosive or oily vapours, moisture, etc. The condenser coil must resist dust accumulation & must transfer heat efficiently.				
2.14.6	Vendor to supply the following information about Air Conditioners and Chiller Unit (s) used in the machine: Type of Air Conditioning/ Chiller Unit. - Capacity of the Unit. - Type of Compressor with complete specifications. - Type of Thermostatic Expansion Valve with complete specifications. - Fan size and flow in CFM (cubic feet meter) of the Condenser unit. - Specifications of the Evaporator Unit. - Functional requirement of temperature of cool air/ oil to be maintained between range +15°C to +40°C. - Type of Microprocessor-based Controller with LCD Display with complete functional details. Detailed specifications of all the components fitted in the Unit (s) are to be submitted with BOM, make, etc. in Technical bid. Vendor have to provide leaflet/ catalogue of all the brought-out items, refrigeration accessories and provide schematic layout of the system.	Vendor to specify			
2.14.7	Compressor, Refrigeration Spares Items, PHE (Plate-type Heat Exchanger), Gear Pump, etc. must be available in India and if possible can be repaired, locally. Vendor have to give training to operate, maintain & repair all the individual items and the Chiller/ AC Unit (s) as a whole. Exhaustive training is to be given for electrically integration of the Unit (s) with the CNC machines.	Vendor to confirm			

<b>2.15</b>	<b>HYDRAULIC SYSTEM</b>					
	<b>(Details should be Submitted by the Vendor)</b>					
2.15.1	The Hydraulic System shall be of Re-circulating Type. Hydraulic Tank should be preferably placed at shop floor.	Vendor to offer and confirm				
2.15.2	Pumps, Valves, Switches (Pressure & Flow) should be of Make : Rexroth / Vickers / Parker / Hawe.	Vendor to offer and confirm				
2.15.3	Filtration System: Sufficient no. of filters ( with electric clogging indicator and alarm on PLC ) should be used to avoid frequent clogging of the filters and other maintenance related problems. Filter elements should, preferably, be of Make : EPE / Hydac.	Vendor to offer and confirm				
2.15.4	Failure indication	Vendor to offer				
2.15.5	Automatic shut off provision, Details should be submitted.	Vendor to offer				
2.15.6	Refrigerated type cooling system of sufficient capacity to maintain complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. keeping in view the specified ambient conditions to be offered with complete details. The temperature of Hydraulic Oil should not go beyond 40 deg. C.	Vendor to offer & submit				
2.15.7	Hydraulic pump capacity (flow / pressure)	Vendor to inform				
2.15.8	No Tandem pumps should be used. Maximum desired permissible pressure is 100 Kg/sqcm. If anywhere, more than 100 Kg/sqcm pressure is used, then one set of such hose pipes and seal kit of such Hydraulic cylinder should be supplied in spare in addition to other spares.	Vendor to confirm & offer				
<b>2.16</b>	<b>FIRST FILLING OF OILS</b>					
2.16.1	First filling of all required Oils & Grease etc. for the machine, voltage stabilizer, isolation transformer & air-compressor etc. to be supplied by vendor. Indigenous (Indian) source or Indian equivalent and specifications of oils/ greases are also to be provided by the vendor.	Vendor to offer & submit				
<b>2.17</b>	<b>COOLANT SYSTEM</b>					
2.17.1	Coolant System with all accessories for following variants shall be provided. Selection of all the variants shall be through program and push buttons as well.	Vendor to offer				
	a) Recirculating Type Flood Coolant System	Vendor to offer				
	b) Air coolant system	Vendor to offer				

2.17.2	All attachments, tool holders, boring bars, cassettes, adapters etc. shall have the provision so that coolant is available directly at the tool-cutting tip.	Vendor to offer			
2.17.3	Coolant collection and recirculation system should be leak proof & perfect to avoid any spillage on shop floor, trenches for cables & foundation pit of the machine etc. In case, any leakage is found, it shall be corrected by vendor. Additionally, suitable equipment should be provided at deepest point of foundation pit to pump out collected oil/coolant up to shop floor.	Vendor to offer & confirm			
2.17.4	Coolant Filtration System: Recirculating type coolant system with Vacuum Rotary drum type Coolant Filtration System and magnetic separator. The filtration system should be mounted at shop floor level, if possible with provision to avoid leakage/spillage of coolant.	Vendor to confirm and submit details.			
2.17.5	Coolant Flow Diagram showing filters, pumps, valves, tanks etc.	Vendor to submit			
2.17.6	Coolant pumps & motor details etc. for all types of coolant variants	Vendor to inform			
2.17.7	Coolant Tank Capacity	Vendor to inform			
2.17.8	Pressure & rate of flow of coolant for different coolant variants for turning operations should be furnished in the offer. The coolant should be able to reach tool tip at full pressure.	Vendor to inform			
2.17.9	All types of coolant variants should be switchable through program as well as manually by push buttons provided on the Operator's control panel.	Vendor to offer			
2.17.10	For finer control of Pressure and Coolant Flow Rate, after its activation through program or switches, Rotary/ potentiometer switches shall be provided on the Operator's Panel.	Vendor to offer			
2.17.11	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Vendor to offer			
<b>2.18</b>	<b>REQUIREMENT FOR ELECTRICAL EQUIPMENT</b>				
2.18.1	415V with fluctuation +/-10%, 50HZ with fluctuation +/- 3 %, 3 Phase AC (3 wire system without neutral) Power Supply Source will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All types of cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine/ control cabinets, etc., shall be the responsibility of vendor. Requirement of grounding/ earthing with required material (Indian make) details is to be informed by vendor well in advance so that same could be incorporated during construction of foundation. The vendor can take earthing connection from the nearest column of the production shop.	Vendor to accept & offer			

2.18.2	Tropicalisation: All electrical / electronic equipment shall be tropicalized.				Vendor to offer	
2.18.3	All electrical & electronic control cabinets & panels should be dust and vermin proof.				Vendor to offer	
2.18.4	All electrical components in the cabinets should be mounted on DIN Rail.				Vendor to offer	
2.18.5	All electrical / electronic panels to be provided with adequate door locks. All electrical & electronic panels including operator's panel should have sufficient illumination and power receptacles/plug points of 220Volts, 5/15 Amp AC with on/off switch. All electrical adapters/receptacles, fittings, consumables etc. should be Indian or should have compatibility with Indian equivalents.				Vendor to offer	
2.18.6	All motors shall conform to IEC or Indian Standards				Vendor to offer	
2.18.7	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 offer	
2.18.8	Vendor should ensure the proper earthing for the machine and its peripherals/accessories. Any material requirement for the same should be informed with foundation design/drawings. The vendor can take earthing connection from the nearest column of the production shop.				Vendor to offer	
<b>2.19</b>	<b>SAFETY ARRANGEMENTS</b>				<b>Vendor to offer</b>	
	<b>Following safety features in addition to other standard safety features should be provided on the machine:</b>					
2.19.1	Machine should have adequate and reliable safety interlocks / devices to avoid damage to the machine, workpiece and the operator due to the malfunctioning or mistakes. Machine functions should be continuously monitored and alarm / warning indications through lights/ alarm number with messages (on CNC display and panels) should be available.				Vendor to offer	
2.19.2	A detailed list of all alarms / indications provided on machine along with cause and remedy should be submitted by the supplier.				Vendor to submit	
2.19.3	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.				As offered & agreed	
2.19.4	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations & noise.				As offered & agreed	
2.19.5	Emergency Switches at suitable locations as per International Norms should be provided.				As offered & agreed	

2.19.6	Oil & water pipe lines should not run with electrical cable in the same trench.	As offered & agreed			
<b>2.20</b>	<b>ENVIRONMENTAL PERFORMANCE OF THE MACHINE :</b> <b>The Machine should conform to following factors related to environment :</b>	<b>Vendor to offer</b>			
2.20.1	Maximum noise level shall be 85 dB(A) at normal load condition, 1 meter away from the machine with correction factor for back ground noise, if necessary. This will be measured as per international standards like DIN 45635-16, if required. Supplier to demonstrate compliance to noise level, if so required.	Vendor to confirm			
2.20.2	There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm			
2.20.3	There should not be any effluent from the machine. In case there are any effluents from the machine, requisite effluent treatment plant or pollution control device should be built into the machine by the supplier.	Vendor to confirm			
2.20.4	No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm			
2.20.5	If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm			
2.20.6	Paint of the machine should be oil / coolant resistant and should not get peeled off and mixed up with coolant.	Vendor to confirm			
<b>2.21</b>	<b>In-cycle hour counter with reset facility for counting table running time, in-feed motion of ram, machine idle time, machine under maintenance time etc. and display the counted data on CNC display on video pages created by vendor.</b>	Vendor to offer			
<b>2.22</b>	<b>Portable Data Input Output Device :</b> <b>Portable unit or its equivalent for bi-directional program &amp; data transfer between the offered unit &amp; supplied system and as well as standard PC available at BHEL works, using floppy drive or its equivalent, should be offered with all required hardware, software, interfaces, cables, protection cover etc.</b>	Vendor to offer			

<b>3</b>	<b>CHIP CONVEYOR</b>					
3.1	An elevating type chip conveyor to carry both short and curly chips efficiently and effectively to the chip bin on shop floor (on either side of the machine) should be provided at appropriate location. Metallic chutes should be provided all around the table for smooth collection of chips upto opening of chip conveyor.	Vendor to offer				
3.2	Type of chip conveyor	Hinged type or superior				
3.3	Width of conveyor	Vendor to inform				
3.4	Elevation of chip conveyor for chip bin	Vendor to inform				
3.5	Material of chip conveyor (should be rust resistant)	Vendor to inform				
3.6	Provision for smooth collection of chips from all-around table to the conveyor and for avoiding clogging of chips should be provided. Removable Grill/Mesh type rigid covers should be provided above some portion of the chip conveyor, to enable machine operator's access to chip conveyor from shop floor for disposal of scattered chips on shop floor, if any, through chip conveyor. Details for the same should be submitted by vendor.	Vendor to offer				
3.7	Operation of chip conveyor (forward & reverse) should be possible through push buttons on operator's panel and also near chips disposal point/chip bin.	Vendor to offer				
3.9	CHIP BIN of appropriate size of Indian make, with wheels, lifting hooks & handle for movement.	Vendor to offer				

<b>4</b>	<b>ULTRA ISOLATION TRANSFORMER</b>					
4.1	Ultra Isolation Transformer (of reputed Indian make) suitable for complete machine , its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions.	Vendor to offer				
4.2	Make	NEEL or Aplab or Auto Electric or Servomax or of international repute.				
4.3	Model, Rating & Input/Output Voltage etc.	Vendor to inform				
4.4	Monitoring device with cutoff facility for under/over output voltage, Devices for load current measurement, MCCB at input for overload/short circuit protection.	Vendor to offer				
<b>5</b>	<b>PNEUMATIC SYSTEM</b>					
5.1	<b>AIR COMPRESSOR</b>					
5.1.1	Independent Air/Oil cooled, Screw Type Air Compressor (of reputed Indian make Elgi or Ingersol Rand) with refrigerated type Dryer & Filter of suitable/sufficient capacity with all required accessories for the total compressed air requirements of the machine & accessories and to suit required air quality should be supplied. The system should be so designed to have additional provision and required accessories so that BHEL compressed air supply ( having pressure 5-6 bar with little moisture/dirt content) could be used as and when required. The compressor unit should be suitable for continuous duty considering specified power supply & ambient conditions..	Vendor to offer				
5.1.2	Capacity (Discharge Air Flow & Pressure, Motor Power etc.)	Vendor to inform				
5.1.3	Refrigerant used	Vendor to inform				
5.1.4	Output Air Quality (Pressure Dew Point in degree Celsius, Residual mist/oil content in ppm etc.). It should be odor-free.	Vendor to inform				
5.1.5	Noise level	Vendor to inform				
5.1.6	Flow diagram	Vendor to submit				
5.1.7	Spares Package for Air Compressor & Dryer ( <b>Sl.No 5.1</b> ): 1.) Air Filter - 06 Nos. 2.) Oil Filter - 15 Nos. 3.) Oil - 50 Ltrs. 4.) Air - Oil Separator Element - 06 Nos. 5.) Belt - 04 Nos. 6.) Flexible Hose Kit - 01 Set	Vendor to offer				

5.2	COMPRESSED AIR POINTS					
5.2.1	Compressed Air Point with connections for Air Coolant System mentioned at <b>SI. No. 2.17.1</b>	Vendor to offer				
5.2.2	Suitably located Compressed Air Point near machine table with manually operated ON/ OFF Valve and flexible pipe of suitable length for cleaning of workpiece, tools and work area etc.	Vendor to offer				
6	<b>TOOLINGS :</b> * Individual package prices against each <b>SI.No.</b> shall be quoted by Vendor. * Ordering quantity for all tooling items shall be decided by BHEL at the time of ordering.	Vendor to confirm				
6.1	<b>TOOL HOLDERS</b> All tool holders & boring bars shall be available on ATC for direct clamping in ram through ATC cycle. All tool holders & boring bars should have holes for lifting by suitable eye-bolts. Each tool holder/boring bar is to be offered complete with clamping screws, eye-bolt for lifting and packing plate (for clamping of 32x32mm shank tool instead of 40*40mm tool), as applicable. Final drawings for offered items shall be submitted by vendor to BHEL after PO, in case of order, for BHEL's approval prior to their manufacturing & supply. (LH - Left Hand / RH - Right Hand )	Vendor to offer				
6.1.1	Tool holder for external turning having provision for rigid cassette type clamping.	Vendor to offer				
6.1.2	Tool holder for internal turning having provision for rigid cassette type clamping.	Vendor to offer				
6.1.3	Tool holder, having provision for both LH and RH facing using rigid cassette type clamping.	Vendor to offer				
6.1.4	Standard ( Conventional ) tool holder for 40*40mm tool shank with direct clamping of tools for internal / external turning and LH/RH facing operations with provision for clamping 32*32mm shank tools with packing pieces.	Vendor to offer				
6.1.5	Eccentric Boring Bar dia. 250 boring bar with length. 500mm with cassette type of tool holding for 40*40mm shank tools and with provision of 32*32mm shank tool both for turning and facing positions.	Vendor to offer				



6.1.6	Centric Boring Bar dia. 250 boring bar with length. 500mm with conventional type of tool holding for 40*40mm shank tools and with provision of 32*32mm shank tool both for turning and facing positions..	Vendor to offer			
6.1.7	General adapter for turning with flange type clamping or equivalent so that special tool holders manufactured by BHEL could be clamped for use in future.	Vendor to offer			
6.2	PRESETTABLE CASSETTES (to suite above cassette type holders). Drg. No. R6300-0965 of RH Cassette is enclosed for vendor's reference. Each cassette is to be offered complete with clamping screws and packing plate (for clamping of 32x32mm shank tool instead of 40*40mm tool), as applicable. Final drawings for offered items shall be submitted by vendor to BHEL after PO, in case of order, for BHEL's approval prior to their manufacturing & supply. ( LH - Left Hand / RH - Right Hand )	Vendor to offer			
6.2.1	LH cassette for 40*40mm tool shank, Length approx. 230 mm, with provision for clamping 32*32mm shank tools also with packing pieces.	Vendor to offer			
6.2.2	RH cassette for 40*40mm tool shank, Length approx. 230 mm, with provision for clamping 32*32mm shank tools also with packing pieces.	Vendor to offer			
6.2.3	LH long cassette for 40*40mm tool shank, Length approx. 430 mm, with provision for clamping 32*32mm shank tools also with packing pieces.	Vendor to offer			
6.2.4	RH long cassette for 40*40mm tool shank, Length approx. 430 mm, with provision for clamping 32*32mm shank tools also with packing pieces.	Vendor to offer			
6.3	TOOLING FOR MACHINING OF PROVE-OUT COMPONENT	Vendor to offer			

6.3.1	TOOLS FOR MACHINING OF PROVE-OUT COMPONENT ( AT SL.NO. 16.2 ) - HP INNER CASING : Package, as specified below at SI.No. 6.3.1.1 Vendor shall submit final list of offered items against <b>SI.Nos. 6.3.1.1 &amp; 6.3.1.2</b> within two months after PO, in case of order. In case of any addition/change in offered items after order or during actual proveout (in case of order), the total requirement shall be replenished by vendor without any financial implications to BHEL.	Vendor to confirm			
6.3.1.1	All types of cassettes, tools, inserts, holders, measuring instruments (if required) etc. in sufficient quantity, as recommended & required by vendor for carrying out all types of turning, grooving, boring operations for complete machining of proveout component as per its drawing to meet required drawing accuracy & surface finish. The package should include all types of cassettes required for proveout machining in addition to cassettes offered at <b>SI.Nos. 6.2.1 to 6.2.4</b> . Tool holders & boring bars offered at <b>SI.Nos. 6.1.1 to 6.1.7</b> need not to be offered here again, if required to be used. In case, any other type of tool holders, different from tool holders at <b>SI.Nos. 6.1.1. to 6.1.7</b> are required to be used, same should be included in package offered here.	Vendor to offer			
6.3.1.2	Complete fixture & set of required clamping elements & fasteners, in sufficient quantity, with setting scheme as recommended & required by vendor for clamping/setting of component on machine table in different setups and for carrying out complete machining of proveout component as per <b>SI.No. 16.2</b>	Vendor to offer			
6.3.1.3	Four Nos. of Extension Blocks of height 1200mm for 4 vices/jaws, with set of all required fasteners, in addition to items offered at <b>SI.No. 6.3.1.2</b> . The extension blocks shall be directly clamped on machine table using T-slots provided for vices/jaws and the vices/jaws shall be clamped on the top faces of these extension blocks which shall have matching T-slots.	Vendor to offer			
6.4	ADDITIONAL TOOLING REQUIREMENTS				
6.4.1	Mounting details of each type of toolings.	Vendor to submit			
6.4.2	Offered tooling system to be rigid to carryout machining without undue vibration, which can effect job accuracy and surface finish in extreme machining conditions like max. overhang of ram etc. .	Vendor to confirm			

6.4.3	In case of order, manufacturing drgs., catalogues & source of all tooling items (Tool Holders, Cassettes, Extension Blocks etc.) should be submitted by vendor.	Vendor to confirm			
6.4.4	Supplier should offer all tools & inserts with latest cutting geometries & grades to achieve high productivity and cutting parameters.	Vendor to confirm			
6.4.5	All supplied tool holders, boring bars, cassettes etc. shall have built in system for the coolant so that coolant is available directly on the cutting tip during all possible operations like grooving, turning etc. Provision for external coolant should also be provided.	Vendor to offer			
6.5	Tool Storage Cabinets ( set of four nos. ) of reputed (Indian) make having covered heavy duty drawers of suitable sizes with lock facility to store offered tooling items etc.	Vendor to offer			
<b>7 MEASURING SYSTEM :</b>					
7.1	<b>AUTOMATIC JOB MEASURING SYSTEM:</b> Automatic job measuring system with measuring cycles, calibration system and all types of probes / styl required for measuring dimensions of the prove-out components. Vendor to furnish detailed description of the system along with offer. The measurement system shall be customised so that the measured result file shall be generated in the CNC System only and shall contain all relevant information such as nominal values, measured values, tolerances along with project details of measured component as per sample format at Annexure-I. Further , all the measurements done on the component shall appear in a single file in the above sample format. The selected probing results output file shall be printable from the CNC screen of the machine on a printer through a single key command/soft Key. Supply should include all necessary hardware, software, Printer (A4 size), all types of cables, communication software, CNC features required for above mentioned setup.	Vendor to offer with details.			
7.2	Spares Package for the Automatic Job Measuring System ( <b>Sl.No. 8.1</b> ) for 2 years trouble free working should also be offered. The spares should include Tool Probes, Interface Unit & Special Tips if any.	Vendor to offer with list.			

7.3	AUTOMATIC TOOL OFFSET MEASURING SYSTEM: Automatic Tool Offset measuring system with measuring cycles, calibration system etc suitable for all types of tools recommended for prove-out component. The system shall be capable of measuring tool length , and loading these values into tool offset memory of the machine. The system shall be such that the measurement should be with an accuracy of 10 microns or less.	Vendor to offer with details.			
7.4	Spares Package for the Automatic Tool Offset Measuring System (SI.no. 8.3) for 2 years trouble free working should also be offered.	Vendor to offer with list.			
8	DIAGNOSTIC SYSTEMS				
8.1	TELE-DIAGNOSTIC SERVICE Tele-diagnostic service should be provided through International telephone lines along with required Hardware / Software package for the supplied CNC system for remote diagnosis and correction of the problems in both CNC System and PLC of the machine. This should be provided free of charge for the guarantee period. Subsequently, it should be possible to use other platforms, such as Internet or ISDN, subject to their availability in future. Help guide should be provided for use of the system/service.	Vendor to offer			
8.2	FAULT DIAGNOSTIC SYSTEM :				
8.2.1	Supplier's own diagnostic system with required Software and Hardware installed on the CNC system, which shows detailed cause and remedy for the fault on the CNC system display with full diagnostics indicating the element /device causing the fault.	Vendor to offer			
8.2.1a	Vendor to offer a PC note book along with Simatic S7 software ( licensed copy), necessary cables, PCMCIA card / Adaptor ( for Communication with MPI port ) for diagnostic purpose. The Note Book PC should be loaded with complete Electrical Schemes, Mechanical Assembly drawings, Hydraulic Circuit Diagrams, Operation and Maintenance Manuals, Machine Alarm list along with Help text wiring diagram, On-Line display of PLC user should be available on the note book PC.	Vendor to offer			

8.2.2	Provision of OEM Screen with soft keys enabling the service personnel to bring back the ATC to its initial/nearest position in case of interruption of positioning cycle of ATC due to alarm on the machine or power failure. With this OEM screen, service personnel should be able to perform individual steps of positioning cycle of ATC, manually. Separate Pendant should also be provided to retrieve the ATC to it's initial position. Similarly, provision shall also be there to bring back the crossrail to its initial/nearest position in case of interruption of positioning cycle of crossrail due to alarm on the machine or power failure.	Vendor to offer			
8.2.3	Machine should have provision to switchover from position feedback system - 2 ( direct) to Position feed back system-1 ( Motor encoder ) through PLC program ( for service personnel only).	Vendor to offer			
8.3	Help guide should be provided to use diagnostic systems.	Vendor to offer			
<b>9</b>	<b>LEVELING &amp; ANCHORING SYSTEM</b>				
9.1	Complete set of anchoring materials including foundation bolts, nuts, washers, fixators, leveling shoes etc for alignment of table, columns etc. and to fix the machine to the foundation should be supplied.	Vendor to offer			
<b>10</b>	<b>TOOLS FOR ERECTION, OPERATION &amp; MAINTENANCE</b>				
10.1	Tools and Equipment required for erection of the machine shall be brought by the vendor. Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc. for operation and maintenance of the machine should be supplied by the vendor. List of such tools should be submitted with offer.	Vendor to offer			
10.2	Set of Test Mandrels/Cylindrical Bars for checking table run-out & alignment of ram etc. should be supplied with protection boxes.	Vendor to offer			
<b>11</b>	<b>AUTOMATIC TOOL CHANGER (ATC)</b>	<b>Vendor to offer</b>			
11.1	Type	Vendor to inform			
11.2	No. of storage locations ( to suit all the tool holders and boring bars, offered at <b>Sl.no. 6.1</b> )	Vendor to inform			
	All tool holders/boring bars ( <b>Sl.No. 6.1</b> ) shall be mounted on ATC and shall be clamped in ram through CNC program for automatic ATC cycle. In case, any other type of tool holders is foreseen by vendor for proveout machining ( <b>Sl.No. 6.3.1.1</b> ), same should also be mounted on ATC.				

11.3	Tool selection method - Random				Vendor to confirm		
11.4	Maximum Tool Overhang out of different Holders in both directions i.e. radial & axial.				Vendor to inform		
11.5	Maximum Permissible Weight on each Pocket.				Vendor to inform		
11.6	Maximum Permissible Weight on Complete ATC.				Vendor to inform		
11.7	The Machine operation should be possible with or without referencing ATC.				Vendor to confirm		
11.8	ATC Drawing (preliminary) should be submitted with the offer.				Vendor to submit		
11.9	Provision for loading/unloading of different holders on ATC using overhead crane, if required.				Vendor to offer		
<b>12</b>	<b>CHIP &amp; SPLASH GUARD</b>						
12.1	Chip / Splash Guards of sufficient height and made of rust resistant material (painted), shall be provided all around the Table (on front side of columns) to avoid spilling of Coolant and scattering of Chips on Operator's Panel and Shop Floor. Front part of splash guards shall be movable provided with safety glass for clear visibility of job to the operator.				Vendor to offer		
12.2	Additionally a fixed type of splash/ chip guard of atleast full turning height should be provided on rear side of machine i.e. around rear portion of table between columns .				Vendor to offer		
12.3	Movable splash guard should have interlock for table rotation. Opening of guards on front side of table should suit maximum possible size of the job which can be loaded on the table. The guards should not provide any hindrance with complete vertical movement of crossrail/ATC on both sides of the table.				Vendor to confirm		
12.4	Drawing of Chip/Splash Guards (pre-liminary) showing total height, layout and other details of the same should be submitted.				Vendor to submit		

<b>13 ACCESSORIES</b>				
13.1	Auto Focus Video Camera System : Complete system having Auto Focus Video Camera with zoom facility & its accessories & connections is to be offered. The camera, mounted inside its enclosure, shall be mounted on the ram or tool holders (SI.No.6.1) with internally connected & concealed electrical connections. In case, the mounting on tool holders is offered, all tool holders/boring bars (at SI.No. 6.1) should have provision for the same and suitable electrical connections. Freely hanging or unsupported/unprotected cables are to be avoided. Color monitor should be suitably located on operator's panel to view tool while machining and also as an aid for setting of casings/long cylindrical jobs using dial indicator. Camera eyes/lens and connecting cables shall be safe guarded against heat, chips, coolant, dust etc. to maintain clear visibility of the tool in these conditions. Suitable sockets for power connections shall be provided for both positions(ram and tool holders). Clamping details of camera on different tool holders shall be shown on drawings of tool holders.			Vendor to offer
13.2	Spare Package for Video Camera System (SI.No. 13.1) : Complete System, as offered against SI.no. 13.1, in spare.			Vendor to offer
<b>14 SPARES :</b>				
14.1	Individual package prices against each SI.No. (i.e. against each of SI.No. 14.1.1.1 to 14.1.1.11 & 14.1.2.1 to 14.1.2.17) shall be quoted by Vendor.			Vendor to confirm
14.1.1	Mechanical & Hydraulic Spares : Following Spares are to be offered.			--
14.1.1.1	Pressure control valves, Pressure reducing valves, Flow control valves & Direction control valves used in Hydraulic / Lubrication / Pneumatic / Coolant Circuit. (1 no. of each type)			Vendor to offer
14.1.1.2	Pressure switches, flow switches used in Hydraulic / Lubrication / Pneumatic / Coolant Circuit. (1 No. of each type)			Vendor to offer
14.1.1.3	All types of regenerative type filter inserts (6 No. of each type in hydraulic, pneumatic & coolant circuit)			Vendor to offer
14.1.1.4	All types of Disposable type filter inserts (30 nos. of each type)			Vendor to offer
14.1.1.5	All types of Accumulator bladders (1 no. of each type) with charging kit			Vendor to offer

14.1.1.1.6	One set of timing belts used in the machine.	Vendor to offer			
14.1.1.1.7	One set of seal kits used in different hydraulic & pneumatic cylinders in the machine.	Vendor to offer			
14.1.1.1.8	One set of hose pipe, ready to use with end connection, as used in the machine.	Vendor to offer			
14.1.1.1.9	All types of couplings used with different pumps (1 no. of each type) & pressure sleeves including coupling of main motor used in machine.	Vendor to offer			
14.1.1.1.10	All types of shaft seals (2 no. of each type), O-rings & Piston Rings (5 nos. of each type), Spindle Brake Liners (1 set of each type) used in the machine.	Vendor to offer			
14.1.1.1.11	One set of pneumatic filtration / condensate drain system.	Vendor to offer			
14.1.1.2	Electrical / Electronic / CNC Spares : Following Spares are to be offered.	Vendor to offer			
14.1.2.1	Limit Switches/ Micro Switches (2 Nos each type )	Vendor to offer			
14.1.2.2	Relays ( 2 Nos each type )	Vendor to offer			
14.1.2.3	Contactors ( 2 Nos each type )	Vendor to offer			
14.1.2.4	RTD temperature transmitter ( 1 No each type )	Vendor to offer			
14.1.2.5	Proximity Switches ( 5 Nos each type )	Vendor to offer			
14.1.2.6	Push Buttons ( 5 Nos each type )	Vendor to offer			
14.1.2.7	Indicating Lamps ( 10 Nos each type )	Vendor to offer			
14.1.2.8	Semiconductor Fuses ( 5 Nos each type )	Vendor to offer			
14.1.2.9	Special Fuses ( 5 Nos each type )	Vendor to offer			
14.1.2.10	Circuit Breakers ( 1 No each type )	Vendor to offer			
14.1.2.11	Main Power Switch ( 1 No each type )	Vendor to offer			
14.1.2.12	Encoders ( 1 No each type )	Vendor to offer			
14.1.2.13	Scanning Heads for Linear Scales ( 1 No each type )	Vendor to offer			
14.1.2.14	PCU module ( Hard disk loaded with Ghost of the machine after final commissioning) or Fanuc equivalent. ( 1 No. )	Vendor to offer			
14.1.2.15	NCU module or Fanuc equivalent ( 1 No. )	Vendor to offer			
14.1.2.16	I/O Cards for PLC ( 1 No each type )	Vendor to offer			
14.1.2.17	Power Module & Control Cards for Main Drive as well as Feed Drives ( 1 Nos each type )	Vendor to offer			



14.2	All types of spares for total machine and accessories should 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			
14.3	Complete list of spares for machine and accessories, along with 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			
14.4	Repair service contract with supplier of offered CNC system for service & spares for motor drives & CNC Unit etc.	Vendor to confirm			
15	<b>DOCUMENTATION : Two Sets of following documents, hard copies (with Soft Copies wherever specified), in English language should be supplied along with the machine. Each set consists of one no. of each document (Hard copy &amp; Soft copy, as specified)</b>	<b>Vendor to offer</b>			
15.1	Operating manuals of Machine & CNC system	Vendor to offer			
15.2	Programming Manuals of Machine & CNC system	Vendor to offer			
15.3	Detailed Maintenance manual of machine and supplied systems.	Vendor to offer			
15.4	Maintenance Interface & commissioning manuals, PLC programming manual for CNC system, Interface & commissioning manuals for table, feed drives and auxiliary drive.	Vendor to offer			
15.5	Drawings for all supplied clamping jaws and its lead screws, coolant connections adapters, tool holders, boring bars, cassettes, adapters, sleeves, fixtures etc.	Vendor to offer			
15.6	Catalogues, Operation & Maintenance Manuals of all bought out items including drawings, wherever applicable.	Vendor to offer			
15.7	Detailed specification of all rubber items and hydraulic/lube fittings	Vendor to offer			
15.8	Operating Manuals, Maintenance Manuals & Catalogues for supplied accessories viz. Voltage Stabilizer, Isolation Transformer, Air-Compressor, Video Camera System etc.	Vendor to offer			
15.9	Program print-outs (hard copy) with comments in English for PLC of main machine and auxiliary systems (if used) alongwith cross reference list and Input/Output list.	Vendor to offer			
15.10	PLC program, NC data & PLC data on CD.	Vendor to offer			

15.11	Complete back-up of PCU-50 hard disk on GHOST CD and clear written Instructions to take back-up and reloading of a new hard disk.	Vendor to offer			
15.12	Complete list of parts/items( Bill of materials) used in the machine in English language.	Vendor to offer			
15.13	Electrical Schematic Diagrams, Wiring Diagrams, Junction Box Layouts, Connector Diagrams and Cable Layouts of the machine in English.	Vendor to offer			
15.14	Drawings of machine assemblies/sub-assemblies/parts including Pneumatic/ Coolant / Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list marked on it in English. B360	Vendor to offer			
15.15	Additional set of all the above documentation on CD ROM, wherever possible including complete backup (on CD) of all cycles/subroutines (provided by both vendor and supplier of CNC System) and any other special programs pertaining to different applications/machining processes/accessories/measuring systems etc. and CNC programs for proveout machining.	Vendor to offer			
<b>16</b>	<b>PROVEOUT MACHINING OF BHEL COMPONENT</b>	<b>Vendor to offer</b>			
16.1	Drawings of proveout component are enclosed. Job Setting & Machining Process Plan & Requirement of Tools etc. for machining of proveout component shall be finally mutually agreed with vendor after the order, in case of order, without any financial implications. Final proveout component drawing no. may change, however, the machining features shall be in line with the original component drawing. Complete machining of prove out component shall be done by Vendor at BHEL works to the specified design accuracy and surface finish, using cutting tools & CNC programs to be provided by the vendor to prove the machine after complete erection, tests & test piece machining etc. Material for the proveout component shall be provided by BHEL. Vendor shall submit final job setting plan, machining process plan, tool layout & list with complete description, time study etc. for the proveout machining within three months of placement of order, in case of order. Vendor shall submit CNC programs prior to start of erection of Machine at BHEL works.	Vendor to accept & offer			

16.1.1	Vendor shall be responsible, financially or otherwise, for any deviation/rejection in proveout component to the extent of cost of Casting/Forging, due to wrong machining or malfunctioning of the machine during proveout machining and also for the delay in machining due to improper recommended tooling etc.. Against the cost of such deviation / rejection, if any, vendor shall be responsible as per respective commercial condition specified in tender documents.	Vendor to accept & confirm			
16.1.2	Vendor shall be fully responsible for machining of proveout components as per drawing and other requirements specified by BHEL to the full satisfaction of BHEL. Clarifications, if any required by vendor, regarding accuracy requirements of the proveout components, whether specified or not, should be discussed and cleared by vendor during initial technical discussions.	Vendor to accept & confirm			
16.2	PROVE-OUT MACHINING OF ONE COMPONENT - HP INNER CASING : as per <b>SI.No. 16.1</b>	Vendor to accept & offer			
16.2.1	The proveout component shall be one HP Inner Casing as per following drawing nos. or similar. The drawings are enclosed. 1. H.P. Inner Casing - Drg.No. 0-10502-29000 (2 sheets) 2. Groove Plan for H.P. Inner Casing - Drg.No. 9-10107-29000 3. T-Groove for H.P. Inner Casing - Drg.No. 4-10107-46018 4. T-Groove for H.P. Inner Casing - Drg.No. 4-10107-46016 5. Casting for H.P. Inner Casing - Drg.No. 0-10502-24901 Above drawings should be treated as BHEL property. Strict confidentiality is to be maintained and under no circumstances these drawings or copy of these must be transferred to third party without permission of BHEL. These drawings must not be used directly or indirectly in any way detrimental to the interest of the BHEL.	Vendor to accept & offer			
16.2.2	Material of H.P. Inner casing : CREEP RESISTANT ALLOY STEEL CASTING WITH IDENTIFICATION NUMBER FOR INTERNAL COMPONENTS(G17CRM0V510) TEMPERATURE >540 <566DEG.C	Vendor to accept			

16.2.3	Prove out machining shall include all types of turning, grooving & boring operations as per different drawings of H.P.Inner Casing (at Sl.no. 16.2.1) including its groove plan. Groove Plan drawing shows both rotor and casing parts out of which only casing part is to be considered. All operations in proveout machining shall be performed using CNC Programs supplied by vendor. The CNC Programs should preferably consist of generalised parametric subroutines for repetitive type of operations like different operations of T-grooves etc. so that these subroutines could be adopted for other similar casing by using different parameter's values and calling same subroutines in other main-program.				Vendor to accept & offer		
16.2.4	Vendor shall be responsible, financially or otherwise, for any deviation/rejection in proveout component to the extent of cost of Casting/Forging, due to wrong machining or malfunctioning of the machine during proveout machining and also for the delay in machining due to improper recommended tooling etc..The cost of such deviation / rejection, if any, shall be refunded by the vendor to BHEL.				Vendor to accept & offer		
16.2.5	During proveout, all tools should be preset by using supplied Tool offset Measuring System (Sl.No.30.3) and measurement of machined dimensions of the respective proveout components for each machine shall be done by supplied Job Measuring System				Vendor to offer		
17	<b>TRAINING</b>				For vendor's information.		
17.1	Four BHEL Persons should be trained at vendor's works for each machine for the area & period given below: (a) CNC Part Programming for the machine, application of all CNC Features, Programming for Measuring Systems & supplied accessories etc. (Period 3 Weeks) (b) Electrical, Electronic & CNC maintenance for machine & other supplied equipments ( Period 2 weeks ) (c) Mechanical & Hydraulic maintenance of the machine & other supplied equipments ( Period 2 weeks ) (d) Operation of the machine & other supplied equipments ( Period 2 weeks ) Pre-dispatch inspection (ref. Sl.No. 22.1) of the machine shall also be carried out by the team during their stay at vendor's works for the training. Vendor may specify days required for pre-dispatch inspection. BHEL reserves the right to choose no. of persons, field & period of training, out of above, while deputing their engineers for training.				Vendor to accept & confirm		

17.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	Vendor to offer			
17.3	Competent, English speaking experts shall be arranged by the vendor for satisfactory & effective training of BHEL personnel.	Vendor to offer			
17.4	Vendor should commit & offer to organize training of Electronics Engineer and Programmer at the CNC System Manufacturer's works/training school for advanced features and specialized training, if so required by BHEL.				
17.5	Vendor to quote for training on per man per week basis.	Vendor to accept & offer			
<b>18 FOUNDATION</b>					
18.1	Vendor shall submit the preliminary layout drawings for getting BHEL's approval within one month from the date of Letter of Intent (LOI) or Purchase Order, whichever is earlier. Soil condition data will be furnished by BHEL alongwith the approval. Complete Foundation Design including details viz. static / dynamic load details etc. and final layout drawings shall be submitted by the supplier within three months after getting BHEL's approval for Preliminary layout Drgs.. The layout should consist of all requirements pertaining to complete machine including space requirement for Voltage Stabilizer, Isolation Transformer, Air compressor, Chip Bin & all other accessories/ attachments/ offered items. BHEL shall construct complete foundation for the machine under supervision of supplier and at vendor's responsibility. Vendor should arrange equipments required for the testing of foundation, if required by the vendor. The vendor shall also indicate detailed specifications/requirement of earthing material, grouting compound and grouting procedure etc. for foundation bolts of the machine.	Vendor to accept & confirm			
<b>19 ERECTION &amp; COMMISSIONING</b>					
	Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control system & all types of other supplied equipment, machining of test pieces etc. Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by supplier in their foundation/layout drawings. Other requirements like overhead crane and unskilled helping personnel shall be provided by BHEL. Details of these requirements should be informed by vendor in advance. The available crane capacity at the proposed location of the machine will be 150 Tons. The vendor will ensure to make requisite arrangement for lifting of heavier consignment/ items/ assembly of the machine not getting covered by this capacity. In case, any crane of higher capacity shall be required for erection of the machine, same (mobile crane) shall be arranged by vendor.	Vendor to offer Vendor to offer			

19.1	Erection & Commissioning of Voltage stabilizer, Isolation Transformer , Air Compressor and other accessories/attachments with all electrical & mechanical connections shall also be responsibility of the vendor.	Vendor to accept			
19.2	Successful proving of BHEL components (SI.No.17.0) by the supplier shall be considered as part of commissioning for the machine. All tests, as mentioned at SI.No. 22.0 (Machine Acceptance) and testing/demonstration of tele-diagnostic service etc. shall also be part of the commissioning activity.	Vendor to accept			
19.3	Tools, Tackles, Test Mandrels, instruments and other necessary equipment including Laser equipment required to carry out all erection & commissioning activities to be brought by the vendor. Out of the complete supply, all tools, tackles, mandrels etc. which may be required by BHEL to maintain the machine, after commissioning, shall not be taken back by vendor. Other equipment including Laser equipment shall be arranged by vendor on returnable basis. Vendor to offer accordingly.	Vendor to accept			
19.4	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to submit			
19.5	All Cover Plates, sheets/plates for chutes for chips flow etc. required for the machine and its peripherals including pits, if any, shall be supplied and installed by the vendor.	Vendor to submit			
19.6	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to offer			
19.7	Terms & conditions for Erection & Commissioning should be furnished in detail separately by vendor along with offer.				
19.8	Portion, if any, of the machine, accessories/attachments and other supplied items where paint got rubbed or peeled off during transit or erection should be repainted and matched with the original adjoining paint by the vendor. For this purpose, the vendor should supply sufficient quantity of touch-up paint of various colours/shades of paints used. The vendor shall ensure performing touching after commissioning but before final acceptance.				
20	<b>ACCURACIES</b>	Vendor to offer			
20.1	GEOMETRICAL ACCURACIES	Vendor to inform			
20.1.1	Geometrical Accuracy Tests shall be in accordance with relevant & prevailing international standards viz. DIN 8609 / ISO 3655 or equivalent applicable standard. Detailed Test Charts for the same, clearly showing the accuracies to be achieved on the machine, shall also be submitted with the offer.	Vendor to inform			

20.1.2	Table Flatness		0.03 mm		
20.1.3	Table Radial Runout		0.016 mm		
20.1.4	Table Axial Runout		0.016 mm		
20.1.5	Cylindricity of turning		Vendor to inform		
20.1.6	True roundness of turning		Vendor to inform		
20.1.7	Facial run-outs		Vendor to offer, confirm & submit		
20.1.8	All other accuracies to conform to specified standard (Latest Revision) or Suppliers Test chart whichever is finer and more accurate.		Vendor to confirm		
20.1.9	All the Geometrical accuracies including test pieces machining etc. should be demonstrated to BHEL engineers during pre-acceptance at vendor's works and again during Erection & Commissioning at BHEL's Works. Test pieces & cutting tools are to be supplied by vendor for test pieces machining both at vendor's works & also at BHEL's works. Drawings of test pieces to be submitted with the offer.		Vendor to confirm		
20.1.10	Vendor to confirm clearly that it will be possible to machine proveout components to specified drawing accuracies with above mentioned machine accuracies.				
20.2	<b>POSITIONING &amp; REPEATABILITY ACCURACIES complying tender specifications including following: (Should be measured as per VDI/DGQ 3441 - Latest Revision) CHECKING BY USING LASER INTERFEROMETER.</b>				
20.2.1	Positioning accuracy in X axis (Pa) per 1000 mm		± 0.005mm or 0.01 mm		
20.2.2	Positioning accuracy in Z axis (Pa) per 1000 mm		± 0.005mm or 0.01 mm		
20.2.3	Repeatability in X axis (Ps)		0.008mm		
20.2.4	Repeatability in Z axis (Ps)		0.008mm		
20.2.5	Positioning accuracy over entire traverse in X axis (Pa)		Vendor to inform		
20.2.6	Positioning accuracy over entire traverse in Z axis (Pa)		Vendor to inform		
20.2.7	Total positioning error along X & Z axes per 1000 mm (P)		Vendor to inform		
20.2.8	Total positioning error along X & Z axes over entire traverse (P)		Vendor to inform		
20.2.9	Vendor to confirm clearly that it will be possible to machine proveout components to specified drawing accuracies with above mentioned machine accuracies.		Vendor to confirm		

20.2.10	All the Positioning and Repeatability accuracies should be demonstrated to BHEL engineers during pre-acceptance at vendor's works and again during Erection & Commissioning at BHEL's Works.	Vendor to offer			
	Note1: LC of scale should be taken to achieve above	Vendor to note			
	Note 2: <b>Accuracy should remain within specified tolerance over a time period of 24 hours (Maximum temperature variation is 25 degree centigrade during peak summer)</b>	Vendor to note			
21	<b>AMBIENT CONDITIONS &amp; THERMAL STABILITY</b>				
21.1	Total machine including all supplied items should work trouble free and should give specified accuracies under existing power supply and ambient operating conditions, as mentioned below at Si. Nos. 22.2 & 22.3.	Vendor to accept & confirm			
21.2	<b>Power Supply (AC):</b> Voltage = 415V +/- 10% of fluctuations , Frequency= 50Hz +/- 3% , No. of phases = 3 phase without neutral.	Vendor to accept & confirm			
21.3	<b>Ambient Operating Conditions:</b> Temperature = 5 to 48 degree Celsius , Relative Humidity = 95% max. Weather conditions are tropical. Atmosphere may be dust laden during some part of the year. Machine shall be kept in the normal shop floor condition without any temperature controlled enclosure/shop. Max. temperature variation is 25 deg Celsius in 24 hours.	Vendor to accept & confirm			
21.4	<b>Thermal Stability:</b> Thermal Stability of the complete machine and all supplied items keeping in view the specified Ambient Conditions at <b>Si.No. 21.3</b> , specified accuracies, machining requirements of BHEL component and trouble free operation of the machine to be ensured by vendor. Since the machine shall be installed in shop with operating conditions as per <b>Si.No. 21.3</b> , the vendor shall ensure to have provisions in the machine for achieving the drawing accuracies on the job under these conditions. Accordingly, Vendor to ensure that machine is suitable for above and provisions on the machine for the suitability should be included by Vendor.	Vendor to offer & confirm			
21.5	The machine should be suitable for continuous operation to its full capacity for 24 hours a day and 7 days a week throughout year. Vendor to ensure and confirm the same.	Vendor to offer & confirm			



22 MACHINE ACCEPTANCE (Tests/Activities to be performed & demonstrated by Vendor)		Vendor to accept & confirm			
22.1	Tests/Activities to be carried out at vendor's works on the machine before dispatch : All these activities (As per <b>Si.Nos. 22.1.1 to 22.1.5</b> ) shall be part of pre-dispatch inspection of the machine which shall be carried out by BHEL's team during their stay at vendor's works for the training ( Ref. <b>Si.No. 17.1</b> ). Report of the same shall be submitted to BHEL by vendor.	Vendor to accept & confirm			
22.1.1	Demonstration of specified/offered Geometrical accuracies as per <b>Si.No. 20.1</b>	Vendor to accept & confirm			
22.1.2	Demonstration of specified/offered Positioning accuracies as per <b>Si.No. 20.2</b>	Vendor to accept & confirm			
22.1.3	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from that time.	Vendor to accept & confirm			
22.1.4	Demonstration of different features of the machine, control system & accessories.	Vendor to accept & confirm			
22.1.5	Machining of standard test pieces as per AFNOR/ISO/NAS for turning operations etc. for machining accuracy tests. Vendor to supply test pieces.	Vendor to accept & confirm			
22.2	Tests/Activities to be carried out at BHEL works while commissioning the machine : as per <b>Si.Nos. 22.2.1 to 22.2.10</b>	Vendor to accept & confirm			
22.2.1	Demonstration of specified/offered Geometrical accuracies as per <b>Si.No. 21.1</b>	Vendor to accept & confirm			
22.2.2	Demonstration of specified/offered Positioning accuracies as per <b>Si.No. 20.2</b>	Vendor to accept & confirm			
22.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to accept & confirm			
22.2.4	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from that time.	Vendor to accept & confirm			
22.2.5	Demonstration of all features of the machine, control system & accessories to the satisfaction of BHEL for efficient and effective use of the machine.	Vendor to accept & confirm			
22.2.6	Demonstration by actual use of all supplied accessories to their full capacity for required applications like Video Camera, Job Measurement System, Tool Offset Measurement System, Milling Attachment (as applicable) etc.	Vendor to accept & confirm			

22.2.7	Machining of standard test pieces as per AFNOR/ISO/NAS for turning operations for machining accuracy tests. Vendor to supply test pieces & tools for their machining.				
22.2.8	Successful machining of proveout components to required drawing accuracies as per SI. No. 17.0.			Vendor to accept & confirm	
22.2.9	Two weeks of supervision by Vendor of independent operation of machine by BHEL after job proveout.			Vendor to accept & confirm	
22.2.10	Training of BHEL machine operators in operation of complete machine & accessories etc by the supplier's experts / engineers during their stay at BHEL works. This training is in addition of the training specified at <b>SI.No. 17.0</b>			Vendor to accept & confirm	
<b>23</b>	<b>PACKING</b>				
	PACKING : Sea worthy & rigid packing for all items of complete machine, CNC 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. Indigenous supply items like Voltage Stabiliser, Isolation Transformer, Air Compressor etc. should be fully packed in proper rigid boxes for safe transportation and avoiding pilferages.			As offered & agreed	
<b>24</b>	<b>GUARANTEE</b>				
	Guarantee for complete machine and all supplied accessories/equipments for 24 months from the date of acceptance of the machine.			Vendor to offer	
<b>25</b>	<b>GENERAL</b>				
25.1	Machine Model No.			Vendor to inform	
25.2	Total connected load (KVA)			Vendor to inform	
25.3	Total Space required (Length, Width, Height) for complete machine, accessories/attachments and other supplied items like Voltage Stabilizer, Isolation Transformer & Air compressor etc.			Vendor to inform	
25.4	Painting of Machine / Electrical Panels : RAL 6011 Apple Green ( Polyurethane Paint )			Vendor to offer	
25.5	Total weight of the machine			Vendor to inform	
25.6	Weight of heaviest part of machine			Vendor to inform	
25.7	Weight of the heaviest assembly of the Machine			Vendor to inform	
25.8	Dimensions of largest part of the machine			Vendor to inform	

25.9	Vendor to submit reference list of customers where similar machines have been supplied mentioning broad specifications of the supplied machine i.e. Model, CNC System, Table Dia, Max. Turning Dia, Max. Turning Height, RPM, Load Carrying Capacity, Main Drive Rating and detail of accessories/attachments, if any, etc.	Vendor to submit			
25.10	Detailed catalogues, sketches / drawings / photographs pertaining to the offered machines and accessories / attachments/items should be submitted with the offer.	Vendor to submit			
25.11	Hydraulic, Pneumatic & Oil piping should be preferably metallic except places where flexible pipings are essential. All the pipes required for the same shall be supplied by the vendor.	Vendor to confirm			
25.12	All Cables and Hoses etc. should be well supported & protected in trays/brackets/drag chains etc.	Vendor to confirm			
25.13	Ladder is to be provided to access the machine elements located at the top of the column.	Vendor to offer & confirm			
26	<b>QUALIFYING CONDITIONS</b>				
	Only those vendors (OEMs), who have supplied and commissioned at least one CNC VERTICAL BORING MACHINE of same ( Table diameter 4M, Load Capacity 80Tons & Max Turning Height 4M) or higher sizes in the past ten years ( on the date of opening of Tender ) should quote. The following information should be submitted by the vendor about the companies where referred machine (s) have been supplied. This is required from all the vendors for qualification of their offer.	Vendor to accept and confirm			
26.1	Name of the customer / company where similar machine is installed.	Vendor to inform			
26.2	Complete postal address of the customer.	Vendor to inform			
26.3	Month & Year of commissioning.	Vendor to inform			
26.4	Parameters of machine(s) supplied (Table diameter, Max. Turning Height, Table Load Carrying Capacity) and application for which the machine is supplied.	Vendor to inform			
26.5	Name and designation of the contact person of the customer.	Vendor to inform			
26.6	Phone, FAX no. and e-mail address of the contact person of the customer.	Vendor to inform			

26.7	Performance certificate from at least one customer regarding satisfactory performance of machine supplied to them. The referred machine should presently be working satisfactorily for more than one year (on the date of opening of Tender ) after its commissioning.	Vendor to submit			
26.9	BHEL reserves the right to verify information submitted by vendor. In case the information is found to be false/incorrect, the offer shall be rejected.	Vendor to accept & confirm			
<b>27 NETWORKING</b>					
27.1	Machine control should have necessary hardware and software for interfacing with gigabit Ethernet Local Area Network with 100 MB/sec through UTP cables for NC program and other related data transfer. This network to be connected to wide area network/Internet. The networking should have following capabilities:	Vendor to offer			
27.2	The machine shall appear as a node in the Entire Network. (Network Neighborhood)	Vendor to offer			
27.3	The program transfer shall be by simple copy and paste method provided sharing access is allowed between any PC and the machine across the network.	Vendor to offer			
27.4	The program transfer between CNC system and network should also be possible in CNC Mode.	Vendor to offer			
<b>28 MACHINE MONITORING SYSTEM (MMS) SIGNALS</b>					
28.1	Following MMS signals would be made available on a specifically earmarked terminal strip. These MMS signals should be sourced from a PLC output card separately.	Vendor to offer			
28.2	Control ON	Vendor to offer			
28.3	Cycle ON	Vendor to offer			
28.4	Spindle Running	Vendor to offer			
28.5	Feed Active (Any of the axes moving)	Vendor to offer			
28.6	M30 (Program Stop)	Vendor to offer			
28.7	Alarm Active	Vendor to offer			