

PART A

1 of 4

CNC VERTICAL BORING MACHINE – TABLE Ø 4000**SECTION – I : QUALIFYING CRITERIA**

The BIDDER has to compulsorily meet the following requirements to get qualified for considering the technical offer for the CNC VERTICAL BORING MACHINE – TABLE Ø 4000.

S. No.	REQUIREMENTS	VENDOR'S RESPONSE
1	<p>Only those vendors (OEMs), who have supplied and commissioned at least ONE CNC VERTICAL Boring Machine of Table Diameter 4000 mm or higher and load carrying capacity 40 Tons or more and Height of turning 3500 mm or more in the past ten years (from the date of opening of Tender) and such machine is presently working satisfactorily for more than one year after commissioning (from the date of opening of Tender) should quote.</p> <p>However, if such machine had already been supplied to BHEL, then that machine should be presently working satisfactorily for more than six months after its commissioning and acceptance (from the date of opening of Tender).</p>	
The vendor should submit following information where similar machine has been supplied for qualification of their offer.		
1.1	Name and postal address of the customer or company where similar machine is installed.	
1.2	Name and designation of the contact person of the customer.	
1.3	Phone, FAX no and email address of the contact person of the customer.	
1.4	Month and Year of commissioning of the machine.	
1.5	Application for which the machine is supplied	
1.6	Performance certificate from the customer regarding satisfactory performance of machine supplied to them.	
2.0	BHEL reserves the right to verify the information provided by vendor. In case the information provided by vendor is found to be false/ incorrect, the offer shall be rejected.	

SP

MSR

TR

AA

AVC

SECTION – I I

2 of 4

The BIDDER / VENDOR is requested to provide the following information:

S. No.	REQUIREMENTS	VENDOR's RESPONSE
3.0	The BIDDER/VENDOR to furnish Reference List of Customers, with full address, details of contact person, where CNC VERTICAL BORING MACHINES have been supplied in the past.	
4.0	Specify details of CNC VERTICAL BORING MACHINES supplied to other units of BHEL, if any. (Year of commissioning, Table size, Table weight carrying capacity etc.)	
5.0	Details on SERVICE-AFTER-SALES Set-Up in India including the Address of Agents / Service Centers in South India.	
6.0	Any Additional Data to supplement the manufacturing capability of the BIDDER for the subject equipment.	

SP

MSR

TR

AA

AVC

SECTION – III

The BIDDER to note:

S. No.	PARTICULARS	VENDOR'S RESPONSE
7.0	The BIDDER / VENDOR shall submit the offer in TWO PARTS. 1. Technical Offer [with PART A & PART B] 2. Commercial offer.	
8.0	The Technical Offer shall contain a comparative statement of Technical Specifications demanded by BHEL and Offer Details submitted by the Bidder , against each clause. A just 'CONFIRMED' or 'COMPLIED' or 'YES' or 'NO-DEVIATION' or similar words in the technical comparative statement may lead to disqualification of the Technical Offer.	
9.0	The Technical Offer shall be supported by product Catalogues & Data Sheets and also technical details of Bought-Out-Items with copies of Product Catalogue to the extent possible.	
10.0	The Commercial Offer (given with the Technical Offer) shall contain the Scope of Supply and the Un-Priced Part of the Price-Bid, for confirmation.	
11.0	For obtaining the performance certificate from the customer, a suggestive format is provided in SECTION – IV	

SP

MSR

TR

AA

AVC

SECTION – IV

The performance certificate should be produced **on Customer’s Letter Head.**

PERFORMANCE CERTIFICATE

1. Supplier of the machine		
2. Make & Model of the M/C		
3. Month & Year of Commissioning		
4. Application for which M/C is used		
5	a) Table Size b) WT. Carrying Capacity c) Ram stroke d) CNC System	
6. Performance of the Machine (Strike off whichever is not applicable)		Best in the market / Satisfactory / Good / Average / Not Satisfactory
7. Any Other remarks		
Date:		Signature & Seal of the Authority Issuing the Performance Certificate

SP

MSR

TR

AA

AVC

PART B:SCOPE- SUPPLY, ERECTION & COMMISSIONING OF CNC VERTICAL BORING MACHINE TABLE DIA 4000 COMPLYING WITH SPECIFICATION AS BELOW			
SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
1.0	PURPOSE & WORKPIECE MATERIAL		
1.1	Purpose: (Operations/Jobs involved)	Machining operation details as given in Annexure 2 & 2A.	
1.2	Work Piece Material: (Material detail, Hardness etc.)	Quenched & Tempered steel (Hardness 180-210 BHN) & SS 321.	
2.0	SPECIFICATION:		
2.1	MACHINE CONFIGURATION		
2.2	CAPACITY & SIZE		
2.2.1	Maximum Workpiece Height	3500 mm.	
2.2.2	Maximum Workpiece Diameter	3500 mm.	
2.2.3	Maximum Workpiece Weight	50 T	
2.2.4	Maximum Swing Diameter	Vendor to specify	
2.2.5	Maximum Turning Diameter	3500 mm.	
2.2.6	Minimum Boring Diameter	Vendor to specify	
2.2.7	Maximum Height for Turning	3500 mm.	
2.2.8	Maximum Height for Facing ,Milling &Grinding	3500 mm.	
2.3	TABLE		
2.3.1	Table Diameter	4000mm	
2.3.2	Load Capacity	50 T (Min.)	
2.3.3	Table Speed (Infinitely Variable) / No of Steps	Vendor to specify	
2.3.4	Power of Main Drive (S1 - Continuous Rating) AC	Vendor to specify	
2.3.5	Details of Main Drive viz.Siemens/Indramat/FanucType, Model etc.	Vendor to specify	
2.3.6	No. of Jaws(Hardened)	Four	
2.3.7	Maximum External Clamping Diameter	Vendor to specify	
2.3.8	Minimum External Clamping Diameter	Vendor to specify	
2.3.9	Maximum Internal Clamping Diameter	Vendor to specify	
2.3.10	Minimum Internal Clamping Diameter	Vendor to specify	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.3.11	Clamping Force of each Jaw.	Vendor to specify	
2.3.12	Positions and Dimensions of the Jaws on Table. Chucking Capacity Diagram should be submitted.	Vendor to specify	
2.3.13	Type of Force Multiplier Mechanism used in Jaws should be explained and Drawings should be submitted.	Vendor to specify	
2.3.14	Maximum permissible Cutting Force	Vendor to specify	
2.3.15	Maximum permissible Torque	Vendor to specify	
2.3.16	RPM at which Max. Torque is available.	Vendor to specify	
2.3.17	Table Torque - Speed diagram should be submitted.	Vendor to specify	
2.3.18	Type of Bearing for the Table. Axial hydrostatic. Complete details like bearing diameters, sizes of pockets etc. should be furnished.	Vendor to specify	
2.3.19	Size of T - slots for M24 studs, their position and accuracy. Drawing of Table showing details of the T - slots etc. should be submitted.	Vendor to specify	
2.3.20	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	
2.3.21	Table Loading Diagram should be submitted (Load v / s Distance from Table Center) for uniform as well as for eccentric loading.	Vendor to specify	
2.3.22	Diameter, Depth and Accuracy of Center Bore on Table Top Surface.	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	0.001 RPM	
2.4.3	No. of Indexing Positions for C - Axis	3,60,000	
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 Siemens/Indramat/Fanuc, torque, rating, type, make etc.	Vendor to specify	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.5	CROSS RAIL		
2.5.1	Vertical Travel.	Vendor to specify	
2.5.2	Vertical Traverse Rate.	Vendor to specify	
2.5.3	No. of Positions.	Vendor to specify	
2.4.4	Distance between each Position	Vendor to specify	
2.5.5	Distance of lowest Step from Table Top	Vendor to specify	
2.5.6	Distance of highest Step from Table Top	Vendor to specify	
2.5.7	Maximum Height of Cross Rail bottom from Table Top	Vendor to specify	
2.5.8	Minimum Height of Cross Rail bottom from Table Top	Vendor to specify	
2.5.9	Movement of Cross Rail : Through CNC Program as well as manually by Push Buttons.	Vendor to confirm	
2.5.10	Machine Reference Point should be at Ram Reference Point and it should be updated automatically with movement of Cross Rail.	Vendor to confirm	
2.5.11	Details of crossrail movement	Vendor to specify	
2.6	CROSS RAIL TOOL HEAD and RAM		
2.6.1	No. of Columns	Double	
2.6.2	No. of Rams	One	
2.6.3	Cross - Section of Ram	340X340 mm (Min.)	
2.6.4	Thread Cutting Capacity - maximum Pitch	12mm-Vendor to confirm	
2.6.5	Minimum dia of bore using ram	Vendor to specify	
2.6.6	Clamping details for mounting Turning Tool Holders/Attachments on ram, should be submitted.	Vendor to specify	
2.6.7	Clamping Force Available for clamping of Turning Tool Holders/Attachments.	Vendor to specify	
2.6.8	Mounting of Turning Tool Holders and Attachments - automatic/ manual	Vendor to confirm	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.7	MILLING, BORING and DRILLING SPINDLE		
2.7.1	Machine should be equipped with Milling Spindle provided in the Ram.	Vendor to confirm	
2.7.2	Power of Spindle Drive.	Vendor to specify	
2.7.3	Details of Spindle Drive viz.Siemens/Indramat/FanucType, Model etc.	Vendor to specify	
2.7.4	Spindle Speed (Infinitely Variable).	Vendor to specify	
2.7.5	Power / Torque / Speed Diagram of Spindle Drive should be submitted.	Vendor to specify	
2.7.6	Possibility of Thread Whirling by Helical Interpolation.	Vendor to confirm	
2.7.7	Clamping details for mounting Milling Heads and Attachments should be submitted.	Vendor to specify	
2.7.8	Clamping Force Available for clamping of Attachments.	Vendor to specify	
2.7.9	Mounting of Milling Heads and Attachments should be automatic through Program as well as manually through Push Buttons.	Vendor to specify	
2.7.10	Milling Heads should be equipped with both External and though Spindle Coolant System.	Vendor to confirm	
2.7.11	Tool mounting and Clamping should be automatic through Program as well as manually through Push Buttons.	Vendor to confirm	
2.8	MAIN TRAVERSES		
2.8.1	Vertical Travel of Ram (Z-Axis)	2000 mm	
2.8.2	Horizontal Travel of Ram (+ve X - Axis)	To suit job dia.vendor to specify	
2.8.3	Horizontal Travel of Ram beyond Center of the Table (-ve X - Axis)	150 mm(Min.)	
2.8.4	Maximum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to specify	
2.8.5	Minimum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to specify	
2.8.6	Maximum Distance between Table Top and Vertical Milling Head with Cutter.	Vendor to specify	
2.8.7	Minimum Distance between Table Top and Vertical Milling Head with Cutter.	Vendor to specify	
2.9	MACHINE GUIDEWAYS:		
2.9.1	Width of Cross Rail guideways	Vendor to specify	
2.9.2	Width of column guideways	Vendor to specify	
2.9.3	X & Z guide ways details.	Vendor to specify	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.9.4	Hardness of guideways	Vendor to specify	
2.9.5	Metallic Telescopic Covers of Stainless Steel material should be provided with wipers for all axes guide ways. Provision to avoid mixing of coolant with lubricating/hydrostatic oil should be provided.	Vendor to confirm	
2.10	FEEDS AND DRIVE SYSTEM:		
2.10.1	Cutting feed in X - Axis (Infinitely Variable)	Vendor to specify	
2.10.2	Cutting feed in Z - Axis (Infinitely Variable)	Vendor to specify	
2.10.3	Rapid feed in X - Axis	Vendor to specify	
2.10.4	Rapid feed in Z - Axis	Vendor to specify	
2.10.5	X - Axis Feed Drives / Motors [AC servo motors] Either Siemens/Indrama digital type (detail like model, make, type, rating etc. should be submitted)	Vendor to specify	
2.10.6	Z-Axis Feed Drives / Motors [AC servo motors] Either Siemens/ Fanuc/Indramat digital type (detail like model, make, type, rating etc. should be submitted)	Vendor to specify	
2.10.7	Maximum cutting force permissible on Ram and at what extension	Vendor to specify	
2.10.8	Maximum permissible Cutting Force at Maximum Ram extension	Vendor to specify	
2.10.9	Permissible Cutting Force v / s Ram Projection - Diagram should be submitted.	Vendor to specify	
2.10.10	Feed back system for X & Z axes. Heidenhain linear scales with pressurised compressed air cleaning if required. (Details should be submitted)	Vendor to specify	
2.10.11	Details of backlash free movement mechanism in X & Z axes should be submitted.	Vendor to specify	
2.10.12	Mechanism for locking X & Z axis	Vendor to specify	
2.11	CONSTRUCTION:	Vendor to specify	
2.11.1	Vendor to furnish details of material, hardness & constructional details, including explanatory drawings, of various components/assemblies like Column, Cross Rail, Ram head, Table, Guideways/slides, Feed Transmission system, Ram, Hydraulic and Lubrication system, Feedback system etc .of the machine.	Vendor to specify	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.11.2	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:	Vendor to specify	
2.12.1	It should be independent motorised type, movable / adjustable in vertical and horizontal directions. It should be able to reach almost to center of the Table in horizontal direction. Interlocks should be provided for its horizontal / downward movement against rotating Table and against the job (rotating or stationary) to avoid collision / accident. 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	
2.12.2	Horizontal movement of complete Platform.	Vendor to specify	
2.12.4	Vertical movement of complete Platform to cover total turning height.	Vendor to specify	
2.12.5	Height of Platform Railing.	Vendor to specify	
2.12.6	Weight Capacity of the Platform.	Vendor to specify	
2.12.7	Minimum Position of Platform from Shop Floor.	Vendor to specify	
2.12.8	Movable Chip / Splash Guard should be 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	
2.13	OPERATION AND CONTROL SYSTEM:		
2.13.1	OPERATOR'S PANEL:		
2.13.1.1	Swiveling type operator's panel having complete CNC and machine control system with CRT of required configuration shall be provided on the operators platform. All switches on the Operator's panel including that for table rotation should be within reach of operator of height 5' 6" for convenient, efficient & safe operation. All displays/indications should also be conveniently placed accordingly. Layout showing complete details of the panel should be submitted.	Vendor to furnish	
2.13.1.2	An auxiliary pendant, which can be taken to the table for job setting and similar other purposes, sould be provided.	Vendor to furnish	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.13.2	CNC SYSTEM & FEATURES :		
2.13.2.1	Make :	Siemens/Fanuc	
2.13.2.2	Type : Open Architecture system	Vendor to confirm	
2.13.2.3	Latest version, as available at the time of ordering, should be supplied.	Vendor to specify	
2.13.2.4	Details of Standard features.	Vendor to specify	
2.13.2.5	Details of optional features.	Vendor to specify	
2.13.2.6	The system should have full alphanumeric keyboard, TFT colour display(preferably 15"), additional draw-out type QWERTY Key Board and mouse in suitable enclosure, two numbers RS232C serial interfaces, parallel interface for printer, network ready with LAN, electronic hand wheels for all axes, CD/DVD drive unit for data input/output, hard disk of not less than 80 GB, graphic simulation and preinstalled system software & other required softwares etc.Dry run & Simulation to be included.	Vendor to specify	
2.13.2.7	Provision for automatic safe shut down of CNC Control in case of Power Failure	Vendor to specify	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.13.3	MANUAL CONTROL :		
	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, spindle rpm, Direction of Spindle Rotation, i.e. CW/ CCW, cutting feed and spindle rpm on/off, display of axis position values etc, for manual operation without using CNC program or MDI mode. Diagram/ Sketches for switches/ keys provided on operators pendant to be submitted.	Vendor to furnish	
2.13.4	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 Confirm	
2.13.5	UPS FOR CNC SYSTEM:		
2.13.5.1	UPS of 30 minutes backup for CNC system with inbuilt cooling and charge status display (Battery charging /discharging time should be specified by vendor)	Vendor to furnish	
2.14	MACHINE LIGHTS:		
2.13.1	Machine Lights for sufficient illumination of complete working area on both sides of operator's platform should be provided for clear visibility.	Vendor to specify	
2.13.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to specify	
2.13.3	Any lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to specify	
2.13.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to specify	
2.13.5	Flashing / rotary type End of Cutting and Program Stop Light.	Vendor to Confirm	
2.14	AIR CONDITIONERS:		

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.14 .1	Air Conditioners with Dehumidifiers of suitable / sufficient capacity to be provided for all Electrical / Electronic Panels / Cabinets including Operator's Panel considering specified ambient conditions. Detailed specifications of the same are to be submitted.Make: Rittal / Warner & Finley or any other reputed make acceptable to BHEL. Detailed specifications to be submitted.	Vendor to specify	
2.15	HYDRAULIC SYSTEM :	Vendor	
2.15.1	The System should be centralised. Hydraulic Tank shall preferably be located at floor level.Hydraulic power pack to have minimum number of pipes/pipe joints and usage of manifolds/stacked valves construction preferred.	Vendor to specify	
2.15.2	Latest version of pump,valves,accessories etc. preferably Make Rexroth / Vickers should be used.Seals used shall be Merkel/Freudenberg/Parker/Bushak+Shamban/Hunger/Smrit make. (Details to be submitted)	Vendor to specify	
2.15.3	Power pack should be energy efficient (Hi-low pump system,proper unloading during idling,etc.)Suitable standby pump unit,filter unit etc. shall be provided for critical areas.The pumps should not be kept immersed/inside the tank.	Vendor to specify	
2.15.4	All the pipe/hose fittings shall be of standard weld nipple with o-ring seating type (DIN 3865) and no ferrule joints are to be proposed in the hydraulic system.All threaded connections shall be of Metric size.	Vendor to specify	
2.15.5	Pressure measuring minimess check points(preferably with 1/4 " BSP end) to be provided,wherever required for quick pressure measuring/setting while troubleshooting.One set of handheld minimess pressure gauge with 1-1.5 m length hose to be supplied.	Vendor to specify	
2.15.6	The power pack should be tropicalised for Indian conditions-for 40 deg C ambient temperature.Suitable oil cooling arrangement preferably with oil chiller & Heat Exchanger,considering 3 shift operation and to maintain oil temperature within 50 deg C.	Vendor to specify	
2.15.7	Suitable vibro mounts,compensators,delivery hose between pump and valve block,polypropylene pipe & hose clamps etc are to be provided to minimise the vibration.	Vendor to specify	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.15.8	Oil used shall be ISO Viscosity grade 32/46/68/150 Centi-stokes at 40 deg C.Maximum pressure shall not exceed 310 bar.	Vendor to specify	
2.15.9	Control voltage for all the solenoidss of the valves shall be 24 V DC and all solenoid operated DC valves should have manual over ride position and light indicating.	Vendor to specify	
2.15.10	Suficient number of filter units for the required level of cleanliness is to be provided with clog indicators and preferably with reusable type of filter elements.As an option,a centrifuge/electrostatic filter unit for oil,dust and moisture separation shall be offered.	Vendor to specify	
2.15.11	The pipelines to be painted with standard colours.The supplier shall provide the hydraulic circuit with bill of materils giving complete purchase specifications for each item.	Vendor to specify	
2.15.12	Documentation:Hydraulic circuits,functional diagram,list of O-rings,seals and wipers.Pump layout & piping layout,cross sectional assembly drawing for allcylinderswith all details.Detailed catalogues for all componenents in the system.	Vendor to specify	
2.15.13	First filling of all required Oils & Grease etc. Should be supplied by vendor. Oil grade: ISO VG46 or 68	Vendor to specify	
2.16	COOLANT SYSTEM :	Vendor to specify	
2.16.1	Coolant System with all accessories for following variants shall be provided.	Vendor to specify	
	a) Recirculating Type Flood Coolant System.	Vendor to specify	
	b) Coolant through Spindle	Vendor to specify	
2.16.2	All attachments, tool holders, boring bars, cassettes, adapters etc. shall have the provision so that coolant is available directly at the tool-cutting tip.	Vendor to confirm	
2.16.3	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	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.16.4	Coolant Filtration System: Recirculating type coolant system with Cartridge Type Filtration System and magnetic separator.	Vendor to confirm	
2.16.5	Coolant Flow Diagram showing filters, pumps, valves, tanks etc. to be submitted with the offer.	Vendor to furnish	
2.16.7	Coolant Tank Capacity (min)	Vendor to furnish	
2.16.8	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 furnish	
2.16.9	Coolant pump & motor details for all variants of coolant system are to be submitted with the offer.	Vendor to furnish	
2.16.10	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Vendor to confirm	
2.17	ELECTRICAL SYSTEM :		
2.17.1	415V + 10% / -10%, 50HZ +/- 1.5 HZ, 3 Phase AC (3 wire system with out neutral) Power Supply Source will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All types of cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine/control cabinets, shall be the responsibility of vendor. Requirement of earthing with required material details is to be informed by vendor well in advance so that same could be incorporated during construction of foundation.	Vendor to confirm	
2.17.2	Tropicalisation: All electrical / electronic equipment shall be tropicalized. All control cables should be of copper.	Vendor to confirm	
2.17.3	All electrical & electronic control cabinets & panels should be dust and vermin proof and shall have IP 54 protection.	Vendor to confirm	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
2.17.4	All electrical components in the cabinets should be mounted on DIN Rail	Vendor to confirm	
2.17.5	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	
2.17.6	Motors shall conform to IEC Standards	Vendor to confirm	
2.17.7	All cables moving with traversing axes should be installed in Caterpillar/	Vendor to confirm	
2.17.8	Vendor should ensure the proper earthing for the machine and its peripherals.	Vendor to confirm	
2.17.9	In-cycle hour counter with reset facility is to be included in the offer.	Vendor to confirm	
2.18	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. 2. A detailed list of all alarms / indications provided on machine should be submitted by the supplier. 3. 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. 4. All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations. 5. Emergency Switches at suitable locations as per International Norms should be provided. 6. Oil & water pipe lines should not run with electrical cable in the same tray / trench.	Vendor to confirm	
2.19	ENVIRONMENTAL PERFORMANCE OF THE MACHINE :	Vendor to confirm	
	The Machine shall conform to following factors related to environment :	Vendor to confirm	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
	(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 specify	
	(f) Paint of the machine should be oil / coolant resistant and should not peel off and mix up with coolant.	Vendor to confirm	
3.0	CHIP CONVEYOR :		
3.1	A chip conveyor round the table to carry both short and curly chips efficiently and effectively to the chip bin to be provided on one end of the machine . Two Chips bins of appropriate size of Indian make, with wheels & handle for movement,should also be supplied	Vendor to 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 (to be rust resistant)	Vendor to specify	
3.6	Provision for smooth flow of chips to the conveyor.	Vendor to specify	
3.7	Operation of chip conveyor (forward & reverse) through push buttons on operator's panel and at Chip Conveyor	Vendor to confirm	
3.8	Layout showing location of chip conveyor to be submitted.	Vendor to confirm	
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 confirm	
4.2	Make	M/s NEEL or other make acceptable to BHEL.	
4.3	Model & Rating	Vendor to specify	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
4.4	Spares Package for the Voltage Stabiliser for 2 years working should also be offered with item wise list.	Vendor to specify	
4.5	Catalogue of the Voltage Stabiliser shall be submitted with the offer.	Vendor to furnish	
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 confirm	
5.2	Make	M/s NEEL or other make acceptable to BHEL.	
5.3	Model and Rating	Vendor to specify	
5.4	Spares Package for the Ultra Isolation Transformer for 2 years working should also be offered.	Vendor to specify	
5.5	Catalogue of the Ultra Isolation Transformer shall be submitted with the offer.	Vendor to furnish	
6.0	PNEUMATIC SYSTEM:		
6.1.	COMPRESSED AIR POINTS: BHEL will provide compressed air at 60 to 70 psi pressure (which is not 100 % dry) at one point near the machine. The vendor shall indicate the inlet pipe size and location for compressed air in the layout drawing of the machine.	Vendor to confirm and specify.	
6.2.	Vendor to provide required pressure booster and suitable air drier (refrigerant type / electrical heater type) to maintain the air quality as per requirement of the machine.	Vendor to confirm and provide the details of the air control equipments used.	
7.0	TOOLINGS:		
7.1	Complete Description of offered Tooling System	Vendor to specify	
7.2	All cutting tools, tool holders, arbors, boring bars, clamping elements, inserts etc recommended for machining of prove out components as given in Annexure 2 & 2A shall be listed out & quoted separately.	Vendor to furnish	
8.0	MEASURING SYSTEMS:		

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
8.1	Automatic job measuring system, comprising of Spindle Mounted Renishaw make Wireless system, with measuring cycles, calibration system and all types of probes/ stylii required for measuring all machined dimensions of the prove-out components. Vendor to furnish detailed description of the system along with offer.	Vendor to offer	
8.2	Automatic Tool Offset measuring system with measuring cycles, calibration 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 offer	
9.0	DIAGNOSTIC SYSTEM:		
9.1	TELE-DIAGNOSTIC SERVICE :		
9.1.1	Tele-diagnostic service should be provided through International telephone lines along with required Hardware / Software package for the supplied CNC system for remote diagnosis and correction of the problems in both CNC System and PLC of the machine.COM port for telediagnosics, This should be provided free of charge for the guarantee period. Terms and conditions for the service after guarantee period should be informed by vendor. Subsequently, it should be possible to use other platforms, such as Internet or ISDN, subject to their availability in future.	Vendor to give as optional with separate quote	
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. On line ladder/STL display of PLC programme should be possible directly on screen or through laptop.	Vendor to offer	
9.3	Help guide should be provided to use both diagnostic systems	Vendor to offer	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
10.0	LEVELING & ANCHORING SYSTEM		
10.1	Complete anchoring system including foundation bolts, anchoring materials, fixators, leveling shoes etc shall be supplied for the Machine, Rotary Table, Floor Plates etc.	Vendor to offer	
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 offer	
11.2	Test mandrel for checking spindle run-out & alignment should be supplied	Vendor to offer	
12.0	ACCESSORIES:		
12.1	AUTOMATIC ATTACHMENT CHANGER (AAC):	Vendor to quote as optional	
12.1.1	All attachments shall be suitable for loading / unloading through AAC	Vendor	
12.1.2	No. of storage positions	Vendor	
12.1.3	Location of the attachment changer	Vendor	
12.1.4	Mounting plates as required for attachments should be supplied	Vendor	
12.1.5	Attachment selection method	Random	
12.1.6	Maximum Permissible Weight on each Position.	Vendor	
12.1.7	Maximum Permissible Weight on Complete AAC.	Vendor	
12.2	CNC UNIVERSAL MILLING HEAD:		
12.2.1	Power	30 Kw(Min.)	
12.2.2	Max torque	Vendor	
12.2.3	Speed Range (Infinitely Variable)	Vendor	
12.2.4	Tool Shank / Spindle taper	Vendor	
12.2.5	Automatic Swiveling through program as separate axis through AC servo motor	+ 90 degree to - 90 degree in Vertical Plane	
12.2.6	Minimum increment for Automatic Swiveling	0.001 degree	
12.2.7	Swiveling accuracy	+ / - 10 seconds.	
12.2.8	Tool Clamping Force	Vendor	
12.2.9	Tool Clamping -automatic/manual	Vendor to confirm	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
12.2.10	Maximum Cutter Diameter	Vendor	
12.2.11	Maximum Cutter Weight	Vendor	
12.2.12	Max. Height for milling with universal milling head	Vendor	
12.2.13	Power - Torque - Speed Diagram	Vendor	
12.2.14	Dimensional details & Weight of the head	Vendor	
12.2.15	Coolant system: Internal (thru spindle) & External coolant with requisite flexible pipes on its snout	Vendor	
12.2.16	Pull Stud for mounting the Head and for mounting the Tools in the taper of the Head shall be supplied by the vendor.	Vendor	
12.3	GRINDING ATTACHMENT:	Required.	
12.3.1	Suitable Grinding Attachment should be offered for Cylindrical (Internal & External both) as well as Surface Grinding. Attachment should grind ID as per Detail-A / Annexure2.		
12.3.2	Power	Vendor to specify	
12.3.3	Speed (Infinitely Variable)	Vendor to specify	
12.3.4	Details of the Drive viz. Make, Model etc.	Vendor to specify	
12.3.5	Power - Torque - Speed Diagram	Vendor to specify	
12.3.6	Maximum Diameter of the Wheel	Vendor to specify	
12.3.7	Minimum Diameter of the Wheel	Vendor to specify	
12.3.8	Width of the Wheel	Vendor to specify	
12.3.9	Provision of the Wheel Dressing	Vendor to specify	
12.3.10	Position of the Wheel Dresser. Drawing should be submitted.	Vendor to specify	
12.3.11	Vendor to confirm that sufficient protection for bearings, Guide Ways etc.	Vendor to specify	
12.3.12	Dimensional Details and Weight of Grinding Attachment	Vendor to specify	
13.0	SPARES:	Vendor to specify	
13.1	Itemised breakup of mechanical, hydraulic, electrical and electronic spares used on the machine in sufficient quantity as per recommendation of Vendor for 2 years of trouble free operation on three shifts continuous running basis should be offered by vendor. The list to include following, in addition to other recommended spares: (Unit Price of each item of spare should be offered)		
	a) Mechanical & Hydraulic Spares: All types of Pumps, Valves, Pressure Switches, Transducers, Flow Switches, Filters, Seals, O-rings, Hydraulic Hoses etc.		

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
	b) Electrical /Electronic / CNC Spares: All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch, Encoders, Scanning Heads for Linear Scales, MMC module, NCU module, Operator's panel with Display Unit, I/O Cards for PLC, Servo Motors for Feed Drives, Power Module & Control Cards for Main Drive as well as Feed Drives etc.		
13.2	All types of spares for total machine and accessories should be available for atleast 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 specify	
13.3	Recommended set of spares for all attachments are to be offered with details.	Vendor to specify	
13.4	Vendor to confirm that complete list of spares for machine and accessories, along with specification / type / model, and name & address of the spare supplier shall be furnished along with documentation to be supplied with the machine	Vendor to confirm	
14.0	DOCUMENTATION : Three sets of following documents (Hard copies) in English language should be supplied along with the machine	Vendor	
14.1	Operating manuals of Machine & CNC system	Vendor	
14.2	Programming Manuals of Machine & CNC system	Vendor	
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 ,major&critical dimensions,weight etc.	Vendor	
14.4	Maintenance, Interface & commissioning manuals for CNC system, spindle & feed drives.	Vendor	
14.5	Manufacturing drawings for all supplied tool holders, coolant connections, adapters, sleeves, fixtures etc.	Vendor	
14.6	Catalogues, O&M Manuals of all bought out items including drawings,wherever applicable.	Vendor	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
14.7	Detailed specification of all rubber items and hydraulic/lube fittings	Vendor	
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	
14.9	PLC program print-outs with comments in English.	Vendor	
14.10	PLC program on CD,CNC data & PLC data on floppy.	Vendor	
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	
14.12	Complete Master List of parts used in the machine shall be submitted by the vendor.	Vendor	
14.13	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor	
15.0	TRAINING	Vendor	
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	
15.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	Vendor	
15.3	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel.	Vendor	
15.4	Vendor to quote for training on man / week basis	Vendor	
15.5	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	
16.0	FOUNDATION :		

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
16.1	Vendor shall submit the preliminary layout drawing for getting BHEL's approval within one month from the date of Letter of Intent (LOI) / P.O. whichever is earlier. Soil condition data will be furnished by BHEL along with the approval. Complete Foundation Design including details viz. static / dynamic load details etc. and Final Layout drawings shall be submitted by the supplier within three months after getting BHEL's approval. The layout should consist of all requirements 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. Vendor should arrange equipments required for the testing of foundation, if required by the vendor.	Vendor	
17.0	ERECTION & COMMISSIONING		
17.1	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	
17.2	Erection & Commissioning of Voltage stabilizer, Isolation Transformer & Air Compressor shall also be responsibility of the vendor.	Vendor	
17.3	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at clause 21 (Machine Acceptance) shall form part of the commissioning activity.	Vendor	
17.4	Test mandrel for checking run-out/taper & alignment should be supplied	Vendor to confirm	
17.5	Tools, Tackels, Test Mandrels, instruments and other necessary equipment including Laser equipment required to carry out all above activities should be brought by the supplier. .	Vendor to confirm	
17.6	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to confirm	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
17.7	All Cover Plates required for the machine and its peripherals including pits, if any, shall be supplied and installed by the vendor. The plates should be sourced from India	Vendor to confirm	
17.8	Portion, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection should be repainted and merged with the original surrounding paint by the vendor. For this purpose, the vendor should supply sufficient quantity of touch-up paint of various colours of paint used.	Vendor to confirm	
17.9	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to confirm	
17.10	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	
18.2	MACHINE POSITIONING ACCURACIES & REPEATABILITY:		
18.2.1	Positioning accuracy in X axis (Pa) per 1000 mm	+/- 0.016 mm	
18.2.2	Positioning accuracy in Z axis (Pa) per 1000 mm	+/- 0.016 mm	
18.2.3	Positioning accuracy Pa for C-axis	Vendor to specify	
18.2.4	Repeatability in X axis (Ps)	+/-0.008 mm	
18.2.5	Repeatability in Z axis (Ps)	+/-0.008 mm	
18.2.6	Repeatability in C axis (Ps)	Vendor to specify	
18.2.7	Total positioning error along X & Z axes per 1000 mm (P)	Vendor to specify	
18.2.8	Total positioning error along X & Z axes over entire traverse (P)	Vendor to specify	
19.0	AMBIENT CONDITIONS & THERMAL STABILITY :		

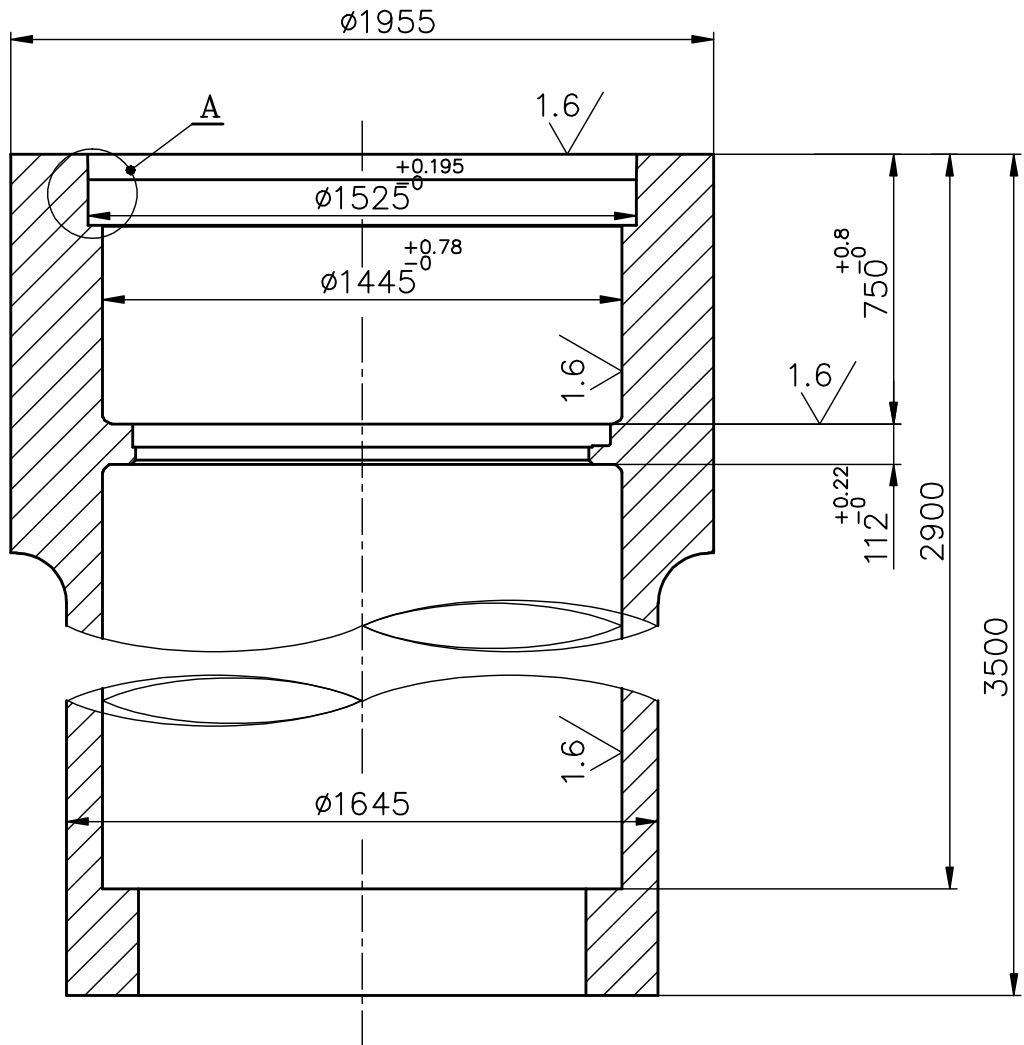
SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
20.1	Drawings of proveout components are enclosed. Vendor to submit preliminary process, time study & tool list recommended by them along with the offer. Change in process/tools may be mutually discussed and agreed. Complete machining of prove out components shall be done by Vendor at BHEL works to the specified design accuracy and surface finish, using cutting tools and CNC programs to be provided by the vendor to prove the machine after complete erection, tests & test piece machining etc. Material for the proveout components shall be provided by BHEL. Vendor should submit the CNC programs, setting schemes, process sheets, tooling layouts, time studies etc. in advance for the prove out components. Vendor shall be fully responsible for machining of proveout components as per drawing and other requirements specified by BHEL to the full satisfaction of BHEL. Clarifications, if any required by vendor, regarding accuracy requirements of the proveout components, whether specified or not, should be discussed and cleared by vendor during initial technical discussions.	Vendor	
20.2	During proveout, all tools shall be set by using supplied Tool Offset Measuring System and final job inspection shall be done by supplied Job Measuring System. Vendor shall be responsible for any deviation/rejection in proveout component due to wrong machining or malfunctioning of the machine during proveout machining and also for the delay in machining due to improper recommended tooling etc. The cost of such deviation / rejection, if any, shall be refunded by the vendor to BHEL.	Vendor	
21.0	MACHINE ACCEPTANCE: (Tests/Activities should be Performed by Vendor)		
21.1	Tests/Activities should be carried out at supplier's works on the machine before despatch :		
21.1.1	Geometrical accuracies as per test chart.	Vendor	
21.1.2	Positioning accuracies as per VDI-DGQ/3441	Vendor	
21.1.3	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from that time.	Vendor	
21.1.4	Demonstration of all features of the machine, control system & accessories	Vendor	

SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
21.1.5	Machining of test piece as per NAS/AFNOR/ISO. Vendor to supply test piece and tooling for it's machining.	Vendor	
21.2	Tests/Activities should be carried out at BHEL works while commissioning the machine :		
21.2.1	Geometrical accuracies as per test chart.	Vendor	
21.2.2	Positioning accuracies as per VDI-DGQ/3441		
21.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor	
21.2.4	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	
21.2.5	Demonstration of all features of the machine, control system & accessories to the satisfaction of BHEL for efficient and effective use of the machine	Vendor	
21.2.6	Machining test piece as per NAS/AFNOR/ISO. Vendor to arrange Test pieces and tooling for it's machining.	Vendor	
21.2.7	Proveout machining.	Vendor	
21.2.8	Two weeks supervision of independent operation of machine by BHEL after job proveout	Vendor	
21.2.9	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	
21.2.10	Demonstration by actual use of all supplied attachments and accessories to their full capacity.	Vendor	
22.0	PACKING:	Required	
22.1	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	Required	
23.0	GUARANTEE :	Vendor	
23.1	24 months from the date of acceptance of the machine.		
24.0	GENERAL :	Vendor	
24.1	Machine Model		
24.2	Total connected load (KVA):		

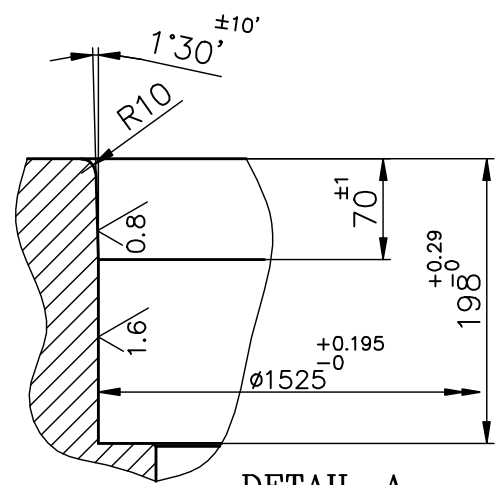
SNO	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	REMARKS
24.3	Floor area required (Length, Width, Height) for complete machine & accessories		
24.4	Painting of Machine / Electrical Panels : RAL 6011 Apple Green		
24.5	Total weight of the machine		
24.6	Weight of heaviest part of machine		
24.7	Weight of the heaviest assembly / sub-assembly of the Machine		
24.8	Dimensions of largest part/ sub-assembly/ assembly of the machine		
24.9	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		
24.10	Detailed catalogues , sketch/ photographs of the m/c and accessories/ attachments should be submitted with the offer.		
24.11	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.		
25.0	OTHER FEATURES:		
25.1	NETWORKING:	Vendor to give as optional with separate quote	
25.1.1	Machine control should have necessary hardware and software for interfacing with gigabit Ethernet Local Area Network with 100 MB/sec through UTP cables for CNC 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)	Vendor to confirm	
	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.	Vendor to confirm	
	c) The program transfer between CNC system and network should also be possible in CNC Mode.	Vendor to confirm	
25.2	MACHINE MONITORING SYSTEM (MMS) SIGNALS	Vendor to confirm	

ANNEXURE-2

VERTICAL BORING MACHINE OPERATIONS



SCALE-1: 20



DETAIL-A
(1: 5)

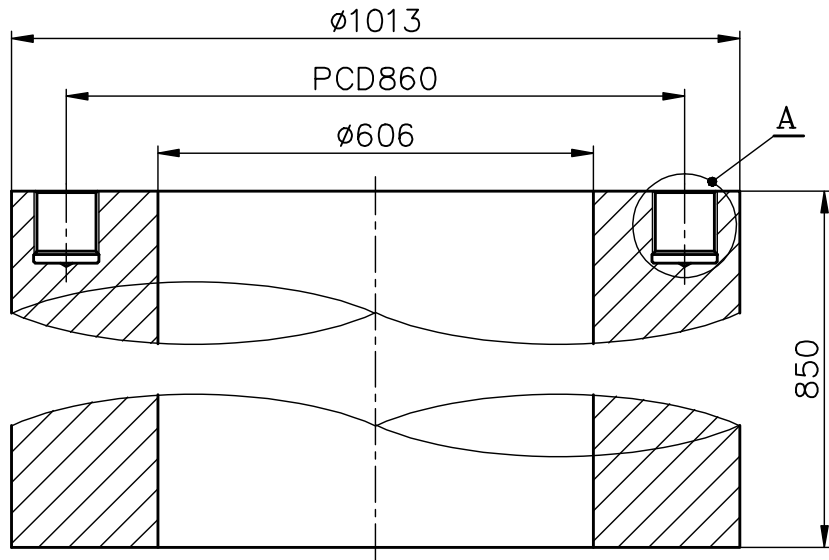
GRINDING OPERATION

MATERIAL: Q&T STEEL

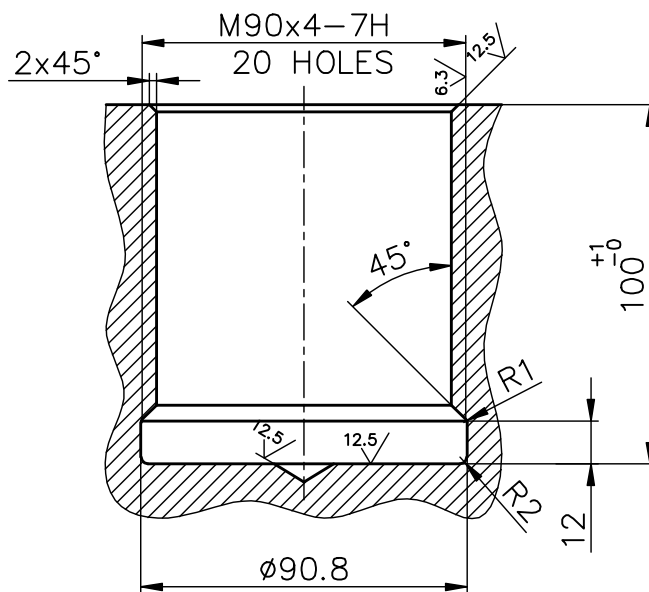
F

ANNEXURE-2A

VERTICAL BORING MACHINE OPERATIONS



SCALE-1:10



DETAIL-A
(1:2)

MATERIAL: SS 321