

					
BHARAT HEAVY ELECTRICAL LIMITED				Enquiry No. :	
UNIT'S ADDRESS:				Due Date :	
CONTACT PERSON'S NAME/DESIGN./PHONE NO./E-MAIL (FROM)				Supplier Qtn. No.:	
				Date :	
SPECIFICATION CUM COMPLIANCE CERTIFICATION FOR FLOOR TYPE CNC HORIZONTAL BORING MACHINE					
NOTE:-					
1. Vendor (only OEM) must submit complete information against clause No.35. The offer meeting this clause would only be processed.					
2. The "Offered" Column and where applicable, the "Deviations" & "Remarks" Column of this format shall be filled in by the Vendor and 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.					
3. The offer and all documents enclosed with offer should be in English language only.					
NAME & ADDRESS OF THE SUPPLIER :			NAME & ADDRESS OF THE INDIAN AGENT :		
TELEPHONE NOS.:			TELEPHONE NOS.:		
FAX NOS.:			FAX NOS.:		
E-MAIL ADDRESS :			E-MAIL ADDRESS :		
SCOPE: SUPPLY, ERECTION & COMMISSIONING OF FLOOR TYPE CNC HORIZONTAL BORING MACHINE COMPLYING WITH SPECIFICATIONS AS BELOW					

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
1.0	MACHINE REQUIREMENTS AND WORK PIECE MATERIAL				
1.1	The CNC floor type Horizontal Boring machine with special attachments is required for heavy duty machining, drilling, tapping, profile machining, milling, OD/ID machining, deep boring etc. with high degree of finish & accuracy. All tooling and tapers as per ISO 50 Big Plus (ISO 7388). Machine fitted with large operator's platform with full comforts. swiveling panel, height adjustment, tie-up seats, all safety devices etc.	Vendor to confirm with details			
1.2	Work piece material: The components to be machined will be mainly of carbon steel, stainless steel, alloy steel & non ferrous material.	Vendor to confirm			
2.0	MACHINE SPECIFICATION: (Minimum Requirements)				
2.1	CNC horizontal floor type Boring machine with Spindle of dia. min. 160mm, CNC Universal auto indexing milling head, D/Andrea NC facing/boring head, orthogonal head. CNC controlled rotary table with traversing bed, Pick up station, ISO 50 tools for all selected tool heads, Floor bed plates, etc. Y-axis carriage (headstock) with positive hydraulic locking.	Vendor to confirm			
2.2	HEAD STOCK				
2.2.1	Boring spindle diameter	160 mm			
2.2.2	Spindle speed in RPM (Infinitely variable) :	5 to 2800 or more			
2.2.3	Spindle drive power :	35 kW or more			
2.2.4	Available torque on the main boring spindle	2850 Nm or more at 100% duty cycle			
2.2.5	Available torque and RPM at 40% and 60% duty cycle	Vendor to submit the details			
2.2.6	Torque-Power-Speed characteristics of the spindle system	Vendor to specify			
2.2.7	Spindle taper:	ISO 50 Big Plus (ISO 7388)			
2.2.8	Tool clamping force	25000 N or more			
2.2.9	Ram Size (min.)	min.450 x 550 mm			

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2.2.10	Make of Spindle drive motor & drives: FANUC <i>ai</i> or SIEMENS 1PH series spindle motor with matching spindle drive.	Vendor to confirm quoting offered models			
2.2.11	Spindle Encoder: FANUC/SIEMENS/HEIDENHAIN rotary encoders for direct reading of actual spindle rpm	Vendor to confirm quoting offered models			
2.2.12	Oriented spindle stop (any position with S value)	Vendor to confirm			
2.3	COLUMN LONGITUDINAL (HORIZONTAL) TRAVERSE:				
2.3.1	Usable Column longitudinal (X-Axis) stroke (excluding that required for machine parking or for pick up station etc.)	7000 mm or more			
2.3.2	X-axis feed rate (Infinitely variable)	1-5000 mm/min.			
2.3.3	X-axis rapid traverse rate	10000 mm/min			
2.3.4	X-axis resolution	1 micron			
2.3.5	Allowed inaccuracy in straightness of machine bed for whole length	0.030 mm			
2.3.6	Backlash free rack and double pinion arrangement.	Vendor to specify and confirm			
2.4	HEADSTOCK VERTICAL TRAVERSE ON COLUMN:				
2.4.1	Usable Headstock vertical (Y-Axis) stroke	5000 mm or more			
2.4.2	Y-axis feed rate (Infinitely variable)	1-5000 mm/min.			
2.4.3	Y-axis rapid traverse rate	10000 mm/min			
2.4.4	Axis resolution	1 micron			
2.4.5	Allowed inaccuracy in straightness of full length of Y-axis guideways	0.025 mm			
2.5	RAM / SPINDLE TRAVERSE:				
2.5.1	Usable Boring spindle (Z-Axis) axial stroke	1000 mm or more			
2.5.2	Usable Ram (W-Axis) axial stroke	1000 mm or more			
2.5.3	Spindle + Ram (W+Z) stroke	2000 mm			
2.5.4	Lowest spindle usable position from table top	300 mm or less			

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2.5.5	Boring spindle (Z-Axis) feed rate (Infinitely variable)	1-5000 mm/min.			
2.5.6	Boring spindle (Z-Axis) rapid traverse rate	7500 mm/min			
2.5.7	Z-Axis Resolution	1 micron			
2.5.8	Ram (W-Axis) feed rate (Infinitely variable)	1-5000 mm/min.			
2.5.9	Ram (W-Axis) rapid traverse rate	7500 mm/min			
2.5.10	W-Axis Resolution	1 micron			
2.5.11	Spindle & ram axes should be independently programmable with independent drives and feed back system.	Vendor to confirm			
2.6 ACCESSORIES:					
2.6.1	UNIVERSAL CNC AUTOMATIC INDEXING MILLING HEAD (To be quoted seperately)				
2.6.1.1	Tool clamping: Automatically	Vendor to specify			
2.6.1.2	Positioning : CNC fully automatic. Additional provision for turning device system for turning operation in the space 3D with provision to mount turning tools.	Vendor to confirm and submit details.			
2.6.1.3	Coolant: External through nozzles round the spindle and Internal through the spindle	Vendor to confirm			
2.6.1.4	Swivelling range	360°			
2.6.1.5	axis 1 (around the Z-axis):	360°			
2.6.1.6	axis 2 (min.45° to axis 1):	360°			
2.6.1.7	Indexing steps (by Herth coupling)	2 x 360 x1°			

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2.6.1.8	Torque:	1500 Nm			
2.6.1.9	Power:	Vendor to specify			
2.6.1.10	Spindle speed RPM	>3500			
2.6.1.11	Axial thrust	20000 NM			
2.6.1.12	Tool holding taper	ISO 50 Big Plus (ISO 7388)			
2.6.1.13	Tool diameter	200mm			
2.6.1.14	Tool length	400mm			
2.6.1.15	Tool weight	25 kgs			
2.6.2	1 no. all axis (5-axis) orthogonal head (optional)	Vendor to offer			
2.7	CNC Boring Head (D'Andrea) model UT 5-630(To be quoted separately)	Vendor to offer			
2.7.1	Adjustment of boring slide (U-axis):	min. 200 mm			
2.7.2	Head speed range	infinitely variable 5-250 RPM or more			
2.7.3	Max. facing dia	1250 mm			
2.7.4	The boring head shall include the turn out tool holder, adaptor etc. for U slide.	Vendor to offer			
2.7.5	Accuracy of Bore Size (Bore Tolerance), Surface Finish of bores and Facial and Radial Run outs.	H6, 1.2 Ra, (Facial) 0.010 and (Radial) 0.020mm respectively.			
2.7.6	The radial axis of the offered Head shall be programmable through Spindle Traverse (Z-Axis). Its details may be submitted with the offer	Vendor to specify and offer			
2.7.7	Item wise details of complete set of Tool Holder kit consisting of turning tool holders, facing tool holder, adapter MR and tool holder TU, to be submitted with the offer. Complete details of any special arrangement offered to meet the specified requirement of Boring range are also to be submitted.	Vendor to specify and offer			

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2.7.8	Coolant system: External coolant with requisite flexible pipes on its snout is to be provided. The arrangement for its supply may be made through the coolant supply system available on the Head Stock. Internal coolant will be preferred.	Vendor to confirm			
2.8	TABLE (To be quoted seperately)				
2.8.1	A CNC controlled size (1.6 M x 2M) table/chuck with continuous rotation (B-Axis) and lateral traverse (U-Axis), perpendicular to the column movement, should be provided. It shall have standard T-SLOTS 36/250 as per DIN 650, finish to DIN 876 III, with sufficient job holding clamps. It shall be lockable at any required angle and able to take tool torque during machining.	Vendor to confirm			
2.8.2	Table size :	1.6 m x 2 m or more			
2.8.3	B-Axis RPM	Vendor to specify			
2.8.4	B-Axis Resolution	0.001 Degrees			
2.8.5	Loading capacity:	upto 20 Tons			
2.8.6	No. of job holding jaws/vices	vendor to specify			
2.8.7	U-Axis Lateral stroke	1250mm			
2.8.8	U-Axis feed rate (Infinitely variable)	1-5000 mm/min.			
2.8.9	U-Axis rapid traverse rate	7500 mm/min			
2.8.10	U-Axis resolution	1 micron			
2.8.11	Lateral movement	min. 1250mm			

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2.8.12	Special locking arrangement of rotary table with the machine bed to avoid any relative movement between them during machining operation.	Vendor to confirm			
2.8.13	Splash / chip guards shall be provided for protection of operator, and to avoid spillage of coolant & chips on floor plate	Vendor to confirm			
2.9	PICK UP STATION :(To be quoted seperately)				
2.9.1	Pick up station for automatic loading and unloading of supplied heads.	Vendor to confirm			
2.9.2	Adapter for automatic attachment of special accessories	Vendor to confirm			
2.10	TOOLINGS:				
2.10.1	Complete Description of Tooling sytem, suitable to spindle taper	Vendor to specify			
2.10.2	All cutting tools, adaptors, tool holders, boring bars, clamping elements etc., recommended for machining of proveout components Water chamber & outer casing, Hemi Head Drg. no: 01602370024, 1165170022 and 31750540718 shall be offered by the vendor. Consumables for offered Tools, like inserts, screws etc., should be quoted for machining of 2 more similar components of each type in addition to the prove-out components. All tools shall be preferably Sandvik or Kennametal make.	Vendor to specify and offer.			
2.10.3	All tools for measurement like, Work piece probe radio, tool probe, tool overload control shall be included in the scope	Vendor to confirm & submit details			

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3.0	FEED AND DRIVE SYSTEMS:				
3.1	Feed motors & drives: FANUC αi or SIEMENS 1FT/IFK series AC servo motors with matching AC servo drives	Vendor to submit			
3.2	Maximum feed force for all axes	Vendor to specify			
3.3	Feed back system for all linear axes shall be by Heidenhain linear scales (Details to be submitted)	Vendor to submit			
3.4	Feed back system for Spindle and rotary axes: FANUC/Heidenhain/SIEMENS rotary encoder (Details to be submitted by the vendor)	Vendor to submit			
3.5	Type of power transmission: 1. Pre-loaded backlash free double pinion & rack drive for X-Axis & B-Axis. 2. Backlash free re-circulating ball screw with Pre-loaded double nut for all other axes. (Complete description of the aforesaid, including diameter of Ball Screw for Y, Z and W Axes, to be submitted with the offer)	Vendor to submit			
3.6	Mechanism for locking all axes	Vendor to specify			
3.7	Maximum thrust rating of all axes.	Vendor to specify			
4.0	MACHINE GUIDEWAYS:				
4.1	Guide ways for X-axis, Y-axis & Z axis: Hydrostatic film for X-20 microns and for Y and Z axes 5 microns. These values shall remain constant at all weather conditions and shall not change even if machine stands to any position for long period of time or doing any type of work. Proof required. Details of lubrication system provided on spindle axis are also to be submitted with the offer	Vendor to confirm and submit details.			

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4.2	Metallic telescopic covers of rust resistant material to be provided with wipers for X & Y axes guide ways. Joints of telescopic covers should be so sealed to avoid mixing of coolant & hydrostatic oil is to be provided. There should be bellow covers of coolant proof material below telescopic covers to eliminate any chance of coolant mixing with hydrostatic oil, as applicable. The movement of telescopic covers should be troublefree and requiring minimum maintenance. Telescopic covers for X-axis should be with a slant towards Chip conveyor. Suitable covers for Y axis protection.	Vendor to confirm and submit details.			
5.0	CONSTRUCTION:				
5.1	Vendor to furnish details of material, hardness & constructional details, including explanatory drawings, of various Components/ Assemblies like Column, bed, Head Stock, Ram, Spindle, chuck etc. of the machine.	Vendor to submit			
5.2	Machine Bed: Machine bed shall have heavily ripped design to achieve column traverse traverses in steps of 1000 mm with a 3 way back-lash free heavy duty compact roller guide system for a precise guidance of the cross slide saddle.	Vendor to submit			
5.3	X-Slide : Column base for the transverse traverse of the column at Machine Bed . Backlash free compact roller guides of X-axis shall driven by double -pinion and rack arrangement.	Vendor to confirm and describe every point in detail with drawings.			
5.4	Column : Column shall have rigid box type cast iron with precisely machined faces for the preloaded compact roller guides and brackets for the ball screw spindle as well as for headstock safety stop device. Vertical traversing headstock on the column shall be completely covered .	Vendor to submit			

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5.5	Y-slide: Solid welded unit with 2 completely close hydrostatic guiding systems for guidance and movement of RAM (Z axis). The hydrostatics shall be regulated based on static and dynamic load. Multiple drop compensation. Mechanical counterweight with hydraulic locking is required for Y-axis carriage.	Vendor to confirm and describe every point in detail with drawings.			
5.6	RAM: A solid steel fabrication for the main spindle system, main drive and drive of boring spindle (W-axis). The Ram shall have a square cross section and shall be internally reinforced to ensure high rigidity and torsional resistance. The guideways of the ram shall be hardened. Hydraulic operated tie rods in the upper section of the Ram or other proven hydraulic system shall be used to ensure droop compensation relative to the longitudinal displacement and the weight of total accessories.	Vendor to confirm and describe the design and working in detail with drawings.			
5.7	Main spindle drive: Drive of main spindle drive by AC motor. 2 step gearbox for automatic change of speed ranges. Cooling of oil circuits for lubrication and hydraulic by a controlled chiller. Precision Poly V belts with low noise level for power transmission at the drive shaft (parallel running to boring spindle). Reduction gear box inside the ram for transmitting turning moment to the boring spindle. Nitrided spindle. Oriented Stop in each angle position. Quick tool clamping for tools and their corresponding pull studs. Boring spindle with hardened taper insert and protection against coolant and chips by a labyrinth seal with permanent pressured air.	Vendor to confirm and describe the design and working in detail with drawings.			
5.8	Video images on CD including hard copy explaining the technical features/ Literature with photographs, drawings explaining the technical features should be enclosed with the offer.				
5.9	Head Stock Counterbalance System. (Details of the offered system to be submitted)	Vendor to submit			
5.10	Design of machine for its sturdiness to bear mechanical, torsional, and temperature stresses but still maintaining its sturdiness and accuracy levels shall be evolved through FEM analysis and submitted. All machine axes readings when taken in full span of 24 hours at particular positions should show same reading.	Vendor to submit			

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6.0	FLOOR PLATES:				
6.1	Material : Shall have Cast Iron or Steel fabrication				
6.1.1	Usable Floor Plate Area (LxBxH) in mm with levelling jacks:	min. 7000 x 3000 x 300 excluding machine parking area and for pick up station			
6.1.2	Number of Floor Plates	Vendor to specify			
6.1.3	Size of each Floor Plate	Vendor to specify			
6.1.4	Load Bearing Capacity,	15000kg/sqm			
6.1.6	T-Slots	28H9, 36/250, DIN 650, finish to DIN 876 III			
6.1.7	Direction of Tee Slots in the Floor Plates.: Along X and Y axes.	Vendor to specify and confirm			
6.1.8	The Floor Plates shall be provided with Coolant collection channels on the side of Floor Plates with proper arrangement for smooth coolant flow.	Vendor to specify			

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7.0	OPERATOR'S PLATFORM:				
7.1	Operator's platform of min 300 kg load carrying capacity attached to Headstock for total Vertical Traverse as well as forward stroke of sufficient length. A 220V/AC, 5 A Plug Point with ON/ OFF switch is also to be provided on the Platform.	Vendor to confirm .			
7.2	Horizontal movement of Operator's Platform.	Vendor to specify			
7.3	Weight carrying Capacity of the Platform should be Min.300 Kg.	Vendor to confirm			
7.4	Minimum Height of Platform from Shop Floor.	Vendor to specify			
7.5	Splash/ Chip guards on operator platform for protection of operator, operator's panel and to avoid spillage of coolant & chips on operator's platform.	Vendor to offer and confirm			
8.0	OPERATION AND CONTROL SYSTEM:				
8.1	OPERATOR'S PANEL:				
8.1.1	Swivelling and sliding type air conditioned operator's pendant of Rittal/Schneider make with complete CNC operator panel (OP) and machine control panel (MCP) of required configuration shall be provided on the operator's side for safe, convenient and efficient operation from both left and right sides of tool post. All switches should be within reach of operator of average height (170 cms) for easy operation. All displays/indications should also be conveniently placed accordingly. Layout showing complete details should be submitted.	Vendor to confirm & submit Photographs & Layout.			

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8.2	CNC SYSTEM & FEATURES :				
8.2.1	Make: FANUC / SIEMENS	Vendor to confirm			
8.2.2	Details of Standard features	Vendor to specify			
8.2.3	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			
8.2.4	Details of optional features, recommended by vendor. (Including features required for Prove-Out Components)	Vendor to offer and submit details			
8.2.5	Details of other optional features:	Vendor to offer and confirm			
8.2.6	Axes Interpolation: Linear, Circular, Cylindrical, Helical.	Vendor to confirm			
8.2.7	Technology Cycles: Geometry Calculation, standard Drilling, Tapping, Milling etc. cycles.	Vendor to confirm			
8.2.8	Graphics simulation of Part Programs and Machining process.	Vendor to confirm			
8.2.9	Co-ordinate Transformation: Datum shift, rotation, mirror image, scaling factor.	Vendor to confirm			
8.2.10	Pitch Error compensation (As applicable)	Vendor to confirm			
8.2.11	Backlash error compensation (As applicable)	Vendor to confirm			
8.2.12	Zero Offset for all axes	Vendor to confirm			

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8.2.13	Feed override switch 0-120% for all axis	Vendor to confirm			
8.2.14	Spindle speed override switch 50-120%	Vendor to confirm			
8.2.15	It shall have cartesian & polar coordinate programming, program jumps, arithmetic, logical, trigonometric functions and branching	Vendor to confirm			
8.2.16	Direct spindle speed programming, spindle speed limitation	Vendor to confirm			
8.2.17	Machining cycle for drilling, tapping pecking, reaming, boring, holepattern, slot milling, circular and rectangular pocket milling, multipass milling of plane surface.	Vendor to confirm			
8.2.18	Turning cycle for facing head operations such as thread cutting, recessing.	Vendor to confirm			
8.2.19	Provision for safe shut down of CNC Control in case of Power Failure	Vendor to confirm			
9.0	MANUAL CONTROL:	Vendor to confirm			
9.1	Complete manual operation of machine should be possible through Machine Control Panel (MCP). The MCP should have Spindle & Feed override switches, +/- Jogging 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.			

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10.0	HAND HELD UNIT:				
10.1	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.			
11.0	UPS FOR CNC SYSTEM: (Only in case of PC based CNC systems)				
11.1	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.			
12.0	NOTE BOOK PC (I/O DEVICE): (Optional - to be quoted seperately)				
12.1	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.			
13.0	MACHINE LIGHTS:				
13.1	Machine Lights for sufficient illumination of complete working area, on both sides of operator's platform, should be provided for clear visibility.	Vendor to offer & specify details.			
13.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to offer & specify details.			
13.3	Any lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to confirm			
13.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to confirm			
13.5	Flashing / rotary type End of Cutting and Program Stop Light.	Vendor to confirm			

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14.0	REFRIGERATION UNITS / AIR CONDITIONERS				
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			
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.	Vendor to offer and confirm			
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			

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14.4	For precise air/ oil temperature with energy-efficient operation, latest state-of-the-art technology features like constant pressure control, variable speed control of fan-motor, hot-gas bypass control, etc. needs to be incorporated in the above Unit (s).	Vendor to offer and confirm			
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.	Vendor to offer and confirm			
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			
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 electrical integration of the Unit (s) with the CNC machines.	Vendor to confirm			
15.0	HYDRAULIC, COOLANT & ELECTRICAL SYSTEM				

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15.1	HYDRAULIC SYSTEM : Details should be Submitted by the Vendor				
15.1.1	The Hydraulic System shall be of Re-circulating Type. Hydraulic Tank should be preferably placed at shop floor.	Vendor to offer and confirm			
15.1.2	Pumps, Valves, Switches (Pressure & Flow) should be of Make : Rexroth / Vickers / Parker / Hawe.	Vendor to offer and confirm			
15.1.3	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 be of Make: EPE / Hydac.	Vendor to offer and confirm			
15.1.4	Failure indication	Vendor to offer			
15.1.5	Automatic shut off provision, Details should be submitted.	Vendor to offer			
15.1.6	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			
15.1.7	Hydraulic pump capacity (flow/ pressure) to be intimated.	Vendor to inform			
15.1.8	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			
15.1.9	First filling of all required Oils & Grease 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			

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15.2	COOLANT SYSTEM:				
15.2.1	Coolant System with all accessories for following variants shall be provided. Selection of all the variants shall be through program and push buttons provided on the Operator's panel as well.	Vendor to confirm			
15.2.2	External coolant supply by a nozzle block with 3 adjustable nozzles. The block shall be swivelled vertically from operator panel	8 bars, 80 LPM			
15.2.3	Recirculating Type Flood Coolant System with nozzles around spindle.	Vendor to offer & confirm			
15.2.4	Air coolant system	Vendor to offer & confirm			
15.2.5	High Pressure Internal coolant supply through the boring spindle & pressurized air for cleaning of system and for the tool taper .	min. 20 bars, 30 LPM			
15.2.6	All offered 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 confirm			
15.2.7	Coolant collection and recirculation system should be leakproof & perfect to avoid any spillage on shop floor, trenches for cables & foundation pit of the machine etc. In no case coolant shall mix up with hydraulic/Lubrication oil.	Vendor to confirm			
15.2.8	Filteration capacity :Min. 40 µm	Vendor to specify			
15.2.9	Coolant Filteration System: Recirculating type coolant system with Vacuum Rotary drum type Filteration System and magnetic separator.	Vendor to confirm and submit details.			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
15.2.10	Coolant Flow Diagram showing filters, pumps, valves, tanks etc. to be submitted with the offer.	Vendor to submit			
15.2.11	Pressure & rate of flow of coolant for different variants should be furnished in the offer. The Pressure should be sufficient for the coolant to reach the tool tip at full pressure.	Vendor to specify & confirm.			
15.2.12	Coolant Tank Capacity. Coolant Tank may preferably be placed on the Floor Level. The details of the system, including requisite sump, pump etc., should be clearly indicated.	min. 900 Liters			
15.2.13	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 confirm			
15.2.14	Coolant pump & motor details for all variants of coolant system are to be submitted with the offer.	Vendor to submit			
15.2.15	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Required.			
15.2.16	Coolant specification (Preferably Indian equivalent shall also be specified)	Vendor to confirm			
15.3	ELECTRICAL SYSTEM:				
15.3.1	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 confirm & specify			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
15.3.2	Tropicalisation: All electrical/ electronic equipment shall be tropicalized.	Vendor to confirm			
15.3.3	Electrical cabinets should be of Rittal/Schneider make, properly air conditioned and sealed from ingress of liquids and encroachment of rodents	Vendor to confirm			
15.3.4	All electrical components in the cabinets should be mounted on DIN Rail	Vendor to confirm			
15.3.5	All electrical and electronic panels including operator's panel should have provision of sufficient illumination and power receptacles of 220VAC, 5 A. All adapters/ receptacles should have compatibility with Indian equivalents.	Vendor to confirm			
15.3.6	Motors shall conform to IEC or Indian Standards	Vendor to confirm			
15.3.7	All cables outside the electrical cabinets and operator pendant must be routed through flexible conduits capable of withstanding stress, chip hazard and ingress of oil/coolant. Additionally, all cables moving with traversing axes should be of trailing type and installed in caterpillar / cable drag chain.	Vendor to confirm			
15.3.8	Vendor should ensure the proper earthing for the machine and its peripherals.	Vendor to confirm			
15.3.9	In-cycle hour counter with reset facility is to be included in the offer.	Vendor to offer			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
16.0	SAFETY ARRANGEMENTS:				
16.1	Following safety features in addition to other standard safety features should be provided on the machine:	Vendor to confirm & specify			
16.2	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 confirm			
16.3	A detailed list of all alarms / indications provided on machine along with cause and remedy should be submitted by the supplier.	Vendor to Submit			
16.4	All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hindrance to machine operator's movement for effective use of machine.	Vendor to confirm			
16.5	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations.	Vendor to confirm			
16.6	Emergency Switches at suitable locations as per International Norms are to be provided.	Vendor to provide			
16.7	Oil & water pipe lines should not run with electrical cable in the same tray / trench.	Vendor to confirm			
16.8	Safety Lights on moving column (preferably Flashing during X-travel).	Vendor to confirm			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
17.0	ENVIRONMENTAL PERFORMANCE OF THE MACHINE:	Vendor to confirm			
17.1	The Machine shall conform to following factors related to environment:				
17.2	Maximum noise level shall be 85 dB(A) at normal load condition, 1 M 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. Supplier to demonstrate compliance to noise level, if so required.	Vendor to confirm			
17.3	There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm			
17.4	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			
17.5	No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm			
17.6	If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm			
17.7	Paint of the machine should be oil / coolant resistant and should not peel off and mix up with coolant.	Vendor to confirm			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
18.0	CHIP CONVEYOR:				
18.1	A chip conveyor to carry both short and curly chips efficiently and effectively to the chip bin to be provided on one end of the machine . Two Chips bins of appropriate size of Indian make, with wheels & handle for movement, should also be supplied	Vendor to confirm			
18.2	Type of chip conveyor	Slat type.			
18.3	Width of conveyor	Vendor to specify			
18.4	Elevation of chip conveyor for chip bin	Vendor to specify			
18.5	Material of chip conveyor (to be rust resistant)	Vendor to specify			
18.6	Provision for smooth flow of chips to the conveyor.	Vendor to confirm			
18.7	Operation of chip conveyor (forward & reverse) through push buttons on operator's panel.	Vendor to confirm			
18.8	Layout showing location of chip conveyor to be submitted.	Vendor to submit			
19.0	ULTRA ISOLATION TRANSFORMER				
19.1	Indian make Ultra Isolation Transformer suitable for complete machine , its drives, controls, PLC etc. shall be offered with complete details.	Vendor to offer			
19.2	Make: NEEL or Aplab or Auto Electric or Servomax or of international repute.	Vendor to specify			
19.3	Model and Rating	Vendor to specify			
19.4	Catalogue of the Isolation Transformer shall be submitted with the offer.	Vendor to submit			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
20.0	PNEUMATIC SYSTEM:				
20.1	AIR COMPRESSOR:				
20.1.1	Independent Air Compressor (of reputed Indian make Elgi, Chicago Pneumatic or Ingersoll Rand) with refrigerated type Dryer & Filter of suitable capacity 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 before Refrigerated type Air Dryer so that BHEL compressed air supply having pressure 5 Kg/sq.cm with high moisture could be used as and when required. The compressor unit should be suitable for continuous duty operation.	Vendor to offer with details.			
20.1.2	Make & Model of Air Compressor and refrigerator type dryer.	Vendor to specify			
20.1.3	Capacity (Flow, Pressure & KW)	Vendor to specify			
20.1.4	Spares Package for the compressor for 2 years trouble free working should also be offered.	Vendor to specify			
20.2	COMPRESSED AIR POINTS:				
20.2.1	Compressed Air Point with manual ON/ OFF Valve and flexible pipe of suitable length for work piece cleaning.	Vendor to confirm			
21.0	ADDITIONAL SYSTEMS:				

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
21.1	TELE-DIAGNOSTIC SERVICE :	Vendor to confirm			
21.1.1	Tele diagnostic service package consisting of Modem and other hardware with all necessary software package for remote diagnosis and resolution of faults of CNC System and PLC of the machine should be offered. With this facility, complete CNC-PLC system can be looked at and operated from remote controlled PC of supplier so that errors can be recognized and changes or correction can be made from supplier's end. Tele-diagnostic service should be provided through International telephone lines. This should be provided free of charge for the guarantee period. Terms and conditions for the service after guarantee period should be informed by vendor. Subsequently, it should be possible to use other platforms, such as Internet or ISDN, subject to their availability in future.	Vendor to confirm			
21.2	FAULT DIAGNOSTIC SYSTEM:				
21.2.1	All alarms and messages should be displayed on the CNC monitor with device ID numbers. Additionally, softcopy and hardcopy of all alarms and messages with cause and remedial measures must be supplied.	Vendor to confirm			
21.3	LEVELING & ANCHORING SYSTEM	Required.			
21.3.1	Complete anchoring system including foundation bolts, anchoring materials, fixators, leveling shoes etc shall be supplied for the Machine	Vendor to offer and submit details.			
21.4	TOOLS FOR ERECTION, OPERATION & MAINTENANCE :				
21.4.1	Special 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. List of such tools should be submitted with offer.	Vendor to confirm			
21.4.2	Test mandrel for checking spindle run-out & alignment should be supplied	Vendor to confirm			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
22.0	SPARES: (Optional : To be quoted separately)				
22.1	Itemwise breakup of mechanical, hydraulic, electrical and electronic spares used on the machine in sufficient quantity as per recommendation of Vendor for 2 years of trouble free operation on three shifts continuous running basis should be offered by vendor. The list to include following, in addition to other recommended spares: (Unit Price of each item of spare should be offered)	Vendor to confirm			
22.2	Mechanical & Hydraulic Spares: The following spares are to be included.				
22.2.1	Pressure control valves, Pressure reducing valves, Flow control valves & Direction control valves used in Hyd / Lub / Pneumatic/ coolant circuit. (1 no. of each type)	Vendor to offer			
22.2.2	Pressure switches, flow switches used in Hyd / Lub / Pneumatic/ coolant circuit. (1 No. of each type)	Vendor to offer			
22.2.3	All types of regenerative type filter inserts (6 No. of each type in hydraulic, pneumatic & coolant circuit)	Vendor to offer			
22.2.4	All types of Disposable type filter inserts (10 nos. of each type)	Vendor to offer			
22.2.5	All types of Accumulator bladders (1 no. of each type) with charging kit	Vendor to offer			
22.2.6	One set of timing belts used in the machine.	Vendor to offer			
22.2.7	One set of seal kits used in different hydraulic & pneumatic cylinders in the machine.	Vendor to offer			
22.3	Electrical /Electronic / CNC Spares : Following Spares are to be offered.	Vendor to offer			
22.3.1	Limit Switches/ Micro Switches (2 Nos each type)	Vendor to offer			
22.3.2	Relays (2 Nos each type)	Vendor to offer			
22.3.3	Contactors (2 Nos each type)	Vendor to offer			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
22.3.4	RTD temperature transmitter (1 No each type)	Vendor to offer			
22.3.5	Proximity Switches (2 Nos each type)	Vendor to offer			
22.3.6	Push Buttons (5 Nos each type)	Vendor to offer			
22.3.7	Indicating Lamps (10 Nos each type)	Vendor to offer			
22.3.8	Semiconductor Fuses (3 Nos each type)	Vendor to offer			
22.3.9	Special Fuses (3 Nos each type)	Vendor to offer			
22.3.10	Circuit Breakers (1 No each type)	Vendor to offer			
22.3.11	Main Power Switch (1 No each type)	Vendor to offer			
22.3.12	Encoders (1 No each type)	Vendor to offer			
22.3.13	Scanning Heads for Linear Scales (1 No each type)	Vendor to offer			
22.3.14	PCBs for CNC Controller (1 No each type)	Vendor to offer			
22.3.15	I/O Cards for PLC (1 No each type)	Vendor to offer			
22.3.16	Control & Power modules for Spindle & Feed Drives (1 No each type)	Vendor to offer			
22.3.17	Operator panel, Machine Control Panel and Hand-held unit (1 Nos each type)	Vendor to offer			
22.3.18	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 offer			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
22.3.19	Recommended set of spares for all attachments, viz.: Angular Milling Head, and Boring Heads are to be offered seperately with details. The spares are to include Motors, Set of Gears, Encoders, Limit/ Cam Switch Connectors with item wise details.	Vendor to offer			
22.3.20	Recommended set of spares for Job and Tool Measuring Systems are to be offered seperately with details.	Vendor to offer			
22.3.21	Vendor to confirm that 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			
23.0	DOCUMENTATION : Four sets of Hard Copies (Print form) and four sets of soft copies (on CD/DVD) of the following documents in English language should be supplied along with the machine	Vendor to offer			
23.1	Operating manuals of Machine & CNC system	Vendor to offer			
23.2	Programming manuals of machine & CNC system	Vendor to offer			
23.3	Detailed Maintenance manual of machine and supplied systems.	Vendor to offer			
23.4	Maintenance, Interface & commissioning manuals for CNC system, spindle & feed drives and position feedback system.	Vendor to offer			
23.5	Manufacturing drawings for all supplied clamping elements, cutting tools, tool holders, arbors, boring bars, coolant connections, adapters, sleeves, fixtures etc.	Vendor to offer			
23.6	Catalogues, Operation & Maintenance Manuals of all bought out items including drawings, wherever applicable.	Vendor to offer			
23.7	Detailed specification of all rubber items and hydraulic/lube fittings	Vendor to offer			
23.8	Operating Manuals, Maintenance Manuals & Catalogues for supplied accessories viz. Isolation Transformer, Air-Compressor, Boring Attachments. etc.	Vendor to offer			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
23.9	Electrical Schematic Diagrams, Wiring Diagrams, Junction Box Layouts, Connector Diagrams and Cable Layouts of the machine in English.	Vendor to offer			
23.10	PLC program with symbols & comments in English.	Vendor to offer			
23.11	Soft copy of complete machine data and PLC project with symbols and comments in English	Vendor to offer			
23.12	Complete software back-up (Ghost) of hard disk (only in case of PC based CNC system) on DVD				
23.13	Complete list of parts/items(Bill of materials) used in the machine in English language.	Vendor to offer			
23.14	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.	Vendor to offer			
23.15	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to offer			
24.0	TRAINING:				
24.1	Four BHEL Persons should be trained at vendor's works for period of 2 weeks for each area given below: (a) CNC Part Programming for the machine, application of all CNC Features, Programming for supplied accessories etc. (b) Electronic & CNC maintenance for machine & other supplied equipment (c) Electrical, Mechanical & Hydraulic maintenance of the machine & other supplied equipment (d) Operation of the machine & other supplied equipment Pre-dispatch inspection (ref. SI.No. 30.1 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 confirm			
24.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL for training at supplier's works.	Vendor to confirm			
24.3	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel.	Vendor to confirm			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
24.4	Vendor to quote for training per person per week basis	Vendor to quote			
24.5	Vendor should commit to organize and quote for training of Electronics Engineer and Programmer at the CNC System Manufacturer's works for advanced features and specialised training if so required by BHEL.	Vendor to confirm			
25.0	FOUNDATION:				
25.1	Vendor shall submit the preliminary layout drawing for getting BHEL's approval within two month from the date of Letter of Intent (LOI)/ P.O., whichever is earlier. Soil condition data will be furnished by BHEL alongwith the approval. Complete Foundation Design including details, like Static/ Dynamic load details etc. and final Layout Drawings shall be submitted by the supplier within three months after getting BHEL's approval. The Layout should consist of all requirements pertaining to complete machine and all accessories, including space requirement for Voltage Stabiliser, Isolation Transformer, Air Compressor, Chip Bin & any other accessory. BHEL shall construct complete foundation for the machine under supervision of supplier and at supplier's responsibility. Vendor should arrange equipment required for the testing of foundation, if required by the vendor. The vendor shall also indicate detailed specifications of grouting compound and grouting procedure etc. for grouting of foundation bolts of the machine.	Vendor to confirm			
26.0	ERECTION & COMMISSIONING				
26.1	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 crane and helping personnel shall also 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 Ton. The vendor will ensure to make requisite arrangement for lifting of heavier consignment/ items/ assembly of the machine not getting covered by this capacity.	Vendor to confirm			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
26.2	Erection & Commissioning of Isolation Transformer & Air Compressor shall also be responsibility of the vendor.	Vendor to confirm			
26.3	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at Clause 8 (Machine Acceptance) shall form part of the commissioning activity.	Vendor to confirm			
26.4	Tools, Tackles, Test Mandrels, instruments and other necessary equipment including Laser equipment required to carry out all above activities should be brought by the supplier.	Vendor to confirm			
26.5	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to confirm			
26.6	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to submit			
26.7	All Cover Plates required for the machine and its peripherals shall be supplied by the vendor.	Vendor to confirm			
26.8	Special 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. List of such tools should be submitted with offer.	Vendor to confirm and submit details.			
26.9	Test mandrel for checking spindle run-out & alignment should be supplied	Vendor to confirm			
26.10	The vendor shall supply sufficient quantity of paint of the machine and carry out touching wherever the paint is damaged during transit or erection of the machine.	Vendor to confirm			
26.11	Charges, duration, terms & conditions for E&C should be furnished in details separately by vendor along with offer.	Vendor to offer			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
27.0	ACCURACY TESTS:				
27.1	GEOMETRICAL ACCURACIES :				
27.1.1	All the machine accuracies to be demonstrated to BHEL engineers during pre-acceptance tests at Suppliers works and during Erection & Commissioning at BHEL Works.	Vendor to confirm			
27.1.2	Straightness of the transverse movement of column (x-axis) in vertical plane	0.02mm upto travel of 5000mm; 0.03 upto 7500mm			
27.1.3	Straightness of the vertical movement of column (x-axis) in horizontal plane	0.02mm upto travel of 5000mm; 0.03 upto 7500mm			
27.1.4	Straightness of the movement of the spindle head along column (Y-axis)	0.015mm upto travel of 2500mm; 0.032 upto 5000mm			
27.1.5	Squareness of the vertical movement of spindle head (Y-axis) to the transverse movement of column (X-axis)	0.012 per 800mm			
27.1.6	Spindle runout	0.008mm			
27.1.7	Tool holder runout fitted on spindle	0.012mm			
27.1.8	Geometrical Accuracy Tests of all other parameters shall be in accordance with ISO 3070 standard 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 confirm			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
27.2	MACHINE POSITIONING & REPEATABILITY ACCURACIES : SHOULD BE MEASURED AS PER VDI/DGQ 3441 FOR X,Y, Z, U & W (LATEST REVISION) USING LASER INTERFEROMETER.				
27.2.1	Positioning deviation Pa for X,Y & Z and U Axis per 1000 mm	max.0.015 mm			
27.2.2	Positioning deviation Pa per 1000mm (W)	max.0.020 mm			
27.2.3	Positioning deviation Pa for B Axis	max 10"			
27.2.4	Positioning scatter Ps for X,Y,Z & U Axis per 1000mm	max.0.010mm			
27.2.5	Positioning scatter Ps for W per 1000mm	max. 0.020 mm			
27.2.6	Positioning scatter Ps for B Axis	max 6"			
27.2.7	Total Positioning error P for entire travel of X,Y,Z & U Axis	Max : X=0.05mm, Y=0.25mm, Z=0.015mm W=0.25mm, U=0.15mm			
27.2.8	Total Positioning error P for B Axis	max 8"			
27.2.9	Reversal error U for all axes	max.0.008 mm			
27.2.10	Deviation from true circle on circular milling dia 300 mm	max.0.015 mm			
27.2.11	Deviation from true circle on 160 mm internal boring	max.0.008 mm			
27.2.12	All the above accuracies to be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and during Erection & Commissioning at BHEL Works.	Vendor to confirm			
27.2.13	Note1: LC of scale should be taken to achieve above	Vendor to note			
27.2.14	Note 2: Accuracy should remain within specified tolerance over a time period of 24 hours (Maximum temperature variation is 25 degree centigrade during peak summer)	Vendor to note & confirm			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
28.0	AMBIENT CONDITIONS & THERMAL STABILITY :				
28.1	Power Supply (AC): Voltage = 415V +/- 10% of fluctuations , Frequency= 50Hz +/- 3% , No. of phases = 3 phase without neutral. Ambient Operating Conditions: Temperature = 5 to 48 degree Celsius , Relative Humidity = 95% max.	Vendor to take note			
28.2	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. Max. temperature variation is up to 25 deg Celsius in 24 hours. (Vendor to confirm that machine is suitable for above and details of provisions on the machine for the same are to be furnished by Vendor)	Vendor to note & confirm			
28.3	Thermal Stability of the complete machine keeping in view specified Ambient Conditions and accuracy requirements of BHEL components and trouble free operation of the machine should be ensured by vendor. (Vendor to confirm that machine is suitable for above and details of provisions on the machine for the same should be furnished by Vendor)	Vendor to confirm			
28.4	Vendor to confirm that machine is suitable for successful running with guaranteed accuracies and production of jobs with accuracies as specified in proveout components in the conditions specified above. Details of provisions made on the machine for the same are to be furnished to BHEL.	Vendor to confirm			
28.5	The machine, including Attachments and Accessories etc., should be suitable for 24 hrs. continuous operation to its full capacity for 24 hour a day and 7 days a week throughout. Vendor to ensure and confirm the same.	Vendor to confirm			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
29.0	PROVEOUT OF BHEL COMPONENTS :				
29.1	Drg. nos.01602370024,11650170022 & 31750540718 will be likely proveout component Job setting plan, Machining process plan & Requirement of Tools etc. for machining of proveout components shall be discussed and mutually agreed with vendor (Final proveout component drawing no. may change, however, the machining features of the changed components shall be in line with the original component drawing). Complete machining of prove out components shall be done by Vendor at BHEL works to the specified design accuracy and surface finish, using cutting tools and CNC programs to be provided by the vendor to prove the machine after complete erection, tests & test piece machining etc. Material for the proveout components 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 two months of placement of order. Vendor shall submit CNC programs prior to start of erection of Machine at BHEL works.	Vendor to offer and confirm			
29.2	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 confirm			
29.3	During proveout, all tools should be preset by using supplied Tool offset Measuring System and measurement of machined dimensions of the job shall be done by supplied Job Measuring System. 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 confirm			
30.0	MACHINE ACCEPTANCE: (Tests/Activities TO be Performed by Vendor)	Should be accepted & confirmed by Vendor			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
30.1	Tests/Activities to be carried out at supplier's works on the machine before dispatch :	Vendor to accept and confirm			
30.1.1	Geometrical Accuracy Tests as per test chart & as per Clause 27.1	Vendor to accept and confirm			
30.1.2	Positioning Accuracy Tests as per VDI-DGQ/3441 & as per clause 27.2	Vendor to accept and confirm			
30.1.3	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 and confirm			
30.1.4	Demonstration of all features of the machine, CNC system and all Accessories.	Vendor to accept and confirm			
30.1.5	Machining of NAS Test Piece. Vendor to supply test piece and tooling for it's machining. The results of machined NAS piece should come within the tolerance limit.	Vendor to accept and confirm			
30.2	Test to be carried out at BHEL works while commissioning the machine :	Vendor to accept and confirm			
30.2.1	Geometrical Accuracy Tests as per test chart & as per Clause 27.1.	Vendor to accept and confirm			
30.2.2	Positioning Accuracy Tests as per VDI-DGQ/3441 & as per clause 27.2	Vendor to accept and confirm			
30.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to accept and confirm			
30.2.4	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 and confirm			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
30.2.5	Demonstration of all features of the machine, CNC system & all accessories to the satisfaction of BHEL for their efficient and effective use.	Vendor to accept and confirm			
30.2.6	Demonstration by actual use of all supplied attachments and accessories to their full capacity.	Vendor to accept and confirm			
30.2.7	Machining of NAS Test Piece. Vendor to supply test piece and tooling for it's machining. The results of machined NAS piece should come within the tolerance limit.	Vendor to accept and confirm			
30.2.8	Job prove out as per clause 29.	Vendor to accept and confirm			
30.2.9	Two weeks supervision of independent operation of machine by BHEL after job proveout.	Vendor to accept and confirm			
30.2.10	Training of BHEL machine operators in operation of complete machine & accessories etc by the supplier's experts / engineers during their stay at BHEL works	Vendor to accept and confirm			
31.0	AFTER SALES SERVICE:				
31.1	Vendor should provide prompt after sales service to ensure smooth trouble free working of the machine and spares availability during and after guarantee period.	Vendor to confirm			
32.0	PACKING:				
30.1	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 despatched in containers, all small loose items shall be suitably packed in boxes	Vendor to confirm			
33.0	GUARANTEE:				
33.1	24 months from the date of acceptance of the machine.	Vendor to comply			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
34.0	GENERAL : The vendor should submit the following information:				
34.1	Machine Model	Vendor to specify			
34.2	Total connected load (KVA):	Vendor to specify			
34.3	Floor area required (Length, Width, Height) for complete machine & accessories. .	Vendor to specify			
34.4	Painting of Machine/ Electrical Panels: RAL 6011 Apple Green (Polyurethane Paint)	Vendor to confirm			
34.5	Total weight of the machine	Vendor to specify			
34.6	Vendor to submit, along with offer, the reference list of customers where similar machines have been supplied mentioning the customer, Machine Model, major specifications of the supplied machine, CNC System, Year of Supply etc.	Vendor to specify			
34.7	Detailed catalogues , sketch/photographs of the m/c and accessories/ attachments should be submitted with the offer.	Vendor to specify			
34.8	Hydraulic, Pneumatic & oil pipings should be preferably metallic except places where flexible pipings are essential.All the pipes required for the same shall be included in the standard scope of the machine.	Vendor to specify			
34.9	Ladder is to be provided to access the machine elements located at the top of the column.	Vendor to offer & confirm			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
35.0	QUALIFYING CONDITIONS :				
35.1	Only those vendors (OEM) , who have supplied and commissioned at least one CNC HORIZONTAL BORING MACHINE of same or higher sizes (Spindle Diameter 160 mm, Ram+Spindle Travel- 2000 mm, with X= 7000 mm, Y= 5000 mm) for similar applications in the past 10 years (on the date of opening of tender) should quote. The following information is to be submitted by the vendor about the companies where similar machines have been supplied. This is required from all the vendors for qualification of their offer.	Vendor to accept & confirm			
35.2	Name of the customer / company where similar machine is installed.	Vendor to inform			
35.3	Complete postal address of the customer.	Vendor to inform			
35.4	Month & Year of commissioning.	Vendor to inform			
35.5	Parameters of machine(s) supplied (Spindle Diameter, Ram+Spindle Travel, X, Y) & application for which the machine is supplied.	Vendor to inform			
35.6	Name and designation of the contact person of the customer.	Vendor to inform			
35.7	Phone, FAX no. and email address of the contact person of the customer.	Vendor to inform			
35.8	Performance certificate from at least one customer regarding satisfactory performance of machine supplied to them and issued with in year 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			
35.9	BHEL reserves the right to verify the information provided by vendor. In case the information is found to be false /incorrect, the offer shall be rejected.	Vendor to accept & confirm			

S.NO	DESCRIPTION FOR BHEL REQUIREMENT	REQUIRED	Offered	Deviation	Remark
36.0	OTHER FEATURES:				
36.1	NETWORKING:	Vendor to confirm			
36.1.1	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. Also the machine should be connected with inbuilt Wi-Fi system of range 1500 meters to receive and send the program. The networking should have following capabilities.	Vendor to confirm			
36.1.2	The machine shall appear as a node in the Entire Network. (Network Neighborhood)	Vendor to confirm			
36.1.3	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 confirm			
36.1.4	The program transfer between CNC system and network should also be possible in CNC Mode.	Vendor to confirm			
36.2	MACHINE MONITORING SYSTEM (MMS) SIGNALS	Vendor to confirm			
36.2.1	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.				
36.2.2	Control ON	Vendor to confirm			
36.2.3	Cycle ON	Vendor to offer			
36.2.4	Spindle Running	Vendor to offer			
36.2.5	Feed Active (Any of the axes moving)	Vendor to offer			
36.2.6	M30 (Program Stop)	Vendor to offer			
36.2.7	Alarm Active	Vendor to offer			