



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 TYPE CNC HORIZONTAL BORING MACHINE

NOTE:-

1. Vendor (OEM) must submit complete information against clause no. 24. The offer meeting this clause would only be processed.
2. The "Offered" Column and where applicable, the "Deviations" & "Remarks" Column of this format shall be filled in by the Vendor and submitted along with the offer. Inadequate / incomplete, ambiguous, or unsustainable information against any of the clauses of the specifications/requirements shall be treated as non-compliance.
3. The offer and all documents enclosed with offer should be in English language only.

NAME & ADDRESS OF THE SUPPLIER :	NAME & ADDRESS OF THE INDIAN AGENT :
TELEPHONE NOS.:	TELEPHONE NOS.:
FAX NOS.:	FAX NOS.:
E-MAIL ADDRESS :	E-MAIL ADDRESS :
SCOPE: SUPPLY, ERECTION & COMMISSIONING OF TABLE TYPE CNC HORIZONTAL BORING MACHINE COMPLYING WITH SPECIFICATIONS AS BELOW (MINIMUM REQUIREMENTS)	

Sl. NO.	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED/TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
1	PURPOSE & WORKPIECE MATERIAL				
1.1	Purpose: The CNC Hor. Boring Machine, with Special Attachments for machining of deep bores, is required for machining of Servo Motor Casings, Valve covers, Shaft Seal covers, Yokes & Bearings etc. of Steam Turbines of various ratings, involving Milling, Drilling, Boring, Reaming, Tapping/ Thread Cutting/ Thread Whirling and machining of deep bores with a high degree of finish and accuracy.				
1.2	Work Piece Material: The machine shall be suitable for machining of castings/Forgings of steel grade G17CrMoV5-10 as per DIN 17245, with Boring Head, and components of Ferrous and non-ferrous metals like Carbon Steel, low & High Alloy Steel, Cast Steel, Nodular Cast Iron and similar other materials.				
2	SPECIFICATIONS: (Minimum requirements)				
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.				

2.2 HEAD STOCK					
2.2.1 Boring spindle diameter		160mm			
2.2.2 Milling spindle diameter		Vendor to specify			
2.2.3 Ram Cross section (LxB)		400 X 400			
2.2.4 Spindle drive power (AC Continuous Rating - S1), Minimum		60 KW			
2.2.5 Spindle speed (Infinitely variable)		5 or less to 2500 or more			
2.2.6 No. of speed ranges		Vendor to specify			
2.2.7 Max torque on the boring spindle (N-m)		3300 Nm			
2.2.8 Max torque on the milling spindle (N-m)		3300 Nm			
2.2.9 Spindle taper		ISO50/BT50			
2.2.10 Spindle Motor & Drive Make: FANUC αi 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 submitted)		Vendor to submit			
2.3 COLUMN:					
2.3.1 Column longitudinal travel (X-Axis)		5000mm			
2.3.2 X-axis feed rate (Infinitely variable)		25000 mm/min			
2.3.3 X-axis rapid traverse rate		25000 mm/min			
2.3.4 Axis Resolution		0.001mm			
2.4 HEADSTOCK TRAVERSE ON COLUMN:					
2.4.1 Headstock vertical travel (Y-Axis)		2500mm			
2.4.2 Traverse Range (wrt Table Top)		0 to 2500mm			
2.4.3 Y-axis feed rate (Infinitely variable)		1-25000 mm/min			
2.4.4 Y-axis rapid traverse rate		25000 mm/min			
2.4.5 Axis Resolution		0.001mm			
2.5 RAM/ SPINDLE TRAVERSE:					
2.5.1 Boring spindle axial travel (W-Axis)		900mm			
2.5.2 Ram axial travel (Z-Axis)		1200mm			
2.5.3 Spindle + Ram travel (W+Z)		2100mm			
2.5.4 Lowest spindle position from table top		Vendor to inform			
2.5.5 Boring Spindle axis feed rate (Infinitely variable)		10000 mm/min			
2.5.6 Boring Spindle axis rapid traverse rate		1-25000 mm/min			
2.5.7 Ram axis feed rate (Infinitely variable)		25000 mm/min			
2.5.8 Ram axis rapid traverse rate		25000mm/min or more			

2.5.9	Axis Resolution		0.001mm			
2.5.10	Spindle & Ram Axes should be independently programmable with Independent Drives and Feed back system.		Vendor to confirm			
	2.6 FEED AND DRIVE SYSTEMS:					
2.6.1	Feed motors & drives: FANUC at 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 MACHINE GUIDEWAYS:					
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. There should be bellow covers of coolant proof material below telescopic covers to eliminate any chance of coolant mixing with hydrostatic oil, as applicable. The movement of telescopic covers should be troublefree and requiring minimum maintenance. Telescopic covers for X-axis should be with a slant towards Chip conveyor.		Vendor to offer and confirm			

2.8	ROTARY TABLE :					
2.8.1	Table size (LxB)		2000x2500mm			
2.8.2	Maximum load carrying capacity (Tons)		40 ton			
2.8.3	Chart/Table showing relation of weight and distance of c.g. from centre of Rotary Table (loading chart of table) to be submitted.		Vendor to confirm & submit.			
2.8.4	Table rotation (Fully programmable B-axis)		360000 indexing positions			
			40000 Nm			
2.8.5	Maximum machining torque on B-axis (N-m)		50000 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)		Suitable for Studs of M24 size.			
2.8.9	Size of T-slots		Vendor to specify and confirm			
2.8.10	T-slots pitch (as per DIN standard)		Vendor to specify			
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		2000mm			
2.8.15	Feed Force on Linear Axis		Vendor to specify			
2.8.16	Feed Rate for Linear axis (mm/ min Infinitely variable)		1 to 10000mmpm			
2.8.17	Rapid Traverse rate for Linear axis (mm/ min)		10000mmpm			
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 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		Suitably positioned in the center of the X axis traverse.			
2.8.24	From Center of Rotary Table, X traverse should be equal on either side.		Vendor to confirm			
2.8.25	Hydrostatic Guideways for Table Rotation, Details to be submitted.		Vendor to confirm.			
2.8.26	Hydrostatic Guideways for Table Linear Traverse. Details to be submitted.		Vendor to confirm.			
2.8.27	4 x 90 deg Precision Positioning (Details to be submitted.)		Vendor to submit.			
2.8.28	Backlash free re-circulating ball screw with Pre-loaded double nut for Table Linear axis. Complete description of the same including diameter of Ball Screw, to be submitted with the offer)		Vendor to submit.			

2.9 CONSTRUCTION:					
2.9.1	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			
2.9.2	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 submit			
2.9.3	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			
2.9.4	Head Stock and Column Counterbalancing System. (Details of the offered system to be submitted)	Vendor to submit			
2.10 OPERATOR'S PLATFORM:					
2.10.1	Operator's platform of min 300 kg load carrying capacity attached to Headstock for total Vertical Traverse as well as forward stroke of sufficient length . A 15 Amp. Plug Point with ON/ OFF switch is also to be provided on the Platform.	Vendor to confirm			
2.10.2	Horizontal movement of Operator's Platform.	Vendor to specify			
2.10.3	Weight carrying Capacity of the Platform should be Min. 300 Kg..	Vendor to confirm			
2.10.4	Minimum Height of Platform from Shop Floor.	Vendor to specify			
2.10.5	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			
2.11 OPERATION AND CONTROL SYSTEM:					
2.11.1 OPERATOR'S PANEL:					
2.11.1.1	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 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.			
2.11.1.2	An auxiliary pendant, which can be taken to the table for job setting and similar other purposes, should be provided.	Vendor to confirm			

2.11.2	CNC SYSTEM & FEATURES :					
2.11.2.1	Make : Fanuc / Siemens.				Vendor to confirm	
2.11.2.2	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	
2.11.3	MANUAL CONTROL:					
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.	

2.11.4	HAND HELD UNIT:				
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	UPS FOR CNC SYSTEM: (Only in case of PC based CNC systems)				
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	NOTE BOOK PC (I/O DEVICE):				
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.			
2.12	MACHINE LIGHTS:				
2.12.1	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.			
2.12.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to offer & specify details.			
2.12.3	Any lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to confirm			
2.12.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to confirm			
2.12.5	Flashing / rotary type End of Cutting and Program Stop Light.	Vendor to confirm			
2.13	REFRIGERATION UNITS / AIR CONDITIONERS				
2.13.1	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			

2.13.2	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.				
2.13.3	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			
2.13.4	For precise air/ oil temperature with energy-efficient operation, latest state-of-the-art technology features like constant pressure control, variable speed control of fan-motor, hot-gas bypass control, etc. needs to be incorporated in the above Unit (s).	Vendor to offer and confirm			
2.13.5	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.				

2.13.6	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			
2.13.7	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			
2.14	HYDRAULIC SYSTEM : Details should be Submitted by the Vendor				
2.14.1	The Hydraulic System shall be of Re-circulating Type. Hydraulic Tank should be preferably placed at shop floor.	Vendor to offer and confirm			
2.14.2	Pumps, Valves, Switches (Pressure & Flow) should be of Make : Rexroth / Vickers / Parker / Hawe.	Vendor to offer and confirm			
2.14.3	Filtration System: Sufficient no. of filters (with electric clogging indicator and alarm on PLC) should be used to avoid frequent clogging of the filters and other maintenance related problems. Filter elements should be of Make: EPE / Hydac.	Vendor to offer and confirm			
2.14.4	Failure indication	Vendor to offer			
2.14.5	Automatic shut off provision, Details should be submitted.	Vendor to offer			
2.14.6	Refrigerated type cooling system of sufficient capacity to maintain complete Hydraulic System, including lubrication oil, hydrostatic oil and gearbox oil, etc. keeping in view the specified ambient conditions to be offered with complete details. The temperature of Hydraulic Oil should not go beyond 40 deg. C.	Vendor to offer & submit			

2.14.7	Hydraulic pump capacity (flow/ pressure) to be intimated.	Vendor to inform			
2.14.8	No Tandem pumps should be used. Maximum desired permissible pressure is 100 Kg/sqcm. If anywhere, more than 100 Kg/sqcm pressure is used, then one set of such hose pipes and seal kit of such Hydraulic cylinder should be supplied in spare in addition to other spares.	Vendor to confirm & offer			
2.14.9	First filling of all required Oils & Grease etc. to be supplied by vendor. Indigenous (Indian) source or Indian equivalent and specifications of oils / greases are also to be provided by the vendor.	Vendor to offer & submit			
2.15	COOLANT SYSTEM:				
2.15.1	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 thru Spindle	Vendor to offer & confirm			
2.15.2	All offered attachments, tool holders, boring bars, cassettes, adapters etc. shall have the provision so that coolant is available directly at the tool-cutting tip.	Vendor to confirm			
2.15.3	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			
2.15.4	Coolant Filtration System: Recirculating type coolant system with Vacuum Rotary drum type Filtration System and magnetic separator.	Vendor to confirm and submit details.			
2.15.5	Coolant Flow Diagram showing filters, pumps, valves, tanks etc. to be submitted with the offer.	Vendor to submit			
2.15.6	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.			
2.15.7	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			

2.15.8	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 confirm			
2.15.9	Coolant pump & motor details for all variants of coolant system are to be submitted with the offer.	Vendor to submit			
2.15.10	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Required.			
2.16	ELECTRICAL SYSTEM:				
2.16.1	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			
2.16.2	Tropicalisation: All electrical/ electronic equipment shall be tropicalized.	Vendor to confirm			
2.16.3	All electrical & electronic control cabinets & panels should be dust and vermin proof.	Vendor to confirm			
2.16.4	All electrical components in the cabinets should be mounted on DIN Rail	Vendor to confirm			
2.16.5	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			
2.16.6	Motors shall conform to IEC or Indian Standards	Vendor to confirm			
2.16.7	All cables moving with traversing axes should be installed in Caterpillar/ Drag chain mounted vertically. Additionally, all the cable trays required for laying of cables should be included in the offer.	Vendor to confirm			
2.16.8	Vendor should ensure the proper earthing for the machine and its peripherals.	Vendor to confirm			
2.16.9	In-cycle hour counter with reset facility is to be included in the offer.	Vendor to offer			

2.17 SAFETY ARRANGEMENTS:						
	Following safety features in addition to other standard safety features should be provided on the machine:					
	1. Machine should have adequate and reliable safety interlocks / devices to avoid damage to the machine, workpiece and the operator due to the malfunctioning or mistakes. Machine functions should be continuously monitored and alarm / warning indications through lights/ alarm number with messages (on CNC display and panels) should be available.	Vendor to confirm				
	2. A detailed list of all alarms / indications provided on machine along with cause and remedy should be submitted by the supplier.	Vendor to Submit				
	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.	Vendor to confirm				
	4. All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations.	Vendor to confirm				
	5. Emergency Switches at suitable locations as per International Norms are to be provided.	Vendor to provide				
	6. Oil & water pipe lines should not run with electrical cable in the same tray / trench.	Vendor to confirm				
	7. Safety Lights on moving column (preferably Flashing during X-travel).	Vendor to confirm				
2.18 ENVIRONMENTAL PERFORMANCE OF THE MACHINE:		Vendor to confirm				
	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.	Vendor to confirm				
	(b) There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm				
	(c) There should not be any effluent from the machine. In case there are any effluents from the machine, requisite effluent treatment plant or pollution control device should be built into the machine by the supplier.	Vendor to confirm				
	(d) No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm				
	(e) If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm				
	(f) Paint of the machine should be oil / coolant resistant and should not peel off and mix up with coolant.	Vendor to confirm				

3	CHIP CONVEYOR:					
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	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				
4	ULTRA ISOLATION TRANSFORMER					
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	NEEL or Aplab or Auto Electric or Servomax or of international repete.				
4.3	Model and Rating	Vendor to specify				
4.4	Catalogue of the Isolation Transformer shall be submitted with the offer.	Vendor to submit				
5	PNEUMATIC SYSTEM:					
5.1	AIR COMPRESSOR:					
5.1.1	Independent Air Compressor (of reputed Indian make Elgi, Chicago Pneumatic or Ingersol Rand) with refrigerated type Dryer & Filter of suitable capacity for the total compressed air requirements of the machine & accessories and to suit required air quality should be supplied. The system should be so designed to have additional provision and required accessories before Refrigerated type Air Dryer so that BHEL compressed air supply having pressure 5 Kg/sq.cm with high moisture could be used as and when required. The compressor unit should be suitable for continuous duty operation.	Vendor to offer with details.				
5.1.2	Make & Model of Air Compressor and Refrigerator type Dryer.	Vendor to specify				
5.1.3	Capacity (Flow, Pressure & KW)	Vendor to specify				
5.1.4	Spares Package for the compressor for 2 years trouble free working should also be offered.	Vendor to specify				

5.2 COMPRESSED AIR POINTS:					
5.2.1 Compressed Air Point with manual ON/ OFF Valve and flexible pipe of suitable length for work piece cleaning.			Vendor to confirm		
6 TOOLINGS:					
6.1 Complete Description of Tooling system			Vendor to specify		
6.2 All cutting tools, tool holders, arbors, boring bars, clamping elements etc., recommended for machining of proveout components (Shaft Sealing Cover Drg. no: 0-10505-24010, Bearing Shell Drg. no: 0-11604-18100, Servo Motor Casing Drg. no: 0-11401-02011 and Valve Cone 1-11320-02002) shall be offered by the vendor. Consumables for offered Tools, like inserts, screws etc., should be quoted for machining of 2 more similar components of each type in addition to the prove-out components.			Vendor to specify and offer.		
7 MEASURING SYSTEM:					
7.1 Automatic job measuring system with measuring cycles, calibration system and all types of probes / stylil required for measuring dimensions of the prove-out components. Vendor to furnish detailed description of the system along with offer. The measurement system shall be customised so that the measured result file shall be generated in the CNC System only and shall contain all relevant information such as nominal values, measured values, tolerances along with project details of measured component as per sample format at Annexure-I. Further , all the measurements done on the component shall appear in a single file in the above sample format. The selected probing results output file shall be printable from the CNC screen of the machine on a printer through a single key command/soft Key. All necessary hardware & software including Printer, all types of cables, communication software, CNC features required for above mentioned setup shall be provided by the party.			Vendor to offer with details.		
7.1.1 Spares Package for the Measuring system for 2 years trouble free working should also be offered. The spares should include Tool Probes, Interface Unit & Special Tips if any.			Vendor to offer with list.		
7.2 Automatic Tool Offset measuring system with measuring cycles, calibration system etc suitable for all types of tools recommended for prove-out components. The system shall be capable of measuring tool length ,tool radius and loading these values into tool offset memory of the machine. The system shall be such that the measurement should be with an accuracy of 10 microns or less. In addition, the system shall be capable of monitoring of runout of tools. Vendor to furnish detailed description of the system along with offer.			Vendor to offer with details.		

7.2.1	Spares Package for the Automatic Tool Offset Measuring system for 2 years trouble free working should also be offered.					
8	DIAGNOSTIC SYSTEM:					
8.1	TELE-DIAGNOSTIC SERVICE :					
8.1.1	Tele diagnostic service package consisting of Modem and other hardware with all necessary software package for remote diagnosis and resolution of faults of CNC System and PLC of the machine should be offered. With this facility, complete Graphic User Interface of CNC system can be looked at and operated from remote controlled PC of supplier so that errors can be recognized and changes or correction can be made from supplier's end. Tele-diagnostic service should be provided through International telephone lines. This should be provided free of charge for the guarantee period. Terms and conditions for the service after guarantee period should be informed by vendor. Subsequently, it should be possible to use other platforms, such as Internet or ISDN, subject to their availability in future.			Vendor to offer and submit details.		
8.2	FAULT DIAGNOSTIC SYSTEM:					
8.2.1	Supplier's own diagnostic system with required Software and Hardware installed on the CNC system, which shows detailed cause and remedy for the fault on the CNC system display with full video diagnostics indicating the element /device causing the fault. Vendor should also offer a PC note book along with Simatic S7 software (licensed copy), necessary cables, PCMCIA card / Adaptor (for Communication with MPI port) for diagnostic purpose. The Note Book PC should be loaded with complete Electrical Schemes, Mechanical Assembly drawings, Hydraulic Circuit Diagrams, Operation and Maintenance Manuals, Machine Alarm list along with Help text wiring diagram, On-Line display of PLC user should be available on the note book PC.			Vendor to offer & submit		
8.2.2	Provision of OEM Screen with soft keys enabling the service personnel to bring back the tool carriers of the ATC/AAC to its initial/nearest position in case of interruption of tool carrier's positioning cycle due to alarm on the machine or power failure. With this OEM screen, service personnel should be able to perform individual steps of Tool carriers positioning cycle manually. Separate Hand Held Pendant should also be provided to retrieve the tool carrier to it's initial position.			Vendor to offer		
8.2.3	Machine should have provision to switchover from position feedback system -2 (direct) to Position feed back system-1 (Motor encoder) through PLC program (for service personnel only).			Vendor to offer		
8.2.4	Help guide should be provided to use both diagnostic systems shall be provided.			Vendor to confirm		

9	LEVELING & ANCHORING SYSTEM					
9.1	Complete anchoring system including foundation bolts, anchoring materials, fixators, leveling shoes etc shall be supplied for the Machine and Rotary Table.	Vendor to offer and submit details.				
10	TOOLS FOR ERECTION, OPERATION & MAINTENANCE :					
10.1	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				
10.2	Test mandrel for checking spindle run-out & alignment should be supplied	Vendor to confirm				
11	ACCESSORIES:					
11.1	AUTOMATIC TOOL CHANGER & TOOL MAGAZINE					
11.1.1	Type	Vendor to specify				
11.1.2	No. of storage locations	40 or more				
11.1.3	Tool shank	ISO50/BT50				
11.1.4	Max tool diameter (all pockets filled)	140mm or more				
11.1.5	Max tool diameter (adjacent pockets empty)	Vendor to specify				
11.1.6	Max tool length	500mm				
11.1.7	Tool change time (tool-to-tool)	Vendor to specify				
11.1.8	Tool change time (chip-to-chip)	Vendor to specify				
11.1.9	Tool selection method: Random with shortest path	Vendor to confirm				
11.1.10	The machine shall have manual Tool loading/ unloading through push button provided on machine head stock/ Auxiliary Hand pendant.	Vendor to confirm				
11.1.11	The spindle taper and tool pocket at changer station will have the provision of cleaning by compressed air blow during ATC cycle. The spindle taper will also have the provision of compressed air blow through push button provided on machine head stock/ Auxiliary Hand pendant during manual tool change.	Vendor to confirm				
11.1.12	Auxiliary Control, with suitable interlocks, for manual insertion / withdrawal of tool from the tool magazine.	Vendor to confirm				
11.1.13	Suitable arrangement, Software based customised screens and manual key based, should be provided to extract a tool trapped in the ATC cycle. Details of both the system to be provided along with the offer.	Vendor to submit				
11.1.14	Tool changing position should be at a convenient height from floor, which will be mutually agreed, so that it remains at an approachable position in order to work manually in case of emergency.	Vendor to confirm				
11.1.15	Maximum Tool Overhang out of different Holders.	Vendor to specify				
11.1.16	Maximum Permissible Weight on each Pocket. (It should not be less than 35 Kg.)	Vendor to specify				

11.1.17	Maximum Permissible Weight on Complete ATC.				Vendor to specify		
11.1.18	The Machine operation should be possible with or without referencing ATC.				Vendor to confirm		
11.1.19	One set of tool holder retention stud equal to Tool Magazine capacity shall be provided as standard item with the machine. Drawing of Pull Stud should also be supplied.				Vendor to confirm & submit		
11.1.20	Tool Changer arm working should be explained in details. Full ATC catalogue should be submitted with the offer.				Vendor to confirm & submit		
11.1.21	During a tool change if Power goes off or the fault occurs : a provision shall be provided by the vendor for auto tool change recovery cycle. So that when the power resumes or fault is removed, the operator can complete the tool change.Provision has to be provided for tool change in manual mode in single individual steps. Also, any tool change performed in manual mode should be recorded by the CNC in the 'Tool Table', as in case of Automatic Tool Change. A by-pass switch has to be provided so that one can change the tool in manual mode instead of Automatic mode.				Vendor to confirm & submit		
11.2	AUTOMATIC ATTACHMENT CHANGER (AAC):						
11.2.1	All attachments shall be suitable for loading / unloading through AAC						
11.2.2	No. of storage positions (Matching with number of offered attachments). The storage rack of Attachment changer should be covered from all sides with provision of automatic opening and closing of doors of attachment rack during change of attachment.				Vendor to confirm		
11.2.3	Location of the attachment changer				At the extreme Right Hand side looking from Spindle.		
11.2.4	Mounting plates as required for attachments should be supplied				Vendor to specify		
11.2.5	Maximum Permissible Weight on each Position.				Vendor to confirm		
11.2.6	Maximum Permissible Weight on Complete AAC.				Vendor to specify		
11.2.7	Additional Longitudinal Traverse of X-axis required to accommodate and use of AAC beyond the specified X-axis traverse shall be separately offered by the vendor.				Vendor to specify		
11.2.8	Suitable Software based customized screens and 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		
11.3	PROGRAMMABLE ANGULAR MILLING HEAD/ RIGHT ANGLE MILLING HEAD:						
11.3.1	Power				60 Kw		
11.3.2	Max torque				3000 Nm. See attachment 45		

11.3.3	Feed rate on which milling head can be operated		Vendor to specify		
11.3.4	Speed Range (Infinitely Variable)		same as spindle		
11.3.5	Speed ratio (1:1 between spindles of Machine and Head)		Vendor to confirm		
11.3.6	Spindle taper		ISO50/BT50		
11.3.7	Traverse Range of C-axis		360 deg.		
11.3.8	Resolution of C-axis		1 deg.		
11.3.9	Power-Torque-Speed characteristic diagram to be submitted		Vendor to submit		
11.3.10	Wt. of the head		Vendor to submit		
11.3.11	Coolant system: Internal (thru spindle) & External coolant with requisite flexible pipes on its snout is to be provided.		Vendor to specify		
11.3.12	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		
	11.4 SPECIAL BORING AND FACING HEAD (Body Dia. 160mm Approx.)		Vendor to confirm		
11.4.1	Min. Boring Dia		Vendor to specify		
11.4.2	Max. Boring dia		320mm		
11.4.3	Max. Boring depth with standard Tool holder		800mm		
11.4.4	Feed rate on which boring head can be operated		Vendor to specify		
11.4.5	Min. Facing Dia		Vendor to specify		
11.4.6	Max. Facing dia		Vendor to specify		
11.4.7	Max. speed		300rpm (approx.)		
11.4.8	Tool slide stroke		40mm approx.		
11.4.9	Accuracy of Bore Size (Bore Tolerance), Surface Finish of bores and Facial and Radial Run outs		H7, 1.6 microns Ra, (Facial) 0.010 and (Radial) 0.020mm respectively.		
11.4.10	The radial axis of the offered Head may be programmable through Spindle Traverse or independent motor. Its details may be submitted with the offer		Vendor to offer		
11.4.11	Item wise details of complete set of standard Tool Holders and Tools, to be used 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 offer		
11.4.12	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 submit		
11.4.13	Details, including schematic sketches, of the offered Head are to be submitted with the offer. Drawing of Pull Stud, if required, should also be submitted.		Vendor to submit		

11.4.14	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.				
11.5	SPECIAL BORING AND FACING HEAD (Body Dia. 225mm Approx.)	Vendor to confirm			
11.5.1	Min. Boring Dia	Vendor to specify			
11.5.2	Max. Boring dia	500mm			
11.5.3	Max. Boring depth with standard Tool holder	900			
11.5.4	Max. Boring depth with special extended Tool holder for dia 150mm	1050			
11.5.5	Feed rate on which boring head can be operated	Vendor to specify			
11.5.6	Min. Facing Dia	Vendor to specify			
11.5.7	Max. Facing dia	Vendor to specify			
11.5.8	Max. speed	300rpm (approx.)			
11.5.9	Tool slide stroke	60mm Approx.			
11.5.10	Accuracy of Bore Size (Bore Tolerance), Surface Finish of bores and Facial and Radial Run outs.	H7, 1.6 microns Ra, (Facial) 0.010 and (Radial) 0.020mm respectively.			
11.5.11	The radial axis of the offered Head may be programmable through Spindle Traverse or independent motor. Its details may be submitted with the offer	Vendor to offer			
11.5.12	Item wise details of complete set of standard Tool Holders and Tools, to be used 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 offer			
11.5.13	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 submit			
11.5.14	Details, including schematic sketches, of the offered Head are to be submitted with the offer. Drawing of Pull Stud, if required, should also be submitted.	Vendor to submit			
11.5.15	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 submit			
12	SPARES:				
12.1	Itemwise breakup of mechanical, hydraulic, electrical and electronic spares used on the machine in sufficient quantity as per recommendation of Vendor for 2 years of trouble free operation on three shifts continuous running basis should be offered by vendor. The list to include following, in addition to other recommended spares: (Unit Price of each item of spare should be offered)	Vendor to confirm			

12.1.1	Mechanical & Hydraulic Spares: The following spares are to be included.				
12.1.1.1	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			
12.1.1.2	Pressure switches, flow switches used in Hyd / Lub / Pneumatic/ coolant circuit. (1 No. of each type)	Vendor to offer			
12.1.1.3	All types of regenerative type filter inserts (6 No. of each type in hydraulic, pneumatic & coolant circuit)	Vendor to offer			
12.1.1.4	All types of Disposable type filter inserts (10 nos. of each type)	Vendor to offer			
12.1.1.5	All types of Accumulator bladders (1 no. of each type) with charging kit	Vendor to offer			
12.1.1.6	One set of timing belts used in the machine.	Vendor to offer			
12.1.1.7	One set of seal kits used in different hydraulic & pneumatic cylinders in the machine.	Vendor to offer			
12.1.2	Electrical /Electronic / CNC Spares : Following Spares are to be offered.	Vendor to offer			
12.1.2.1	Limit Switches/ Micro Switches (2 Nos each type)	Vendor to offer			
12.1.2.2	Relays (2 Nos each type)	Vendor to offer			
12.1.2.3	Contactors (2 Nos each type)	Vendor to offer			
12.1.2.4	RTD temperature transmitter (1 No each type)	Vendor to offer			
12.1.2.5	Proximity Switches (5 Nos each type)	Vendor to offer			
12.1.2.6	Push Buttons (5 Nos each type)	Vendor to offer			
12.1.2.7	Indicating Lamps (10 Nos each type)	Vendor to offer			
12.1.2.8	Semiconductor Fuses (5 Nos each type)	Vendor to offer			
12.1.2.9	Special Fuses (5 Nos each type)	Vendor to offer			
12.1.2.10	Circuit Breakers (1 No each type)	Vendor to offer			
12.1.2.11	Main Power Switch (1 No each type)	Vendor to offer			
12.1.2.12	Encoders (1 No each type)	Vendor to offer			
12.1.2.13	Scanning Heads for Linear Scales (1 No each type)	Vendor to offer			
12.1.2.14	PCU module (Hard disk loaded with Ghost of the machine after final commissioning)	Vendor to offer			
12.1.2.15	NCU module	Vendor to offer			
12.1.2.16	I/O Cards for PLC (1 No each type)	Vendor to offer			
12.1.2.17	Power Module & Control Cards for Main Drive as well as Feed Drives (1 Nos each type)	Vendor to offer			
12.2	All types of spares for total machine and accessories should be available for at least ten years after supply of the machine. If machine or control is likely to become obsolete in this period, the vendor should inform BHEL sufficiently in advance and provide drawings of parts / details of spares & suppliers to enable BHEL to procure these in advance, if required.	Vendor to offer			

12.3	Recommended set of spares for all attachments, viz.: Angular Milling Head, and Boring Heads are to be offered with details. The spares are to include Motors, Set of Gears, Encoders, Limit/ Cam Switch Connectors with item wise details.	Vendor to offer			
12.4	Recommended set of spares for Job and Tool Measuring Systems are to be offered with details.	Vendor to offer			
12.5	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			
13	DOCUMENTATION : Three sets of following documents (Hard copies with Soft Copies wherever specified) in English language should be supplied along with the machine	Vendor to offer			
13.1	Operating manuals of Machine & CNC system	Vendor to offer			
13.2	Programming Manuals of Machine & CNC system	Vendor to offer			
13.3	Detailed Maintenance manual of machine and supplied systems.	Vendor to offer			
13.4	Maintenance Interface & commissioning manuals, PLC programming manual for CNC system, Interface & commissioning manuals for spindle ,feed drives and auxiliary drive.	Vendor to offer			
13.5	Manufacturing drawings for all supplied clamping elements, cutting tools, tool holders, arbors, boring bars, coolant connections, adapters, sleeves, fixtures etc.	Vendor to offer			
13.6	Catalogues, Operation & Maintenance Manuals of all bought out items including drawings, wherever applicable.	Vendor to offer			
13.7	Detailed specification of all rubber items and hydraulic/lube fittings	Vendor to offer			
13.8	Operating Manuals, Maintenance Manuals & Catalogues for supplied accessories viz. Voltage Stabilizer, Isolation Transformer, Air-Compressor, Boring Attachments, Automatic Tool & Job measurement system etc.	Vendor to offer			
13.9	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			
13.10	PLC program, NC data & PLC data on CD.	Vendor to offer			
13.11	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			
13.12	Complete list of parts/items(Bill of materials) used in the machine in English language.	Vendor to offer			

13.13	Electrical Schematic Diagrams, Wiring Diagrams, Junction Box Layouts, Connector Diagrams and Cable Layouts of the machine in English.	Vendor to offer			
13.14	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			
13.15	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to offer			
14	TRAINING:				
14.1	Four BHEL Persons should be trained at vendor's works for each machine for the area & period given below: (a) CNC Part Programming for the machine, application of all CNC Features, Programming for Measuring Systems & supplied accessories etc. (Period 3 Weeks) (b) Electrical, Electronic & CNC maintenance for machine & other supplied equipments (Period 2 weeks) (c) Mechanical & Hydraulic maintenance of the machine & other supplied equipments (Period 2 weeks) (d) Operation of the machine & other supplied equipments (Period 2 weeks) Pre-dispatch inspection (ref. Sl.No. 20.1) of the machine shall also be carried out by the team during their stay at vendor's works for the training. Vendor may specify days required for pre-dispatch inspection. BHEL reserves the right to choose no. of persons, field & period of training, out of above, while deputing their engineers for training.	Vendor to confirm			
14.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	Vendor to confirm			
14.3	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel.	Vendor to confirm			
14.4	Vendor to quote for training per person per week basis	Vendor to quote			
14.5	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			

15 FOUNDATION:					
15.1	Vendor shall submit the preliminary layout drawing for getting BHEL's approval within two month from the date of Letter of Intent (LOI)/ P.O., whichever is earlier. Soil condition data will be furnished by BHEL alongwith the approval. Complete Foundation Design including details, like Static/ Dynamic load details etc. and final Layout Drawings shall be submitted by the supplier within three months after getting BHEL's approval. The Layout should consist of all requirements pertaining to complete machine and all accessories, including space requirement for Voltage Stabiliser, Isolation Transformer, Air Compressor, Chip Bin & any other accessory. BHEL shall construct complete foundation for the machine under supervision of supplier and at supplier's responsibility. Vendor should arrange equipment required for the testing of foundation, if required by the vendor. The vendor shall also indicate detailed specifications of grouting compound and grouting procedure etc. for grouting of foundation bolts of the machine.	Vendor to confirm			
16 ERECTION & COMMISSIONING					
16.1	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			
16.2	Erection & Commissioning of Voltage stabilizer, Isolation Transformer & Air Compressor shall also be responsibility of the vendor.	Vendor to confirm			
16.3	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at Clause 21.0 (Machine Acceptance) shall form part of the commissioning activity.	Vendor to confirm			
16.4	Tools, Tackles, Test Mandrels, instruments and other necessary equipment including Laser equipment required to carry out all above activities should be brought by the supplier.	Vendor to confirm			
16.5	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to confirm			
16.6	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to submit			
16.7	All Cover Plates required for the machine and its peripherals shall be supplied by the vendor.	Vendor to confirm			

16.8	Special tools and equipment required for erection of the machine shall be brought by the vendor. Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc. for operation and maintenance of the machine should be supplied. List of such tools should be submitted with offer.				Vendor to confirm and submit details.		
16.9	Test mandrel for checking spindle run-out & alignment should be supplied				Vendor to confirm		
16.1	The vendor shall supply sufficient quantity of paint of the machine and carry out touching wherever the paint is damaged during transit or erection of the machine.				Vendor to confirm		
16.11	Charges, duration, terms & conditions for E&C should be furnished in details separately by vendor along with offer.				Vendor to offer		
17	ACCURACY TESTS:						
17.1	GEOMETRICAL ACCURACIES :						
17.1.1	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		
17.1.2	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		
17.2	MACHINE POSITIONING & REPEATABILITY ACCURACIES : SHOULD BE MEASURED AS PER VDI/DGQ 3441 (LATEST REVISION) USING LASER INTERFEROMETER.						
17.2.1	Positioning uncertainty (Pa per 1000mm) for X, Y, Z, W & V axes				0.015 mm		
17.2.2	Positioning uncertainty Pa for B-axis				3.6 secs		
17.2.3	Positional scatter (Ps per 1000mm) for X, Y, Z, W & V axes				0.008 mm		
17.2.4	Positional scatter Ps for B-axis				1.8 secs		
17.2.5	Total positioning error P for entire travel for X, Y, Z, W & V axes				X=40, Z=30, Y=20, V=20, W=20 micron		
17.2.6	Total positioning error P for B-axis				B= 6 sec. See attachment 63 for test protocol		
17.2.7	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: L/C 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		

18	AMBIENT CONDITIONS & THERMAL STABILITY :				
18.1	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			
18.2	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			
18.3	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			
18.4	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			
18.5	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			

	19 PROVEOUT OF BHEL COMPONENTS :	Vendor to offer and confirm			
19.1	<p>Drg. nos. 0-10505-24010 (Shaft Sealing Cover), 0-11604-18100 (Bearing Shell) , 0-11401-02011 (Servo Motor Casing) & 1-11320-02002 (Valve Cone) will be likely proveout component for second machine. 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</p>				
	two months of placement of order. 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. Clarifications, if any required by vendor, regarding accuracy requirements of the proveout components, whether specified or not, should be discussed and cleared by vendor during initial technical discussions.	Vendor to confirm			
19.2	During proveout, all tools should be preset by using supplied Tool offset Measuring System and measurement of machined dimensions of the job shall be done by supplied Job Measuring System. Vendor shall be responsible, financially or otherwise, for any deviation/ rejection in proveout component to the extent of cost of Casting/Forging, due to wrong machining or malfunctioning of the machine during proveout machining and also for the delay in machining due to improper recommended tooling etc..The cost of such deviation / rejection, if any, shall be refunded by the vendor to BHEL.	Vendor to confirm			
20	MACHINE ACCEPTANCE: (Tests/Activities TO be Performed by Vendor)	Should be accepted & confirmed by Vendor			

20.1	Tests/Activities to be carried out at supplier's works on the machine before dispatch :				
20.1.1	Geometrical Accuracy Tests as per test chart.	Vendor to accept and confirm			
20.1.2	Positioning Accuracy Tests as per VDI-DGQ/3441	Vendor to accept and confirm			
20.1.3	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from that time.	Vendor to accept and confirm			
20.1.4	Demonstration of all features of the machine, CNC system and all Accessories.	Vendor to accept and confirm			
20.1.5	Machining of NAS Test Piece. Vendor to supply test piece and tooling for it's machining.	Vendor to accept and confirm			
20.2	Test to be carried out at BHEL works while commissioning the machine :	Vendor to accept and confirm			
20.2.1	Geometrical Accuracy Tests as per test chart.	Vendor to accept and confirm			
20.2.2	Positioning Accuracy Tests as per VDI-DGQ/3441	Vendor to accept and confirm			
20.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to accept and confirm			
20.2.4	The machine should be tested for continuous running of 48 hrs. If any break down occurs during this test, the test should be repeated for 48 hrs from that time.	Vendor to accept and confirm			
20.2.5	Demonstration of all features of the machine, CNC system & all accessories to the satisfaction of BHEL for their efficient and effective use.	Vendor to accept and confirm			
20.2.6	Demonstration by actual use of all supplied attachments and accessories to their full capacity.	Vendor to accept and confirm			
20.2.7	Machining of NAS Test Piece. Vendor to supply test piece and tooling for it's machining.	Vendor to accept and confirm			
20.2.8	Job prove out.	Vendor to accept and confirm			
20.2.9	Two weeks supervision of independent operation of machine by BHEL after job proveout.	Vendor to accept and confirm			
20.2.10	Training of BHEL machine operators in operation of complete machine & accessories etc by the supplier's experts / engineers during their stay at BHEL works	Vendor to accept and confirm			

21	PACKING:		Vendor to accept and confirm		
21.1	Sea worthy & rigid packing for all items of complete machine, CNC System, all Accessories and other supplied items to avoid any damage/loss in transit. When machine is despatched in containers, all small loose items shall be suitably packed in boxes		Vendor to confirm		
22	GUARANTEE:				
22.1	24 months from the date of acceptance of the machine.		Vendor to comply		
23	GENERAL : The vendor should submit the following information:				
23.1	Machine Model		Vendor to specify		
23.2	Total connected load (KVA):		Vendor to specify		
23.3	Floor area required (Length, Width, Height) for complete machine & accessories. The Layout of the machine may be planned so that the AAC rack shall be at the Right Hand side of the X-Traverse while looking from the Spindle.		Vendor to specify		
23.4	Painting of Machine/ Electrical Panels: RAL 6011 Apple Green (Polyurethane Paint)		Vendor to confirm		
23.5	Total weight of the machine		Vendor to specify		
23.6	Weight of heaviest part of machine		Vendor to specify		
23.7	Weight of the heaviest assembly/ subassembly of the Machine		Vendor to specify		
23.8	Dimensions of largest part/ subassembly/ assembly of the machine		Vendor to specify		
23.9	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		
23.1	Detailed catalogues , sketch/photographs of the m/c and accessories/ attachments should be submitted with the offer.		Vendor to specify		
23.11	Hydraulic, Pneumatic & oil pipings should be preferably metallic except places where flexible pipings are essential.All the pipes required for the same shall be included in the standard scope of the machine.		Vendor to specify		
23.12	Ladder is to be provided to access the machine elements located at the top of the column.		Vendor to offer & confirm		

24	QUALIFYING CONDITIONS :					
24.1	Only those vendors (OEM) , who have supplied and commissioned at least one CNC HORIZONTAL BORING MACHINE of same or higher sizes (Spindle Diameter 160 mm, Ram+Spindle Travel- 2100 mm, with X= 4000 mm, Y= 2500 mm) for similar applications in the past ten years (on the date of opening of tender) should quote. The following information is to be submitted by the vendor about the companies where similar machines have been supplied. This is required from all the vendors for qualification of their offer.	Vendor to accept & confirm				
	1. Name of the customer / company where similar 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 Travel, X, Y) & 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 is found to be false /incorrect, the offer shall be rejected.	Vendor to accept & confirm				
25	OTHER FEATURES:	Vendor to confirm				
25.1	NETWORKING:					
	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				

25.2	MACHINE MONITORING SYSTEM (MMS) SIGNALS					
	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 confirm		
	a) Control ON			Vendor to offer		
	b) Cycle ON			Vendor to offer		
	c) Spindle Running			Vendor to offer		
	d) Feed Active (Any of the axes moving)			Vendor to offer		
	e) M30 (Program Stop)			Vendor to offer		
	f) Alarm Active			Vendor to offer		