



**BHARAT HEAVY ELECTRICAL LIMITED**

**UNIT'S ADDRESS:**

**CONTACT PERSON'S NAME/DESIGN./PHONE NO./E-MAIL (FROM PURCHASE DEPTT.)**

**Enquiry No. :**

**Due Date :**

**Supplier Qtn. No.:**

**Date :**

**SPECIFICATION CUM COMPLIANCE CERTIFICATE OF TABLE + FLOOR TYPE CNC HORIZONTAL BORING MACHINE**

**NOTE:-**

1. Vendor (OEM) must submit complete information against clause no. 23. The offer meeting this clause would only be processed.
2. The "Offered" Column and where applicable, the "Deviations" & "Remarks" Column of this format shall be filled in by the Vendor and submitted along with the offer. Inadequate / incomplete, ambiguous, or unsustainable information against any of the clauses of the specifications/requirements shall be treated as non-compliance.

**3. The offer and all documents enclosed with offer should be in English language only.**

<b>NAME &amp; ADDRESS OF THE SUPPLIER :</b>	<b>NAME &amp; ADDRESS OF THE INDIAN AGENT :</b>
<b>TELEPHONE NOS.:</b>	<b>TELEPHONE NOS.:</b>
<b>FAX NOS.:</b>	<b>FAX NOS.:</b>
<b>E-MAIL ADDRESS :</b>	<b>E-MAIL ADDRESS :</b>

**SCOPE: SUPPLY, ERECTION & COMMISSIONING OF TABLE + FLOOR TYPE CNC HORIZONTAL BORING MACHINE COMPLYING WITH SPECIFICATIONS AS BELOW (MINIMUM REQUIREMENTS)**

S/ NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED/TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
<b>1</b>	<b>PURPOSE &amp; WORKPIECE MATERIAL</b>				
1.1	Purpose: The machine is required for machining of HP and IP Outer Casings of Steam Turbines of various ratings. The Machine should be suitable for heavy duty Milling, heavy Drilling, Boring, Threading-Metric & Buttress Threads, Reverse Counter Boring, Core Drilling, Reaming, etc. on high alloy Steel Castings. The machine is to be used mainly for Joint Plane Facing, Drilling, Boring, Tapping/ Thread Cutting/ Thread Whirling, Reverse Counter Boring, complete peripheral finish machining of Turbine casings. The machine will also be used for machining of other similar Outer Casings of Steam Turbines.				
1.2	Work Piece Material: The machine shall be suitable for machining of Castings of High Alloy Steel, like GS17CrMoV511. The components to be machined will be mainly high temperature & creep resistant alloy steel castings of Mat. grade 17CrMoV511, X22CrMoV121 having tensile strength 40-95 Kg/mm <sup>2</sup> , %Elongation 15-22% & Hardness up to 300BHN. , with Boring Head and Boaring Spindle , and components of Ferrous and non-ferrous metals like Carbon Steel, low & High Alloy Steel, Cast Steel, Cast Iron and similar other materials shall be machined.				

<b>2</b>	<b>SPECIFICATIONS: (Minimum requirements)</b>				
2.1	MACHINE CONFIGURATION: The Machine shall be Floor Type CNC Horizontal Boring Machine with a Rotary Table. Looking from spindle side, AAC is to be on Right side of Rotary Table. Linear movement of Table is to be perpendicular to X-axis.				
<b>2.2</b>	<b>HEAD STOCK</b>				
2.2.1	Boring spindle diameter	200mm			
2.2.2	Milling spindle diameter	Vendor to specify			
2.2.3	Ram Cross section (LxB)	500x550mm			
2.2.4	Spindle drive power (AC Continuous Rating - S1), Minimum	85 KW or more			
2.2.5	Spindle speed (Infinitely variable)	10 or less to 2000 or more			
2.2.6	No. of speed ranges	Vendor to specify			
2.2.7	Max torque on the boring spindle (N-m)	15000 Nm			
2.2.8	Max torque on the milling spindle (N-m)	15000 Nm			
2.2.9	Spindle Taper (ISO-50); ISO60 to ISO50 adaptor sleeve, if required.	BT50			
2.2.10	Spindle Motor & Drive Make: FANUC <i>ci</i> or SIEMENS 1PH series spindle motor with matching spindle drive	Vendor to confirm			
2.2.11	Spindle Encoder: FANUC/SIEMENS/HEIDENHAIN rotary encoders for direct reading of actual spindle rpm	Vendor to confirm			
2.2.12	Torque-Power-Speed characteristics of the spindle system to be submitted by the vendor.	Vendor to submit			
2.2.13	Oriented Spindle Stop (Any position)	Vendor to confirm			
2.2.14	Spindle Cooling System (Details to be informed)	Vendor to submit			
<b>2.3</b>	<b>COLUMN:</b>				
2.3.1	Column longitudinal travel (X-Axis)	16000mm			
2.3.2	X-axis feed rate (Infinitely variable)	15000 mm/min (or more)			
2.3.3	X-axis rapid traverse rate	15000 mm/min (or more)			
2.3.4	Axis Resolution	0.001mm			
<b>2.4</b>	<b>HEADSTOCK TRAVERSE ON COLUMN:</b>				
2.4.1	Headstock vertical travel (Y-Axis)	5000mm			
2.4.2	Traverse Range (wrt table Top)	0 to 5000mm			
2.4.3	Y-axis feed rate (Infinitely variable)	15000 mm/min (or more)			
2.4.4	Y-axis rapid traverse rate	15000 mm/min (or more)			
2.4.5	Axis Resolution	0.001mm			
<b>2.5</b>	<b>RAM/ SPINDLE TRAVERSE:</b>				
2.5.1	Boring spindle axial travel (W-Axis)	1000mm or more			
2.5.2	Ram axial travel (Z-Axis)	1500mm or more			
2.5.3	Spindle + Ram travel (W+Z)	2500mm or more			
2.5.4	Boring Spindle axis feed rate (Infinitely variable)	Vendor to specify			

2.5.5	Boring Spindle axis rapid traverse rate		Vendor to specify		
2.5.6	Ram axis feed rate (Infinitely variable)		15000 mm/min (or more)		
2.5.7	Ram axis rapid traverse rate		15000 mm/min (or more)		
2.5.8	Axis Resolution		0.001mm		
2.5.9	Spindle & Ram Axes should be independently programmable with Independent Drives and Feed back system.		Vendor to confirm		
2.6	<b>FEED AND DRIVE SYSTEMS:</b>				
2.6.1	Feed motors & drives: FANUC ai or SIEMENS 1FT/1FK series AC servo motors with matching AC servo drives		Vendor to submit		
2.6.2	Maximum feed force for all axes		Vendor to specify		
2.6.3	Feed back system for X, Y & Ram (Z) axes: Heidenhain linear scales (Details to be submitted)		Vendor to submit		
2.6.4	Feed back system for Spindle (W) Axis: FANUC/Heidenhain/SIEMENS rotary encoder (Details to be submitted by the vendor)		Vendor to submit		
2.6.5	Type of power transmission: 1. Pre-loaded backlash free double pinion & rack drive for X-axis. 2. Backlash free re-circulating ball screw with Pre-loaded double nut for all other axes. (Complete description of the aforesaid, including diameter of Ball Screw for each axis, to be submitted with the offer)		Vendor to submit		
2.6.6	Mechanism for locking X, Y & Z axis		Vendor to specify		
2.6.7	Maximum thrust rating of all axes.		Vendor to specify		
2.7	<b>MACHINE GUIDEWAYS:</b>				
2.7.1	Width of bed guideways, X-axis		Vendor to specify		
2.7.2	Width of column guideways, Y-axis		Vendor to specify		
2.7.3	Details of Guide ways for Ram axis and bearing details of Spindle axis are to be submitted with offer.		Vendor to submit		
2.7.4	Guide ways for X-axis, Y-axis & Z-axis: Hydrostatic (Details to be submitted), Details of lubrication system provided on Spindle axis are also to be submitted with the offer.		Vendor to submit		
2.7.5	Hardness of guideways		Vendor to specify		
2.7.6	Metallic Telescopic covers of rust resistant material to be provided with wipers for X & Y axes guide ways. Joints of telescopic covers should be so sealed to avoid mixing of coolant & hydrostatic oil is to be provided. Telescopic covers for X-axis should be with a slant towards Chip conveyor.		Vendor to offer and confirm		
2.8	<b>ROTARY TABLE :</b>				
2.8.1	Table size (LxB)		4500x4500		
2.8.2	Maximum load carrying capacity (Tons)		90 T		
2.8.3	Rotary Table shall be capable of eccentric loading of jobs. The table should be capable of loading one half of IP Outer casing on one end of Table for machining of Parting Plane marked as 'A' (zone J13 of sheet 1). From table center Chart/Table showing relation of weight and distance of c.g. from centre of Rotary Table to be submitted.		Vendor to confirm & submit.		
2.8.4	Table rotation (Fully programmable B-axis)		360000 Indexing positions		
2.8.5	Maximum machining torque on B-axis (N-m)		750000 Nm		
2.8.6	Maximum clamping torque on B-axis (N-m)		Vendor to specify		

2.8.7	Feed rate for Table Rotary Axis. (Deg/ min Infinitely variable or rpm)	Vendor to specify			
2.8.8	Rapid Traverse Rate for Rotary Axis (Deg/ min. or rpm)	Vendor to specify			
2.8.9	Size of T-slots	Suitable for Studs of M36 size.			
2.8.10	T-slots pitch (as per DIN standard)	Vendor to specify and confirm			
2.8.11	Central slot tolerance	Vendor to specify			
2.8.12	Perpendicular Lateral slot size/ tolerance	Vendor to specify			
2.8.13	Size of bore at the center.	Vendor to specify			
2.8.14	Linear traverse. (To suite machining of Prove out Component placed at center)	3000 mm or more			
2.8.15	Feed Force on Linear Axis	Vendor to specify			
2.8.16	Feed Rate for Linear axis (mm/ min Infinitely variable)	Vendor to specify			
2.8.17	Rapid Traverse rate for Linear axis (mm/ min)	Vendor to specify			
2.8.18	Minimum distance between ram face and table face.	Vendor to specify.			
2.8.19	Cheveron type Metallic Telescopic Covers of rust resistant material are to be supplied with replaceable wipers for Table Linear axis. Joints of telescopic covers should be so sealed to avoid mixing of coolant and Hydrostatic oil.	Vendor to confirm			
2.8.20	Feed back devices :				
	a) Heidenhain rotary encoder for B-Axis	Vendor to confirm			
	b) Heidenhain Linear Scale for linear axis (U-Axis)	Vendor to confirm			
2.8.21	Feed motors & drives: FANUC ai or SIEMENS 1FT/1FK series AC servo motors with matching AC servo drives	Vendor to submit.			
2.8.22	Mechanism for locking/ clamping of Table axes	Vendor to specify			
2.8.23	Location of the Table	On extreme Left side of X-traverse looking from Spindle side.			
2.8.24	Spindle should reach 1000 mm beyond extreme end of Rotary Table.	Vendor to confirm			
2.8.25	Level of Rotary table should be such that it can freely rotate without interfering with the floor plates.	Vendor to confirm.			
2.8.26	Hydrostatic Guideways for Table Rotation.	Vendor to confirm.			
2.8.27	Hydrostatic Guideways for Table Linear Traverse.	Vendor to confirm.			
2.8.28	4 x 90 deg Precision Positioning (Details to be submitted.)	Vendor to submit.			
<b>2.9 FLOOR PLATES:</b>					
2.9.1	Floor plates to cover the floor area to a width of 6000mm along the complete longitudinal travel (X axis) of the machine, except that covered by Rotary Table and AAC.	Vendor to confirm			
2.9.2	Floor Plate Area (L X B)	Vendor to specify			
2.9.3	Number of Floor Plates	Vendor to specify			
2.9.4	Size of each Floor Plate	Vendor to specify			
2.9.5	Load bearing capacity, Tons / sq. Meter	15Tonnes/sq. meter			

2.9.6	Thickness		Vendor to specify			
2.9.7	T-slot size		Suitable for T-Bolts of size M30			
2.9.8	T-slot pitch as per DIN standard		Vendor to confirm			
2.9.9	Direction of T-slots in the Floor Plates		Parallel to X axis movement			
2.9.10	The Floor Plates shall be provided with Coolant collection channels on the side of Floor Plates with proper arrangement for smooth coolant flow.		Vendor to confirm			
2.10	<b>CONSTRUCTION:</b>					
2.10.1	Vendor to furnish details of material, hardness & constructional details, including explanatory drawings, of various Components/ Assemblies like Column, bed, Head Stock, Ram, Spindle, Rotary Table etc. of the machine.		Vendor to submit			
2.10.2	Hard copy explaining the technical features/ Literature with photographs, drawings explaining the technical features should be enclosed with the offer.		Vendor to submit			
2.10.3	Automatic deflection compensation for ram and column effective at any extension of the ram plus spindle is to be provided taking into consideration weight of all possible cutters/ attachments offered. Details of the offered system should be submitted with offer.		Vendor to confirm and submit			
2.10.4	Head Stock and Column Counterbalancing System. (Details of the offered system to be submitted)		Vendor to submit			
2.11	<b>OPERATOR'S PLATFORM:</b>					
2.11.1	Operator's platform of suitable load carrying capacity to be provided with Independent Motorised Vertical Movement for total Vertical Traverse as well as forward stroke of sufficient length . Push Button switches are to be provided on the Operator's Platform at suitable location for motorised movement. A 15 Amp. Plug Point with ON/ OFF switch is also to be provided on the Platform.		Vendor to confirm .			
2.11.2	Horizontal movement of Operator's Platform.		Vendor to specify			
2.11.3	Weight carrying Capacity of the Platform should be Min. 300 Kg..		Vendor to confirm			
2.11.4	Minimum Height of Platform from Shop Floor.		Vendor to specify			
2.11.5	Splash/ Chip guards on operator platform for protection of operator, operator's panel and to avoid spillage of coolant & chips on operator's platform.		Vendor to offer and confirm			
2.12	<b>OPERATION AND CONTROL SYSTEM:</b>					
2.12.1	<b>OPERATOR'S PANEL:</b>					
2.12.1.1	Swiveling type operator's panel having complete CNC and machine control system with TFT 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 average height of 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 confirm & submit Photographs & Layout.			

<b>2.12.2</b>	<b>CNC SYSTEM &amp; FEATURES :</b>								
2.12.2.1	Make	: Fanuc / Siemens.		Vendor to confirm					
2.12.2.2	Type	: PC based latest version		Vendor to confirm					
2.11.2.3	The system should have full alphanumeric keyboard, TFT colour display (10.4" or larger), Machine Control Panel (MCP), RS232C serial interface, USB port for data input/output, network ready, graphic simulation and on-screen PLC Ladder display. All PLC input/output modules should be of FANUC/SIEMENS make. (Latest hardware & software versions, as available at the time of delivery, should be supplied).				Vendor to offer and submit details				
2.11.2.4	Details of optional features, recommended by vendor. (Including features required for Prove-Out Components)				Vendor to offer and submit details				
2.11.2.5	Details of other optional features:				Vendor to offer and confirm				
2.12.2.5.1	Axes Interpolation: Linear, Circular, Cylindrical, Helical, Spline				Vendor to confirm				
2.12.2.5.2	Max Number of simultaneous interpolation: 3				Vendor to confirm				
2.12.2.5.3	Part Program Storage: 2 MB or more				Vendor to confirm				
2.12.2.5.4	Technology Cycles: Geometry Calculation, standard Drilling, Tapping, Milling cycles.				Vendor to confirm				
2.12.2.5.5	Graphics simulation (Static and dynamic) of Part Programs and Machining process				Vendor to confirm				
2.12.2.5.6	Co-ordinate Transformation: Datum shift, rotation, mirror image, scaling factor.				Vendor to confirm				
2.12.2.5.7	Pitch Error compensation (As applicable)				Vendor to confirm				
2.12.2.5.8	Backlash error compensation (As applicable)				Vendor to confirm				
2.12.2.5.9	Zero Offset for all axes				Vendor to confirm				
2.12.2.5.10	Feed override switch 0-120% for all axis				Vendor to confirm				
2.12.2.5.11	Spindle speed override switch 70-120%				Vendor to confirm				
2.12.2.6	Provision for safe shut down of CNC Control in case of Power Failure				Vendor to confirm				
<b>2.11.3</b>	<b>MANUAL CONTROL:</b>								
2.11.3.1	Complete manual operation of machine should be possible through Machine Control Panel (MCP). The MCP should have Spindle & Feed override switches, +/- Jog keys for individual axis, Start/Stop keys for Cycle, Spindle & Feed and additional keys/switches for auxiliary functions. Diagram of complete operator pendant with full details of all the switches/keys should be submitted.				Vendor to confirm. Layout of panel showing requisite switches to be submitted.				
<b>2.11.4</b>	<b>HAND HELD UNIT:</b>								
2.11.4.1	Hand Held unit, alongwith sufficient length of interfacing cable is to be offered for handwheel (MPG) operation of individual axis in jog & increment mode and provision for spindle inch in c.w & c.c.w directions				Vendor to offer & details to be submitted.				

2.11.5	<b>UPS FOR CNC SYSTEM: (Only in case of PC based CNC systems)</b>				
2.11.5.1	UPS of 15 minutes for CNC system with inbuilt cooling and charge status display is to be supplied only in case of PC based CNC systems.	Vendor to offer & details to be submitted.			
2.11.6	<b>NOTE BOOK PC (I/O DEVICE):</b>				
2.11.6.1	Note Book PC (Internationally reputed make and latest model) with Windows operating system is to be supplied for bi-directional transfer of program and data between the offered unit and supplied CNC system. The notebook must contain all application softwares for the supplied CNC, PLC and Drives systems along with required interfaces and cables.	Vendor to offer with details.			
2.13	<b>MACHINE LIGHTS:</b>				
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 offer & specify details.			
2.13.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to offer & specify details.			
2.13.3	Any lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to confirm			
2.13.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to confirm			
2.13.5	Flashing / rotary type End of Cutting and Program Stop Light.	Vendor to confirm			
2.14	<b>REFRIGERATION UNITS / AIR CONDITIONERS</b>				
2.14.1	Door mounted Air Conditioners with Dehumidifiers of reputed international make who have after-sales spares support in India or of Indian make like Advance/ Werner Finley/ Rittal for all Electrical/ Electronic Panels/ Cabinets including Operator's Panel (One no.of sufficient capacity for each cabinet/ panel considering continuous operation at ambient temperature of 50°C). The blow of cool air from the air conditioners shall not fall directly on the electronic circuits/ modules. ACs must be incorporated with electrical/ refrigeration interlocks.	Vendor to offer and confirm			
2.14.2	ACs unit must be mounted on the movable pendant with well-supported universal-head bolt. Two sets of cut-out labels are mandatory to be supplied with the units. The electrical connection of the AC unit must be with male-female connector, easily disconnected from the AC unit side. There has to be a MCCB to isolate the AC unit from the electrical panel.				
2.14.3	Oil Chiller units of reputed international make who have after-sales spares support in India or of Indian make like Advance/ Werner Finley/ Rittal/ Gem in package should have minimum 50% standby with multiple refrigeration circuits having energy-efficient HFC-based Hermetically-sealed Rotary/ Scroll/ Reciprocating Compressors with independent refrigeration circuits having SS-brazed Plate-type Heat Exchanger, Air-cooled Condenser, Thermostatic Expansion Valve, HP/ LP Switch, Oil Flow/ Anti Freeze Cut-out, etc. The units must have In-line Multistage Gear Pumps (with 100% standby), SS Storage Tank, Valves, NRVs, Filters, Automatic Microprocessor-based Controller with LCD Display, Safety Interlocks, etc. in one complete package. The unit must operate continuously with equal-run-time of Compressor at ambient temperature of 50°C.	Vendor to offer and confirm			

2.14.4	For precise air/ oil temperature with energy-efficient operation, latest state-of-the-art technology features like constab pressure control, variable speed control of fan-motor, hot-gas bypass control, etc. needs to be incorporated in the above Unit (s).	Vendor to offer and confirm			
2.14.5	Unit (s) must be designed to work in extremely harsh industrial environment and needs protection from heat, dust, fumes, corrosive or oily vapours, moisture, etc. The condenser coil must resist dust accumulation & must transfer heat efficiently.				
2.14.6	Vendor to supply the following information about Air Conditioners and Chiller Unit (s) used in the machine: Conditioning/ Chiller Unit. Capacity of the Unit. - Type of Compressor with complete specifications. - Type of Thermostatic Expansion Valve with complete specifications. - Fan size and flow in CFM (cubic feet meter) of the Condenser unit. - Specifications of the Evaporator Unit. - Functional requirement of temperature of cool air/ oil to be maintained between range +15°C to +40°C. - Type of Microprocessor-based Controller with LCD Display with complete functional details. Detailed specifications of all the components fitted in the Unit (s) are to be submitted with BOM, make, etc. in Technical bid. Vendor have to provide leaflet/catalogue of all the brought-out items, refrigeration accessories and provide schematic layout of the system.	Vendor to specify			
2.14.7	Compressor, Refrigeration Spares Items, PHE (Plate-type Heat Exchanger), Gear Pump, etc. must be available in India and if possible can be repaired, locally. Vendor have to give training to operate, maintain & repair all the individual items and the Chiller/ AC Unit (s) as a whole. Exhaustive training is to be given for electrically integration of the Unit (s) with the CNC machines.	Vendor to confirm			
<b>2.15</b>	<b>HYDRAULIC SYSTEM : Details should be Submitted by the Vendor</b>				
2.15.1	The System should be centralised. Hydraulic Oil Tank should preferably be located at Floor level.	Vendor to confirm			
2.15.2	Make Rexroth/ Vickers Sperry/ Hawe or equivalent from a reputed manufacturer. (Details to be submitted)	Vendor to confirm			



2.15.3	Filtration System: Sufficient no. of filters ( with electric clogging indicator and alarm on PLC ) should be used to avoid frequent clogging of the filters and other maintenance related problems. Filter elements should be of Make: EPE / Hydac.				
2.15.4	Failure indication			Vendor to confirm	
2.15.5	Automatic shut off provision, Details to be informed.			Vendor to inform	
2.15.6	Refrigerated type cooling system of sufficient capacity to maintain complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. keeping in view the specified ambient conditions to be offered with complete details. The temperature of Hydraulic Oil should not go beyond 40 deg. C.			Vendor to confirm	
2.15.7	Hydraulic pump capacity (flow/ pressure) to be intimated .			Vendor to specify	
2.15.8	No Tandem pumps should be used. Maximum desired permissible pressure is 100 Kg/sqcm. If anywhere, more than 100 Kg/sqcm pressure is used, then one set of such hose pipes and seal kit of such Hydraulic cylinder should be supplied in spare in addition to other spares.			Vendor to confirm	
2.15.9	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	<b>COOLANT SYSTEM :</b>				
2.16.1	Coolant System with all accessories for following variants shall be provided. Selection of all the variants shall be through program and push buttons provided on the Operator's panel as well.			Vendor to confirm	
	a) Recirculating Type Flood Coolant System with nozzles around spindle.			Vendor to offer & confirm	
	b) Air coolant system			Vendor to offer & confirm	
	c) High Pressure Coolant through Spindle			Vendor to offer & confirm	
2.16.2	All offered attachments, tool holders, boring bars, 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	
2.16.4	Coolant Filtration System: Recirculating type coolant system with Vacuum Rotary drum 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 submit	
2.16.6	Pressure & rate of flow of coolant for different variants should be furnished in the offer. The Pressure should be sufficient for the coolant to reach the tool tip at full pressure.			Vendor to specify & confirm.	
2.16.7	Coolant Tank Capacity. Coolant Tank may preferably be placed on the Floor Level. The details of the system, including requisite sump, pump etc., should be clearly indicated.			Vendor to specify	

2.16.8	For finer control of Pressure and Coolant Flow Rate, after its activation through program or switches, Rotary/ potentiometer switches/ Push Buttons shall be provided on the Operator's Panel.	Vendor to confirm			
2.16.9	Coolant pump & motor details for all variants of coolant system are to be submitted with the offer.	Vendor to submit			
2.16.10	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Required.			
<b>2.17</b>	<b>ELECTRICAL SYSTEM :</b>				
2.17.1	415V with fluctuation +/-10%, 50HZ with fluctuation +/- 3 %, 3 Phase AC (3 wire system without neutral) Power Supply Source will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All types of cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine/ control cabinets, etc., shall be the responsibility of vendor. Requirement of grounding/ earthing with required material (indian make) details is to be informed by vendor well in advance so that same could be incorporated during construction of foundation. The vendor can take earthing connection from the nearest column of the production shop.	Vendor to confirm & specify			
2.17.2	Tropicalisation: All electrical/ electronic equipment shall be tropicalized.	Vendor to confirm			
2.17.3	All electrical & electronic control cabinets & panels should be dust and vermin proof.	Vendor to confirm			
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 have provision of 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 or Indian Standards	Vendor to confirm			
2.17.7	All cables moving with traversing axes should be installed in Caterpillar/ Drag chain. Additionally, all the cable trays required for laying of cables should be included in the offer.	Vendor to 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 offer			
<b>2.18</b>	<b>SAFETY ARRANGEMENTS:</b>	<b>Vendor to confirm &amp; specify</b>			
	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 along with cause and remedy 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 hindrance 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 are to be provided.				
	6. Oil & water pipe lines should not run with electrical cable in the same tray / trench.				
	7. Safety Lights on moving column (preferably Flashing during X-travel):				
	<b>2.19 ENVIRONMENTAL PERFORMANCE OF THE MACHINE:</b>			<b>Vendor to confirm</b>	
	The Machine shall conform to following factors related to environment :				
	(a) Maximum noise level shall be 85 dB(A) at normal load condition, 1 M away from the machine with correction factor for back ground noise, if necessary. This will be measured as per international standards like DIN 45635-16. Supplier to demonstrate compliance to noise level, if so required.				
	(b) There shall not be any emissions from the machine except fumes of cutting fluid during machining.				
	(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.				
	(d) No hazardous chemicals shall be required to be used in the machine.				
	(e) If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.				
	(f) Paint of the machine should be oil / coolant resistant and should not peel off and mix up with coolant.				
	<b>3 CHIP CONVEYOR :</b>				
3.1	A chip conveyor to carry both short and curly chips efficiently and effectively to the chip bin to be provided on one end of the machine . Two Chips bins of appropriate size of Indian make, with wheels & handle for movement, should also be supplied			Vendor to confirm	
3.2	Type of chip conveyor (Hinged Slat type)			Slat type.	
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 confirm	
3.7	Operation of chip conveyor (forward & reverse) through push buttons on operator's panel.			Vendor to confirm	
3.8	Layout showing location of chip conveyor to be submitted.			Vendor to submit	

<b>4</b>	<b>ULTRA ISOLATION TRANSFORMER</b>					
4.1	Indian make Ultra Isolation Transformer suitable for complete machine , its drives, controls, PLC etc. shall be offered with complete details.	Vendor to offer				
4.2	Make (To be specified by indenter as per the practice of units.)	NEEL or Aplab or Auto Electric or Servomax or of international repute.				
4.3	Model and Rating	Vendor to specify				
4.4	Catalogue of the Isolation Transformer shall be submitted with the offer.	Vendor to submit				
	<b>5 PNEUMATIC SYSTEM:</b>					
5.1	<b>AIR COMPRESSOR:</b>					
5.1.1	Independent Air Compressor (of reputed Indian make: Elgi or Ingersol Rand), Screw Type, with refrigerated type Dryer & Filter of suitable capacity for the total compressed air requirements of the machine & accessories and to suit required air quality should be supplied. The system should be so designed to have additional provision and required accessories before Refrigerated type Air Dryer so that BHEL compressed air supply having pressure 5 Kg/sq.cm could be used as and when required. The compressor unit should be suitable for continuous duty operation.	Vendor to offer with details.				
5.1.2	Make & Model of Air Compressor and Refrigerator type Dryer.	Vendor to specify				
5.1.4	Capacity (Flow, Pressure & KW)	Vendor to specify				
5.1.5	Spare parts for offered Air Compressor & Dryer as listed below: 1.) Air Filter - 06 Nos. 2.) Oil Filter - 15 Nos. 3.) Oil - 50 Ltrs. 4.) Air - Oil Separator Element - 06 Nos. 5.) Belt - 04 Nos. 6.) Flexible Hose Kit - 01 Set	Vendor to offer				
	<b>5.2 COMPRESSED AIR POINTS:</b>					
5.2.1	Compressed Air Point with manual ON/ OFF Valve and flexible pipe of suitable length for work piece cleaning.	Vendor to confirm				
	<b>6 TOOLINGS:</b>					
6.1	All cutting tools, tool holders, arbors, boring bars, clamping elements etc., recommended for machining of proveout component ( I.P. Outer Casings Drg. no: 0-10601-57500 ) shall be offered by the vendor. Consumables for offered Tools, like inserts, screws etc., should be offered for machining of 2 more similar casings in addition to the prove-out casings. For all Boring Heads, in addition to standard tools supplied along with Boring heads, one extra set of top mounting tool holders like TU/TP along with each Boring Tool/ Cartridge shall also be supplied, for number of tools used in machining of prove out component.	Vendor to specify and offer.				

6.2	Complete tooling system / special arrangement for machining of deep grooves (of width 27.1 upto dia 790 & of width 70 upto dia 1175; in detail III and II), considering blank material as solid instead of rough machined grooves shown in casting drawings. Is to be offered as the casting which shall be provided to vendor by BHEL for proveout machining may have blank material (casting) without rough machined grooves.	Vendor to offer			
6.3	Preliminary Drawings/Sketches of the offered tools/ tool holders are to be submitted with the offer. Vendor to confirm that, in case of order, final Drawings/Sketches for offered items shall be submitted to BHEL after PO.	Vendor to submit & confirm			
<b>7</b>	<b>FAULT DIAGNOSTIC SYSTEM:</b>				
7.1.1	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. Machine should have provision to switchover from position feedback system -2 ( direct) to Position feed back system-1 ( Motor encoder ) through PLC program ( for service personnel only).	Vendor to offer and submit details.			
7.1.2	Help guide should be provided to use both diagnostic systems shall be provided.	Vendor to confirm			
<b>8</b>	<b>LEVELING &amp; ANCHORING SYSTEM</b>	<b>Required.</b>			
8.1.1	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 and submit details.			
<b>9</b>	<b>TOOLS FOR ERECTION, OPERATION &amp; MAINTENANCE :</b>				
9.1	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			
9.2	Test mandrel for checking spindle run-out & alignment should be supplied	Vendor to confirm			
<b>10</b>	<b>ACCESSORIES:</b>				
<b>10.1</b>	<b>AUTOMATIC ATTACHMENT CHANGER (AAC):</b>				
10.1.1	All attachments shall be suitable for loading / unloading through AAC	Vendor to confirm			
10.1.2	No. of storage positions (Matching with number of offered attachments)	Vendor to confirm			
10.1.3	Location of the attachment changer	At the extreme Right Hand side looking from Spindle.			
10.1.4	Mounting plates as required for attachments should be supplied	Vendor to confirm			
10.1.5	Maximum Permissible Weight on each Position.	Vendor to specify			
10.1.6	Maximum Permissible Weight on Complete AAC.	Vendor to specify			

10.1.7	Additional Longitudinal Traverse of X-axis required to accommodate and use of AAC beyond the specified X-axis traverse shall be seperately offered by the vendor.				Vendor to specify		
10.1.8	Suitable Software based/ Manual key based arrangement should be provided to extract an Attachment trapped in the AAC cycle. Details of both the system to be provided along with the offer.				Vendor to offer		
10.2	<b>SPECIAL CNC ANGULAR MILLING HEAD/ RIGHT ANGLE MILLING HEAD:</b> <b>This Head is required to machine Slots at internal diameter as per Sec. CC, at a Depth of 2520 mm (Reference drawing of HP Outer Casing, drg. no. 010501-09500 is also enclosed)</b>						
10.2.1	Power				20 KW or more		
10.2.2	Max torque				Vendor to inform		
10.2.3	Speed Range ( Infinitely Variable)				vendor to inform		
10.2.4	Speed ratio (1:1 between spindle of Machine and Head)				Vendor to inform		
10.2.5	Feed rate on which milling head can be operated				Vendor to specify		
10.2.6	Spindle taper				BT50		
10.2.7	Traverse Range of C-axis				360°		
10.2.8	Resolution of C-axis :				1 deg.		
10.2.9	Power-Torque-Speed characteristic diagram to be submitted				Vendor		
10.2.10	Wt. of the head				Vendor		
10.2.11	Length of Milling Head: (Pl. refer drawing mentioned at 12.2 )				1400mm Approx.		
10.2.12	Coolant system: Internal (thru spindle) & External coolant with requisite flexible pipes on its snout is to be provided.				Vendor to confirm		
10.2.13	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		
10.2.14	Drawing/Catalogue page showing major dimensions of the head shall be submitted with the offer.				Vendor to submit		
10.3	<b>CNC ANGULAR MILLING HEAD/ RIGHT ANGLE MILLING HEAD:</b>						
10.3.1	Power				40 kw or more		
10.3.2	Max torque				Vendor to inform		
10.3.3	Speed Range ( Infinitely Variable)				vendor to inform		
10.3.4	Speed ratio (1:1 between spindle of Machine and Head)				Vendor to confirm		
10.3.5	Feed rate on which milling head can be operated				Vendor to specify		
10.3.6	Spindle taper				BT50		
10.3.7	Traverse Range of C-axis				360 deg.		
10.3.8	Resolution of C-axis.				1 deg.		
10.3.9	Power-Torque-Speed characteristic diagram to be submitted				Vendor to submit		
10.3.10	Wt. of the head				Vendor to inform		
10.3.11	Coolant system: Internal (thru spindle) & External coolant with requisite flexible pipes on its snout is to be provided.				Vendor to confirm		
10.3.12	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		
10.3.13	Drawing/Catalogue page showing major dimensions of the head shall be submitted with the offer.				Vendor to submit		

<b>10.4</b>	<b>PROGRAMMABLE UNIVERSAL MILLING HEAD :</b>					
10.4.1	Power		30 KW or more			
10.4.2	Max torque		Vendor to inform			
10.4.3	Speed Range ( Infinitely Variable)		Vendor to inform			
10.4.4	Speed ratio (1:1 between spindle of Machine and Head)		Vendor to inform			
10.4.5	Feed rate on which milling head can be operated		Vendor to specify			
10.4.6	Spindle taper		BT50			
10.4.7	Traverse Range of A-axis		(+/- ) 95 deg			
10.4.8	Resolution of A-axis		0.001 deg.			
10.4.9	Rotation of C-axis		360 deg			
10.4.10	Resolution of C-axis		0.001 deg.			
10.4.11	Torque-Power-Speed chacteristic diagram to be submitted.		Vendor to submit			
10.4.12	Weight of the head		Vendor to inform			
10.4.13	Coolant system: Internal (thru spindle) & External coolant with requisite flexible pipes on its snout is to be provided.		Vendor to confirm			
10.4.14	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			
10.4.15	Drawing/Catalogue page showing major dimensions of the head shall be submitted with the offer.		Vendor to submit			
<b>10.5</b>	<b>SPECIAL BORING AND FACING HEAD (Body Dia. 600mm Approx.): The Boring Head shall be used to make bores of shaft seal area as shown in Detail II and III of I.P.Outer casing drg. No. 0-10601-57500. The job shall be placed approx. at the center of the Table. The vendor should briefly describe the process to be followed for this application. Vendor shall submit a preliminary sketch/ diagram showing maximum retraction of Rotary Table and extension of Ram along with the Boring Head with Tool holder and Tool which is required for machining of Shaft seal area as shown in Detail II and III. The cutting shall be done with to and fro motion of rotary table.</b>					
10.5.1	Model No:		Vendor to offer			
10.5.2	Head body diameter		600 mm approx.			
10.5.3	Speed Range		0-250 rpm			
10.5.4	Feed rate on which boring head can be operated		Vendor to specify			
10.5.5	Radial axis independent positioning		Vendor to inform			
10.5.6	Slide stroke		200 mm			
10.5.7	Slide feed rate		1-400 mmpm			
10.5.8	Machining range in Boring internal diameter		1050 mm			
10.5.9	Accuracy of Bore Size (Bore Tolerance), Surface Finish of bores and Facial and Radial Run outs .		H7, 1.6 microns Ra, (Facial) 0.030 and (Radial) 0.030mm respectively.			

10.5.10	Diameter range for machining external diameter indicating max. depth	Vendor to inform			
10.5.11	Machining range in facing indicating maximum depth.	D1250 mm x 150mm depth			
10.5.12	Maximum boring depth (with tool) (Job placed at center of table)	Vendor to inform			
10.5.13	Maximum torque	Vendor to inform			
10.5.14	Maximum cutting force in boring	Vendor to inform			
10.5.15	Maximum cutting force in facing	Vendor to inform			
10.5.16	Slide Counter Balance mechanism	Vendor to inform			
10.5.17	Item wise details of complete set of standard Tool Holders and Tools, available with the offered Head, are to be submitted with the offer. Complete details of any special arrangement offered to meet the specified requirement of Boring range are also to be submitted.	Vendor to inform			
10.5.18	Tool Holder with BT 50 taper for presetting of the Tools for offered Boring and Facing Head is to be offered with complete details.	Vendor to offer.			
10.5.19	Details, including drawing/ schematic sketches, of the offered Head are to be submitted with the offer. Drawing of Pull Studs, if required, should also be submitted.	Vendor to offer and submit			
10.5.20	Coolant system: External coolant with requisite flexible pipes on its snout is to be provided. The arrangement for its supply may be made through the coolant supply system available on the Head Stock.	Vendor to offer and submit			
10.5.21	Minimum bore dia. of shaft seal area of IP Outer Casing as per detail III and detail IV will be D750mm.				
<b>10.6</b>	<b>Jib Crane :</b>				
10.6.1	Capacity	1 T			
10.6.2	Mounted on top of column with all power operated movements (including swivel motion ) through push buttons	Vendor to confirm			
10.6.3	Swivelling range and speed	Vendor to confirm			
10.6.4	Crane reach should cover the rotary table when fully drawn towards machine spindle	Vendor to confirm			
<b>11</b>	<b>SPARES:</b>				
11.1	Itemised breakup of mechanical, hydraulic, electrical and electronic spares as below are to be offered. The list to include following spares: (Unit Price of each item of spare should be offered)	Vendor to confirm			
<b>11.1.1</b>	<b>Mechanical &amp; Hydraulic Spares: The following spares are to be included.</b>				
11.1.1.1	Pressure control valves, Pressure reducing valves, Flow control valves & Direction control valves used in Hyd / Lub/ Pneumatic/ coolant circuit. (1 no. of each type)	Vendor to offer			
11.1.1.2	Pressure switches, flow switches used in Hyd / Lub / Pneumatic/ coolant circuit. (1 No. of each type)	Vendor to offer			



11.1.1.3	All types of regenerative type filter inserts (6 No. of each type in hydraulic, pneumatic & coolant circuit)	Vendor to offer			
11.1.1.4	All types of Disposable type filter inserts (15 nos. of each type)	Vendor to offer			
11.1.1.5	All types of Accumulator bladders (1 no. of each type) with charging kit	Vendor to offer			
11.1.1.6	One set of timing belts used in the machine.	Vendor to offer			
11.1.1.7	One set of seal kits used in different hydraulic & pneumatic cylinders in the machine.	Vendor to offer			
11.1.1.8	One set of hose pipe with end connection used in the machine.	Vendor to offer			
11.1.1.9	All types of couplings used with different pumps (1 no. of each type) & pressure sleeves used in machine.	Vendor to offer			
11.1.1.10	All types of shaft seals (2 no. of each type), O-rings & Piston Rings (5 nos. of each type) used in the machine.	Vendor to offer			
11.1.1.11	One set of pneumatic filtration / condensate drain system.	Vendor to offer			
11.1.2	<b>Electrical /Electronic / CNC Spares : Following Spares are to be offered.</b>	<b>Vendor to offer</b>			
11.1.2.1	Limit Switches/ Micro Switches (2 Nos each type )	Vendor to offer			
11.1.2.2	Relays ( 2 Nos each type )	Vendor to offer			
11.1.2.3	Contactors ( 2 Nos each type )	Vendor to offer			
11.1.2.4	RTD temperature transmitter ( 1 No each type )	Vendor to offer			
11.1.2.5	Proximity Switches ( 5 Nos each type )	Vendor to offer			
11.1.2.6	Push Buttons ( 5 Nos each type )	Vendor to offer			
11.1.2.7	Indicating Lamps ( 10 Nos each type )	Vendor to offer			
11.1.2.8	Circuit Breakers ( 1 No each type )	Vendor to offer			
11.1.2.9	Main Power Switch ( 1 No each type )	Vendor to offer			
11.1.2.10	Encoders ( 1 No each type )	Vendor to offer			
11.1.2.11	Scanning Heads for Linear Scales ( 1 No each type )	Vendor to offer			
11.1.2.12	PCU module ( Hard disk loaded with Ghost of the machine after final commissioning)	Vendor to offer			
11.1.2.13	I/O Cards for PLC (1 No each type )	Vendor to offer			
11.1.2.14	Power Module & Control Cards for Main Drive as well as Feed Drives (1 Nos each type )	Vendor to offer			
11.2	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 confirm			
11.3	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			

12	<b>DOCUMENTATION : Three sets of following documents (Hard copies with Soft Copies wherever specified) in English language should be supplied along with the machine</b>				
12.1	Operating manuals of Machine & CNC system	Vendor to offer			
12.2	Programming Manuals of Machine & CNC system	Vendor to offer			
12.3	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.	Vendor to offer			
12.4	Maintenance, Interface & commissioning manuals for CNC system, spindle & feed drives.	Vendor to offer			
12.5	Manufacturing drawings for all supplied clamping elements, cutting tools, tool holders, arbors, boring bars, coolant connections, adapters, sleeves, fixtures etc.	Vendor to offer			
12.6	Catalogues, Operation & Maintenance Manuals of all bought out items including drawings, wherever applicable.	Vendor to offer			
12.7	Detailed specification of all rubber items and hydraulic/lube fittings	Vendor to offer			
12.8	Operating Manuals, Maintenance Manuals & Catalogues for supplied Automatic Tool offset & Job measuring system, Voltage Stabilizer, Isolation Transformer, Air-Compressor and all supplied Accessories.	Vendor to offer			
12.9	User Program print-outs (hard copy) with comments in English for PLC of main machine and auxiliary systems (if used) alongwith cross reference list and Input/Output list.	Vendor to offer			
12.10	PLC program, NC data & PLC data on CD.	Vendor to offer			
12.11	Complete back-up of PCU-50 or equivalent (in case of Fanuc) hard disk on GHOST CD and clearly written Instructions to take back-up and reloading on a new hard disk.	Vendor to offer			
12.12	Complete list of parts/items( Bill of materials) used in the machine in English language.	Vendor to offer			
12.13	Electrical Schematic Diagrams, Wiring Diagrams, Junction Box Layouts, Connector Diagrams and Cable Layouts of the machine in English.	Vendor to offer			
12.14	Drawings of machine assemblies/sub-assemblies/parts including Pneumatic/ Coolant / Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list marked on it in English.	Vendor to offer			
12.15	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to offer			

<b>13 TRAINING:</b>					
13.1	Four BHEL Persons should be trained at vendor's works for each machine for the area & period given below: (a) CNC Part Programming for the machine, application of all CNC Features, Programming for Measuring Systems & supplied accessories etc. (Period 3 Weeks) (b) Electrical, Electronic & CNC maintenance for machine & other supplied equipments ( Period 2 weeks ) (c) Mechanical & Hydraulic maintenance of the machine & other supplied equipments ( Period 2 weeks ) (d) Operation of the machine & other supplied equipments ( Period 2 weeks ) Pre-dispatch inspection (ref. <b>Sl.No. 19.1</b> ) of the machine shall also be carried out by the team during their stay at vendor's works for the training. Vendor may specify days required for pre-dispatch inspection. BHEL reserves the right to choose no. of persons, field & period of training, out of above, while deputing their engineers for training.	Vendor to offer			
13.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	Vendor to confirm			
13.3	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel.	Vendor to confirm			
13.4	Vendor to quote for training on per man/ week basis	Vendor to quote			
13.5	Vendor should commit to organize and quote for training of Electronics Engineer and Programmer at the CNC System Manufacturer's works for advanced features and specialised training if so required by BHEL.	Vendor to confirm			
<b>14 FOUNDATION:</b>					
14.1	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. Soil condition data will be furnished by BHEL alongwith the approval. Complete Foundation Design including details, like Static/ Dynamic load details etc. and final Layout Drawings shall be submitted by the supplier within three months after getting BHEL's approval. The Layout should consist of all requirements pertaining to complete machine and all accessories, including space requirement for Voltage Stabiliser, Isolation Transformer, Air Compressor, Chip Bin & any other accessory. BHEL shall construct complete foundation for the machine under supervision of supplier's representative and at supplier's responsibility. Vendor should arrange equipment required for the testing of foundation, if required by the vendor. The vendor shall also indicate detailed specifications of grouting compound and grouting procedure etc. for foundation bolts of the machine.	Vendor to confirm			

<b>15</b>	<b>ERECTION &amp; COMMISSIONING</b>					
15.1	Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control system & all types of other supplied equipment, machining of test pieces etc. Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by supplier in their foundation/layout drawings. Other requirements like crane and helping personnel shall also be provided by BHEL. Details of these requirements should be informed by vendor in advance. The available crane capacity at the proposed location of the machine will be 150 Ton. The vendor will ensure to make requisite arrangement for lifting of heavier consignment/ items/ assembly of the machine not getting covered by this capacity.	Vendor to confirm				
15.2	Erection & Commissioning of Voltage stabilizer, Isolation Transformer & Air Compressor shall also be responsibility of the vendor.	Vendor to confirm				
15.3	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 to confirm				
15.4	Test mandrel for checking run-out/taper & alignment should be supplied	Vendor to confirm				
15.5	Tools, Tackles, Test Mandrels, instruments and other necessary equipment including Laser equipment required to carry out all above activities should be brought by the supplier.	Vendor to confirm				
15.6	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to confirm				
15.7	All cover plates required for the machine and its peripherals including pits, if any, shall be supplied and installed by the Vendor	Vendor to confirm				
15.8	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				
15.9	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to offer				
15.10	Charges, duration, terms & conditions for E&C should be furnished in details separately by vendor along with offer.	Vendor to offer				
15.11	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.					
<b>16</b>	<b>ACCURACY TESTS:</b>					
<b>16.1</b>	<b>GEOMETRICAL ACCURACIES :</b>					
16.1.1	Geometrical Accuracy Tests shall be in accordance with ISO 3070 standard or equivalent applicable standard. Detailed Test Charts for the same, clearly showing the accuracies to be achieved on the machine, shall also be submitted with the offer.	Vendor to confirm				
16.1.2	All the above accuracies to be demonstrated to BHEL engineers during pre-acceptance tests at Suppliers works and during Erection & Commissioning at BHEL Works.	Vendor to confirm				
16.2	MACHINE POSITIONING ACCURACIES & REPEATABILITY: Should be measured as per VDI/ DGQ3441/ ISO 230-2 (Latest Revision) using LASER INTERFERO METER.	Vendor to confirm				

16.2.1	Positioning uncertainty (Pa per 1000mm) for X,Y,Z,W & V axes	0.015mm			
16.2.2	Positioning uncertainty Pa for B-axis	3.6 secs			
16.2.3	Positional scatter (Ps per 1000mm) for X,Y,Z,W & V axes	0.008 mm			
16.2.4	Positional scatter Ps for B-axis	1.8 secs			
16.2.5	Total positioning error P for entire travel for X,Y,Z,W & V axes	X40,Y30,Z20,W20,V20 microns			
16.2.6	Total positioning error P for B-axis	Vendor to specify			
16.2.7	All the above accuracies to be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and during Erection & Commissioning at BHEL Works.	Vendor to confirm			
	Note 1: LC of scale should be taken to achieve above	Vendor to note			
	Note 2: Accuracy should remain within specified tolerance over a time period of 24 hours (Maximum temperature variation is 25 degree centigrade during peak summer)	Vendor to note			
	<b>17 AMBIENT CONDITIONS &amp; THERMAL STABILITY :</b>				
17.1	Power Supply (AC): Voltage = 415V +/- 10% of fluctuations , Frequency= 50Hz +/- 3% , No. of phases = 3 phase without neutral. Ambient Operating Conditions: Temperature = 5 to 48 degree Celsius , Relative Humidity = 95% max.	Vendor to take note			
17.2	Weather conditions are tropical. Atmosphere may be dust laden during some part of the year. Machine shall be kept in the normal shop floor condition. Max. temperature variation is up to 25 deg Celsius in 24 hours. (Vendor to confirm that machine is suitable for above and details of provisions on the machine for the same are to be furnished by Vendor)	Vendor to confirm			
17.3	Thermal Stability of the complete machine keeping in view specified Ambient Conditions and accuracy requirements of BHEL components and trouble free operation of the machine should be ensured by vendor. (Vendor to confirm that machine is suitable for above and details of provisions on the machine for the same should be furnished by Vendor)	Vendor to confirm			
17.4	Vendor to confirm that machine is suitable for successful running with guaranteed accuracies and production of jobs with accuracies as specified in proveout components in the conditions specified above. Details of provisions made on the machine for the same are to be furnished to BHEL.	Vendor to confirm			
17.5	The machine, including Attachments and Accessories etc., should be suitable for 24 hrs. continuous operation to its full capacity for 24 hour a day and 7 days a week throughout. Vendor to ensure and confirm the same.	Vendor to confirm			

<b>18</b>	<b>PROVEOUT OF BHEL COMPONENTS :</b>				
18.1	Drawing nos. 0-10601-57500, IP Outer Casing (Casting Drawing No.0-10601-57901) proveout components is enclosed. Job setting plan, Machining process plan & Requirement of Tools etc. for machining of proveout components shall be discussed and mutually agreed with vendor (Final proveout component drawing no. may change, however, the machining features of the changed components shall be in line with the original component drawing). Complete machining of prove out components shall be done by Vendor at BHEL works to the specified design accuracy and surface finish, using cutting tools and CNC programs to be provided by the vendor to prove the machine after complete erection, tests & test piece machining etc. Material for the proveout components shall be provided by BHEL. Vendor shall submit final job setting plan, machining process plan, tool layout & list with complete description, time study etc. for the proveout machining within two months of placement of order.	Vendor to offer.			
18.2	Vendor shall submit CNC programs prior to start of erection of Machine at BHEL works. 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. Any additional item required for completion of prove out components shall be supplied by the vendor in the specified quantity without any financial implications to BHEL. Clarifications, if any required by vendor, regarding accuracy requirements of the proveout components, whether specified or not, should be discussed and cleared by vendor during initial technical discussions.	Vendor to offer.			
18.3	Vendor shall be responsible, financially or otherwise, for any deviation/ rejection in proveout component to the extent of cost of Casting/ Forging, due to wrong machining or malfunctioning of the machine during proveout machining and also for the delay in machining due to improper recommended tooling etc..For such deviation / rejection, commercial condition as informed separately shall be applicable.	Vendor to confirm			
<b>19</b>	<b>MACHINE ACCEPTANCE: (Tests/Activities TO be Performed by Vendor)</b>	<b>Should be accepted &amp; confirmed by Vendor</b>			
19.1	Tests/Activities to be carried out at supplier's works on the machine before dispatch :	Vendor to confirm			
19.1.1	Geometrical Accuracy Tests as per test chart.	Vendor to confirm			
19.1.2	Positioning Accuracy Tests as per VDI-DGQ/3441	Vendor to confirm			
19.1.3	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from that time.	Vendor to confirm			
19.1.4	Demonstration of all features of the machine, CNC system and all Accessories.	Vendor to confirm			
19.1.5	Machining of NAS Test Piece. Vendor to supply test piece and tooling for it's machining.	Vendor to confirm			
19.2	Test to be carried out at BHEL works while commissioning the machine :	Vendor to confirm			
19.2.1	Geometrical Accuracy Tests as per test chart.	Vendor to confirm			
19.2.2	Positioning Accuracy Tests as per VDI-DGQ/3441	Vendor to confirm			

19.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to confirm			
19.2.4	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			
19.2.5	Demonstration of all features of the machine, CNC system & all accessories to the satisfaction of BHEL for their efficient and effective use.	Vendor to confirm			
19.2.6	Demonstration by actual use of all supplied attachments and accessories to their full capacity.	Vendor to confirm			
19.2.7	Machining of NAS Test Piece. Vendor to supply test piece and tooling for it's machining.	Vendor to confirm			
19.2.8	Prove out of BHEL component.				
19.2.9	Two weeks supervision of independent operation of machine by BHEL after job proveout.	Vendor to confirm			
19.2.10	Training of BHEL machine operators in operation of complete machine & accessories etc by the supplier's experts / engineers during their stay at BHEL works	Vendor to confirm			
<b>20</b>	<b>PACKING:</b>				
20.1	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			
<b>21</b>	<b>GUARANTEE :</b>				
21.1	24 months from the date of acceptance of the machine.	Vendor to confirm			
<b>22</b>	<b>GENERAL : The vendor should submit the following information:</b>				
22.1	Machine Model	Vendor to specify			
22.2	Total connected load (KVA):	Vendor to specify			
22.3	Floor area required (Length, Width, Height) for complete machine & accessories.	Vendor to specify			
22.4	Painting of Machine/ Electrical Panels: RAL 6011 Apple Green (Polyurethane Paint)	Vendor to confirm			
22.5	Total weight of the machine	Vendor to specify			
22.6	Weight of heaviest part of machine	Vendor to specify			
22.7	Weight of the heaviest assembly/ subassembly of the Machine	Vendor to specify			
22.8	Dimensions of largest part/ subassembly/ assembly of the machine	Vendor to specify			
22.9	Vendor to submit, along with offer, the reference list of customers where similar machines have been supplied mentioning the customer, Machine Model, major specifications of the supplied machine, CNC System, Year of Supply etc.	Vendor to specify			
22.10	Detailed catalogues , sketch/ photographs of the m/c and accessories/ attachments and Layout of the machine should be submitted with the offer.	Vendor to specify			

22.11	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			
22.12	Ladder, at suitable location, is to be provided to access the machine elements located at the top of the column as well as movement of operator from/ to Operator's platform in case of power failure or any other emergency.	Vendor to offer & confirm			
<b>23</b>	<b>QUALIFYING CONDITIONS :</b>	Vendor to accept & confirm			
23.1	Only those vendors (OEMs) should quote, who have supplied and commissioned at least one number CNC HORIZONTAL BORING MACHINE of (Spindle Diameter 160 mm, Ram+Spindle Traverse: 2100 mm) or higher sizes, for similar applications in the past ten years (on the date of opening of Tender). The following information is to be submitted by the vendor about the companies where similar machines have been supplied. This is required from all the vendors for qualification of their offer.	Vendor to accept & confirm			
	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 (Spindle Diameter, Ram+Spindle Traverse ) 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 at least one customer regarding satisfactory performance of machine supplied to them. The referred machine should presently be working satisfactorily for more than one year (on the date of opening of Tender ) after its commissioning.	Vendor to submit			
	8. 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	Vendor to accept & confirm			
<b>24</b>	<b>OTHER FEATURES:</b>	<b>Vendor to confirm</b>			
<b>24.1</b>	<b>NETWORKING:</b>				
	Machine control should have necessary hardware and software for interfacing with gigabit Ethernet Local Area Network with 100 MB/sec through UTP cables for NC program and other related data transfer. This network to be connected to wide area network/Internet. The networking should have following capabilities.	Vendor to confirm			
	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			



<b>24.2</b>	<b>MACHINE MONITORING SYSTEM (MMS) SIGNALS</b>					
	Following MMS signals would be made available on a specifically earmarked terminal strip. These MMS signals should be sourced from a PLC output card separately.			Vendor to offer		
	a) Control ON					
	b) Cycle ON					
	c) Spindle Running					
	d) Feed Active (Any of the axes moving)					
	e) M30 (Program Stop)					
	f) Alarm Active			Vendor to offer		
	<b>OPTIONAL ITEMS:</b>			<b>SHOULD BE QUOTED SEPARATELY</b>		
	<b>25 MEASURING SYSTEMS:</b>					
25.1	<b>JOB MEASURING SYSTEMS</b>					
25.1.1	Automatic job measuring system, comprising of Spindle Mounted 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. The party agreed that the measured result file shall be generated on the machine only ( not dependent on any external software/PC) & shall contain all relevant information such as nominal values, measured values, tolerances along with project details of measured component as per sample format enclosed as Annexure-I. Further, all the measurements done on the component shall appear in a single file in the above sample format so that it can be used by the inspection department directly. The same shall be demonstrated during the commissioning of the machine by using it for measurement of the prove out components after machining (All important dimensions of the proveout components will be mutually decided). Vendor to furnish detailed description of the system along with offer.			Vendor to offer with details.		
	<b>25.2 TOOL OFFSET MEASURING SYSTEMS</b>					
25.2.1	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 with list.		

<b>26</b>	<b>DIAGNOSTIC SYSTEM:</b>					
<b>26.1</b>	<b>TELE-DIAGNOSTIC SERVICE :</b>					
26.1.1	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. 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 offer with details.		
<b>27</b>	<b>CNC BORING &amp; FACING HEAD:</b>					
27.1	Model No: Preferably D' Andrea UT5-630S or equivalent			Vendor to offer		
27.2	Head body diameter			Vendor to inform		
27.3	Speed Range			0-250 rpm		
27.4	Feed rate on which boring head can be operated			Vendor to specify		
27.5	Radial axis independent positioning			Vendor to inform		
27.6	Slide stroke			200 mm		
27.7	Slide feed rate			1-400 mmpm		
27.8	Machining range in Boring internal diameter			1050 mm		
27.9	Accuracy of Bore Size (Bore Tolerance), Surface Finish of bores and Facial and Radial Run outs .			H7, 1.6 microns Ra, (Facial) 0.030 and (Radial) 0.030mm respectively.		
27.10	Diameter range for machining external diameter indicating max. depth			Vendor to inform		
27.11	Machining range in facing indicating maximum depth.			D1250 mm x 150mm depth		
27.12	Maximum boring depth without entry of Boring Head.			500 mm		
27.13	Maximum torque			Vendor to inform		
27.14	Maximum cutting force in boring			Vendor to inform		
27.15	Maximum cutting force in facing			Vendor to inform		
27.16	Slide Counter Balance mechanism			Vendor to inform		
27.17	Item wise details of complete set of standard Tool Holders and Tools, available with the offered Head, are to be submitted with the offer. Complete details of any special arrangement offered to meet the specified requirement of Boring range are also to be submitted.			Vendor to inform		

27.18	Tool Holder with BT 50 taper for presetting of the Tools for offered Boring and Facing Head is to be offered with complete details.				Vendor to offer.			
27.19	Catalogue of the offered Head is to be submitted with the offer.				Vendor to offer and submit			
27.20	Coolant system: External coolant with requisite flexible pipes on its snout is to be provided. The arrangement for its supply may be made through the coolant supply system available on the Head Stock.				Vendor to offer and submit			
	<b>28 CNC BORING &amp; FACING HEAD:</b>							
28.1	Model No: Preferably D' Andrea UT8-1000 or equivalent				Vendor to offer			
28.2	Head body diameter				Vendor to inform			
28.3	Speed Range				0-160 rpm			
27.4	Feed rate on which boring head can be operated				Vendor to specify			
28.5	Radial axis independent positioning				Vendor to inform			
28.6	Slide stroke				300 mm approx.			
28.7	Slide feed rate				1-500 mmrpm			
28.8	Machining range in Boring for internal diameter				1600 mm			
28.9	Accuracy of Bore Size (Bore Tolerance), Surface Finish of bores and Facial and Radial Run outs.				H7, 1.6 microns Ra, (Facial) 0.030 and (Radial) 0.030mm respectively.			
28.10	Diameter range for machining external diameter indicating max. depth				D1200 x 500 mm depth			
28.11	Machining range in facing indicating maximum depth.				800 mm			
28.12	Maximum boring depth without entry of Boring Head.				Vendor to inform			
28.13	Maximum torque				Vendor to inform			
28.14	Maximum cutting force in boring				Vendor to inform			
28.15	Maximum cutting force in facing				Vendor to inform			
28.16	Slide Counter Balance mechanism				Vendor to inform			
28.17	Item wise details of complete set of standard Tool Holders and Tools, available with the offered Head, are to be submitted with the offer. Complete details of any special arrangement offered to meet the specified requirement of Boring range are also to be submitted.				Vendor to inform			
28.18	Tool Holder with BT 50 taper for presetting of the Tools for offered Boring and Facing Head is to be offered with complete details.				Vendor to offer and submit			
28.19	Catalogue of the offered Head is to be submitted with the offer.				Vendor to offer and submit			
28.20	Coolant system: External coolant with requisite flexible pipes on its snout is to be provided. The arrangement for its supply may be made through the coolant supply system available on the Head Stock.				Vendor to offer and submit			