	BHARAT HEAVY ELECTRICAL LIMITED		**Enquiry No. :**	**2791301E**	
	UNIT'S ADDRESS: BAP, RANIPET		**Due Date :**	**02-03-2020**	
			Supplier Qtn. No.:		
	CONTACT PERSON'S NAME/DESIGN./PHONE NO./E-MAIL (FROM PURCHASE DEPTT.) : MR. SACHIN SAINI/Sr.Er/04172283132/sachin.saini@bhel.in		**Date :**		
SPECIFICATION CUM COMPLIANCE CERTIFICATE FOR CNC VERTICAL TURN & MILL CENTRE 3M					
	NOTE:-				
	1. Vendor (OEM) must submit complete information against clause no. 26 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				
	3. The offer and all documents enclosed with offer should be in English language only.				
ADDRESS OF THE SUPPLIER :		**ADDRESS OF THE INDIAN AGENTS :**			
TELEPHONE NOS.:		**TELEPHONE NOS.:**			
FAX NOS.:		**FAX NOS.:**			
E-MAIL ADDRESS :		**E-MAIL ADDRESS :**			
SCOPE: SUPPLY, ERECTION & COMMISSIONING OF CNC VERTICAL TURN & MILL CENTRE COMPLYING WITH SPECIFICATION AS					
	Ref: BAP : CAPEX: 1.1a Rev 03				
SNO	**DESCRIPTION FOR BHEL REQUIREMENT**	**SPECIFIED / TO BE CONFIRMED BY**	**OFFERED**	**DEVIATIONS**	**REMARKS**
1.0	**PURPOSE & WORKPIECE MATERIAL**				
1.1	Purpose: (Operations/Jobs involved)				
	The CNC Vertical Turn and Milling Centre (VTMC) is intended for Profile Turning, Milling and Boring operations in aerospace grade metallic material like Stainless Steels, Al alloys, hardened 15CDV6 steel, Ti alloys etc. The machine shall be a Fixed Double Column Vertical Turn Mill Centre with movable rotary table, movable crossrail, ram, spindle in ram, detachable turning head and a detachable universal milling head with electrospindle. The machine shall be configured with 4 Programmable Axes(X, Y,Z,&C) with capability of simultaneous interpolation of the 4 axes.	Vendor to note			
	The machine shall have two modes of operation:				
1.2	**Turning Mode**: The machine shall be configured as CNC programmable simultaneously interpolated linear axes-X & Z with a turning tool attachment/head which will be used for turning operations on the 3m diameter rotary table	Vendor to note			
1.3	**Milling Mode**: The machine shall be configured as a CNC programmable simultaneously interpolate4-axis machine having three linear axes and one rotary axis, with axes defined as X, Y,Z & C.	Vendor to note			
1.4	Work Piece Material: (Material detail, Hardness etc.) : Stainless Steels, Al alloys, hardened 15CDV6 steel, Ti alloys etc.	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.0	**SPECIFICATION:**				
2.1	**MACHINE CONFIGURATION**				
2.1.1	CNC Double Column Vertical Turning and milling centre, Single ram tool head on Cross rail.	Vendor to note and furnish details.			
2.2	**CAPACITY & SIZE**				
2.2.1	Maximum Workpiece Height:	2000 mm			
2.2.2	Maximum Workpiece Diameter:	3000 mm			
2.2.3	Maximum Workpiece Weight	10 tons			
2.2.4	Maximum Swing Diameter	Vendor to specify			
2.2.5	Maximum Turning Diameter	3000 mm or more			
2.2.6	Minimum Boring Diameter	Vendor to specify			
2.2.7	Maximum Height for Turning	2000 mm			
2.2.8	Maximum Height for Facing and Milling	2000mm			
2.3	**TABLE**				
2.3.1	The Rotary Table shall be made of rigid Cast Iron and have proven design with radial T-Slots and Slot tracks. The Table shall have pre-loaded bearing system with high running accuracy. The Table shall be adequately supported by Hydrostatic bearing system. Table shall be radially guided by suitable angular roller/ball bearing system with oil pressure lubrication. The drive elements and the bearing systems shall be designed considering the self weight, dynamics, size and weight of the job, cutting parameters for the specified operations.The rotary control shall be CNC controlled to operate in turning mode and in milling mode. Feedback system for the rotary table shall be fully integrated to the machine controller.	Vendor to specify			
2.3.2	Table Diameter	3000 mm			
2.3.3	Load Capacity	Vendor to specify			
2.3.4	Table Speed (Infinitely Variable) / No of Steps	Vendor to specify			
2.3.5	Power of Main Drive : Turning Mode @ S1 / 100% duty cycle (with 1 or 2 motors)	100 Kw Min.			
2.3.6	Details of Main Drive viz.Type, Make, Model etc.	Vendor to specify			
2.3.7	No. of Jaws : Number of manual independent jaws on Table; 8 Nos. (4 Nos. for Radial movements + 4Nos. for height adjustment)	8 Nos			
2.3.8	Torque, Turning Mode @ S1 / 100% duty cycle :250000 Nm	Vendor to Confirm			
2.3.9	Table Speed in Milling Mode : 50rpm	Vendor to Confirm			
2.3.10	Power, Milling Mode @ S1/100% duty cycle : 105 kw	Vendor to Confirm			
2.3.11	Torque, Milling Mode @S1/100% duty cycle :250000 Nm	Vendor to Confirm			
2.3.12	Table indexing accuracy :0.001 deg	Vendor to Confirm			
2.3.13	Table top surface flatness : ≤ 0.03mm	Vendor to Confirm			
2.3.14	Table top surface axial run out at periphery :≤ 0.03mm	Vendor to Confirm			
2.3.15	Table radial run out at outer periphery : ≤ 0.03mm	Vendor to Confirm			
2.3.16	Backlash elimination in Milling Mode	Vendor to Confirm			
2.3.17	Maximum External Clamping Diameter	Vendor to specify			
2.3.18	Minimum External Clamping Diameter	Vendor to specify			
2.3.19	Maximum Internal Clamping Diameter	Vendor to specify			
2.3.20	Minimum Internal Clamping Diameter	Vendor to specify			
2.3.21	Clamping Force of each Jaw. : 20000 daN	Vendor to specify			
2.3.22	Positions and Dimensions of the Jaws on Table. Chucking Capacity Diagram should be submitted.	Vendor to specify			
2.3.23	Type of Force Multiplier Mechanism used in Jaws should be explained and Drawings should be submitted.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.3.24	Maximum permissible Cutting Force	Vendor to specify			
2.3.25	Maximum permissible Torque	Vendor to specify			
2.3.26	RPM at which Max. Torque is available.	Vendor to specify			
2.3.27	Table Torque - Speed diagram should be submitted.	Vendor to specify			
2.3.28	Type of Bearing for the Table : Hydrostatic (should be confirmed by Vendor) . Complete details like bearing diameters, sizes of pockets etc. should be furnished.	Vendor to specify			
2.3.29	Size of T - slots, their position and accuracy. Drawing of Table showing details of the T - slots etc. should be submitted.	Vendor to specify			
2.3.30	Two perpendicular accurate Slots should be provided at the Center of the table to use for alignment purposes. Sizes (Width & Depth), accuracy etc. of these slots should be furnished along with a Drawing.	Vendor to specify			
2.3.31	Table Loading Diagram should be submitted (Load v / s Distance from Table Center) for uniform as well as for eccentric loading.	Vendor to specify			
2.3.32	Diameter, Depth and Accuracy of Center Bore on Table Top Surface.	Vendor to specify			
2.3.33	Full details of the rotary table including the table base, moving table part, bearing system, drive system, feedback system shall be provided.	Vendor to specify			
2.4	**C - Axis**				
2.4.1	Maximum Continuous Speed of C - Axis	Vendor to specify			
2.4.2	Minimum Continuous Speed of C - Axis	Vendor to Specify			
2.4.3	No. of Indexing Positions for C - Axis	360000			
2.4.4	Minimum Increment in C - Axis	0.001 degree			
2.4.5	Table Clamping Mechanism for C - Axis (Drawing should be submitted.)	Vendor to specify			
2.4.6	Clamping Force available on each Clamp and No. of Clamps.	Vendor to specify			
2.4.7	Feed back system - Heidenhain Encoder (Details should be submitted)	Vendor to specify			
2.4.8	Details of C-axis servomotor like torque, rating, type, make etc.	Vendor to specify			
2.5	**CROSS RAIL**				
2.5.1	A moving cross rail shall be mounted on the columns. The Cross Rail shall be capable of moving up and down vertically the guideways provided on the columns and may be positioned at definite intervals and locked, maintaining the positional and geometrical accuracy.The drive elements of the cross rail shall be adequately sized & synchronised. The cross rail shall be largely dimensioned and adequately ribbed to provide the requisite stiffness and strength.The Cross slide/saddle shall be mounted on the Cross Rail and shall carry the Ram. The cross slide/saddle shall moveon the guideways provided on the crossrail. The drive elements of the cross slide shall be adequately sized. Provisions shall be made on the cross slide/saddle for mounting the ram. Guiding elements for precise vertical traverse of the ram shall be provided on the cross slide/saddle. Appropriate counter balance system shall be provided for the cross rail. Full details of the cross rail, cross slide/saddle and ram attachment shall be provided.				
2.5.2	Vertical Travel	Vendor to specify			
2.5.3	Vertical Traverse Rate.	Vendor to specify			
2.5.4	No. of Positions.	Vendor to specify			
2.5.5	Distance between each Position	Vendor to specify			
2.5.6	Distance of lowest Step from Table Top	Vendor to specify			
2.5.7	Distance of highest Step from Table Top	Vendor to specify			
2.5.8	Maximum Height of Cross Rail bottom from Table Top	Vendor to specify			
2.5.9	Minimum Height of Cross Rail bottom from Table Top	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.5.10	Movement of Cross Rail : Through NC Program as well as manually by Push Buttons - should be confirmed.	Vendor to specify			
2.5.11	Machine Reference Point should be at Ram Reference Point and it should be updated automatically with movement of Cross Rail - should be confirmed.	Vendor to specify			
2.5.12	Details of crossrail movement	Vendor to specify			
2.6	**CROSS RAIL TOOL HEAD and RAM**				
2.6.1	No. of Columns :	2 (Two)			
	The Ram shall be rugged box type structure, steel fabricated (Fe360A or better) or forged with adequate ribbing, stress relieved and precision machined. The ram shall be designed to provide adequate stiffness and strength considering the machining operations involved, materials to be cut, depth of cut, dynamics of the machine etc.				
2.6.2	No. of Rams :	1 (one)			
	Cross - Section of Ram: 330x330mm (Nominal)	Vendor to specify			
2.6.3	The ram shall have precise vertical motion over the guide elements provided on the saddle.	Vendor to specify			
	Ram Travel shall be 1000mm (Nominal)	Vendor to specify			
2.6.4	The Ram shall be adequately supported and stiffly guided on the inner part of Cross Slide/Saddle	Vendor to specify			
	The drive elements of the ram shall be adequately sized.	Vendor to specify			
2.6.5	The inside of the ram shall house the main milling spindle along with its drive and control elements	Vendor to specify			
	Ram shall be designed to receive the detachable turning head and the detachable milling head. It shall be provided with hirth coupling or similar better design for precise automatic positioning &rigid clamping of the above attachments.Suitable mechanisms for unclamping of the attachments also shall be provided. All actions shall be interfaced with the control system.	Vendor to specify			
2.6.6	Cutting force: 70kN (Minimum)	Vendor to specify			
	Suitable counter balance system shall be provided for the ram.	Vendor to specify			
2.6.7	Thread Cutting Capacity - maximum Pitch	Vendor to specify			
	Minimum dia of bore using ram	Vendor to specify			
2.6.8	Clamping details for mounting Turning Tool Holders/Attachments on ram, should be submitted.	Vendor to specify			
	Clamping Force Available for clamping of Turning Tool Holders/Attachments.	Vendor to specify			
2.6.9	Mounting of Turning Tool Holders and Attachments should be automatic through Program as well as manually through push Buttons -should be confirmed.	Vendor to specify			
2.7	**MILLING SPINDLE**				
2.7.1	The main milling spindle shall be enclosed in the RAM, driven by a dynamically balanced digitally controlled AC spindle motor through a gearbox and a drive shaft.The spindle motor RPM and position shall be programmable.Overload *protection for main spindle drive shall be provided. A suitable load meter shall be provided to indicate the spindle power during machining process* . The spindle motor shall be capable of delivering constant power over wide range of spindle speed and the range of speed over which constant power/torque are available. Details to be provided	Vendor to specify			
2.7.2	Spindle assembly shall be made of suitable grade of alloy steel as per design requirement. The spindle assembly shall be properly hardened and precision finished by super finishing operation. Bidder shall furnish full details of the system.Temperature sensors shall be provided on the spindle system and interfaced with the controller for activation of safety related alarm functions.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.7.3	The spindle shall be supported on adequate number of preloaded bearings preferably of roller type/taper roller type. The bearing shall preferably be of P4/SP class accuracy or better of reputed make.	Vendor to specify			
2.7.4	The vertical milling tools shall be attached directly to the ram spindle or through a vertical spindle head attachment. Automatic change of tools shall be provided.	Vendor to confirm			
2.7.5	There shall not be any thermal growth in ram with milling tool after continuous operation for long hours. *Bidder shall demonstrate the same at the time of Pre delivery Inspection(PDI)*	Vendor to confirm			
2.7.6	Spindle Torque (S1/100% Duty cycle) :1200 Nm (Minimum)	Vendor to Confirm			
2.7.7	Spindle Nose Taper: BT50 or Equivalent	Vendor to Confirm			
2.7.8	Spindle Run out at Nose : less than 0.01mm	Vendor to Confirm			
2.7.9	Spindle Run out at 300 mm from Face : less than 0.02 mm	Vendor to Confirm			
2.7.10	Spindle Run out at Face : less than 0.02 mm	Vendor to Confirm			
2.7.11	Temperature Monitoring	Vendor to specify			
2.7.12	Taper cleaning	Vendor to specify			
2.7.13	Tool Clamping&Unclamping: Mechanical (Please specify)	Vendor to specify			
2.7.14	Bidder to provide the full details of the system offered. Power & Torque Vendor to specify Speed characteristics of the offered system shall be attached.	Vendor to specify			
2.7.15	Power of Spindle Drive.: (S1/100% Duty cycle) :	35KW MIN			
2.7.16	Details of Spindle Drive viz.Type, Make, Model, Rating, Torque etc.	Vendor to specify			
2.7.17	Spindle Speed (Infinitely Variable).:	10rpm to 5000 rpm(Nominal)			
2.7.18	Power / Torque / Speed Diagram of Spindle Drive should be submitted.	Vendor to specify			
2.7.19	Possibility of Thread Whirling by Helical Interpolation should be confirmed.	Vendor to specify			
2.7.20	Clamping details for mounting Milling Heads and Attachments should be submitted.	Vendor to specify			
2.7.21	Clamping Force Available for clamping of Attachments.	Vendor to specify			
2.7.22	Mounting of Milling Heads and Attachments should be automatic through Program as well as manually through Push Buttons.	Vendor to specify			
2.7.23	Milling Heads should be equipped with both External and though Spindle Coolant System - should be confirmed.	Vendor to specify			
2.7.24	Tool mounting and Clamping should be automatic through Program as well as manually through Push Buttons - should be confirmed.	Vendor to specify			
2.8	**MAIN TRAVERSES**				
2.8.1	Vertical Travel of Ram (Z-Axis) :	1000mm (Nominal)			
2.8.2	Table lenier movement (Y axis)	1000 mm (nomial)			
2.8.3	Horizontal Travel of Ram (+ve X - Axis)	Vendor to specify			
2.8.4	Horizontal Travel of Ram beyond Center of the Table (-ve X - Axis)	Minimum 200 mm			
2.8.5	Maximum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.8.6	Minimum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to specify			
2.8.7	Maximum Distance between Table Top and Vertical Milling Head with Cutter.	Vendor to specify			
2.8.8	Minimum Distance between Table Top and Vertical Milling Head with Cutter.	Vendor to specify			
2.9	**MACHINE GUIDEWAYS:**				
2.9.1	The Guideways shall be necessarily **Hydrostatic for all linear axes** - X, Y & Z and shall be adequately configured and sized.	Vendor to confirm			
2.9.2	The Guideways shall be sealed drip free hydrostatic type for linear movements. The hydrostatic system shall be integral part of slide and to the full length of the slides of linear axes. The hydrostatic system shall be such that constant pressure is acting on all four sides of guideway. Hydrostatic circuit shall be provided with safety devices which stop in case of insufficient oil pressure. The counter guides shall be coated with anti-friction material such as bronze or polymeric material with liner having negligible stick-slip and excellent damping characteristics.	Vendor to specify			
2.9.3	The bidder shall provide full details of offered guideway system including maximum oil pressure applied and maximum oil film level available during linear axis movements on full axis slide. The details shall be clearly explained with layout/sketch/drawings.	Vendor to specify			
2.9.4	Width of Cross Rail guideways	Vendor to specify			
2.9.5	Width of column guideways	Vendor to specify			
2.9.6	X, Y& Z guide ways should be hydrostatic (Details should be submitted)	Vendor to specify			
2.9.7	Hardness of guideways	Vendor to specify			
2.9.8	**Metallic Telescopic Covers** of rust resistant material should be provided with wipers for **X &Z** axes guide ways. Provision to avoid mixing of coolant & hydrostatic oil should be provided. **(Bellow type telescopic Covers to be provided under the Metallic Telescopic Covers)**	Vendor to confirm			
2.10	**FEEDS AND DRIVE SYSTEM:**				
2.10.1	The drive system shall be fully integrated to the CNC control system.	Vendor to Confirm			
2.10.2	All the drive motors shall be three phase AC servo (IP64 protection). The AC servomotor shall be of same make as those of CNC control system i.e. Siemens/ Fanuc (latest of either two). The AC servomotors shall be provided with inbuilt absolute encoders. Details of the drive systems including designation of modules proposed for each axis to be provided	Vendor to Confirm			
2.10.3	All the linear axes movement shall be equipped with servo lock/brake in AC servomotor. Hydraulic clamping shall be provided for rotary axes and vertical traverse of the cross rail.Clamping system shall be controlled by CNC system. It shall be possible to operate it through part program instructions. The bidder shall furnish the details of clamping system offered.	Vendor to Confirm			
2.10.4	The rotary table shall be driven by a suitable motor of required capacity for the Turning mode and Table speed shall be infinitely variable to provide constant cutting speed.	Vendor to Confirm			
2.10.5	The rotary table shall also be configured as a Rotary Milling Axis. Drive mechanism for C axis shall be specified in detail.	Vendor to specify			
2.10.6	The bidders shall provide the details of the offered drive system along with Catalogues	Vendor to specify			
2.10.7	Cutting feed in X - Axis (Infinitely Variable)	0 - 2000 mm/min			
2.10.8	Cutting feed in Z - Axis (Infinitely Variable)	0 - 2000 mm/min			
2.10.9	Cutting feed in Y - Axis (Infinitely Variable)	0 - 2000 mm/min			
2.10.10	Rapid feed in X - Axis	6000 mm/min			
2.10.11	Rapid feed in Z - Axis	6000 mm/min			
2.10.12	Rapid feed in Y - Axis	6000 mm/min			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.10.13	X - Axis Feed Drives / Motors [AC servo motors] Either Siemens or Fanuc digital type (detail like model, make, type, rating etc. should be submitted)	Vendor to specify			
2.10.14	Z-Axis Feed Drives / Motors [AC servo motors] Either Siemens or Fanuc digital type (detail like model, make, type, rating etc. should be submitted)	Vendor to specify			
2.10.15	Maximum cutting force permissible on Ram and at what extension	Vendor to specify			
2.10.16	Maximum permissible Cutting Force at Maximum Ram extension	Vendor to specify			
2.10.17	Permissible Cutting Force v / s Ram Projection - Diagram should be submitted.	Vendor to specify			
2.10.18	Position feedback for all the linear axes shall have absolute direct measurement systems for CNC control i.e.pressurized linear Optical Glass/Metallic Scales with zero Multi-Reference System of latest design for linear axes of Heidenhain make and rotary encoders for rotary axes and shall be of Heidenhain make.	Vendor to Confirm			
2.10.19	There shall be adequate provision to prevent ingress of dirt, chip, coolant etc. in the Linear Scale.	Vendor to Confirm			
2.10.20	The bidder shall furnish the actual details of make, resolution, accuracy of measuring system provided for the various axis and details of means provided for the protection of Linear Scales.	Vendor to specify			
2.10.21	Details of backlash free movement mechanism in X, Y& Z axes should be submitted.	Vendor to specify			
2.10.22	Mechanism for locking X,Y& Z axis	Vendor to specify			
2.11	**CONSTRUCTION:**				
2.11.1	All machine elements shall be designed and validated by using finite element analysis (FEA) to arrive at optimum construction, cross-sections and ribbings. The machine structural elements shall be designed to meet the cutting forces generated during heavy-duty machining applications. All machine elements such as bed, column, gantry, spindle headstock etc. shall be of proven design. The machine elements shall be made of highest quality, heavily ribbed, rigid grey cast iron preferably or Fabricated Steel Structure with proper stress relieving. The machine elements shall be suitably stress relived and aged to ensure dimensional stability and freedom from distortion over the entire life of the machine. The machine elements shall have suitable damping characteristics to ensure vibration free machining at full load. In case of fabricated structure, the steel used for fabrication shall be Fe360A conforming to ISO630-2011 standard or better The fabricated structure shall be subjected to double stress relieving cycle-first relieving to be done after welding, and second stress relieving to be done after rough machining and before finish machining. The details of various machine elements (Base, Column, Table, Cross Rail, Spindle Head Stock, Ram etc.) material shall be clearly indicated in the offer. Special design and constructional features of the machine elements (Base, Column, Table, Cross Rail, Spindle Head Stock, Ram etc.) must be fully explained in the offer.				
2.11.2	Turning diameter	3M (nominal)			
2.11.3	Milling diameter	3M (nominal)			
2.11.4	Maximum Turning height on Table, with Turning Tool holder	Vendor to specify			
2.11.5	Distance of RAM face from the table surface with cross rail at lowest position: Less than offered RAM stroke	Vendor to specify			
2.11.6	Distance from spindle face to table at two extreme positions of cross rail , with standard tool.	10 - 1500mm			
2.11.7	Distance between columns	vendor to specify			
2.11.8	Standard Turning tool with turning attachment & Milling tool directly clamped to when crossrail is at its lowest position	vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.11.9	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 specify			
2.11.10	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	Vendor to specify			
2.12	**OPERATOR'S PLATFORM and OPERATOR'S PANEL:**				
2.12.1	**OPERATOR'S PLATFORM**				
2.12.1.1	It is 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. Positions of the gates provided in the platform for Operator's convenience should be informed by the Vendor . Drawing / Details of the Operator's Platform should be submitted.A 15 Amp. Plug Point with ON/ OFF switch is also to be provided on the Platform	Vendor to specify			
2.12.1.2	Horizontal movement of complete Platform.	Vendor to specify			
2.12.1.3	Vertical movement of complete Platform to cover total turning height.	Vendor to specify			
2.12.1.4	Height of Platform Railing.	Vendor to specify			
2.12.1.5	Weight Capacity of the Platform.	Vendor to specify			
2.12.1.6	Minimum Position of Platform from Shop Floor.	Vendor to specify			
2.12.1.7	Movable Chip / Splash Guard should be provided all around the Table with sufficient height to avoid spilling of Coolant and scattering of Chips on Operator's Platform and Shop Floor. Details of the same should be submitted.	Vendor to specify			
2.12.2	**OPERATOR'S PANEL:**				
2.12.2.1	The operator panel shall have complete CNC and machine control system with TFT colour display of 19" size or more. It shall be adjustable in all direction including vertical direction for the convenience of operation. All switches with suitable interlocks shall be within the reach of operator of average height (Indian) for easy & safe operation. Pendent control shall be included with Manual Data Input, 1 Manual Pulse Generator (Electronic Hand Wheel) unit in addition to other manual controls.	Vendor to specify			
2.12.2.2	Complete manual control of machine with required switches/ keys shall be provided on operator's panel for selection of required axis, axis direction, cutting feed, table/spindle speed, cutting feed on/off, display of axis position value single block / continuous, emergency stop for manual operation without using CNC program.	Vendor to specify			
2.12.2.3	Hand operated auxiliary unit of Siemens/Fanuc make, for the convenience of setting, all axis movement, rotation of spindle, tool clamping etc., shall be supplied. It shall be provided with manual pulse generator, axis selection, Jog buttons, and emergency stop button.	Vendor to specify			
2.12.2.4	Solid graphic simulation	Vendor to specify			
2.12.2.5	Feed and speed override rotary switches	Vendor to Confirm			
2.12.2.6	Block searching with automatic update of axes positions and parameters	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.12.2.7	RS232C serial communication interface with port	Vendor to Confirm			
2.12.2.8	Ethernet interface 10/100 MBPS with RJ45 connector	Vendor to Confirm			
2.12.2.9	USB interface with ports on the operator console	Vendor to Confirm			
2.12.2.10	Visual display system for the feed from the camera installed in the working area of the machine.	Vendor to specify			
2.13	**OPERATION AND CONTROL SYSTEM:**				
2.13.1	**CNC SYSTEM & FEATURES :**				
2.13.1.1	Make	Fanuc / Siemens.			
2.13.1.2	Type	PC based latest version			
2.13.1.3	Model	Siemens 840DSL / Fanuc32i (Latest verion, as available at the time of ordering, should be supplied).			
2.13.1.4	Details of optional features, recommended by vendor.	Vendor to specify			
2.13.1.5	The system should have full alphanumeric keyboard, additional draw-out type Querty Key Board and mouse in suitable enclosure, RS232C serial interfaces, parallel interface for printer, COM port for telediagnostics, network ready with LAN, electronic hand wheels for all axes, 4 nos. USB Ports for data input/output, hard disk of sufficient capacity **(Largest size available at the time of order shall be supplied)**, graphic simulation and preinstalled system software & other required softwares etc.(Details should be submitted by Vendor)	Vendor to specify			
2.13.1.6	Provision for automatic safe shut down of CNC System in case of Power Failure	Vendor to specify			
2.13.1.7	Resolution	Vendor to specify			
2.13.1.8	Programmable axes	4			
2.13.1.9	Simultaneously interpolatable axes (X,Z,Y,C)	Vendor to Confirm			
2.13.1.10	Block Processing time	Vendor to specify			
2.13.1.11	Display	19" TFT Colour graphicdisplay			
2.13.1.12	HMI (PCU 50.3 OF Siemens/ Fanuc equivalent)	Vendor to specify			
2.13.1.13	UPS(For CNC Shut down duing power failure) min. 10 minutes	Vendor to specify			
2.13.1.14	NC Memory	4 GB or more			
2.13.1.15	Solid state drive capacity	128 GB or more			
2.13.1.16	Backup of all data (NC, CNC, HMI, etc.) to be provided in a working mirror SSD needed for replacement in the event of failure of original SSD	Vendor to Confirm			
2.13.1.17	ISO Programming in Metric	Vendor to Confirm			
2.13.1.18	Turning, Drilling and Milling cycles	Vendor to Confirm			
2.13.1.19	Cutter Radius / Tool Nose Radius Compensation	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.13.1.20	Linear Interpolation	Vendor to Confirm			
2.13.1.21	Circular Interpolation	Vendor to Confirm			
2.13.1.22	Rigid Tapping	Vendor to Confirm			
2.13.1.23	Tool/Work Offsets	Vendor to Confirm			
2.13.1.24	Tool length Compensation	Vendor to Confirm			
2.13.1.25	Pitch Error Compensation	Vendor to Confirm			
2.13.1.26	Backlash Compensation	Vendor to Confirm			
2.13.1.27	Parametric Programming	Vendor to Confirm			
2.13.1.28	Read/Write System Memory	Vendor to Confirm			
2.13.1.29	Probe Cycles	Vendor to Confirm			
2.13.1.30	CNC System enclosed in dust-proof casing	Vendor to Confirm			
2.13.1.31	Remote Diagnosis	Vendor to Confirm			
2.13.1.32	UPS Backup for Control System refered in 2.13.1.30 .	Vendor to Confirm			
2.13.1.33	Applicable functions required for 4 axis simultaneous machining(TRANSMIT, TRACYL etc.). All functions related to 4-axis machining such ORIVECT, ORICON, Inclined plane machiningetc. shall be provided and activated	Vendor to Confirm			
2.13.1.34	An automatic tool retract system shall be offered to prevent tool digging in 4-axis machining in case of power failure.	Vendor to Confirm			
2.13.1.35	The full details of the control system offered including the designation of all the modules selected to execute the functionalities specified shall be provided. The same shall be substantiated by the OEM catalogues with appropriate markings.	Vendor to Confirm			
2.13.2	**MANUAL CONTROL :**				
2.13.2.1	Complete manual control of machine with required switches / keys should be provided on operator's panel for selection of required axis, axis direction, cutting feed, table / spindle rpm, cutting feed on/off, display of axis position values etc, for manual operation without using CNC program, CNC option Manual Turn or MDI mode. Diagram / Sketches for switches / keys provided on operators pendant should be submitted.	Vendor to specify			
2.13.3	**HAND HELD UNIT:**				
2.13.4.1	Hand Held unit, Type B-MPI of Siemens make or equivalent alongwith sufficient length of interfacing cable is to be offered with complete details.	Vendor to specify			
2.13.4	**UPS FOR CNC SYSTEM (STAND ALONE OR INBUILT):**				
2.13.4.1	UPS of 30 minutes for CNC system with inbuilt cooling and charge status display (Battery charging /discharging time should be specified by vendor)	Vendor to specify			
2.14	**MACHINE LIGHTS:**				
2.14.1	Machine Lights for sufficient illumination of complete working area on both sides of operator's platform should be provided for clear visibility.	Vendor to specify			
2.14.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to specify			
2.14.3	Any lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to specify			
2.14.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to specify			
2.14.5	Flashing / rotary type End of Cutting and Program Stop Light.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.14.6	Integral lighting suitable for the operations concerned where its lack is likely to cause a risk despite ambient lighting of normal intensity shall be provided	Vendor to Confirm			
2.14.7	The manufacturer must ensure that there is no area of shadow likely to cause nuisance, there is no irritating dazzle and that there are no dangerous stroboscopic effects due to lighting provided by the manufacturer.	Vendor to Confirm			
2.14.8	Integral parts requiring frequent inspection and adjustment and maintenance areas must be provided with appropriate lighting.	Vendor to Confirm			
2.14.9	The machine lighting shall be low voltage so as to prevent any hazard to the operator.	Vendor to Confirm			
2.14.10					
2.15	**AIR CONDITIONERS:**				
2.15.1	Air Conditioners with Dehumidifiers of suitable / sufficient capacity to be provided for all Electrical / Electronic Panels / Cabinets/ CNC Sytem panel considering specified ambient conditions. Detailed specifications of the same are to be submitted.	Vendor to specify			
2.16	**HYDRAULIC SYSTEM : Details should be Submitted by the Vendor**				
2.16.1	The System should be centralised. Hydraulic Tank shall preferably be located at floor level	Vendor to specify			
2.16.2	Make Rexroth / Vickers/ HAWE/PARKER/ECKERIC/VOGEL/YUKEN/CENLUB/Sperry or equivalent from a reputed manufacturer. (Details to be submitted)	Vendor to specify			
2.16.3	Filtration System	Vendor to specify			
2.16.4	Failure indication	Vendor to specify			
2.16.5	Automatic shut off provision. Details should be submitted.	Vendor to specify			
2.16.6	Refrigerated type cooling and electric heating (Elecrtic heating only if required) system of sufficient capacity to maintain complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. at a temperature not exceeding 40 deg C irrespective of the ambient conditions. Complete details should be submitted	Vendor to specify			
2.16.7	Hydraulic pump capacity (flow / pressure)	Vendor to specify			
2.16.8	Each pump should have an independent motor. Tandem pumps should not be used	Vendor to specify			
2.16.9	**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 confirm			
2.16.10	Hydraulic power pack may be provided for counterbalance of RAM, clamping/de-clamping of tool, rotary table etc. All functions using hydraulics shall be clearly described.	Vendor to specify			
2.16.11	Pressure gauges at all places where pressure has to be inspected.	Vendor to Confirm			
2.16.12	Safety valves for hydraulic/hydrostatic circuit, if relief valve does not fulfil this function.	Vendor to Confirm			
2.16.13	Equipment for checking of temperature in the circuit or in the pump wherever necessary.	Vendor to specify			
2.16.14	Pressure line filter (10 micron size)shall be provided for longer life of hydraulic equipment. All piping used in hydraulic system shall conform to DIN standard. Arrangement to be provided to show if filters are choked and need cleaning.	Vendor to specify			
2.16.15	This filter shall be of reusable type and indigenously available. If reusable filter cannot be offered, the filter cartridge shall be readily available in India. Source of supply in India shall be indicated.	Vendor to Confirm			
2.16.16	Adequate number of filters for 5 years working shall be offered as spare.	Vendor to specify			
2.16.17	Alarm for low oil level to be provided	Vendor to specify			
2.16.18	Level float switches shall be used in the hydraulic tank for indicating safe and danger level of oil and it shall be interlocked with the machine control. Pressure switch for each feed line shall also be provided for controlling the maximum pressure.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.16.19	The temperature of oil in hydraulic/hydrostatic reservoir, pump and allied equipment shall be suitably segregated from the machine in order to remove major source of heat.	Vendor to specify			
2.16.20	The hydraulic/hydrostatic system and its elements like pump, valve etc. shall be from reputed manufacturers. Stackable valves and manifolds shall be used for ease of assembly, reduced piping and leakage through fittings.	Vendor to specify			
2.16.21	The make of different element of hydraulic systems such as make of pump, tank capacity, motor power in kW, filter size and safety devices, hydraulic equipment, size of tank, maximum pressure and flow rate, sizes of filters etc.shall be furnished along with the offer.	Vendor to specify			
2.17	**COOLANT SYSTEM :**				
2.17.1	**Flood type coolant system** with external output from ramshall be provided. A re-circulating type flood coolant system through adjustable trajectory multiple nozzle around the spindle. The supply of external coolant shall be in ample volume and pressure. The details of the system and coolant flow diagrams showing filters, pumps, valves, tanks, etc. to be submitted with the offer.	Vendor to specify			
2.17.2	Through coolant system shall also be provided for turning operation	Vendor to confirm			
2.17.3	All attachments, tool holders, boring bars, cassettes, adapters etc. shall have the provision for external coolant so that coolant is available directly at the tool-cutting tip.	Vendor to confirm			
2.17.4	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.	Vendor to confirm			
2.17.5	**Coolant Filteration System:** Recirculating type coolant system with centrifugal Hydrocyclone System/ Vaccum Rotary drum type System/ Cartridge Type Filtration System and magnetic separator.	Vendor to specify			
2.17.6	Coolant Flow Diagram showing filters, pumps, valves, tanks etc. to be submitted with the offer.	Vendor to specify			
2.17.7	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			
2.17.8	Coolant Tank Capacity	Vendor to specify			
2.17.9	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			
2.17.10	Coolant pump & motor details for all variants	Vendor to specify			
2.17.11	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Vendor to confirm			
2.17.12	A **separate portable pump with motor** with its control (manual) suitable for pumping out the entire coolant during maintenance / replenishment. The pump shall be capable of sucking the coolant with sludge and other sediments	Vendor to confirm			
2.17.13	Washing Gun	Vendor to specify			
2.18	**ELECTRICAL :**				
2.18.1	415V (fluctuation ±10%), 50HZ (fluctuation ±3%), 3 Phase AC (3 wire system with out neutral) Power Supply Voltage 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, shall be the resposibility of vendor. Requirement of grounding/earthing with required material details is to be informed by vendor well in advance so that same could be incorporated during construction of foundation.				

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.18.2	The party shall confirm satisfactory performance of the machine at the incoming power supply in the range of 415volt ±10 %AC, 3 phase, 50 Hz ±3%	Vendor to confirm			
2.18.3	**Tropicalisation:** All electrical / electronic equipment shall be tropicalized	Vendor to confirm			
2.18.4	All electrical & electronic control cabinets & panels should be dust and vermin proof	Vendor to confirm			
2.18.5	All electrical components in the cabinets should be mounted on DIN Rail	Vendor to confirm			
2.18.6	All electrical and electronic panels including operator's panel should be provided with fluorescent lamps for sufficient illumination and power receptacles of 220Volts, 5/15 Amp AC. All adapters/receptacles should have compatibility with Indian equivalents.	Vendor to confirm			
2.18.7	Motors shall conform to IEC or Indian Standards	Vendor to confirm			
2.18.8	All cables moving with traversing axes should be installed in caterpillar / Drag chain. Additionally, all the cable trays required for laying of cables should be included in the offer.	Vendor to confirm			
2.18.9	Vendor should ensure the proper earthing for the machine and its peripherals.	Vendor to confirm			
2.18.10	In-cycle hour counter with reset facility.	Vendor to confirm			
2.18.11	Total Power required	Vendor to specify			
2.18.12	Air supply : Piping, manifolds, circuits etc for air supply on the machine shall be provided by bidder.CFM, reservoir capacity, air quality and operating pressure required to be mentioned.(Air Supply:5-6 Bar)	Vendor to Confirm			
2.18.13	Power source of 220V, 5 Amps, multi-pin Indian socket shall be provided in the machine panel as service sockets with facility to switch "ON" while machine is in switch "OFF" condition.	Vendor to Confirm			
2.18.14	The control gear for AC/DC motors shall incorporate the following protection devices as concomitant accessories.	Vendor to Confirm			
2.18.15	No Voltage protection- No voltage protection shall be provided so that the machine shall not start up again by itself when, following an interruption, supply is restored.	Vendor to Confirm			
2.18.16	Short circuit protection- To protect against short circuits due to insulation failure of faulty connections MCB shall be provided for each motor. The rating of the MCB shall be such as to take care of the over current due to motor starting.	Vendor to Confirm			
2.18.17	Over load protection- To prevent motors from overloading, overload protection shall be provided separately for each motor. Three phase motors shall be protected by overload tripping devices on each phase.	Vendor to Confirm			
2.18.18	Single phasing protection- A separate current sensitive delayed action single phasing preventer shall be provided for each motor separately. Overload protection shall not be treated as single phasing preventer.	Vendor to Confirm			
2.19	**SAFETY ARRANGEMENTS:**				
	Following safety features in addition to other standard safety features should be provided on the machine:				
	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 confirm			
	2. When feed hold is 'ON', all slide motions are to be inoperative.	Vendor to Confirm			
	3. Software limit switches are to be provided to restrict the total slide travel, maximum feed velocity and maximum spindle speed. Hardware features shall be available for controlling the above movements.	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
	4. Improper tool clamping in the spindle nose shall inhibit spindle rotation and error is to be displayed on the control screen.	Vendor to specify			
	5. The tool shall not get unclamped in the event of power failure or an emergency stop.	Vendor to Confirm			
	6. Load meter shall be provided to indicate the load on spindle drive motor, so that the load on motor can be maintained with in safe limit.	Vendor to Confirm			
	7. When any of the machine functions like spindle rotation, slide movement, ATC movement etc. come to be a stop without being programmed to stop, the machine shall come to stop, and shall be operative only in the manual mode till the fault is rectified.	Vendor to Confirm			
	8. Suitable interlocks shall be provided to protect the machine in the event of hydraulic oil failure, lubrication failure, pneumatic system failure, fluctuation in voltage and frequency.	Vendor to Confirm			
	9. The safety features shall include safety devices against overloading of any drive, over travel of any slide and interlock against conflicting motions.	Vendor to Confirm			
	10. Mushroom type emergency stop shall be provided on the machine, which shall be easily accessible and capable of disabling the machine, drives in case of emergency.	Vendor to Confirm			
	11. A detailed list of all alarms / indications provided on machine should be submitted by the supplier.	Vendor to confirm			
	12. All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hinderance to machine operator's movement for effective use of machine.	Vendor to confirm			
	13. All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations.All rotating parts should be suitably guarded.	Vendor to confirm			
	14. Emergency Switches at suitable locations as per International Norms should be provided.	Vendor to confirm			
	15. Oil & water pipe lines should not run with electrical cable in the same tray / trench.	Vendor to confirm			
2.20	**ENVIRONMENTAL PERFORMANCE OF THE MACHINE :**				
	The Machine shall conform to following factors related to environment :				
	(a) 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. Supplier to demonstrate compliance to noise level, if so required.	Vendor to confirm			
	(b) There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm			
	(c) 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			
	(d) No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm			
	(e) If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm			
	(f) Paint of the machine should be oil / coolant resistant and should not peel off and mix up with coolant.	Vendor to confirm			
	(g).The machine shall be capable of working in tropical weather conditions with ambient temperature of max 45°C and RH 95%. All electrical & electronic components shall be tropicalized. Bidder to confirm the suitability of operating machine for such conditions.	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
3.0	**CHIP CONVEYOR :**				
3.1	Elevating chip conveyor to carry both short and curly chips efficiently and effectively to the chip bin on floor, should be provided at the side of the machine. Two Chip bins of appropriate size of Indian make, with wheels & handle for movement, should also be supplied.	Vendor to specify			
3.2	Type of chip conveyor	Vendor to specify			
3.3	Width of conveyor	Vendor to specify			
3.4	Elevation of chip conveyor for chip bin	Vendor to specify			
3.5	Material of chip conveyor (should be rust resistant)	Vendor to specify			
3.6	Provision for smooth flow of chips to the conveyor.	Vendor to specify			
3.7	In case of grinding, provision for flushing out grinding dust to avoid clogging of conveyor's holes is should be provided.	Vendor to specify			
3.8	Operation of chip conveyor (forward & reverse) through push buttons on operator's panel and at Chip Conveyor	Vendor to specify			
3.9	Layout showing location of chip conveyor should be submitted.	Vendor to specify			
4.0	**SERVO VOLTAGE STABILIZER:**				
4.1	Indian make Oil / **Air** Cooled servo Controlled Voltage Stabilizer suitable for complete machine, its drives, controls, PLC etc with no undesirable Harmonics in the stabiliser output.	Vendor to specify			
4.2	Make (To be specified by indentor as per the practice of units.)	Vendor to specify			
4.3	Model & Rating	Vendor to specify			
4.4	Catalogue of the Voltage Stabiliser shall be submitted with the offer.	Vendor to specify			
5.0	**ULTRA ISOLATION TRANSFORMER**				
5.1	Indian make Ultra Isolation Transformer suitable for complete machine, its drives, controls, PLC etc. shall be supplied	Vendor to specify			
5.2	Make (NEEL, Aplab or Auto Electric)	Vendor to confirm			
5.3	Model and Rating	Vendor to specify			
5.4	Catalogue of the Ultra Isolation Transformer shall be submitted with the offer.	Vendor to specify			
6.0	**PNEUMATIC SYSTEM:**				
6.1	**AIR COMPRESSOR:**				
6.1.1	Independent Air Compressor (of reputed Indian make) 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 so that BHEL compressed air supply having pressure **(to be specified by indentor)** could be used as and when required. The compressor unit should be suitable for continuous duty.	Vendor to specify			
6.1.2	Make & Model of Air Compressor	Vendor to specify			
6.1.3	Make & Model of Refrigerated Air Dryer	Vendor to specify			
6.1.4	Capacity (Flow, Pressure & KW)	Vendor to specify			
6.2	**COMPRESSED AIR POINTS:**				
6.2.1	Compressed Air Point with manual ON/ OFF Valve and flexible pipe of suitable length for work piece cleaning.	Vendor to confirm			
7.0	**TOOLINGS:**				
7.1	Quick change type Cassette Adaptor type of Tool Holders as well as Standard Conventional type Tool Holders. Any other latest type of Tooling System may also be offered with all relevant details. Mounting details should be submitted.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
8.0	**MEASURING SYSTEMS :**				
8.1	Automatic Job Measuring System comprising of Renishaw make Wireless system, with measuring cycles, calibration system and all types of probes / styli required for measuring all machined dimensions of the prove-out components. Vendor to furnish detailed description of the system along with offer.	Vendor to specify			
8.2	Three probes (1 vertical + 2 horizontal) Renishaw RMP-60 (or equivalent) touch trigger radio probe with suitable attachment/headto measure points on diameter of components, height, drilled holes etc. and store data. The following are the broad functions:	Vendor to specify			
8.3	Probe Calibration	Vendor to specify			
8.4	Zero point location	Vendor to specify			
8.5	Setting of inclined planes	Vendor to specify			
8.6	Measuring edges, holes	Vendor to specify			
8.7	Centre distance of holes	Vendor to specify			
8.8	Measurement of radius of arcs, Diameters , height etc	Vendor to specify			
8.9	spare probes 5 sets	Vendor to specify			
8.10	Above options shall be integrated to the Siemens 840DSL work piece measuring cycles.				
8.11	Automatic Tool Offset measuring system with measuring cycles, calibtration system etc suitable for all types of tools recommended for prove-out components. Vendor to furnish detailed description of the system along with offer.	Vendor to specify			
8.12	Tool pre-setting/probe system shall be offered and relevant cycles for tool length and tool radius measurementof milling tool and for turning tools.	Vendor to specify			
9.0	**DIAGNOSTIC SYSTEM**				
9.1	**TELE-DIAGNOSTIC SERVICE :**				
9.1.1	**Tele-diagnostic service should be provided through International telephone lines/ Internet/ ISDN 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. Terms and conditions for the service after guarantee period should be informed by vendor.**	Vendor to specify			
9.2	**FAULT DIAGNOSTIC SYSTEM:**				
9.2.1	Supplier's own diagnostic system with required hardware and software should be supplied and installed on the CNC system. This should include customised auto-diagnostic system with supporting hardware and software which shows detailed cause and remedy for the fault on the display with full video diagnostic help for faults related to mechanical and electrical maintenance.	Vendor to specify			
9.3	Help guide should be provided to use both diagnostic systems	Vendor to specify			
10.0	**LEVELING & ANCHORING SYSTEM**				
10.1	Complete anchoring system including foundation bolts, anchoring materials, fixators, leveling shoes etc should be supplied	Vendor to specify			
11.0	**TOOLS FOR ERECTION, OPERATION & MAINTENANCE :**				
11.1	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			
11.2	Test mandrel for checking run-out/taper & alignment should be supplied	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
12.0	**ACCESSORIES:** (To be selected from below mentioned list as per jobs requirement. Any other accessories not listed below, but essentially required to be specified by Indentor)				
12.1	**AUTOMATIC TOOL CHANGER**				
12.1.1	The machine shall be provided with CNC controlled Vertical chain type automatic Tool, Changer/magazine for automatic changing of both turning and milling tools. It shall have a provision for minimum of 40 tools. Tool types to be accommodated are :	Vendor to confirm			
12.1.2	Type	Vendor to specify			
12.1.3	No. of storage locations (20 nominal)	Vendor to specify			
12.1.4	Turning Tools Capto C8 - 10 Nos (or more)	Vendor to confirm			
12.1.5	Milling Tools (BT50/HSK100) - 20 Nos(or more)	Vendor to confirm			
12.1.6	The magazine shall have sufficient pockets to hold the offered spindle nose taper and shall be driven by an AC servo motor through CNC control & AC servo drive.	Vendor to specify			
12.1.7	The machine shall also be provided with CNC controlled automatic ATC for tool head parking.	Vendor to confirm			
12.1.8	Detailed arrangement of grippers & swivelling shall be furnished	Vendor to specify			
12.1.9	All the ATC servo axes shall be configured in a different channel than the machine axes, so that ATC and machine can work simultaneously in different channels.	Vendor to confirm			
12.1.10	Random selection of tool shall be possible. The tool magazine shall have a bi-directional rotation and tool shall be presented to ATC arm through shortest route.	Vendor to Confirm			
12.1.11	An effective power tool lock system shall be provided to ensure proper tool locking in the spindle.	Vendor to Confirm			
12.1.12	For manual ejection/loading of tools from spindle and magazine in manual mode, push button control shall be available.	Vendor to specify			
12.1.13	An interlock shall be provided to ensure that tool cannot be ejected unless machine spindle stops and orients itself to a specific direction. The interlock shall be provided to ensure that CNC cycle doesn't start unless the tool has been changed so as to keep the spindle clean.	Vendor to Confirm			
12.1.14	The machine shall be capable of pre-selecting the tool for next operation while machining operation is in progress to reduce idle time. There shall be a provision for cleaning of tool by compressed air during tool change so as to keep the spindle clean.	Vendor to Confirm			
12.1.15	The system shall enable tool change from the ram, milling head attachment and turning head attachment.	Vendor to Confirm			
12.1.16	Tool shank : (Max)	40mm x 40mm			
12.1.17	Max tool diameter / Width (all pockets filled)	Vendor to specify			
12.1.18	Max tool diameter (adjacent pockets empty)	Vendor to specify			
12.1.19	Max tool length	Vendor to specify			
12.1.20	Tool change time (tool-to-tool)	Vendor to specify			
12.1.21	Tool change time (chip-to-chip)	Vendor to specify			
12.1.22	Tool selection method	Vendor to specify			
12.1.23	Maximum Tool Overhang out of different Holders.	Vendor to specify			
12.1.24	Maximum Permissible Weight on each Pocket.	Vendor to specify			
12.1.25	Maximum Permissible Weight on Complete ATC.	Vendor to specify			
12.1.26	The Machine operation should be possible with or without referencing ATC.	Vendor to specify			
12.1.27	ATC Drawing should be submitted with the offer.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
12.1.28	**Suitable arrangement, Software based and manual key based, should be provided to extract a Tool trapped in the ATC cycle. Details of both the system to be provided along with the offer.**	Vendor to specify			
12.1.29	Full details of the proposed system shall be provided.	Vendor to Confirm			
12.2	**AUTOMATIC ATTACHMENT CHANGER (AAC)**				
12.2.1	An automatic attachment changer/device magazine attached to crossrail shall be provided, which automatically clamp/unclamp on special accessories such as Universal Milling Head, 90°attachment, turning tool attachments, workpiece measuring probe attachment etc. hydraulically as well as mechanically to the RAM face. Centering and referencing pin as well as clamping check system shall also be provided. The details of clamping interface shall be furnished.	Vendor to specify			
12.2.2	All attachments shall be suitabe for loading / unloading through AAC	Vendor to specify			
12.2.3	No. of storage positions : for 12 or more attachments	Vendor to specify			
12.2.4	Location of the attachment changer	Vendor to specify			
12.2.5	Mounting plates as required for attachments should be supplied	Vendor to specify			
12.2.6	Attachment selection method	Vendor to specify			
12.2.7	Maximum Permissible Weight on each Position.	Vendor to specify			
12.2.8	Maximum Permissible Weight on Complete AAC.	Vendor to specify			
12.2.9	**Suitable arrangement, Software based and manual key based, should be provided to extract a Attachment trapped in the AAC cycle. Details of both the system to be provided along with the offer.**	Vendor to specify			
12.2.10	Full details of the proposed system shall be provided.	Vendor to Confirm			
12.3	**VERTICAL MILLING HEAD**				
12.3.1	Power	Vendor to specify			
12.3.2	Maximum Torque.	Vendor to specify			
12.3.3	Speed Range (Infinitely Variable)	Vendor to specify			
12.3.4	Tool Shank / Spindle Taper. (HSK or its equivalent)	Vendor to specify			
12.3.5	Tool Clamping (by program as well as manually through push buttons)	Vendor to specify			
12.3.6	Tool Clamping Force	Vendor to specify			
12.3.7	Maximum Cutter Diameter 50mm nominal	Vendor to specify			
12.3.8	Maximum Cutter Weight	Vendor to specify			
12.3.9	Maximum Height for Milling with Vertical Milling Head.	Vendor to specify			
12.3.10	Power - Torque - Speed Diagram	Vendor to specify			
12.3.11	Dimensional details & Weight of the head	Vendor to specify			
12.3.12	Coolant system: Internal (thru spindle) **&** External coolant with requisite flexible pipes on its snout	Required			
12.3.13	Pull Stud for mounting the Head and for mounting the Tools in the taper of the Head shall be supplied	Required			
12.4	**CNC UNIVERSAL MILLING HEAD**				
12.4.1	A detachable CNC Universal Milling Head shall be offered for Milling/Drilling/Boring operations on the material specified.	Vendor to confirm			
12.4.2	Universal Head shall have a continuous movement with angle positioning at every 0.001 degree for an angle ± 95° (Minimum) from the vertical plane	Vendor to confirm			
12.4.3	Universal Head shall have an electro-spindle of reputed make	Vendor to confirm			
12.4.4	Rigid construction capable of heavy material removal.	Vendor to confirm			
12.4.5	It shall be possible to hold HSK100/BT50 or equivalent tooling on this Universal Head for Milling/Drilling/Boring operation.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
12.4.6	Automatic clamp and unclamping of this attachment to RAM through CNC control.	Vendor to specify			
12.4.7	Interface with RAM	Vendor to specify			
12.4.8	Spindle speed: more than 3000 rpm	Vendor to specify			
12.4.9	Power @ S1/100% Duty cycle	Vendor to specify			
12.4.10	Const. Torque @ S1/100% Duty cycle	Vendor to specify			
12.4.11	Const. Power Range:	Vendor to specify			
12.4.12	Spindle Runout at nose :0.02	Vendor to confirm			
12.4.13	Spindle Runout at 300 mm from face:0.01	Vendor to confirm			
12.4.14	Spindle Runout at face:0.01	Vendor to confirm			
12.4.15	Spindle lubrication	Vendor to specify			
12.4.16	Spindle cooling	Vendor to specify			
12.4.17	Parking place for head	Vendor to specify			
12.4.18	Maximum Cutter Diameter	Vendor to specify			
12.4.19	Maximum Cutter Weight	Vendor to specify			
12.4.20	Tool Clamping Force	Vendor to specify			
12.4.21	Full details of the proposed universal head including interface with ram, Electro-spindle attachment, speed/power/torque characteristics, feedback system, tool clamp/unclampetc shall be provided.	Vendor to specify			
12.4.22	Dimensional details & Weight of the head	Vendor to specify			
12.4.23	Coolant system: Internal (thru spindle) **&** External coolant with requisite flexible pipes on its snout	Vendor to confirm			
12.4.24	Pull Stud for mounting the Head and for mounting the Tools in the taper of the Head shall be supplied by the vendor.	Vendor to confirm			
12.5	**PORTABLE DATA INPUT/OUTPUT UNIT**				
12.5.1	Portable data input/output unit, for bi-directional program & data transfer between the offered unit & supplied CNC system and as well as with standard PC (available at BHEL works), shall be provided with all required interfaces, hardware & software etc..	Vendor to confirm			
12.6	**AUTO-FOCUS VIDEO CAMERA**				
12.6.1	Auto focus video camera with zoom facility shall be provided on the ram / tool holders internally connected with color Monitor fixed on operator's panel to view tool while machining and also as an aid for setting of casings. Camera eye / lens and connecting cables shall be safe guarded against heat, chips, coolant, dust etc. to maintain clear visibility of the tool in these adverse machining conditions. Suitable sockets for power connection shall be provided for both positions (ram and all tool holders). Clamping details of camera on different tool holders shall be shown on drawings of tool holders.	Vendor to specify			
12.6.2	The camera shall be capable of viewing the tool tip while machining and also dial gauge readings for job setting. It shall be possible to zoom in / zoom out /swivel the camera to view the dial indicator reading which at a distance of 3m from the camera. The camera shall also be capable of viewing the entire working area of machine. It shall have following parameters:	Vendor to Confirm			
12.6.3	• Exceptional low light sensitivity: 0.0077 Lx	Vendor to Confirm			
12.6.4	• High dynamic range: 120 db to view details of both bright area and dark area simultaneously	Vendor to Confirm			
12.6.5	• Robust and rugged design rated to Industry IP68, type 6P, IK10	Vendor to Confirm			
12.6.6	• Pan and tilt drive mechanism	Vendor to Confirm			
12.6.7	• Intelligent tracking	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
13.0	**SPARES:**				
13.1	Vendor to provide complete list of recommended spares with unit cost, for machine & accessories, for 2 years of continuous operation ,along with specification / type / model, and name & address of the spare supplier. Price fixation for these spares for next two years, to be confirmed by the vendor	Vendor to specify & Confirm			
13.2	Vendor to quote price of recommended spares along with the machine separately.	Vendor to Quote			
13.3	All types of spares for total machine and accessories should be available for 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			
14.0	**DOCUMENTATION :** **Five sets** of following documents (Hard copies) in English language should be supplied along with the machine	Vendor to confirm			
14.1	Operating manuals of Machine & CNC system	Vendor to confirm			
14.2	Programming Manuals of Machine & CNC system	Vendor to confirm			
14.3	Detailed Maintenance manual of machine with all drawings of machine assemblies/sub-assemblies/parts including Electrical/ Pneumatic/ Coolant/ Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list also. Complete details including make, tolerance and precision class of all the critical bearings such as spindle bearings, ball screw support bearings, ball lead screw etc. with replacement procedure and approximate life of these bearings to be furnished.	Vendor to confirm			
14.4	Maintenance, Interface & commissioning manuals for CNC system, spindle & feed drives.	Vendor to confirm			
14.5	Manufacturing drawings for all supplied tool holders, coolant connections, adapters, sleeves, fixtures etc.	Vendor to confirm			
14.6	Catalogues, O&M Manuals of all bought out items including drawings,wherever applicable.	Vendor to confirm			
14.7	Detailed specification of all rubber items and hydraulic tube fittings and hoses.	Vendor to confirm			
14.8	Operating Manuals, Maintenance Manuals & Catalogues for supplied Automatic Tool Offset & Job Measuring Systems, Voltage Stabilizer, Isolation Transformer, Air-Compressor and all supplied Accessories.	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
14.9	PLC program print-outs with comments in English.	Vendor to confirm			
14.10	PLC program on CD, NC data & PLC data on floppy.	Vendor to confirm			
14.11	Complete back-up of hard disk on GHOST CD and clear written Instructions (3 copies) to take back-up and reloading of a new hard disk.	Vendor to confirm			
14.12	Complete Master List of parts used in the machine shall be submitted by the vendor.	Vendor to confirm			
14.13	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to confirm			
15.0	**TRAINING**				
15.1	Training of two persons for each of the following modules at manufacturer's works.Boarding,Lodging and travelling will be under BHEL's scope. Training charges to be borne by Bidder.	Vendor to Confirm			
15.1	BHEL Persons should be trained at supplier's Works for mutually agreed period in the area of (a) CNC Part Programming / Technology, Use of all CNC Features, Programming for Measuring Systems & supplied accessories etc. (b) Electrical, Electronic & CNC maintenance for machine & other supplied equipments (c) Mechanical & Hydraulic maintenance of the machine & other supplied equipments (d) Operation of the machine & other supplied equipments.	Vendor to confirm			
	Post commissioning training at BHEL work's for operation & maintenance personnel.	Vendor to Confirm			
	Training of three persons for each of the mentioned modules at reputed training centre in India.Boarding, Lodging, and travelling will be under BHEL's scope. Training charges to be borne by Bidder.	Vendor to Confirm			
15.2	**GENERAL:**				
15.2.1	Air-fare, boarding & lodging of BHEL Team shall be borne by BHEL.				
15.2.2	Competent, English speaking experts shall be arranged by the vendor during Training for satisfactory & effective training of BHEL personnel.	Vendor to confirm			
15.2.3	Vendor to quote for Training on per man per Day basis within BHEL premises.	Vendor to confirm			
15.2.4	Vendor should commit to organize 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			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
16.0	**FOUNDATION :**				
16.1	Vendor shall submit the preliminary layout drawing along with the offer.Vendor to submit Complete Foundation Design including details viz. static / dynamic load details etc. and Final Layout drawings shall be submitted by the supplier after PO/LOI for BHEL approval. BHEL will approve the drawing within three weeks time from date of submission/clarification. Tentative Soil bearing capacity of BHEL Ranipet is 50KN/sqm. The layout should consist of all reqirements pertaining to complete machine including space requirement for Voltage Stabilizer, Isolation Transformer, Air compressor, Chip Bin & any other accessories. BHEL shall construct complete foundation for the machine under supervision of supplier and at supplier's responsibility. Vendor should arrange equipments 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 foundation bolts of the machine.	Vendor to confirm			
17.0	**ERECTION & COMMISSIONING**				
17.1	**ERECTION**				
17.1.1	Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control & 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.	Vendor to confirm			
17.1.2	Machine shall be transported in disassembled condition in Shipper owned container(*Container will become BHEL property after unloading of job at BHEL works*) and erected &commissioned at BHEL site by the bidder on turnkey basis.Arrangements of Unloading and storage of same at BHEL work will only be under BHEL scope.However Vendor is suggested to depute their representative during unloading at BHEL work.	Vendor to Confirm			
17.1.3	Manufacturer shall depute/hire necessary skilled engineer/technicians for erection and commissioning.	Vendor to Confirm			
17.1.4	Bidder shall be solely responsible for arrangement of additional material handling equipment/tools/accessories if necessary at their expenses.	Vendor to Confirm			
17.1.5	Foundation plan, general arrangement plan showing layout with accessories and indicative drawings shall be enclosed as a part of technical bid.	Vendor to Confirm			
17.1.6	Detailed foundation design requirements, final foundation drawings, final layout drawings etc shall be provided by the bidder to BHEL well in advance before machine erection.	Vendor to Confirm			
17.1.7	The Bidder or their agent would be required to carry out a joint check at the consignee's end along with BHEL, before unpacking is done, to avoid subsequent complaints regarding short shipment/transit damages. It is necessary that the joint receipt inspection be done immediately on the receipt of the machine.	Vendor to Confirm			
17.1.8	The Bidder is responsible for any breakage / damage to the machine or its equipment / accessories / tools holders etc.during erection / commissioning done. Bidder shall rectify / replace such damage parts free of cost at site with original parts.	Vendor to Confirm			
17.1.9	The scope of foundation as per bidder's drawing is under BHEL scope	Vendor to Confirm			
17.1.10	Max weight and dimension of individual packings/parts shall be specified.	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
17.1.11	Vendor representative at BHEL during Erection should be well verse in communicating in English.Otherwise Vendor should hire translator(to speak in English) for the same at his expense)				
17.2	COMMISSIONING				
17.2.1	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at **clause 20** (Machine Acceptance) shall form part of the commissioning activity.	Vendor to confirm			
17.2.2	Laser calibration and proving of accuracy values as per section 2.1 at Bidder's expense	Vendor to Confirm			
17.2.3	Geometrical accuracy tests proving the values reported during PDI as per section 2.2 at Bidder's expense	Vendor to Confirm			
17.2.4	Cutting test for conforming machine accuracies and performance.	Vendor to Confirm			
17.2.5	Machining a component (to be identified by BHEL) requiring 4-axis interpolation and contour turning	Vendor to Confirm			
17.2.6	Special tools and equipment required for erection and commissioning of the machine and necessary tools like Torque Wrench, Spanners, Keys, grease guns etc. for operation and maintenance for Mechanical, Electrical, Electronics of the machine, Straight edge, parallelism checking equipment, Test mandrel for checking run-out/taper & alignment and Tools, Tackles, Instruments and other necessary equipment including Laser equipment and other latest optical instrument if any required to carry out all above activities shall be brought by the bidder on returnable basis.	Vendor to Confirm			
17.2.7	All **Cover Plates / chequered plates** required for the machine and for covering its peripherals including pits, if any, shall be supplied and installed by the bidder.	Vendor to Confirm			
17.2.8	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on non returnable basis.	Vendor to confirm			
17.2.9	Damaged surface, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection shall be repainted and merged with the original surrounding paint by the bidder. For this purpose, the biddershall bring / supply sufficient quantity of touch-up paint of various colours of paint used at Bidder's expense.	Vendor to confirm			
17.2.10	Vendor representative at BHEL during Commissioning should be well verse in communicating in English.Otherwise Vendor should hire translator(to speak in English) for the same at his expense)	Vendor to confirm			
17.2.11	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to confirm			
17.2.12	Charges, duration, terms & conditions for E&C should be furnished in detail separately by vendor along with offer.	Vendor to confirm			
18.0	**ACCURACY TESTS:**				
18.1	**GEOMETRICAL ACCURACIES :**				
18.1.1	Geometrical Accuracy Tests shall be in accordance with DIN 8609 / ISO 3655 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			
18.1.2	All the above accuracies should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and during Erection & Commissioning at BHEL Works.	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
18.2	**MACHINE POSITIONING ACCURACIES & REPEATABILITY: Should be measured as per VDI/ DGQ3441/ ISO 230-2 (Latest Revision) using LASER INTERFERO METER.**				
18.2.1	Positioning accuracy in X,Y axis (Pa) per 1000 mm : 0.015 mm or better(for entire Travel)	Vendor to confirm			
18.2.2	Positioning accuracy in Z axis (Pa) per 1000 mm : 0.010 mm or better(for entire Travel)	Vendor to confirm			
18.2.3	Positioning accuracy Pa for C-axis: 5Arc sec	Vendor to confirm			
18.2.4	Positional Uncertainty, P : 0.010 mm or better	Vendor to Confirm			
18.2.5	Positional Scatter, Ps 0.007 mm	Vendor to Confirm			
18.2.6	Rotary AxIs (C) (for entire rotation):10 Arc sec	Vendor to Confirm			
18.2.7	Positional Uncertainty, P : 6 ARC SEC	Vendor to Confirm			
18.2.8	Positional Scatter, Ps : 4 ARC SEC	Vendor to Confirm			
18.2.9	Repeatability in X axis (Ps) : 0.02mm or Better	Vendor to Confirm			
18.2.10	Repeatability in Z axis (Ps) : 0.02mm or Better	Vendor to Confirm			
18.2.11	Repeatability in Z axis (Ps) : 0.02mm or Better	Vendor to Confirm			
18.2.12	Repeatability in C axis (Ps) : 5 Arc sec or Better	Vendor to Confirm			
18.2.13	Positioning accuracy over entire traverse in X axis (Pa)	Vendor to specify			
18.2.14	Positioning accuracy over entire traverse in Z axis (Pa)	Vendor to specify			
18.2.15	Total positioning error along X & Z axes per 1000 mm (P)	Vendor to specify			
18.2.16	Total positioning error along X & Z axes over entire traverse (P)	Vendor to specify			
18.2.17	Clamping force of Tool and Tool Holders as per global standard.	Vendor to Confirm			
18.2.18	All the above accuracies should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and during Erection & Commissioning at BHEL Works	Vendor to confirm			
19.0	**OPERATING CONDITIONS & THERMAL STABILITY**				
19.1	Total machine including CNC system and all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies. Power Supply: Voltage: 415V (fluctuation ±10%), Frequency: 50HZ (fluctuation ±3%) No. of phases = 3 Ambient Conditions: Temperature = 5 to 45 degree celsius Relative Humidity = 95% max. (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 confirm			
19.2	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 20 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 confirm			
19.3	The machine shall be equipped with **refrigeration type cooling system** for cooling lubricating oil, hydraulic oil. The cooling system shall be provided with thermostatic control having thermal sensors and provision of automatic regulation with the reference to the actual temperature of machine main body(spindle bearing)/environmental temperature(machine column) so as to minimise thermal expansion and keep high machining accuracy even during heavy duty continuous machining operations. The temperature control system shall be based on digital system for better accuracy.	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
19.4	The cooling system shall be of reputed make conforming to DIN/ISO and provide with environmental friendly refrigerant. The system shall be capable of working in maximum ambient temperature of 45°C, temperature change of 4°C/hour and RH 95%. The biddershall furnish the details of systems such as make, maximum heat transfer rate, type of refrigerant(must be environmental friendly) used, temperature control logic and temperature sensing probes.	Vendor to specify			
19.5	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. (Confirm that machine is suitable for above and details of provisions on the machine for the same should be furnished)	Vendor to confirm			
19.6	The machine, including attachments and accessories, 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			
20.0	**MACHINE ACCEPTANCE: (Tests/Activities should be Performed by Vendor)**				
20.1	**Tests/Activities to be carried out at supplier's works on the machine in the presence of BHEL Team before dispatch :**				
20.1.1	Geometrical accuracies as per test chart.	Vendor to confirm			
20.1.2	Positioning accuracies as per VDI-DGQ/3441	Vendor to confirm			
20.1.3	**Cutting test** confirming simultaneous 4 axis machining	Vendor to Confirm			
20.1.4	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 confirm			
20.1.5	Thermal growth of spindle in ram face shall be inspected and presented after endurance test	Vendor to confirm			
20.1.6	Demonstration of all features of the machine, control system & accessories	Vendor to confirm			
20.1.7	**Demonstration** of all features & options of machine, accessories etc	Vendor to confirm			
20.1.8	**Presentation** of all original certificates, documents,reports, manuals of OEMs of all supplied connected to the machine	Vendor to confirm			
20.1.9	All necessary tools, instruments and materials for above tests are to the arranged by bidder				
20.1.10	Machining of **test piece as per NAS/AFNOR/ISO**. Test piece will be supplied by VENDOR.	Vendor to confirm			
20.2	**Tests/Activities should be carried out at BHEL works while commissioning the machine :**				
20.2.1	Geometrical accuracies as per test chart.	Vendor to confirm			
20.2.2	Positioning accuracies as per VDI-DGQ/3441	Vendor to confirm			
20.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to confirm			
20.2.4	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 confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
20.2.5	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 confirm			
20.2.6	Machining test piece as per NAS/AFNOR/ISO. Test piece will be supplied by BHEL.	Vendor to confirm			
20.2.7	Proveout machining.	Vendor to confirm			
20.2.8	Job prove out machining should also include the prove out of time furnished by vendors for the specified components	Vendor to confirm			
20.2.9	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 confirm			
20.2.10	Demostration by actual use of all supplied attachments and accessories to their full capacity.	Vendor to confirm			
21.0	**PACKING:**				
21.1	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			
22.0	**Warranty**				
22.1	12 months from the date of acceptance of the machine.	Vendor to confirm			
22.2	The bidder shall clearly spell out in the offer the facilities available with him or his agent for providing adequate after-sales service in India during the warranty period. The complete details such as organization for after-sales service, availability of technically competent engineers and warehousing facilities for spares shall be clearly indicated. **Bidders not offering complete servicing/repair facilities in India to ensure quick response to maintenance/servicing calls are not likely to be considered.**	Vendor to confirm			
22.3	Bidders who are OEM, shall undertake to supply spare parts for a period of expected life of the machine. **Alternatively bidders shall also submit undertaking from OEM for supply of spare parts for a period of expected life of the machine**	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
23.0	**GENERAL :**				
23.1	Machine Model	Vendor to specify			
23.2	Total connected load (KVA):	Vendor to specify			
23.3	Floor area required (Length, Width, Height) for complete machine & accessories	Vendor to specify			
23.4	Painting of Machine / Electrical Panels : RAL 6011 Apple Green (Polyurethane Paint)	Vendor to confirm			
23.5	Total weight of the machine	Vendor to specify			
23.6	Weight of heaviest part of machine	Vendor to specify			
23.7	Weight of the heaviest assembly / sub-assembly of the Machine	Vendor to specify			
23.8	Dimensions of largest part/ sub-assembly/ assembly of the machine	Vendor to specify			
23.9	Vendor to submit, along with offer, reference list of customers where similar machines have been supplied mentioning broad specifications of the supplied machine i.e. Model, Table diameter, Load Capacity, Maximum Turning Diameter, Max Turning Height, Main Drive Rating, CNC System etc	Vendor to confirm			
23.10	Detailed catalogues , sketch/ photographs of the m/c and accessories/ attachments should be submitted with the offer.	Vendor to confirm			
23.11	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			
23.12	**Access ladder and Maintenance platform should be provided on one of the Columns.**	Vendor to confirm			
24	**Standard Accessories (Must be supplied along with machine)**				
24.1	Tool holders/attachments :	Vendor to specify			
24.2	Hyper mill or equivalent CAM software (latest version) along with postprocessor with perpetual license.	Vendor to specify			
24.3	CAM software shall have all relevant modules for milling operation by interpolation of 4 axes and contour turning	Vendor to specify			
24.4	The supply of the software shall be sourced from India.	Vendor to specify			
24.5	Prove out on a mutually agreed component covering all the features of the machine. Responsibility of proveout lies with Bidder and Software Supplier	Vendor to Confirm			
24.6	Two weeks training on the software has to be provided by the software provider	Vendor to Confirm			
24.7	Modules to be covered				
24.8	HyperCAD-S or equivalent- Gemoetrical Engine (Surface & Curves)	Vendor to Confirm			
24.9	HyperMILLEXPERT or equivalent :2D, 3D and 3D Advanced Milling Cycles, Drilling Cycles, Multi Axis Machining)	Vendor to Confirm			
24.10	HyperMILL MAXX Machining or equivalent - Roughing (HPC)	Vendor to Confirm			
24.11	Turning	Vendor to Confirm			
24.12	Milling	Vendor to Confirm			
24.13	TurnMill	Vendor to Confirm			
24.14	5X Drilling	Vendor to Confirm			
24.15	5X Automatic indexing	Vendor to Confirm			
24.16	Cavity Bundle (5X Profile Finishing,5X Z-Level Finishing,5X Equidistant Finishing,5X Rest Machining,5X Freepath Machining,5X Rework)	Vendor to Confirm			
24.17	Surface Bundle (5X ISO Top Milling, 5X Top Milling Multi surfaces, 5X SWARF Cutting, 5X Contouring, 5X Shape level roughing/Finishing)	Vendor to Confirm			
24.18	4 Axis Post Processor for indexing & simultaneous	Vendor to Confirm			
24.19	4 Axis Machine Model simulation (with 3D model of the machine)	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
24.20	Installation of all software mentioned in the Scope of Supply are to be installed during on-site training sessions itself	Vendor to Confirm			
24.21	Dedicated colour monitor 19" (or bigger size) fixed on side/top of main switchboard panel or near operator panel	Vendor to Confirm			
24.22	Necessary software to view and zoom the real time images from the camera has to be installed in the PC and CD of software shall be supplied.	Vendor to Confirm			
24.23	First fill of oil& grease	Vendor to specify			
24.24	Suitable Workstation for operation of CAM software defined in this section.	Vendor to specify			
24.25	Any relevant accessory pertaining to machinesafe/ operation /maintenance shall also be quoted.	Vendor to specify			
25	**Others**				
25.1	The bidder shall have requisite facilities for manufacture/testing and inspection as per international standards.	Vendor to Confirm			
25.2	Details of the foundation of the company, its financial stability and its turnover shall be provided.	Vendor to specify			
25.3	Consumable & list of deliverables shall be included in scope of supply. In case of foreign suppliers, Indian equivalent of oil, grease & other consumables (supplied along with the machine) shall be mentioned with complete technical specifications, bidder addresses and contact persons details.	Vendor to specify			
25.4	Complete address, contact person, telephone number and fax number of original manufacturer of the equipment.	Vendor to specify			
25.5	The bidders shall provide a comprehensive list of the OEM components used in the machine. The offer shall include the technical brochure indicating clearly the model used for each part / component.	Vendor to specify			
25.6	Technical leaflet and write-up of equipment and CNC system must be furnished by the applicant along with the quotation.Bids without catalogue for the offered machine shall not be considered.	Vendor to Confirm			
25.7	In case there is a mismatch between technical offer and standard catalogue value, BHEL reserve right to chose the final value for the comparison	Vendor to Confirm			
25.8	The manufacturer has to provide a compliance matrix mentioning point by point given in the specification. It will be assumed that points are acceptable to you if not given an objection/clarification on the point. Final specification in the purchase order will be based on the compliance matrix provided by the party and the party have to satisfy all the points in the specification at the time of supply and installation of the machine.	Vendor to Confirm			
25.9	The bid MUST contain clear, direct, required, actual information with respect to the tender specification/clauses. Descriptive data or words viz complied, confirmed are not acceptable for the numerical data. Offers violating these will be treated as rejected.	Vendor to Confirm			
25.10	Relevant proof / supplementary document for the compliances shall be furnished along with the offer.Party have to satisfy all these points in the specification at the time of supply and installation of the machine.	Vendor to Confirm			
25.11	The price bid shall be quoted for basic machine,recommended spares, standard accessories, optional accessories, etc explicitly.Split-up cost details may be inside each section of quoted price.**Optional accessories & recommended spares cost not to be taken for price bid evaluation**.	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
26	**QUALIFYING CONDITIONS :**				
26.1	**a)** Only those vendors (OEMs) should quote who have commissioned in the past **(10) years** ***(o*** *n the date of opening of Tender)* at least **two CNC VERTICAL TURN MILL CENTRE** of same or higher sizes (Table diameter, Load Capacity, Max Turning Height) **to Aerospace industries** and capable of achieving machining accuracies as required in proveout component mentioned at **clause no. 20** (Accuracies for Proveout components) either (i) in at least one country other than the country from where the machine tool will be supplied to establish vendor's (OEM's) global business activity or (ii) in India ; and the referred machine is presently working satisfactorily for more than **one year after** commissioning (on the date of opening of Tender). The vendor should have experience of manufacturing & supplying CNC machines with Hydrostatic Guideways and/or Hydrostatic Rotary Table *(as applicable for tendered machine)* in the past ten years (on the date of opening of Tender) and should submit proof of the same. **b)** However, such Indian machine tool vendors (OEMs), who do not meet specified qualifying conditions, *can quote* if they have running Collaboration/ Joint Venture/ Joint Working Arrangement for manufacture of CNC VERTICAL TURN MILL CENTRE of same or higher sizes (Table diameter, Load Capacity, Max Turning Height) with foreign machine tool manufacturer , who meets specified qualifying conditions. Such Indian machine tool vendors (OEMs) shall have to submit from their foreign partner a back to back guarantee for satisfactory performance of the offered machine in compliance to all specified tender requirements. BHEL reserves the right to accept or reject the OEMs based on the assessment of their technical and financial capability. In respect of Indian vendors (OEMs) against **(b)** above, BHEL reserves the right to accept or reject both the Indian vendors (OEMs) & their Foreign Partners based on the assessment of their technical and financial capability.	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
26.2	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.				
	1. Name of the customer / company where referred machine is installed.	Vendor to inform			
	2. Complete postal address of the customer.	Vendor to inform			
	3. Month & Year of commissioning	Vendor to inform			
	4.Parameters of machine(s) supplied and application for which the machine is supplied	Vendor to inform			
	5. Name and designation of the contact person of the customer.	Vendor to inform			
	6. Phone, FAX no. and email address of the contact person of the customer.	Vendor to inform			
	7. Performance certificate from the customers regarding satisfactory performance of machine supplied to them (Original Certificate or through E-mail directly from the customer). The original performance certificate may be returned after verification by BHEL, if required.	Vendor to submit			
	8. BHEL reserves the right to verify the information provided by the Vendor for the referred machine at their referred customer's works including machining accuracies. It shall be the responsibility of the vendor to facilitate the visit of BHEL's team at their referred customer works .The Travel and Boarding expenses for BHEL Personnel shall be borne by BHEL. In case the information provided by vendor is found to be false/ incorrect, the offer shall be rejected.	Vendor to accept & confirm			
27.0	**OTHER FEATURES:**				
27.1	**NETWORKING:**				
27.1.1	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. The networking should have following capabilities.				
	a) The machine shall appear as a node in the Entire Network. (Network Neighborhood)				
	b) 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.				
	c) The program transfer between CNC system and network should also be possible in CNC Mode.				
27.2	**MACHINE MONITORING SYSTEM (MMS) SIGNALS**				
27.2.1	Following MMS signals would be made available on a specifically earmarked terminal strip. These MMS signals would be sourced from a SIMATIC S-7 PLC output card separately.				
	a) Control ON				
	b) Cycle ON				
	c) Spindle Running				
	d) Feed Active (Any of the axes moving)				
	e) M30 (Program Stop)				

	BHARAT HEAVY ELECTRICAL LIMITED		**Enquiry No. :**	**2791301E**	
	UNIT'S ADDRESS: BAP, RANIPET		**Due Date :**	**02-03-2020**	
			Supplier Qtn. No.:		
	CONTACT PERSON'S NAME/DESIGN./PHONE NO./E-MAIL (FROM PURCHASE DEPTT.) : MR. SACHIN SAINI/Sr.Er/04172283132/sachin.saini@bhel.in		**Date :**		
	SPECIFICATION CUM COMPLIANCE CERTIFICATE FOR CNC VERTICAL TURN & MILL CENTRE 5M				
	NOTE:-				
	1. Vendor (OEM) must submit complete information against clause no. 26 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				
	3. The offer and all documents enclosed with offer should be in English language only.				
ADDRESS OF THE SUPPLIER :		**ADDRESS OF THE INDIAN AGENTS :**			
TELEPHONE NOS.:		**TELEPHONE NOS.:**			
FAX NOS.:		**FAX NOS.:**			
E-MAIL ADDRESS :		**E-MAIL ADDRESS :**			
	Ref: BAP:CAPEX: 1.1b Rev 03				
SCOPE: SUPPLY, ERECTION & COMMISSIONING OF CNC VERTICAL TURN & MILL CENTRE COMPLYING WITH SPECIFICATION AS BELOW:					
SNO	**DESCRIPTION FOR BHEL REQUIREMENT**	**SPECIFIED / TO BE CONFIRMED BY**	**OFFERED**	**DEVIATIONS**	**REMARKS**
1.0	**PURPOSE & WORKPIECE MATERIAL**				
1.1	Purpose: (Operations/Jobs involved)				
	The CNC Vertical Turn and Milling Centre (VTMC) is intended for Profile Turning, Milling and Boring operations in aerospace grade metallic material like Stainless Steels, Al alloys, hardened 15CDV6 steel, Ti alloys etc. The machine shall be a Fixed Double Column Vertical Turn Mill Centre with movable rotary table, movable crossrail, ram, spindle in ram, detachable turning head and a detachable universal milling head with electrospindle. The machine shall be configured with 4 Programmable Axes(X, Y,Z,&C) with capability of simultaneous interpolation of the 4 axes.	Vendor to note			
	The machine shall have two modes of operation:				
1.2	**Turning Mode**: The machine shall be configured as CNC programmable simultaneously interpolated linear axes-X & Z with a turning tool attachment/head which will be used for turning operations for jobs up to 5m diameter on the 4m diameter rotary table	Vendor to note			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
1.3	**Milling Mode**: The machine shall be configured as a CNC programmable simultaneously interpolate4-axis machine having three linear axes and one rotary axis, with axes defined as X, Y,Z & C.	Vendor to note			
1.4	Work Piece Material: (Material detail, Hardness etc.) : Stainless Steels, Al alloys, hardened 15CDV6 steel, Ti alloys etc.	Vendor to confirm			
2.0	**SPECIFICATION:**				
2.1	**MACHINE CONFIGURATION**				
2.1.1	CNC Double Column Vertical Turning and milling centre, Single ram tool head on Cross rail.	Vendor to note and furnish details.			
2.2	**CAPACITY & SIZE**				
2.2.1	Maximum Workpiece Height:	3000 mm			
2.2.2	Maximum Workpiece Diameter:	5000 mm			
2.2.3	Maximum Workpiece Weight	15 tons			
2.2.4	Maximum Swing Diameter	Vendor to specify			
2.2.5	Maximum Turning Diameter	5000 mm			
2.2.6	Minimum Boring Diameter	Vendor to specify			
2.2.7	Maximum Height for Turning	3000 mm			
2.2.8	Maximum Height for Facing and Milling	3000mm			
2.3	**TABLE**				
2.3.1	The Rotary Table shall be made of rigid Cast Iron and have proven design with radial T-Slots and Slot tracks. The Table shall have pre-loaded bearing system with high running accuracy. The Table shall be adequately supported by Hydrostatic bearing system. Table shall be radially guided by suitable angular roller/ball bearing system with oil pressure lubrication. The drive elements and the bearing systems shall be designed considering the self weight, dynamics, size and weight of the job, cutting parameters for the specified operations.The rotary control shall be CNC controlled to operate in turning mode and in milling mode. Feedback system for the rotary table shall be fully integrated to the machine controller.	Vendor to specify			
2.3.2	Table Diameter	4000 mm			
2.3.3	Load Capacity	Vendor to specify			
2.3.4	Table Speed (Infinitely Variable) / No of Steps	Vendor to specify			
2.3.5	Power of Main Drive : Turning Mode @ S1 / 100% duty cycle (with 1 or 2 motors)	100 Kw Min.			
2.3.6	Details of Main Drive viz.Type, Make, Model etc.	Vendor to specify			
2.3.7	No. of Jaws : Number of manual independent jaws on Table; 8 Nos. (4 Nos. for Radial movements + 4Nos. for height adjustment)	8 Nos			
2.3.8	Torque, Turning Mode @ S1 / 100% duty cycle :250000 Nm	Vendor to Confirm			
2.3.9	Table Speed in Milling Mode : 50rpm	Vendor to Confirm			
2.3.10	Power, Milling Mode @ S1/100% duty cycle : 105 kw	Vendor to Confirm			
2.3.11	Torque, Milling Mode @S1/100% duty cycle :250000 Nm	Vendor to Confirm			
2.3.12	Table indexing accuracy :0.001 deg	Vendor to Confirm			
2.3.13	Table top surface flatness : ≤ 0.03mm	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.3.14	Table top surface axial run out at periphery :≤ 0.03mm	Vendor to Confirm			
2.3.15	Table radial run out at outer periphery : ≤ 0.03mm	Vendor to Confirm			
2.3.16	Backlash elimination in Milling Mode	Vendor to Confirm			
2.3.17	Maximum External Clamping Diameter	Vendor to specify			
2.3.18	Minimum External Clamping Diameter	Vendor to specify			
2.3.19	Maximum Internal Clamping Diameter	Vendor to specify			
2.3.20	Minimum Internal Clamping Diameter	Vendor to specify			
2.3.21	Clamping Force of each Jaw. : 20000 daN	Vendor to specify			
2.3.22	Positions and Dimensions of the Jaws on Table. Chucking Capacity Diagram should be submitted.	Vendor to specify			
2.3.23	Type of Force Multiplier Mechanism used in Jaws should be explained and Drawings should be submitted.	Vendor to specify			
2.3.24	Maximum permissible Cutting Force	Vendor to specify			
2.3.25	Maximum permissible Torque	Vendor to specify			
2.3.26	RPM at which Max. Torque is available.	Vendor to specify			
2.3.27	Table Torque - Speed diagram should be submitted.	Vendor to specify			
2.3.28	Type of Bearing for the Table : Hydrostatic (should be confirmed by Vendor) . Complete details like bearing diameters, sizes of pockets etc. should be furnished.	Vendor to specify			
2.3.29	Size of T - slots, their position and accuracy. Drawing of Table showing details of the T - slots etc. should be submitted.	Vendor to specify			
2.3.30	Two perpendicular accurate Slots should be provided at the Center of the table to use for alignment purposes. Sizes (Width & Depth), accuracy etc. of these slots should be furnished along with a Drawing.	Vendor to specify			
2.3.31	Table Loading Diagram should be submitted (Load v / s Distance from Table Center) for uniform as well as for eccentric loading.	Vendor to specify			
2.3.32	Diameter, Depth and Accuracy of Center Bore on Table Top Surface.	Vendor to specify			
2.3.33	Full details of the rotary table including the table base, moving table part, bearing system, drive system, feedback system shall be provided.	Vendor to specify			
2.4	**C - Axis**				
2.4.1	Maximum Continuous Speed of C - Axis	Vendor to specify			
2.4.2	Minimum Continuous Speed of C - Axis	Vendor to Specify			
2.4.3	No. of Indexing Positions for C - Axis	360000			
2.4.4	Minimum Increment in C - Axis	0.001 degree			
2.4.5	Table Clamping Mechanism for C - Axis (Drawing should be submitted.)	Vendor to specify			
2.4.6	Clamping Force available on each Clamp and No. of Clamps.	Vendor to specify			
2.4.7	Feed back system - Heidenhain Encoder (Details should be submitted)	Vendor to specify			
2.4.8	Details of C-axis servomotor like torque, rating, type, make etc.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.5	**CROSS RAIL**				
2.5.1	A moving cross rail shall be mounted on the columns. The Cross Rail shall be capable of moving up and down vertically the guideways provided on the columns and may be positioned at definite intervals and locked maintaining the positional and geometrical accuracy.The drive elements of the cross rail shall be adequately sized & synchronised. The cross rail shall be largely dimensioned and adequately ribbed to provide the requisite stiffness and strength.The Cross slide/saddle shall be mounted on the Cross Rail and shall carry the Ram. The cross slide/saddle shall moveon the guideways provided on the crossrail. The drive elements of the cross slide shall be adequately sized. Provisions shall be made on the cross slide/saddle for mounting the ram. Guiding elements for precise vertical traverse of the ram shall be provided on the cross slide/saddle. Appropriate counter balance system shall be provided for the cross rail. Full details of the cross rail, cross slide/saddle and ram attachment shall be provided.				
2.5.2	Vertical Travel	Vendor to specify			
2.5.3	Vertical Traverse Rate.	Vendor to specify			
2.5.4	No. of Positions.	Vendor to specify			
2.5.5	Distance between each Position	Vendor to specify			
2.5.6	Distance of lowest Step from Table Top	Vendor to specify			
2.5.7	Distance of highest Step from Table Top	Vendor to specify			
2.5.8	Maximum Height of Cross Rail bottom from Table Top	Vendor to specify			
2.5.9	Minimum Height of Cross Rail bottom from Table Top	Vendor to specify			
2.5.10	Movement of Cross Rail : Through NC Program as well as manually by Push Buttons - should be confirmed.	Vendor to specify			
2.5.11	Machine Reference Point should be at Ram Reference Point and it should be updated automatically with movement of Cross Rail - should be confirmed.	Vendor to specify			
2.5.12	Details of crossrail movement	Vendor to specify			
2.6	**CROSS RAIL TOOL HEAD and RAM**				
2.6.1	No. of Columns :	2 (Two)			
	The Ram shall be rugged box type structure, steel fabricated (Fe360A or better) or forged with adequate ribbing, stress relieved and precision machined. The ram shall be designed to provide adequate stiffness and strength considering the machining operations involved, materials to be cut, depth of cut, dynamics of the machine etc.				
2.6.2	No. of Rams :	1 (one)			
	Cross - Section of Ram: 330x330mm (Nominal)	Vendor to specify			
2.6.3	The ram shall have precise vertical motion over the guide elements provided on the saddle.	Vendor to specify			
	Ram Travel shall be 1000mm (Nominal)	Vendor to specify			
2.6.4	The Ram shall be adequately supported and stiffly guided on the inner part of Cross Slide/Saddle	Vendor to specify			
	The drive elements of the ram shall be adequately sized.	Vendor to specify			
2.6.5	The inside of the ram shall house the main milling spindle along with its drive and control elements	Vendor to specify			
	Ram shall be designed to receive the detachable turning head and the detachable milling head. It shall be provided with hirth coupling or similar better design for precise automatic positioning &rigid clamping of the above attachments.Suitable mechanisms for unclamping of the attachments also shall be provided. All actions shall be interfaced with the control system.	Vendor to specify			
2.6.6	Cutting force: 70kN (Minimum)	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
	Suitable counter balance system shall be provided for the ram.	Vendor to specify			
2.6.7	Thread Cutting Capacity - maximum Pitch	Vendor to specify			
	Minimum dia of bore using ram	Vendor to specify			
2.6.8	Clamping details for mounting Turning Tool Holders/Attachments on ram, should be submitted.	Vendor to specify			
	Clamping Force Available for clamping of Turning Tool Holders/Attachments.	Vendor to specify			
2.6.9	Mounting of Turning Tool Holders and Attachments should be automatic through Program as well as manually through push Buttons -should be confirmed.	Vendor to specify			
2.7	**MILLING SPINDLE**				
2.7.1	The main milling spindle shall be enclosed in the RAM, driven by a dynamically balanced digitally controlled AC spindle motor through a gearbox and a drive shaft.The spindle motor RPM and position shall be programmable.Overload *protection for main spindle drive shall be provided. A suitable load meter shall be provided to indicate the spindle power during machining process*. The spindle motor shall be capable of delivering constant power over wide range of spindle speed and the range of speed over which constant power/torque are available. Details to be provided	Vendor to specify			
2.7.2	Spindle assembly shall be made of suitable grade of alloy steel as per design requirement. The spindle assembly shall be properly hardened and precision finished by super finishing operation. Bidder shall furnish full details of the system.Temperature sensors shall be provided on the spindle system and interfaced with the controller for activation of safety related alarm functions.	Vendor to specify			
2.7.3	The spindle shall be supported on adequate number of preloaded bearings preferably of roller type/taper roller type. The bearing shall preferably be of P4/SP class accuracy or better of reputed make.	Vendor to specify			
2.7.4	The vertical milling tools shall be attached directly to the ram spindle or through a vertical spindle head attachment. Automatic change of tools shall be provided.	Vendor to confirm			
2.7.5	There shall not be any thermal growth in ram with milling tool after continuous operation for long hours. *Bidder shall demonstrate the same at the time of Pre delivery Inspection(PDI)*	Vendor to confirm			
2.7.6	Spindle Torque (S1/100% Duty cycle) :1200 Nm (Minimum)	Vendor to Confirm			
2.7.7	Spindle Nose Taper: BT50 or Equivalent	Vendor to Confirm			
2.7.8	Spindle Run out at Nose : less than 0.01mm	Vendor to Confirm			
2.7.9	Spindle Run out at 300 mm from Face : less than 0.02 mm	Vendor to Confirm			
2.7.10	Spindle Run out at Face : less than 0.02 mm	Vendor to Confirm			
2.7.11	Temperature Monitoring	Vendor to specify			
2.7.12	Taper cleaning	Vendor to specify			
2.7.13	Tool Clamping&Unclamping: Mechanical (Please specify)	Vendor to specify			
2.7.14	Bidder to provide the full details of the system offered. Power & Torque Vendor to specify Speed characteristics of the offered system shall be attached.	Vendor to specify			
2.7.15	Power of Spindle Drive.: (S1/100% Duty cycle) :	35KW MIN			
2.7.16	Details of Spindle Drive viz.Type, Make, Model, Rating, Torque etc.	Vendor to specify			
2.7.17	Spindle Speed (Infinitely Variable).:	10rpm to 5000 rpm(Nominal)			
2.7.18	Power / Torque / Speed Diagram of Spindle Drive should be submitted.	Vendor to specify			
2.7.19	Possibility of Thread Whirling by Helical Interpolation should be confirmed.	Vendor to specify			
2.7.20	Clamping details for mounting Milling Heads and Attachments should be submitted.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.7.21	Clamping Force Available for clamping of Attachments.	Vendor to specify			
2.7.22	Mounting of Milling Heads and Attachments should be automatic through Program as well as manually through Push Buttons.	Vendor to specify			
2.7.23	Milling Heads should be equipped with both External and though Spindle Coolant System - should be confirmed.	Vendor to specify			
2.7.24	Tool mounting and Clamping should be automatic through Program as well as manually through Push Buttons - should be confirmed.	Vendor to specify			
2.8	**MAIN TRAVERSES**				
2.8.1	Vertical Travel of Ram (Z-Axis) :	1000mm (Nominal)			
2.8.2	Table lenier movement (Y axis)	1000mm (Nominal)			
2.8.3	Horizontal Travel of Ram (+ve X - Axis)	Vendor to specify			
2.8.4	Horizontal Travel of Ram beyond Center of the Table (-ve X - Axis)	Minimum 200 mm			
2.8.5	Maximum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to specify			
2.8.6	Minimum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to specify			
2.8.7	Maximum Distance between Table Top and Vertical Milling Head with Cutter.	Vendor to specify			
2.8.8	Minimum Distance between Table Top and Vertical Milling Head with Cutter.	Vendor to specify			
2.9	**MACHINE GUIDEWAYS:**				
2.9.1	The Guideways shall be necessarily **Hydrostatic for all linear axes** - X, Y & Z and shall be adequately configured and sized.	Vendor to confirm			
2.9.2	The Guideways shall be sealed drip free hydrostatic type for linear movements. The hydrostatic system shall be integral part of slide and to the full length of the slides of linear axes. The hydrostatic system shall be such that constant pressure is acting on all four sides of guideway. Hydrostatic circuit shall be provided with safety devices which stop in case of insufficient oil pressure. The counter guides shall be coated with anti-friction material such as bronze or polymeric material with liner having negligible stick-slip and excellent damping characteristics.	Vendor to specify			
2.9.3	The bidder shall provide full details of offered guideway system including maximum oil pressure applied and maximum oil film level available during linear axis movements on full axis slide. The details shall be clearly explained with layout/sketch/drawings.	Vendor to specify			
2.9.4	Width of Cross Rail guideways	Vendor to specify			
2.9.5	Width of column guideways	Vendor to specify			
2.9.6	X, Y& Z guide ways should be hydrostatic (Details should be submitted)	Vendor to specify			
2.9.7	Hardness of guideways	Vendor to specify			
2.9.8	**Metallic Telescopic Covers** of rust resistant material should be provided with wipers for **X &Z** axes guide ways. Provision to avoid mixing of coolant & hydrostatic oil should be provided. **(Bellow type telescopic Covers to be provided under the Metallic Telescopic Covers)**	Vendor to confirm			
2.10	**FEEDS AND DRIVE SYSTEM:**				
2.10.1	The drive system shall be fully integrated to the CNC control system.	Vendor to Confirm			
2.10.2	All the drive motors shall be three phase AC servo (IP64 protection). The AC servomotor shall be of same make as those of CNC control system i.e. Siemens/ Fanuc (latest of either two). The AC servomotors shall be provided with inbuilt absolute encoders. Details of the drive systems including designation of modules proposed for each axis to be provided	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.10.3	All the linear axes movement shall be equipped with servo lock/brake in AC servomotor. Hydraulic clamping shall be provided for rotary axes and vertical traverse of the cross rail.Clamping system shall be controlled by CNC system. It shall be possible to operate it through part program instructions. The bidder shall furnish the details of clamping system offered.	Vendor to Confirm			
2.10.4	The rotary table shall be driven by a suitable motor of required capacity for the Turning mode and Table speed shall be infinitely variable to provide constant cutting speed.	Vendor to Confirm			
2.10.5	The rotary table shall also be configured as a Rotary Milling Axis. Drive mechanism for C axis shall be specified in detail.	Vendor to specify			
2.10.6	The bidders shall provide the details of the offered drive system along with Catalogues	Vendor to specify			
2.10.7	Cutting feed in X - Axis (Infinitely Variable)	0 - 2000 mm/min			
2.10.8	Cutting feed in Z - Axis (Infinitely Variable)	0 - 2000 mm/min			
2.10.9	Cutting feed in Y - Axis (Infinitely Variable)	0 - 2000 mm/min			
2.10.10	Rapid feed in X - Axis	6000 mm/min			
2.10.11	Rapid feed in Z - Axis	6000 mm/min			
2.10.12	Rapid feed in Y - Axis	6000 mm/min			
2.10.13	X - Axis Feed Drives / Motors [AC servo motors] Either Siemens or Fanuc digital type (detail like model, make, type, rating etc. should be submitted)	Vendor to specify			
2.10.14	Z-Axis Feed Drives / Motors [AC servo motors] Either Siemens or Fanuc digital type (detail like model, make, type, rating etc. should be submitted)	Vendor to specify			
2.10.15	Maximum cutting force permissible on Ram and at what extension	Vendor to specify			
2.10.16	Maximum permissible Cutting Force at Maximum Ram extension	Vendor to specify			
2.10.17	Permissible Cutting Force v / s Ram Projection - Diagram should be submitted.	Vendor to specify			
2.10.18	Position feedback for all the linear axes shall have absolute direct measurement systems for CNC control i.e.pressurized linear Optical Glass/Metallic Scales with zero Multi-Reference System of latest design for linear axes of Heidenhain make and rotary encoders for rotary axes and shall be of Heidenhain make.	Vendor to Confirm			
2.10.19	There shall be adequate provision to prevent ingress of dirt, chip, coolant etc. in the Linear Scale.	Vendor to Confirm			
2.10.20	The bidder shall furnish the actual details of make, resolution, accuracy of measuring system provided for the various axis and details of means provided for the protection of Linear Scales.	Vendor to specify			
2.10.21	Details of backlash free movement mechanism in X, Y& Z axes should be submitted.	Vendor to specify			
2.10.22	Mechanism for locking X,Y& Z axis	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.11	**CONSTRUCTION:**				
2.11.1	All machine elements shall be designed and validated by using finite element analysis (FEA) to arrive at optimum construction, cross-sections and ribbings. The machine structural elements shall be designed to meet the cutting forces generated during heavy-duty machining applications. All machine elements such as bed, column, gantry, spindle headstock etc. shall be of proven design. The machine elements shall be made of highest quality, heavily ribbed, rigid grey cast iron preferably or Fabricated Steel Structure with proper stress relieving. The machine elements shall be suitably stress relived and aged to ensure dimensional stability and freedom from distortion over the entire life of the machine. The machine elements shall have suitable damping characteristics to ensure vibration free machining at full load. In case of fabricated structure, the steel used for fabrication shall be Fe360A conforming to ISO630-2011 standard or better The fabricated structure shall be subjected to double stress relieving cycle-first relieving to be done after welding, and second stress relieving to be done after rough machining and before finish machining. The details of various machine elements (Base, Column, Table, Cross Rail, Spindle Head Stock, Ram etc.) material shall be clearly indicated in the offer. Special design and constructional features of the machine elements (Base, Column, Table, Cross Rail, Spindle Head Stock, Ram etc.) must be fully explained in the offer.				
2.11.2	Turning diameter	5m			
2.11.3	Milling diameter	4m			
2.11.4	Maximum Turning height on Table, with Turning Tool holder	Vendor to specify			
2.11.5	Distance of RAM face from the table surface with cross rail at lowest position: Less than offered RAM stroke	Vendor to specify			
2.11.6	Distance from spindle face to table at two extreme positions of cross rail , with standard tool.	10 - 2000 mm			
2.11.7	Distance between columns	vendor to specify			
2.11.8	Standard Turning tool with turning attachment & Milling tool directly clamped to when crossrail is at its lowest position	vendor to specify			
2.11.9	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 specify			
2.11.10	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	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.12	**OPERATOR'S PLATFORM and OPERATOR'S PANEL:**				
2.12.1	**OPERATOR'S PLATFORM**				
2.12.1.1	It is 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. Positions of the gates provided in the platform for Operator's convenience should be informed by the Vendor . Drawing / Details of the Operator's Platform should be submitted.A 15 Amp. Plug Point with ON/ OFF switch is also to be provided on the Platform	Vendor to specify			
2.12.1.2	Horizontal movement of complete Platform.	Vendor to specify			
2.12.1.3	Vertical movement of complete Platform to cover total turning height.	Vendor to specify			
2.12.1.4	Height of Platform Railing.	Vendor to specify			
2.12.1.5	Weight Capacity of the Platform.	Vendor to specify			
2.12.1.6	Minimum Position of Platform from Shop Floor.	Vendor to specify			
2.12.1.7	Movable Chip / Splash Guard should be provided all around the Table with sufficient height to avoid spilling of Coolant and scattering of Chips on Operator's Platform and Shop Floor. Details of the same should be submitted.	Vendor to specify			
2.12.2	**OPERATOR'S PANEL:**				
2.12.2.1	The operator panel shall have complete CNC and machine control system with TFT colour display of 19" size or more. It shall be adjustable in all direction including vertical direction for the convenience of operation. All switches with suitable interlocks shall be within the reach of operator of average height (Indian) for easy & safe operation. Pendent control shall be included with Manual Data Input, 1 Manual Pulse Generator (Electronic Hand Wheel) unit in addition to other manual controls.	Vendor to specify			
2.12.2.2	Complete manual control of machine with required switches/ keys shall be provided on operator's panel for selection of required axis, axis direction, cutting feed, table/spindle speed, cutting feed on/off, display of axis position value single block / continuous, emergency stop for manual operation without using CNC program.	Vendor to specify			
2.12.2.3	Hand operated auxiliary unit of Siemens/Fanuc make, for the convenience of setting, all axis movement, rotation of spindle, tool clamping etc., shall be supplied. It shall be provided with manual pulse generator, axis selection, Jog buttons, and emergency stop button.	Vendor to specify			
2.12.2.4	Solid graphic simulation	Vendor to specify			
2.12.2.5	Feed and speed override rotary switches	Vendor to Confirm			
2.12.2.6	Block searching with automatic update of axes positions and parameters	Vendor to Confirm			
2.12.2.7	RS232C serial communication interface with port	Vendor to Confirm			
2.12.2.8	Ethernet interface 10/100 MBPS with RJ45 connector	Vendor to Confirm			
2.12.2.9	USB interface with ports on the operator console	Vendor to Confirm			
2.12.2.10	Visual display system for the feed from the camera installed in the working area of the machine.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.13	**OPERATION AND CONTROL SYSTEM:**				
2.13.1	**CNC SYSTEM & FEATURES :**				
2.13.1.1	Make	Fanuc / Siemens.			
2.13.1.2	Type	PC based latest version			
2.13.1.3	Model	Siemens 840DSL / Fanuc32i (Latest verion, as available at the time of ordering, should be supplied).			
2.13.1.4	Details of optional features, recommended by vendor.	Vendor to specify			
2.13.1.5	The system should have full alphanumeric keyboard, additional draw-out type Querty Key Board and mouse in suitable enclosure, RS232C serial interfaces, parallel interface for printer, COM port for telediagnostics, network ready with LAN, electronic hand wheels for all axes, 4 nos. USB Ports for data input/output, hard disk of sufficient capacity **(Largest size available at the time of order shall be supplied)**, graphic simulation and preinstalled system software & other required softwares etc.(Details should be submitted by Vendor)	Vendor to specify			
2.13.1.6	Provision for automatic safe shut down of CNC System in case of Power Failure	Vendor to specify			
2.13.1.7	Resolution	Vendor to specify			
2.13.1.8	Programmable axes	4			
2.13.1.9	Simultaneously interpolatable axes (X,Z,Y,C)	Vendor to Confirm			
2.13.1.10	Block Processing time	Vendor to specify			
2.13.1.11	Display	19" TFT Colour graphicdisplay			
2.13.1.12	HMI (PCU 50.3 OF Siemens/ Fanuc equivalent)	Vendor to specify			
2.13.1.13	UPS(For CNC Shut down duing power failure) min. 10 minutes	Vendor to specify			
2.13.1.14	NC Memory	4 GB or more			
2.13.1.15	Solid state drive capacity	128 GB or more			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.13.1.16	Backup of all data (NC, CNC, HMI, etc.) to be provided in a working mirror SSD needed for replacement in the event of failure of original SSD	Vendor to Confirm			
2.13.1.17	ISO Programming in Metric	Vendor to Confirm			
2.13.1.18	Turning, Drilling and Milling cycles	Vendor to Confirm			
2.13.1.19	Cutter Radius / Tool Nose Radius Compensation	Vendor to Confirm			
2.13.1.20	Linear Interpolation	Vendor to Confirm			
2.13.1.21	Circular Interpolation	Vendor to Confirm			
2.13.1.22	Rigid Tapping	Vendor to Confirm			
2.13.1.23	Tool/Work Offsets	Vendor to Confirm			
2.13.1.24	Tool length Compensation	Vendor to Confirm			
2.13.1.25	Pitch Error Compensation	Vendor to Confirm			
2.13.1.26	Backlash Compensation	Vendor to Confirm			
2.13.1.27	Parametric Programming	Vendor to Confirm			
2.13.1.28	Read/Write System Memory	Vendor to Confirm			
2.13.1.29	Probe Cycles	Vendor to Confirm			
2.13.1.30	CNC System enclosed in dust-proof casing	Vendor to Confirm			
2.13.1.31	Remote Diagnosis	Vendor to Confirm			
2.13.1.32	UPS Backup for Control System referred in 2.13.1.30	Vendor to Confirm			
2.13.1.33	Applicable functions required for 4 axis simultaneous machining(TRANSMIT, TRACYL etc.). All functions related to 4-axis machining such ORIVECT, ORICON, Inclined plane machiningetc. shall be provided and activated	Vendor to Confirm			
2.13.1.34	An automatic tool retract system shall be offered to prevent tool digging in 4-axis machining in case of power failure.	Vendor to Confirm			
2.13.1.35	The full details of the control system offered including the designation of all the modules selected to execute the functionalities specified shall be provided. The same shall be substantiated by the OEM catalogues with appropriate markings.	Vendor to Confirm			
2.13.2	**MANUAL CONTROL :**				
2.13.2.1	Complete manual control of machine with required switches / keys should be provided on operator's panel for selection of required axis, axis direction, cutting feed, table / spindle rpm, cutting feed on/off, display of axis position values etc, for manual operation without using CNC program, CNC option Manual Turn or MDI mode. Diagram / Sketches for switches / keys provided on operators pendant should be submitted.	Vendor to specify			
2.13.3	**HAND HELD UNIT:**				
2.13.4.1	Hand Held unit, Type B-MPI of Siemens make or equivalent alongwith sufficient length of interfacing cable is to be offered with complete details.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.13.4	**UPS FOR CNC SYSTEM (STAND ALONE OR INBUILT):**				
2.13.4.1	UPS of 30 minutes for CNC system with inbuilt cooling and charge status display (Battery charging /discharging time should be specified by vendor)	Vendor to specify			
2.14	**MACHINE LIGHTS:**				
2.14.1	Machine Lights for sufficient illumination of complete working area on both sides of operator's platform should be provided for clear visibility.	Vendor to specify			
2.14.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to specify			
2.14.3	Any lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to specify			
2.14.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to specify			
2.14.5	Flashing / rotary type End of Cutting and Program Stop Light.	Vendor to specify			
2.14.6	Integral lighting suitable for the operations concerned where its lack is likely to cause a risk despite ambient lighting of normal intensity shall be provided	Vendor to Confirm			
2.14.7	The manufacturer must ensure that there is no area of shadow likely to cause nuisance, there is no irritating dazzle and that there are no dangerous stroboscopic effects due to lighting provided by the manufacturer.	Vendor to Confirm			
2.14.8	Integral parts requiring frequent inspection and adjustment and maintenance areas must be provided with appropriate lighting.	Vendor to Confirm			
2.14.9	The machine lighting shall be low voltage so as to prevent any hazard to the operator.	Vendor to Confirm			
2.15	**AIR CONDITIONERS:**				
2.15.1	Air Conditioners with Dehumidifiers of suitable / sufficient capacity to be provided for all Electrical / Electronic Panels / Cabinets/ CNC Sytem panel considering specified ambient conditions. Detailed specifications of the same are to be submitted.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.16	**HYDRAULIC SYSTEM : Details should be Submitted by the Vendor**				
2.16.1	The System should be centralised. Hydraulic Tank shall preferably be located at floor level	Vendor to specify			
2.16.2	Make Rexroth / Vickers/ HAWE/PARKER/ ECKERIC/ VOGEL/ YUKEN/ CENLUB/Sperry or equivalent from a reputed manufacturer. (Details to be submitted)	Vendor to specify			
2.16.3	Filtration System	Vendor to specify			
2.16.4	Failure indication	Vendor to specify			
2.16.5	Automatic shut off provision. Details should be submitted.	Vendor to specify			
2.16.6	Refrigerated type cooling and electric heating (Elecrtic heating only if required) system of sufficient capacity to maintain complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. at a temperature not exceeding 40 deg C irrespective of the ambient conditions. Complete details should be submitted	Vendor to specify			
2.16.7	Hydraulic pump capacity (flow / pressure)	Vendor to specify			
2.16.8	Each pump should have an independent motor. Tandem pumps should not be used	Vendor to specify			
2.16.9	**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 confirm			
2.16.10	Hydraulic power pack may be provided for counterbalance of RAM, clamping/de-clamping of tool, rotary table etc. All functions using hydraulics shall be clearly described.	Vendor to specify			
2.16.11	Pressure gauges at all places where pressure has to be inspected.	Vendor to Confirm			
2.16.12	Safety valves for hydraulic/hydrostatic circuit, if relief valve does not fulfil this function.	Vendor to Confirm			
2.16.13	Equipment for checking of temperature in the circuit or in the pump wherever necessary.	Vendor to specify			
2.16.14	Pressure line filter (10 micron size)shall be provided for longer life of hydraulic equipment. All piping used in hydraulic system shall conform to DIN standard. Arrangement to be provided to show if filters are choked and need cleaning.	Vendor to specify			
2.16.15	This filter shall be of reusable type and indigenously available. If reusable filter cannot be offered, the filter cartridge shall be readily available in India. Source of supply in India shall be indicated.	Vendor to Confirm			
2.16.16	Adequate number of filters for 5 years working shall be offered as spare.	Vendor to specify			
2.16.17	Alarm for low oil level to be provided	Vendor to specify			
2.16.18	Level float switches shall be used in the hydraulic tank for indicating safe and danger level of oil and it shall be interlocked with the machine control. Pressure switch for each feed line shall also be provided for controlling the maximum pressure.	Vendor to specify			
2.16.19	The temperature of oil in hydraulic/hydrostatic reservoir, pump and allied equipment shall be suitably segregated from the machine in order to remove major source of heat.	Vendor to specify			
2.16.20	The hydraulic/hydrostatic system and its elements like pump, valve etc. shall be from reputed manufacturers. Stackable valves and manifolds shall be used for ease of assembly, reduced piping and leakage through fittings.	Vendor to specify			
2.16.21	The make of different element of hydraulic systems such as make of pump, tank capacity, motor power in kW, filter size and safety devices, hydraulic equipment, size of tank, maximum pressure and flow rate, sizes of filters etc.shall be furnished along with the offer.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.17	**COOLANT SYSTEM :**				
2.17.1	**Flood type coolant system** with external output from ramshall be provided. A re-circulating type flood coolant system through adjustable trajectory multiple nozzle around the spindle. The supply of external coolant shall be in ample volume and pressure. The details of the system and coolant flow diagrams showing filters, pumps, valves, tanks, etc. to be submitted with the offer.	Vendor to specify			
2.17.2	Through coolant system shall also be provided for turning operation	Vendor to confirm			
2.17.3	All attachments, tool holders, boring bars, cassettes, adapters etc. shall have the provision for external coolant so that coolant is available directly at the tool-cutting tip.	Vendor to confirm			
2.17.4	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.	Vendor to confirm			
2.17.5	**Coolant Filteration System:** Recirculating type coolant system with centrifugal Hydrocyclone System/ Vaccum Rotary drum type System/ Cartridge Type Filtration System and magnetic separator.	Vendor to specify			
2.17.6	Coolant Flow Diagram showing filters, pumps, valves, tanks etc. to be submitted with the offer.	Vendor to specify			
2.17.7	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			
2.17.8	Coolant Tank Capacity	Vendor to specify			
2.17.9	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			
2.17.10	Coolant pump & motor details for all variants	Vendor to specify			
2.17.11	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Vendor to confirm			
2.17.12	A **separate portable pump with motor** with its control (manual) suitable for pumping out the entire coolant during maintenance / replenishment. The pump shall be capable of sucking the coolant with sludge and other sediments	Vendor to confirm			
2.17.13	Washing Gun	Vendor to specify			
2.18	**ELECTRICAL :**				
2.18.1	415V (fluctuation ±10%), 50HZ (fluctuation ±3%), 3 Phase AC (3 wire system with out neutral) Power Supply Voltage 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, shall be the resposibility of vendor. Requirement of grounding/earthing with required material details is to be informed by vendor well in advance so that same could be incorporated during construction of foundation.				
2.18.2	The party shall confirm satisfactory performance of the machine at the incoming power supply in the range of 415volt ±10 %AC, 3 phase, 50 Hz ±3%	Vendor to confirm			
2.18.3	**Tropicalisation:** All electrical / electronic equipment shall be tropicalized	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.18.4	All electrical & electronic control cabinets & panels should be dust and vermin proof	Vendor to confirm			
2.18.5	All electrical components in the cabinets should be mounted on DIN Rail	Vendor to confirm			
2.18.6	All electrical and electronic panels including operator's panel should be provided with fluorescent lamps for sufficient illumination and power receptacles of 220Volts, 5/15 Amp AC. All adapters/receptacles should have compatibility with Indian equivalents.	Vendor to confirm			
2.18.7	Motors shall conform to IEC or Indian Standards	Vendor to confirm			
2.18.8	All cables moving with traversing axes should be installed in caterpillar / Drag chain. Additionally, all the cable trays required for laying of cables should be included in the offer.	Vendor to confirm			
2.18.9	Vendor should ensure the proper earthing for the machine and its peripherals.	Vendor to confirm			
2.18.10	In-cycle hour counter with reset facility.	Vendor to confirm			
2.18.11	Total Power required	Vendor to specify			
2.18.12	Air supply : Piping, manifolds, circuits etc for air supply on the machine shall be provided by bidder.CFM, reservoir capacity, air quality and operating pressure required to be mentioned.(Air Supply:5-6 Bar)	Vendor to Confirm			
2.18.13	Power source of220V, 5 Amps, multi-pin Indian socket shall be provided in the machine panel as service sockets with facility to switch "ON" while machine is in switch "OFF" condition.	Vendor to Confirm			
2.18.14	The control gear for AC/DC motors shall incorporate the following protection devices as concomitant accessories.	Vendor to Confirm			
2.18.15	No Voltage protection- No voltage protection shall be provided so that the machine shall not start up again by itself when, following an interruption, supply is restored.	Vendor to Confirm			
2.18.16	Short circuit protection- To protect against short circuits due to insulation failure of faulty connections MCB shall be provided for each motor. The rating of the MCB shall be such as to take care of the over current due to motor starting.	Vendor to Confirm			
2.18.17	Over load protection- To prevent motors from overloading, overload protection shall be provided separately for each motor. Three phase motors shall be protected by overload tripping devices on each phase.	Vendor to Confirm			
2.18.18	Single phasing protection- A separate current sensitive delayed action single phasing preventer shall be provided for each motor separately. Overload protection shall not be treated as single phasing preventer.	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.19	**SAFETY ARRANGEMENTS:**				
	Following safety features in addition to other standard safety features should be provided on the machine:				
	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 confirm			
	2. When feed hold is 'ON', all slide motions are to be inoperative.	Vendor to Confirm			
	3. Software limit switches are to be provided to restrict the total slide travel, maximum feed velocity and maximum spindle speed. Hardware features shall be available for controlling the above movements.	Vendor to Confirm			
	4. Improper tool clamping in the spindle nose shall inhibit spindle rotation and error is to be displayed on the control screen.	Vendor to specify			
	5. The tool shall not get unclamped in the event of power failure or an emergency stop.	Vendor to Confirm			
	6. Load meter shall be provided to indicate the load on spindle drive motor, so that the load on motor can be maintained with in safe limit.	Vendor to Confirm			
	7. When any of the machine functions like spindle rotation, slide movement, ATC movement etc. come to be a stop without being programmed to stop, the machine shall come to stop, and shall be operative only in the manual mode till the fault is rectified.	Vendor to Confirm			
	8. Suitable interlocks shall be provided to protect the machine in the event of hydraulic oil failure, lubrication failure, pneumatic system failure, fluctuation in voltage and frequency.	Vendor to Confirm			
	9. The safety features shall include safety devices against overloading of any drive, over travel of any slide and interlock against conflicting motions.	Vendor to Confirm			
	10. Mushroom type emergency stop shall be provided on the machine, which shall be easily accessible and capable of disabling the machine, drives in case of emergency.	Vendor to Confirm			
	11. A detailed list of all alarms / indications provided on machine should be submitted by the supplier.	Vendor to confirm			
	12. All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hinderance to machine operator's movement for effective use of machine.	Vendor to confirm			
	13. All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations.	Vendor to confirm			
	14. Emergency Switches at suitable locations as per International Norms should be provided.	Vendor to confirm			
	15. Oil & water pipe lines should not run with electrical cable in the same tray / trench.	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.20	**ENVIRONMENTAL PERFORMANCE OF THE MACHINE :**				
	The Machine shall conform to following factors related to environment :				
	(a) 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. Supplier to demonstrate compliance to noise level, if so required.	Vendor to confirm			
	(b) There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm			
	(c) 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			
	(d) No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm			
	(e) If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm			
	(f) Paint of the machine should be oil / coolant resistant and should not peel off and mix up with coolant.	Vendor to confirm			
	(g).The machine shall be capable of working in tropical weather conditions with ambient temperature of max 45°C and RH 95%. All electrical & electronic components shall be tropicalized. Bidder to confirm the suitability of operating machine for such conditions.	Vendor to confirm			
3.0	**CHIP CONVEYOR :**				
3.1	Elevating chip conveyor to carry both short and curly chips efficiently and effectively to the chip bin on floor, should be provided at the side of the machine. Two Chip bins of appropriate size of Indian make, with wheels & handle for movement, should also be supplied.	Vendor to specify			
3.2	Type of chip conveyor	Vendor to specify			
3.3	Width of conveyor	Vendor to specify			
3.4	Elevation of chip conveyor for chip bin	Vendor to specify			
3.5	Material of chip conveyor (should be rust resistant)	Vendor to specify			
3.6	Provision for smooth flow of chips to the conveyor.	Vendor to specify			
3.7	In case of grinding, provision for flushing out grinding dust to avoid clogging of conveyor's holes is should be provided.	Vendor to specify			
3.8	Operation of chip conveyor (forward & reverse) through push buttons on operator's panel and at Chip Conveyor	Vendor to specify			
3.9	Layout showing location of chip conveyor should be submitted.	Vendor to specify			
4.0	**SERVO VOLTAGE STABILIZER:**				
4.1	Indian make Oil / **Air** Cooled servo Controlled Voltage Stabilizer suitable for complete machine, its drives, controls, PLC etc with no undesirable Harmonics in the stabiliser output.	Vendor to specify			
4.2	Make (To be specified by indentor as per the practice of units.)				
4.3	Model & Rating	Vendor to specify			
4.4	Catalogue of the Voltage Stabiliser shall be submitted with the offer.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
5.0	**ULTRA ISOLATION TRANSFORMER**				
5.1	Indian make Ultra Isolation Transformer suitable for complete machine, its drives, controls, PLC etc. shall be supplied	Vendor to specify			
5.2	Make (NEEL, Aplab or Auto Electric)	Vendor to confirm			
5.3	Model and Rating	Vendor to specify			
5.4	Catalogue of the Ultra Isolation Transformer shall be submitted with the offer.	Vendor to specify			
6.0	**PNEUMATIC SYSTEM:**				
6.1	**AIR COMPRESSOR:**				
6.1.1	Independent Air Compressor (of reputed Indian make) 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 so that BHEL compressed air supply having pressure **(to be specified by indentor)** could be used as and when required. The compressor unit should be suitable for continuous duty.	Vendor to specify			
6.1.2	Make & Model of Air Compressor	Vendor to specify			
6.1.3	Make & Model of Refrigerated Air Dryer	Vendor to specify			
6.1.4	Capacity (Flow, Pressure & KW)	Vendor to specify			
6.2	**COMPRESSED AIR POINTS:**				
6.2.1	Compressed Air Point with manual ON/ OFF Valve and flexible pipe of suitable length for work piece cleaning.	Vendor to confirm			
7.0	**TOOLINGS:**				
7.1	Quick change type Cassette Adaptor type of Tool Holders as well as Standard Conventional type Tool Holders. Any other latest type of Tooling System may also be offered with all relevant details. Mounting details should be submitted.	Vendor to specify			
8.0	**MEASURING SYSTEMS**				
8.1	Automatic Job Measuring System comprising of Renishaw make Wireless system, with measuring cycles, calibration system and all types of probes / styli required for measuring all machined dimensions of the prove-out components. Vendor to furnish detailed description of the system along with offer.	Vendor to specify			
8.2	Three probes (1 vertical + 2 horizontal) Renishaw RMP-60 (or equivalent) touch trigger radio probe with suitable attachment/headto measure points on diameter of components, height, drilled holes etc. and store data. The following are the broad functions:	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
8.3	Probe Calibration	Vendor to specify			
8.4	Zero point location	Vendor to specify			
8.5	Setting of inclined planes	Vendor to specify			
8.6	Measuring edges, holes	Vendor to specify			
8.7	Centre distance of holes	Vendor to specify			
8.8	Measurement of radius of arcs, Diameters , height etc	Vendor to specify			
8.9	spare probes 5 sets	Vendor to specify			
8.10	Above options shall be integrated to the Siemens 840DSL work piece measuring cycles.				
8.11	Automatic Tool Offset measuring system with measuring cycles, calibtration system etc suitable for all types of tools recommended for prove-out components. Vendor to furnish detailed description of the system along with offer.	Vendor to specify			
8.12	Tool pre-setting/probe system shall be offered and relevant cycles for tool length and tool radius measurementof milling tool and for turning tools.	Vendor to specify			
9.0	**DIAGNOSTIC SYSTEM**				
9.1	**TELE-DIAGNOSTIC SERVICE :**				
9.1.1	**Tele-diagnostic service should be provided through International telephone lines/ Internet/ ISDN 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. Terms and conditions for the service after guarantee period should be informed by vendor.**	Vendor to specify			
9.2	**FAULT DIAGNOSTIC SYSTEM:**				
9.2.1	Supplier's own diagnostic system with required hardware and software should be supplied and installed on the CNC system. This should include customised auto-diagnostic system with supporting hardware and software which shows detailed cause and remedy for the fault on the display with full video diagnostic help for faults related to mechanical and electrical maintenance.	Vendor to specify			
9.3	Help guide should be provided to use both diagnostic systems	Vendor to specify			
10.0	**LEVELING & ANCHORING SYSTEM**				
10.1	Complete anchoring system including foundation bolts, anchoring materials, fixators, leveling shoes etc should be supplied	Vendor to specify			
11.0	**TOOLS FOR ERECTION, OPERATION & MAINTENANCE :**				
11.1	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			
11.2	Test mandrel for checking run-out/taper & alignment should be supplied	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
12.0	**ACCESSORIES:** (To be selected from below mentioned list as per jobs requirement. Any other accessories not listed below, but essentially required to be specified by Indentor)				
12.1	**AUTOMATIC TOOL CHANGER**				
12.1.1	The machine shall be provided with CNC controlled Vertical chain type automatic Tool, Changer/magazine for automatic changing of both turning and milling tools. It shall have a provision for minimum of 40 tools. Tool types to be accommodated are :	Vendor to confirm			
12.1.2	Type	Vendor to specify			
12.1.3	No. of storage locations (20 nominal)	Vendor to specify			
12.1.4	Turning Tools Capto C8 - 10 Nos (or more)	Vendor to confirm			
12.1.5	Milling Tools (BT50/HSK100) - 20 Nos(or more)	Vendor to confirm			
12.1.6	The magazine shall have sufficient pockets to hold the offered spindle nose taper and shall be driven by an AC servo motor through CNC control & AC servo drive.	Vendor to specify			
12.1.7	The machine shall also be provided with CNC controlled automatic ATC for tool head parking.	Vendor to confirm			
12.1.8	Detailed arrangement of grippers & swivelling shall be furnished	Vendor to specify			
12.1.9	All the ATC servo axes shall be configured in a different channel than the machine axes, so that ATC and machine can work simultaneously in different channels.	Vendor to confirm			
12.1.10	Random selection of tool shall be possible. The tool magazine shall have a bi-directional rotation and tool shall be presented to ATC arm through shortest route.	Vendor to Confirm			
12.1.11	An effective power tool lock system shall be provided to ensure proper tool locking in the spindle.	Vendor to Confirm			
12.1.12	For manual ejection/loading of tools from spindle and magazine in manual mode, push button control shall be available.	Vendor to specify			
12.1.13	An interlock shall be provided to ensure that tool cannot be ejected unless machine spindle stops and orients itself to a specific direction. The interlock shall be provided to ensure that CNC cycle doesn't start unless the tool has been changed so as to keep the spindle clean.	Vendor to Confirm			
12.1.14	The machine shall be capable of pre-selecting the tool for next operation while machining operation is in progress to reduce idle time. There shall be a provision for cleaning of tool by compressed air during tool change so as to keep the spindle clean.	Vendor to Confirm			
12.1.15	The system shall enable tool change from the ram, milling head attachment and turning head attachment.	Vendor to Confirm			
12.1.16	Tool shank : (Max)	40mm x 40mm			
12.1.17	Max tool diameter / Width (all pockets filled)	Vendor to specify			
12.1.18	Max tool diameter (adjacent pockets empty)	Vendor to specify			
12.1.19	Max tool length	Vendor to specify			
12.1.20	Tool change time (tool-to-tool)	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
12.1.21	Tool change time (chip-to-chip)	Vendor to specify			
12.1.22	Tool selection method	Vendor to specify			
12.1.23	Maximum Tool Overhang out of different Holders.	Vendor to specify			
12.1.24	Maximum Permissible Weight on each Pocket.	Vendor to specify			
12.1.25	Maximum Permissible Weight on Complete ATC.	Vendor to specify			
12.1.26	The Machine operation should be possible with or without referencing ATC.	Vendor to specify			
12.1.27	ATC Drawing should be submitted with the offer.	Vendor to specify			
12.1.28	**Suitable arrangement, Software based and manual key based, should be provided to extract a Tool trapped in the ATC cycle. Details of both the system to be provided along with the offer.**	Vendor to specify			
12.1.29	Full details of the proposed system shall be provided.	Vendor to Confirm			
12.2	**AUTOMATIC ATTACHMENT CHANGER (AAC)**				
12.2.1	An automatic attachment changer/device magazine attached to crossrail shall be provided, which automatically clamp/unclamp on special accessories such as Universal Milling Head, 90°attachment, turning tool attachments, workpiece measuring probe attachment etc. hydraulically as well as mechanically to the RAM face. Centering and referencing pin as well as clamping check system shall also be provided. The details of clamping interface shall be furnished.	Vendor to specify			
12.2.2	All attachments shall be suitabe for loading / unloading through AAC	Vendor to specify			
12.2.3	No. of storage positions : for 12 or more attachments	Vendor to specify			
12.2.4	Location of the attachment changer	Vendor to specify			
12.2.5	Mounting plates as required for attachments should be supplied	Vendor to specify			
12.2.6	Attachment selection method	Vendor to specify			
12.2.7	Maximum Permissible Weight on each Position.	Vendor to specify			
12.2.8	Maximum Permissible Weight on Complete AAC.	Vendor to specify			
12.2.9	**Suitable arrangement, Software based and manual key based, should be provided to extract a Attachment trapped in the AAC cycle. Details of both the system to be provided along with the offer.**	Vendor to specify			
12.2.10	Full details of the proposed system shall be provided.	Vendor to Confirm			
12.3	**VERTICAL MILLING HEAD**				
12.3.1	Power	Vendor to specify			
12.3.2	Maximum Torque.	Vendor to specify			
12.3.3	Speed Range (Infinitely Variable)	Vendor to specify			
12.3.4	Tool Shank / Spindle Taper. (HSK or its equivalent)	Vendor to specify			
12.3.5	Tool Clamping (by program as well as manually through push buttons)	Vendor to specify			
12.3.6	Tool Clamping Force	Vendor to specify			
12.3.7	Maximum Cutter Diameter 50mm nominal	Vendor to specify			
12.3.8	Maximum Cutter Weight	Vendor to specify			
12.3.9	Maximum Height for Milling with Vertical Milling Head.	Vendor to specify			
12.3.10	Power - Torque - Speed Diagram	Vendor to specify			
12.3.11	Dimensional details & Weight of the head	Vendor to specify			
12.3.12	Coolant system: Internal (thru spindle) **&** External coolant with requisite flexible pipes on its snout	Required			
12.3.13	Pull Stud for mounting the Head and for mounting the Tools in the taper of the Head shall be supplied	Required			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
12.4	**CNC UNIVERSAL MILLING HEAD**				
12.4.1	A detachable CNC Universal Milling Head shall be offered for Milling/Drilling/Boring operations on the material specified.	Vendor to confirm			
12.4.2	Universal Head shall have a continuous movement with angle positioning at every 0.001 degree for an angle ± 95° (Minimum) from the vertical plane	Vendor to confirm			
12.4.3	Universal Head shall have an electro-spindle of reputed make	Vendor to confirm			
12.4.4	Rigid construction capable of heavy material removal.	Vendor to confirm			
12.4.5	It shall be possible to hold HSK100/BT50 or equivalent tooling on this Universal Head for Milling/Drilling/Boring operation.	Vendor to specify			
12.4.6	Automatic clamp and unclamping of this attachment to RAM through CNC control.	Vendor to specify			
12.4.7	Interface with RAM	Vendor to specify			
12.4.8	Spindle speed: more than 3000 rpm	Vendor to specify			
12.4.9	Power @ S1/100% Duty cycle	Vendor to specify			
12.4.10	Const. Torque @ S1/100% Duty cycle	Vendor to specify			
12.4.11	Const. Power Range:	Vendor to specify			
12.4.12	Spindle Runout at nose :0.02	Vendor to confirm			
12.4.13	Spindle Runout at 300 mm from face:0.01	Vendor to confirm			
12.4.14	Spindle Runout at face:0.01	Vendor to confirm			
12.4.15	Spindle lubrication	Vendor to specify			
12.4.16	Spindle cooling	Vendor to specify			
12.4.17	Parking place for head	Vendor to specify			
12.4.18	Maximum Cutter Diameter	Vendor to specify			
12.4.19	Maximum Cutter Weight	Vendor to specify			
12.4.20	Tool Clamping Force	Vendor to specify			
12.4.21	Full details of the proposed universal head including interface with ram, Electro-spindle attachment, speed/power/torque characteristics, feedback system, tool clamp/unclampetc shall be provided.	Vendor to specify			
12.4.22	Dimensional details & Weight of the head	Vendor to specify			
12.4.23	Coolant system: Internal (thru spindle) **&** External coolant with requisite flexible pipes on its snout	Vendor to confirm			
12.4.24	Pull Stud for mounting the Head and for mounting the Tools in the taper of the Head shall be supplied by the vendor.	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
12.5	**PORTABLE DATA INPUT/OUTPUT UNIT**				
12.5.1	Portable data input/output unit, for bi-directional program & data transfer between the offered unit & supplied CNC system and as well as with standard PC (available at BHEL works), shall be provided with all required interfaces, hardware & software etc..	Vendor to confirm			
12.6	**AUTO-FOCUS VIDEO CAMERA**				
12.6.1	Auto focus video camera with zoom facility shall be provided on the ram / tool holders internally connected with color Monitor fixed on operator's panel to view tool while machining and also as an aid for setting of casings. Camera eye / lens and connecting cables shall be safe guarded against heat, chips, coolant, dust etc. to maintain clear visibility of the tool in these adverse machining conditions. Suitable sockets for power connection shall be provided for both positions (ram and all tool holders). Clamping details of camera on different tool holders shall be shown on drawings of tool holders.	Vendor to specify			
12.6.2	The camera shall be capable of viewing the tool tip while machining and also dial gauge readings for job setting. It shall be possible to zoom in / zoom out /swivel the camera to view the dial indicator reading which at a distance of 3m from the camera. The camera shall also be capable of viewing the entire working area of machine. It shall have following parameters:	Vendor to Confirm			
12.6.3	• Exceptional low light sensitivity: 0.0077 Lx	Vendor to Confirm			
12.6.4	• High dynamic range: 120 db to view details of both bright area and dark area simultaneously	Vendor to Confirm			
12.6.5	• Robust and rugged design rated to Industry IP68, type 6P, IK10	Vendor to Confirm			
12.6.6	• Pan and tilt drive mechanism	Vendor to Confirm			
12.6.7	• Intelligent tracking	Vendor to Confirm			
13.0	**SPARES:**				
13.1	Vendor to provide complete list of recommended spares with unit cost, for machine & accessories, for 2 years of continuous operation ,along with specification / type / model, and name & address of the spare supplier. Price fixation for these spares for next two years, to be confirmed by the vendor	Vendor to specify & Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
13.2	Vendor to quote price of recommended spares along with the machine separately.	Vendor to Quote			
13.3	All types of spares for total machine and accessories should be available for 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			
14.0	**DOCUMENTATION :** **Five sets** of following documents (Hard copies) in English language should be supplied along with the machine	Vendor to confirm			
14.1	Operating manuals of Machine & CNC system	Vendor to confirm			
14.2	Programming Manuals of Machine & CNC system	Vendor to confirm			
14.3	Detailed Maintenance manual of machine with all drawings of machine assemblies/sub-assemblies/parts including Electrical/ Pneumatic/ Coolant/ Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list also. Complete details including make, tolerance and precision class of all the critical bearings such as spindle bearings, ball screw support bearings, ball lead screw etc. with replacement procedure and approximate life of these bearings to be furnished.	Vendor to confirm			
14.4	Maintenance, Interface & commissioning manuals for CNC system, spindle & feed drives.	Vendor to confirm			
14.5	Manufacturing drawings for all supplied tool holders, coolant connections, adapters, sleeves, fixtures etc.	Vendor to confirm			
14.6	Catalogues, O&M Manuals of all bought out items including drawings,wherever applicable.	Vendor to confirm			
14.7	Detailed specification of all rubber items and hydraulic tube fittings and hoses.	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
14.8	Operating Manuals, Maintenance Manuals & Catalogues for supplied Automatic Tool Offset & Job Measuring Systems, Voltage Stabilizer, Isolation Transformer, Air-Compressor and all supplied Accessories.	Vendor to confirm			
14.9	PLC program print-outs with comments in English.	Vendor to confirm			
14.10	PLC program on CD, NC data & PLC data on floppy.	Vendor to confirm			
14.11	Complete back-up of hard disk on GHOST CD and clear written Instructions (3 copies) to take back-up and reloading of a new hard disk.	Vendor to confirm			
14.12	Complete Master List of parts used in the machine shall be submitted by the vendor.	Vendor to confirm			
14.13	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to confirm			
15.0	**TRAINING**				
15.1	Training of two persons for each of the following modules at manufacturer's works.Boarding,Lodging and travelling will be under BHEL's scope. Training charges to be borne by Bidder.	Vendor to Confirm			
15.1	BHEL Persons should be trained at supplier's Works for mutually agreed period in the area of (a) CNC Part Programming / Technology, Use of all CNC Features, Programming for Measuring Systems & supplied accessories etc. (b) Electrical, Electronic & CNC maintenance for machine & other supplied equipments (c) Mechanical & Hydraulic maintenance of the machine & other supplied equipments (d) Operation of the machine & other supplied equipments.	Vendor to confirm			
	Post commissioning training at BHEL work's for operation & maintenance personnel.	Vendor to Confirm			
	Training of three persons for each of the mentioned modules at reputed training centre in India.Boarding, Lodging, and travelling will be under BHEL's scope. Training charges to be borne by Bidder.	Vendor to Confirm			
15.2	**GENERAL:**				
15.2.1	Air-fare, boarding & lodging of BHEL Team shall be borne by BHEL.				
15.2.2	Competent, English speaking experts shall be arranged by the vendor during Training for satisfactory & effective training of BHEL personnel.	Vendor to confirm			
15.2.3	Vendor to quote for Training on per man per Day basis within BHEL premises.	Vendor to confirm			
15.2.4	Vendor should commit to organize 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			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
16.0	**FOUNDATION :**				
16.1	Vendor shall submit the preliminary layout drawing along with the offer.Vendor to submit Complete Foundation Design including details viz. static / dynamic load details etc. and Final Layout drawings shall be submitted by the supplier after PO/LOI for BHEL approval. BHEL will approve the drawing within three weeks time from date of submission/clarification. Tentative Soil bearing capacity of BHEL Ranipet is 50KN/sqm. The layout should consist of all reqirements pertaining to complete machine including space requirement for Voltage Stabilizer, Isolation Transformer, Air compressor, Chip Bin & any other accessories. BHEL shall construct complete foundation for the machine under supervision of supplier and at supplier's responsibility. Vendor should arrange equipments 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 foundation bolts of the machine.	Vendor to confirm			
17.0	**ERECTION & COMMISSIONING**				
17.1	**ERECTION**				
17.1.1	Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control & 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.	Vendor to confirm			
17.1.2	Machine shall be transported in disassembled condition in Shipper owned container(*Container will become BHEL property after unloading of job at BHEL works*) and erected &commissioned at BHEL site by the bidder on turnkey basis.Arrangements of Unloading and storage of same at BHEL work will only be under BHEL scope.However Vendor is suggested to depute their representative during unloading at BHEL work.	Vendor to Confirm			
17.1.3	Manufacturer shall depute/hire necessary skilled engineer/technicians for erection and commissioning.	Vendor to Confirm			
17.1.4	Bidder shall be solely responsible for arrangement of additional material handling equipment/tools/accessories if necessary at their expenses.	Vendor to Confirm			
17.1.5	Foundation plan, general arrangement plan showing layout with accessories and indicative drawings shall be enclosed as a part of technical bid.	Vendor to Confirm			
17.1.6	Detailed foundation design requirements, final foundation drawings, final layout drawings etc shall be provided by the bidder to BHEL well in advance before machine erection.	Vendor to Confirm			
17.1.7	The Bidder or their agent would be required to carry out a joint check at the consignee's end along with BHEL, before unpacking is done, to avoid subsequent complaints regarding short shipment/transit damages. It is necessary that the joint receipt inspection be done immediately on the receipt of the machine.	Vendor to Confirm			
17.1.8	The Bidder is responsible for any breakage / damage to the machine or its equipment / accessories / tools holders etc.during erection / commissioning done. Bidder shall rectify / replace such damage parts free of cost at site with original parts.	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
17.1.9	The scope of foundation as per bidder's drawing is under BHEL scope	Vendor to Confirm			
17.1.10	Max weight and dimension of individual packings/parts shall be specified.	Vendor to Confirm			
17.1.11	Vendor representative at BHEL during Erection should be well verse in communicating in English.Otherwise Vendor should hire translator(to speak in English) for the same at his expense)				
17.2	COMMISSIONING				
17.2.1	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at **clause 20** (Machine Acceptance) shall form part of the commissioning activity.	Vendor to confirm			
17.2.2	Laser calibration and proving of accuracy values as per section 2.1 at Bidder's expense	Vendor to Confirm			
17.2.3	Geometrical accuracy tests proving the values reported during PDI as per section 2.2 at Bidder's expense	Vendor to Confirm			
17.2.4	Cutting test for conforming machine accuracies and performance.	Vendor to Confirm			
17.2.5	Machining a component (to be identified by BHEL) requiring 4-axis interpolation and contour turning	Vendor to Confirm			
17.2.6	Special tools and equipment required for erection and commissioning of the machine and necessary tools like Torque Wrench, Spanners, Keys, grease guns etc. for operation and maintenance for Mechanical, Electrical, Electronics of the machine, Straight edge, parallelism checking equipment, Test mandrel for checking run-out/taper & alignment and Tools, Tackles, Instruments and other necessary equipment including Laser equipment and other latest optical instrument if any required to carry out all above activities shall be brought by the bidder on returnable basis.	Vendor to Confirm			
17.2.7	All **Cover Plates / chequered plates** required for the machine and for covering its peripherals including pits, if any, shall be supplied and installed by the bidder.	Vendor to Confirm			
17.2.8	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on non returnable basis.	Vendor to confirm			
17.2.9	Damaged surface, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection shall be repainted and merged with the original surrounding paint by the bidder. For this purpose, the biddershall bring / supply sufficient quantity of touch-up paint of various colours of paint used at Bidder's expense.	Vendor to confirm			
17.2.10	Vendor representative at BHEL during Commissioning should be well verse in communicating in English.Otherwise Vendor should hire translator(to speak in English) for the same at his expense)	Vendor to confirm			
17.2.11	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to confirm			
17.2.12	Charges, duration, terms & conditions for E&C should be furnished in detail separately by vendor along with offer.	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
18.0	**ACCURACY TESTS:**				
18.1	**GEOMETRICAL ACCURACIES :**				
18.1.1	Geometrical Accuracy Tests shall be in accordance with DIN 8609 / ISO 3655 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			
18.1.2	All the above accuracies should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and during Erection & Commissioning at BHEL Works.	Vendor to confirm			
18.2	**MACHINE POSITIONING ACCURACIES & REPEATABILITY:** **Should be measured as per VDI/ DGQ3441/ ISO 230-2 (Latest Revision) using LASER INTERFERO METER.**				
18.2.1	Positioning accuracy in X,Y axis (Pa) per 1000 mm : 0.015 mm or better(for entire Travel)	Vendor to confirm			
18.2.2	Positioning accuracy in Z axis (Pa) per 1000 mm : 0.010 mm or better(for entire Travel)	Vendor to confirm			
18.2.3	Positioning accuracy Pa for C-axis: 5Arc sec	Vendor to confirm			
18.2.4	Positional Uncertainty, P : 0.010 mm or better	Vendor to Confirm			
18.2.5	Positional Scatter, Ps 0.007 mm	Vendor to Confirm			
18.2.6	Rotary AxIs (C) (for entire rotation):10 Arc sec	Vendor to Confirm			
18.2.7	Positional Uncertainty, P : 6 ARC SEC	Vendor to Confirm			
18.2.8	Positional Scatter, Ps : 4 ARC SEC	Vendor to Confirm			
18.2.9	Repeatability in X axis (Ps) : 0.02mm or Better	Vendor to Confirm			
18.2.10	Repeatability in Z axis (Ps) : 0.02mm or Better	Vendor to Confirm			
18.2.11	Repeatability in Z axis (Ps) : 0.02mm or Better	Vendor to Confirm			
18.2.12	Repeatability in C axis (Ps) : 5 Arc sec or Better	Vendor to Confirm			
18.2.13	Positioning accuracy over entire traverse in X axis (Pa)	Vendor to specify			
18.2.14	Positioning accuracy over entire traverse in Z axis (Pa)	Vendor to specify			
18.2.15	Total positioning error along X & Z axes per 1000 mm (P)	Vendor to specify			
18.2.16	Total positioning error along X & Z axes over entire traverse (P)	Vendor to specify			
18.2.17	Clamping force of Tool and Tool Holders as per global standard.	Vendor to Confirm			
18.2.18	All the above accuracies should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and during Erection & Commissioning at BHEL Works	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
19.0	**OPERATING CONDITIONS & THERMAL STABILITY**				
19.1	Total machine including CNC system and all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies. Power Supply: Voltage: 415V (fluctuation ±10%), Frequency: 50HZ (fluctuation ±3%) No. of phases = 3 Ambient Conditions: Temperature = 5 to 45 degree celsius Relative Humidity = 95% max. (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 confirm			
19.2	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 20 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 confirm			
19.3	The machine shall be equipped with **refrigeration type cooling system** for cooling lubricating oil, hydraulic oil. The cooling system shall be provided with thermostatic control having thermal sensors and provision of automatic regulation with the reference to the actual temperature of machine main body(spindle bearing)/environmental temperature(machine column) so as to minimise thermal expansion and keep high machining accuracy even during heavy duty continuous machining operations. The temperature control system shall be based on digital system for better accuracy.	Vendor to confirm			
19.4	The cooling system shall be of reputed make conforming to DIN/ISO and provide with environmental friendly refrigerant. The system shall be capable of working in maximum ambient temperature of 45°C, temperature change of 4°C/hour and RH 95%. The biddershall furnish the details of systems such as make, maximum heat transfer rate, type of refrigerant(must be environmental friendly) used, temperature control logic and temperature sensing probes.	Vendor to specify			
19.5	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. (Confirm that machine is suitable for above and details of provisions on the machine for the same should be furnished)	Vendor to confirm			
19.6	The machine, including attachments and accessories, 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			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
20.0	**MACHINE ACCEPTANCE: (Tests/Activities should be Performed by Vendor)**	Vendor to confirm			
20.1	**Tests/Activities to be carried out at supplier's works on the machine in the presence of BHEL Team before dispatch :**				
20.1.1	Geometrical accuracies as per test chart.	Vendor to confirm			
20.1.2	Positioning accuracies as per VDI-DGQ/3441	Vendor to confirm			
20.1.3	**Cutting test** confirming simultaneous 4 axis machining	Vendor to Confirm			
20.1.4	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 confirm			
20.1.5	Thermal growth of spindle in ram face shall be inspected and presented after endurance test	Vendor to confirm			
20.1.6	Demonstration of all features of the machine, control system & accessories	Vendor to confirm			
20.1.7	**Demonstration** of all features & options of machine, accessories etc	Vendor to confirm			
20.1.8	**Presentation** of all original certificates, documents,reports, manuals of OEMs of all supplied connected to the machine	Vendor to confirm			
20.1.9	All necessary tools, instruments and materials for above tests are to the arranged by bidder				
20.1.10	Machining of **test piece as per NAS/AFNOR/ISO**. Test piece will be supplied by BHEL.	Vendor to confirm			
20.2	**Tests/Activities should be carried out at BHEL works while commissioning the machine :**				
20.2.1	Geometrical accuracies as per test chart.	Vendor to confirm			
20.2.2	Positioning accuracies as per VDI-DGQ/3441	Vendor to confirm			
20.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to confirm			
20.2.4	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 confirm			
20.2.5	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 confirm			
20.2.6	Machining test piece as per NAS/AFNOR/ISO. Test piece will be supplied by BHEL.	Vendor to confirm			
20.2.7	Proveout machining.	Vendor to confirm			
20.2.8	Job prove out machining should also include the prove out of time furnished by vendors for the specified components	Vendor to confirm			
20.2.9	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 confirm			
20.2.10	Demostration by actual use of all supplied attachments and accessories to their full capacity.	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
21.0	**PACKING:**				
21.1	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			
22.0	**Warranty**				
22.1	12 months from the date of acceptance of the machine.	Vendor to confirm			
22.2	The bidder shall clearly spell out in the offer the facilities available with him or his agent for providing adequate after-sales service in India during the warranty period. The complete details such as organization for after-sales service, availability of technically competent engineers and warehousing facilities for spares shall be clearly indicated. **Bidders not offering complete servicing/repair facilities in India to ensure quick response to maintenance/servicing calls are not likely to be considered.**	Vendor to confirm			
22.3	Bidders who are OEM, shall undertake to supply spare parts for a period of expected life of the machine. **Alternatively bidders shall also submit undertaking from OEM for supply of spare parts for a period of expected life of the machine**	Vendor to confirm			
23.0	**GENERAL :**				
23.1	Machine Model	Vendor to specify			
23.2	Total connected load (KVA):	Vendor to specify			
23.3	Floor area required (Length, Width, Height) for complete machine & accessories	Vendor to specify			
23.4	Painting of Machine / Electrical Panels : RAL 6011 Apple Green (Polyurethane Paint)	Vendor to confirm			
23.5	Total weight of the machine	Vendor to specify			
23.6	Weight of heaviest part of machine	Vendor to specify			
23.7	Weight of the heaviest assembly / sub-assembly of the Machine	Vendor to specify			
23.8	Dimensions of largest part/ sub-assembly/ assembly of the machine	Vendor to specify			
23.9	Vendor to submit, along with offer, reference list of customers where similar machines have been supplied mentioning broad specifications of the supplied machine i.e. Model, Table diameter, Load Capacity, Maximum Turning Diameter, Max Turning Height, Main Drive Rating, CNC System etc	Vendor to confirm			
23.10	Detailed catalogues , sketch/ photographs of the m/c and accessories/ attachments should be submitted with the offer.	Vendor to confirm			
23.11	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			
23.12	**Access ladder and Maintenance platform should be provided on one of the Columns.**	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
24	**Standard Accessories (Must be supplied along with machine)**				
24.1	Tool holders/attachments :	Vendor to specify			
24.2	Hyper mill or equivalent CAM software (latest version) along with postprocessor with perpetual license.	Vendor to specify			
24.3	CAM software shall have all relevant modules for milling operation by interpolation of 4 axes and contour turning	Vendor to specify			
24.4	The supply of the software shall be sourced from India.	Vendor to specify			
24.5	Prove out on a mutually agreed component covering all the features of the machine. Responsibility of proveout lies with Bidder and Software Supplier	Vendor to Confirm			
24.6	Two weeks training on the software has to be provided by the software provider	Vendor to Confirm			
24.7	Modules to be covered				
24.8	HyperCAD-S or equivalent- Gemoetrical Engine (Surface & Curves)	Vendor to Confirm			
24.9	HyperMILLEXPERT or equivalent :2D, 3D and 3D Advanced Milling Cycles, Drilling Cycles, Multi Axis Machining)	Vendor to Confirm			
24.10	HyperMILL MAXX Machining or equivalent - Roughing (HPC)	Vendor to Confirm			
24.11	Turning	Vendor to Confirm			
24.12	Milling	Vendor to Confirm			
24.13	TurnMill	Vendor to Confirm			
24.14	5X Drilling	Vendor to Confirm			
24.15	5X Automatic indexing	Vendor to Confirm			
24.16	Cavity Bundle (5X Profile Finishing,5X Z-Level Finishing,5X Equidistant Finishing,5X Rest Machining,5X Freepath Machining,5X Rework)	Vendor to Confirm			
24.17	Surface Bundle (5X ISO Top Milling, 5X Top Milling Multi surfaces, 5X SWARF Cutting, 5X Contouring, 5X Shape level roughing/Finishing)	Vendor to Confirm			
24.18	4 Axis Post Processor for indexing & simultaneous	Vendor to Confirm			
24.19	4 Axis Machine Model simulation (with 3D model of the machine)	Vendor to Confirm			
24.20	Installation of all software mentioned in the Scope of Supply are to be installed during on-site training sessions itself	Vendor to Confirm			
24.21	Dedicated colour monitor 19" (or bigger size) fixed on side/top of main switchboard panel or near operator panel	Vendor to Confirm			
24.22	Necessary software to view and zoom the real time images from the camera has to be installed in the PC and CD of software shall be supplied.	Vendor to Confirm			
24.23	First fill of oil& grease	Vendor to specify			
24.24	Suitable Workstation for operation of CAM software defined in this section.	Vendor to specify			
24.25	Any relevant accessory pertaining to machinesafe/ operation /maintenance shall also be quoted.	Vendor to specify			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
25	**Others**				
25.1	The bidder shall have requisite facilities for manufacture/testing and inspection as per international standards.	Vendor to Confirm			
25.2	Details of the foundation of the company, its financial stability and its turnover shall be provided.	Vendor to specify			
25.3	Consumable & list of deliverables shall be included in scope of supply. In case of foreign suppliers, Indian equivalent of oil, grease & other consumables (supplied along with the machine) shall be mentioned with complete technical specifications, bidder addresses and contact persons details.	Vendor to specify			
25.4	Complete address, contact person, telephone number and fax number of original manufacturer of the equipment.	Vendor to specify			
25.5	The bidders shall provide a comprehensive list of the OEM components used in the machine. The offer shall include the technical brochure indicating clearly the model used for each part / component.	Vendor to specify			
25.6	Technical leaflet and write-up of equipment and CNC system must be furnished by the applicant along with the quotation.Bids without catalogue for the offered machine shall not be considered.	Vendor to Confirm			
25.7	In case there is a mismatch between technical offer and standard catalogue value, BHEL reserve right to chose the final value for the comparison	Vendor to Confirm			
25.8	The manufacturer has to provide a compliance matrix mentioning point by point given in the specification. It will be assumed that points are acceptable to you if not given an objection/clarification on the point. Final specification in the purchase order will be based on the compliance matrix provided by the party and the party have to satisfy all the points in the specification at the time of supply and installation of the machine.	Vendor to Confirm			
25.9	The bid MUST contain clear, direct, required, actual information with respect to the tender specification/clauses. Descriptive data or words viz complied, confirmed are not acceptable for the numerical data. Offers violating these will be treated as rejected.	Vendor to Confirm			
25.10	Relevant proof / supplementary document for the compliances shall be furnished along with the offer.Party have to satisfy all these points in the specification at the time of supply and installation of the machine.	Vendor to Confirm			
25.11	The price bid shall be quoted for basic machine,recommended spares, standard accessories, optional accessories, etc explicitly.Split-up cost details may be inside each section of quoted price.**Optional accessories & recommended spares cost not to be taken for price bid evaluation**.	Vendor to Confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
26	**QUALIFYING CONDITIONS :**				
26.1	**a)** Only those vendors (OEMs) should quote who have commissioned in the past **(10) years** ***(on the date of opening of Tender)*** at least **two CNC VERTICAL TURN MILL CENTRE** of same or higher sizes (Table diameter, Load Capacity, Max Turning Height) **to Aerospace industries** and capable of achieving machining accuracies as required in proveout component mentioned at **clause no. 20**(Accuracies for Proveout components) either (i) in at least one country other than the country from where the machine tool will be supplied to establish vendor's (OEM's) global business activity or (ii) in India ; and the referred machine is presently working satisfactorily for more than **one year after** commissioning (on the date of opening of Tender). The vendor should have experience of manufacturing & supplying CNC machines with Hydrostatic Guideways and/or Hydrostatic Rotary Table *(as applicable for tendered machine)* in the past ten years (on the date of opening of Tender) and should submit proof of the same. **b)** However, such Indian machine tool vendors (OEMs), who do not meet specified qualifying conditions, *can quote* if they have running Collaboration/ Joint Venture/ Joint Working Arrangement for manufacture of CNC VERTICAL TURN MILL CENTRE of same or higher sizes (Table diameter, Load Capacity, Max Turning Height) with foreign machine tool manufacturer , who meets specified qualifying conditions. Such Indian machine tool vendors (OEMs) shall have to submit from their foreign partner a back to back guarantee for satisfactory performance of the offered machine in compliance to all specified tender requirements. BHEL reserves the right to accept or reject the OEMs based on the assessment of their technical and financial capability. In respect of Indian vendors (OEMs) against **(b)** above, BHEL reserves the right to accept or reject both the Indian vendors (OEMs) & their Foreign Partners based on the assessment of their technical and financial capability.	Vendor to confirm			

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
26.2	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.				
	1. Name of the customer / company where referred machine is installed.	Vendor to inform			
	2. Complete postal address of the customer.	Vendor to inform			
	3. Month & Year of commissioning	Vendor to inform			
	4.Parameters of machine supplied and application for which the machine is supplied	Vendor to inform			
	5. Name and designation of the contact person of the customer.	Vendor to inform			
	6. Phone, FAX no. and email address of the contact person of the customer.	Vendor to inform			
	7. Performance certificate from the customers regarding satisfactory performance of machine supplied to them (Original Certificate or through E-mail directly from the customer). The original performance certificate may be returned after verification by BHEL, if required.	Vendor to submit			
	8. BHEL reserves the right to verify the information provided by the Vendor for the referred machine at their referred customer's works including machining accuracies. It shall be the responsibility of the vendor to facilitate the visit of BHEL's team at their referred customer works .The Travel and Boarding expenses for BHEL Personnel shall be borne by BHEL. In case the information provided by vendor is found to be false/ incorrect, the offer shall be rejected.	Vendor to accept & confirm			
27.0	**OTHER FEATURES:**				
27.1	**NETWORKING:**				
27.1.1	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. The networking should have following capabilities.				
	a) The machine shall appear as a node in the Entire Network. (Network Neighborhood)				
	b) 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.				
	c) The program transfer between CNC system and network should also be possible in CNC Mode.				
27.2	**MACHINE MONITORING SYSTEM (MMS) SIGNALS**				
27.2.1	Following MMS signals would be made available on a specifically earmarked terminal strip. These MMS signals would be sourced from a SIMATIC S-7 PLC output card separately.				
	a) Control ON				
	b) Cycle ON				
	c) Spindle Running				
	d) Feed Active (Any of the axes moving)				
	e) M30 (Program Stop)				

Purchase, Materials Management,
Bharat Heavy Electricals Limited,
Boiler Auxiliaries Plant, Ranipet - 632 406, **INDIA.**
(A Government of India Undertaking)
Enquiry Number: 2791301E/30.01.2020
Revision 01

Item Annexure for Enquiry no 2791301E/30.01.2020

Sl no	Material Code	Item Description	Quantity (No)	Quoted/ Not Quoted
1	CA8367280004	Supply of Double Column Vertical Turn Mill Centre--04 axis, 05 meter as per technical specification	01	
2	----------	Erection & Commissioning of Double Column Vertical Turn Mill Centre--04 axis, 05 meter as per technical specification	01	
3	CA8367280005	Supply of Double Column Vertical Turn Mill Centre--04 axis, 03 meter as per technical specification	01	
4	----------	Erection & Commissioning of Double Column Vertical Turn Mill Centre--04 axis, 03 meter as per technical specification	01	

Sl no 01 & 02 will be evaluated together as Package 1 and Sl no 03 & 04 will be evaluated together as Package 02.

Signature and Office Seal of Vendor

Purchase, Materials Management,
Bharat Heavy Electricals Limited,
Boiler Auxiliaries Plant, Ranipet - 632 406, **INDIA.**
(A Government of India Undertaking)
Enquiry Number: 2791301E/30.01.2020
Revision 01

PRICE SCHEDULE FORMAT FOR SUPPLY AND ERECTION & COMMISSIONING OF DOUBLE COLUMN VERTICAL TURN MILL CENTRE-04 AXIS, *05 METER* AS PER TECHNICAL SPECIFICATION

(FOR FOREIGN SUPPLIERS only)

A: MAIN ITEMS: (Pl mention the currency)

Sl. No	Description	Unit Price
0	Quoted currency::	
1	**C&F Price of** Supply of Double Column Vertical Turn Mill Centre--04 axis, 05 meter as per technical specification **including P&F and Freight from port of origin to Chennai Port, India.**	
2	**Insurance (from Port of Origin to BHEL Ranipet, India)**	**BHEL Scope**
3	**CIF Price** (Including Cost, Insurance , P&F and Freight) **(Total of Sl.No. 1+2)**	**BHEL to calculate**
4	**Net Effective Custom Duty (applicable on CIF)**	**BHEL Scope**
5	Inland freight from Chennai Port to BHEL Stores, Ranipet, India	**BHEL Scope**
6	GST on (sl no 05) inland freight	**BHEL Scope**
7	Total Price including Customs Duty, Inland Freight and GST **(Total of Sl.No. 3+4+5+6)**	**BHEL Scope**
8	GST credit on inland freight	**BHEL Scope**
9	Any other charges (if applicable) will be loaded on all suppliers	**BHEL Scope**
10	**Total Price after availing credit of GST credit on inland freight (Sl.No: 7-8+9)**	**BHEL to calculate**

B: Services:(Pls mention the currency)

Sl.No	Description	Price (Currency)
1	Charges for Erection & Commissioning of Double Column Vertical Turn Mill Centre--04 axis, 05 meter as per technical specification	
2	Charges for Training within India	
3	Total cost for services (B1+B2)	

Total cost = A10 + B3 in words (in English)	

C: OPTIONAL ITEMS: (not to be considered for bidder ranking evaluation)

Sl. No	Description	Price (Currency)
1	Recommended spares (List of recommended spares to be attached separately with individual price)	
2	Optional Accessories (List of optional accessories to be attached separately with individual price)	

Note: Total cost to BHEL shall be considered for evaluation purpose as given below:
For imported equipment, total cost = A10 **+** B3 + LC opening Charges.
The Price bid should be submitted only as per the above format. No row shall be left blank. Please indicate "Not Applicable" explicitly, in case the price for a particular line item is not applicable.

Purchase, Materials Management,
Bharat Heavy Electricals Limited,
Boiler Auxiliaries Plant, Ranipet - 632 406, **INDIA.**
(A Government of India Undertaking)
Enquiry Number: 2791301E/30.01.2020
Revision 01

PRICE SCHEDULE FORMAT FOR SUPPLY AND ERECTION & COMMISSIONING OF DOUBLE COLUMN VERTICAL TURN MILL CENTRE-04 AXIS, *05 METER* AS PER TECHNICAL SPECIFICATION

(FOR INDIAN BIDDERS only)

A: MAIN ITEMS: (Currency will be INR only)

Sl. No	Description	Unit Price in INR
1	**FOR destination (BHEL Stores, Ranipet) Price of** Supply of Double Column Vertical Turn Mill Centre--04 axis, 05 meter as per technical specification including P&F and freight.	
2	**GST on 1 (pl specify in terms of % FOR destination Price)**	
3	**Insurance (From Supplier works to BHEL Ranipet)**	
4	**TOTAL Price (Sum of 1 + 2 + 3)**	
5	**GST Credit (for Sl.No.2)**	
6	**Total Price after removal of GST Credit (Sl.No.4-5)**	**BHEL to calculate**

B: Services:(Pls mention the currency)

Sl.No	Description	Price in INR
1	Charges for Erection & Commissioning of Double Column Vertical Turn Mill Centre--04 axis, 05 meter as per technical specification	
2	Training Charges	
3	**GST on 1 & 2 (pl specify in terms of % FOR destination Price)**	
4	**GST Credit (for Sl.No.3)**	
5	Total cost for services (B1+B2+B3-B4)	

Total cost = A6 + B5 in words (in English)	

C: OPTIONAL ITEMS: (not to be considered for bidder ranking evaluation)

Sl. No	Description	Price in INR
1	Recommended spares (List of recommended spares to be attached separately with individual price)	
2	Optional Accessories (List of optional accessories to be attached separately with individual price)	

Note: Total cost to BHEL shall be considered for evaluation purpose as given below:
For imported equipment, total cost = A6 + B5.
The Price bid should be submitted only as per the above format. No row shall be left blank. Please indicate "Not Applicable" explicitly, in case the price for a particular line item is not applicable.

Purchase, Materials Management,
Bharat Heavy Electricals Limited,
Boiler Auxiliaries Plant, Ranipet - 632 406, **INDIA.**
(A Government of India Undertaking)
Enquiry Number: 2791301E/30.01.2020
Revision 01

PRICE SCHEDULE FORMAT FOR SUPPLY AND ERECTION & COMMISSIONING OF DOUBLE COLUMN VERTICAL TURN MILL CENTRE-04 AXIS, *03 METER* AS PER TECHNICAL SPECIFICATION

(FOR FOREIGN SUPPLIERS only)

A: MAIN ITEMS: (Pl mention the currency)

Sl. No	Description	Unit Price
0	Quoted currency::	
1	**C&F Price of** Supply of Double Column Vertical Turn Mill Centre--04 axis, 03 meter as per technical specification **including P&F and Freight from port of origin to Chennai Port, India.**	
2	**Insurance (from Port of Origin to BHEL Ranipet, India)**	**BHEL Scope**
3	**CIF Price** (Including Cost, Insurance , P&F and Freight) **(Total of Sl.No. 1+2)**	**BHEL to calculate**
4	**Net Effective Custom Duty (applicable on CIF)**	**BHEL Scope**
5	Inland freight from Chennai Port to BHEL Stores, Ranipet, India	**BHEL Scope**
6	GST on (sl no 05) inland freight	**BHEL Scope**
7	Total Price including Customs Duty, Inland Freight and GST **(Total of Sl.No. 3+4+5+6)**	**BHEL Scope**
8	GST credit on inland freight	**BHEL Scope**
9	Any other charges (if applicable) will be loaded on all suppliers	**BHEL Scope**
10	**Total Price after availing credit of GST credit on inland freight (Sl.No: 7-8+9)**	**BHEL to calculate**

B: Services:(Pls mention the currency)

Sl.No	Description	Price (Currency)
1	Charges for Erection & Commissioning of Double Column Vertical Turn Mill Centre--04 axis, 03 meter as per technical specification	
2	Charges for Training within India	
3	Total cost for services (B1+B2)	

Total cost = A10 + B3 in words (in English)	

C: OPTIONAL ITEMS: (not to be considered for bidder ranking evaluation)

Sl. No	Description	Price (Currency)
1	Recommended spares (List of recommended spares to be attached separately with individual price)	
2	Optional Accessories (List of optional accessories to be attached separately with individual price)	

Note: Total cost to BHEL shall be considered for evaluation purpose as given below:
For imported equipment, total cost = A10 **+** B3 + LC opening Charges.
The Price bid should be submitted only as per the above format. No row shall be left blank. Please indicate "Not Applicable" explicitly, in case the price for a particular line item is not applicable.

Purchase, Materials Management,
Bharat Heavy Electricals Limited,
Boiler Auxiliaries Plant, Ranipet - 632 406, **INDIA.**
(A Government of India Undertaking)
Enquiry Number: 2791301E/30.01.2020
Revision 01

PRICE SCHEDULE FORMAT FOR SUPPLY AND ERECTION & COMMISSIONING OF DOUBLE COLUMN VERTICAL TURN MILL CENTRE-04 AXIS, *03 METER* AS PER TECHNICAL SPECIFICATION

(FOR INDIAN BIDDERS only)

A: MAIN ITEMS: (Currency will be INR only)

Sl. No	Description	Unit Price in INR
1	**FOR destination (BHEL Stores, Ranipet) Price of** Supply of Double Column Vertical Turn Mill Centre--04 axis, 03 meter as per technical specification including P&F and freight.	
2	**GST on 1 (pl specify in terms of % FOR destination Price)**	
3	**Insurance (From Supplier works to BHEL Ranipet)**	
4	**TOTAL Price (Sum of 1 + 2 + 3)**	
5	**GST Credit (for Sl.No.2)**	
6	**Total Price after removal of GST Credit (Sl.No.4-5)**	**BHEL to calculate**

B: Services:(Pls mention the currency)

Sl.No	Description	Price in INR
1	Charges for Erection & Commissioning of Double Column Vertical Turn Mill Centre--04 axis, 03 meter as per technical specification	
2	Training Charges	
3	**GST on 1 & 2 (pl specify in terms of % FOR destination Price)**	
4	**GST Credit (for Sl.No.3)**	
5	Total cost for services (B1+B2+B3-B4)	

Total cost = A6 + B5 in words (in English)	

C: OPTIONAL ITEMS: (not to be considered for bidder ranking evaluation)

Sl. No	Description	Price in INR
1	Recommended spares (List of recommended spares to be attached separately with individual price)	
2	Optional Accessories (List of optional accessories to be attached separately with individual price)	

Note: Total cost to BHEL shall be considered for evaluation purpose as given below:
For imported equipment, total cost = A6 + B5.
The Price bid should be submitted only as per the above format. No row shall be left blank. Please indicate "Not Applicable" explicitly, in case the price for a particular line item is not applicable.

Important Points to note while submitting offer: -

1. Both machines along with respective E&C charges (Material code: - CA8367280004 & CA8367280005) will be procured as an individual package.

This is a conventional Tender (hard Copy Submission) not through EPS. Sealed tenders super-scribed with Tender Number, Due Date, Item Name & Supplier's Name shall be addressed to Manager / Purchase dept., Bharat Heavy Electricals Limited,

Ranipet – 632 406, Tamil Nadu, INDIA, so as to reach him on or before the date and time specified in the tender. It shall contain Three separate sealed covers as under: -

a. Sealed envelope super-scribed Cover I (EMD), with Tender Number, Item Name, Tender Due Date & Name of the Supplier
b. Sealed envelope super-scribed "Cover II – "Technical-Commercial Bid", with Tender Number, Item Name, Tender Due Date & Supplier's Name and
c. Sealed envelope super-scribed Cover III (Price bid), with Tender Number, Item Name, Tender Due Date & Name of the Supplier.

2. Price bid of each machine to be submitted in separate sealed cover.
3. Documents to be attached in Technical Cover: - Complete Technical Bid, PQR, Annexure-A, Annexure-B, Annexure-F, Unpriced Bid and Integrity Pact copy.
4. Documents to be attached in EMD Cover: - Only EMD.
5. Documents to be attached in Price Cover: - Only Price (Price bid of each machine to be submitted in separate sealed cover).
6. Technical Cover and EMD cover will be opened together on due date & time and Price bid will be opened later with information to techno-commercially supplier.