

	<u>BHARAT HEAVY ELECTRICAL LIMITED</u>				Enquiry No. :	
	UNIT'S ADDRESS: HEEP, RANIPUR HARIDWAR - 249403 UTTARANCHAL, INDIA				Due Date :	
					Supplier Qtn. No.:	
	<u>CONTACT PERSON FROM PURCHASE DEPTT.:</u> <u>NAME:</u> <u>DESIGNATION:</u> <u>PHONE NO.:</u> <u>E-MAIL:</u> <u>FAX NO. :</u>				Date :	
<u>SPECIFICATION CUM COMPLIANCE CERTIFICATION FOR CNC VERTICAL BORER</u>						
	NOTE :-					
	<p>1. Vendor must submit complete information against clause at Sl.No.. 26.0 (Qualifying condition). The offer meeting this clause would only be processed (OEM : Original Equipment Manufacturer).</p> <p>2. This tender is for two machines of identical size. Machine No.1 will be without Milling spindle and C axis . Machine No.2 will be with milling spindle and C axis. Proveout components will be different for both the machines as specified at clause no. 16.0</p> <p>2. The vendor(OEM) should fill the "Offered" Column in compliance to specified requirements and also "Deviations" Column, where there is deviation from the requirement. Duly filled specification cum compliance certificate should be 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.</p> <p>3. The offer and all documents enclosed with offer should be in English language only.</p>					
	ADDRESS OF THE SUPPLIER :					
	TELEPHONE NOS.:					
	FAX NOS.:					
	E-MAIL ADDRESS :					
SCOPE:	SUPPLY, ERECTION & COMMISSIONING OF CNC VERTICAL BORERS COMPLYING WITH SPECIFICATIONS AS BELOW.					
SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS	

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
1.0	PURPOSE & WORKPIECE MATERIAL				
1.1	Purpose: This machine is required to rough & finish machine casings and other components of Steam Turbines/Gas Turbines/Hydro Turbine etc demanding high accuracies & surface finish.	Vendor to note & accept			
1.2	Work Piece Material: are forgings / castings of high alloy steels, Nimonic Steel, Stainless Steel, Inconel, cast iron and similar other materials which are generally used in power producing equipments having hardness 150 to 500 BHN.	Vendor to note & accept			
2.0	SPECIFICATION:				
2.1	MACHINE CONFIGURATION				
2.1.1	Double Column CNC Vertical Borer with single ram	Vendor to offer			
2.2	CAPACITY & SIZE				
2.2.1	Maximum Height for Turning & Facing	4000mm or more			
2.2.1.1	Extension of turning height - per 500mm	Vendor to offer			
2.2.2	Maximum Turning Diameter	4500mm or more			
2.2.3	Maximum Workpiece Weight	80000kg			
2.2.4	Maximum Swing Diameter	4500mm or more			
2.2.5	Minimum Boring Diameter (using standard turning tool holder & tool clamped on the ram)	500mm			
2.3	TABLE				
2.3.1	Table Diameter	4000mm			
2.3.2	Load Capacity	80000Kg or more			
2.3.3	Table Speed (Infinitely Variable)	0.5-70 rpm			
2.3.3.1	No. of Speed Ranges	Vendor to inform			
2.3.4	Power of Main Drive (S1 - Continuous Rating) AC	100 kw or more			
2.3.5	Details of Main Drive viz. Type, Make, Model etc.	Vendor to inform			
2.3.6	No. of Jaws/Vices	4			
2.3.7	Maximum External Clamping Diameter	Vendor to inform			

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2.3.8	Minimum External Clamping Diameter (It should be equal or lesser than central bore of table, if possible)	Vendor to inform			
2.3.9	Maximum Internal Clamping Diameter	Vendor to inform			
2.3.10	Minimum Internal Clamping Diameter	Vendor to inform			
2.3.11	Clamping Force of each Jaw.	Vendor to inform			
2.3.12	Positions and Dimensions of the Jaws on Table. Chucking Capacity Diagram should be submitted.	Vendor to inform & submit			
2.3.13	Type of Force Multiplier Mechanism used in Jaws should be explained and Drawings should be submitted.	Vendor to inform & submit			
2.3.14	Maximum permissible Cutting Force	Vendor to inform			
2.3.15	Maximum permissible Torque	Vendor to inform			
2.3.16	RPM at which Max. Torque is available.	Vendor to inform			
2.3.17	Table Torque - Speed diagram should be submitted.	Vendor to submit			
2.3.18	Type of Bearing for the Table (Details to be submitted)	Vendor to inform			
2.3.19	Size of T - slots, their position and accuracy. Drawing of Table showing details of the T - slots etc. should be submitted.	Vendor to submit			
2.3.20	Two perpendicular accurate Slots should be provided at the Center of the table to use for alignment purposes. Sizes (Width & Depth), accuracy etc. of these slots should be furnished along with a Drawing.	Vendor to inform & submit			
2.3.21	Table Loading Diagram should be submitted (Load v / s Distance from Table Center) for uniform as well as for eccentric loading.	Vendor to submit			
2.3.22	Diameter, Depth and Accuracy of Center Bore on Table Top Surface.	Vendor to inform			
2.3.23	Single piece construction of machine table	Vendor to confirm			
2.4	CROSS RAIL				
2.4.1	Vertical Travel.	Vendor to inform			
2.4.2	Vertical Traverse Rate.	Vendor to inform			
2.4.3	No. of Positions.	Vendor to inform			

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2.4.4	Distance between each Position/Step	100mm			
2.4.5	Distance of lowest Step from Table Top	Vendor to inform			
2.4.6	Distance of highest Step from Table Top	Vendor to inform			
2.4.7	Maximum Height of Cross Rail bottom from Table Top	Vendor to inform			
2.4.8	Minimum Height of Cross Rail bottom from Table Top	Vendor to inform			
2.4.9	Movement of Cross Rail : Through NC Program as well as manually by Push Buttons	Vendor to offer			
2.4.10	Machine Reference Point should be at Ram Reference Point and it should be updated automatically with movement of Cross Rail	Vendor to offer			
2.4.11	Details of crossrail movement/positioning/locking mechanism	Vendor to submit			
2.5	TOOL HEAD and RAM				
2.5.1	No. of Columns	2			
2.5.2	No. of Rams	1			
2.5.3	Cross - Section of Ram (It should be rigid enough for troublefree machining with maximum projection of ram and also suitable for specified minimum bore dia)	Vendor to inform			
2.5.4	Thread Cutting Capacity - maximum Pitch	Vendor to inform			
2.5.5	Clamping details for mounting Turning Tool Holders/Attachments on ram, should be submitted.	Vendor to submit			
2.5.6	Clamping Force Available for clamping of Turning Tool Holders/Attachments.	Vendor to inform			
2.5.7	Mounting of Turning Tool Holders and Attachments should be automatic through Program as well as manually through push buttons.	Vendor to confirm			
2.6	MAIN TRAVERSESES				
2.6.1	Vertical Travel of Ram (Z-Axis) For maximum turning/facing height of 4000mm. (If offered Turning Height, Sl.No.. 2.2.1, is more than 4000mm, Ram travel should also be increased by half value of increase in Turning Height above 4000mm)	Minimum2600mm			

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2.6.1.1	Per 100mm increase in Vertical Travel of Ram	Vendor to submit			
2.6.2	Horizontal Travel of Ram (+ve X-Axis)	Vendor to inform			
2.6.3	Horizontal Travel of Ram beyond Center of the Table (-ve X-Axis)	Minimum 1000mm			
2.6.4	Maximum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to inform			
2.6.5	Minimum Distance between Table Top and Standard Turning Tool Holder with Tool.	Vendor to inform			
2.7	MACHINE GUIDEWAYS				
2.7.1	Width of Cross Rail guideways	Vendor to inform			
2.7.2	Width of column guideways	Vendor to inform			
2.7.3	X & Z guide ways should be hydrostatic (Details should be submitted)	Vendor to confirm			
2.7.31	Rotary guide ways for the table should be hydrostatic detail along with minimum & maximum dia. of hydrostatic bearing should be submitted.				
2.7.4	Hardness of guideways	Vendor to inform			
2.7.5	Metallic Telescopic Covers: Waterproof Telescopic Covers of rust resistant steel should be provided with pads/wipers on both left and right sides of tool head on the crossrail and also above & below the crossrail on both columns covering the guide ways. Joints of telescopic covers should be sealed to avoid mixing of coolant & hydrostatic oil . The movement of telescopic covers should be troublefree and requiring minimum maintenance.	Vendor to offer			
2.8	FEEDS AND DRIVE SYSTEM				
2.8.1	Cutting feed in X & Z Axes (Infinitely Variable)	0 - 5000mm/min or more			
2.8.2	Rapid feed in X & Z Axes	Min. 5000mm/min			
2.8.3	Feed drives/motors X & Z axes [AC servo motors] of Siemens or FANUC digital type (detail of model, make, type, rating etc. should be submitted)	Vendor to offer			

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2.8.4	Maximum cutting force permissible on Ram & at what extension	Vendor to inform			
2.8.5	Maximum permissible Cutting Force at Maximum Ram extension	Vendor to inform			
2.8.6	Permissible Cutting Force v / s Ram Projection - Diagram should be submitted.	Vendor to submit			
2.8.7	Feed back system for X & Z axes should be Heidenhain linear scales with pressurised compressed air cleaning (Details should be submitted)	Vendor to offer			
2.8.8	Details of backlash free movement mechanism in X & Z axes should be submitted.	Vendor to submit			
2.8.9	Mechanism for locking X & Z axis	Vendor to inform			
2.9	CONSTRUCTION				
2.9.1	Vendor to furnish details of material, hardness & constructional details, including explanatory drawings, of various components/ assemblies like Column, Cross Rail, Ram head, Table, Guideways/slides, Feed Transmission system, Ram, Hydraulic and Lubrication system, Feedback system etc .of the machine.	Vendor to 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			
2.10	OPERATION AND CONTROL SYSTEM				
2.10.1	OPERATOR'S PANEL				

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	Swivling type operator's panel having complete CNC and machine control system with all displays of required configuration shall be provided and suitably located on operators plate form for convenient, efficient & safe operation of the machine. All switches with suitable interlocks with table rotation should be within reach of operator of average height (5' 5") for easy & safe operation. All displays/indications should also be conveniently placed accordingly. A protection cover made of steel sheet or equivalent should be provided above the operator's panel. Layout showing complete details should be submitted.	Vendor to offer			
2.10.2	CNC SYSTEM & FEATURES				
2.10.2.1	Make : Fanuc / Siemens.	Siemens or Fanuc			
2.10.2.2	Type : PC based latest version	PC based latest version			
2.10.2.3	Model: Sinumerik 840D with PC Version PCU 50, NCU 573.5 or higher with Intel Pentium III, 1GHz, 512 MB SDRAM (or higher), Windows XP Operating System or equivalent Fanuc system. (Latest version, as available at the time of ordering, should be supplied).	Vendor to offer and submit details			

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2.10.2.4	The system should, preferably, have OP 15 Operator's Panel with TFT colour display (15 inch or more), 19 Inch Machine Control Panel , Full CNC Keyboard with Qwerty keys and Mouse/Trackball or equivalent for Fanuc system, RS232-C interface for I/O devices, COM1(V.24), COM (V.24), LPT1 Parrallel Interface for Printer, VGA, MPI interface & USB, 2 Channels and Expansion slots. The operator Panel configuration will be as per Rittal VIP6000 or equivalent. The CNC System shall also have Electronic hand wheels selectable for all axes, USB Port with 1 GB Pen drive (for each machine) for data input/output, Hard disk of 10 GB or higher (Largest size available at the time of order shall be supplied), Graphic Simulation, COM port for tediagnosics, Network ready with LAN and preinstalled system software & other required softwares etc. (Details should be submitted by Vendor)	Vendor to offer and submit details			
2.10.2.5	Details of Standard features	Vendor to submit			
2.10.2.6	Details of optional features, recommended by vendor for proveout components for specified turning for both the machines and milling / drilling operations for the machine with live spindle or forseen as required keeping in view of offered accessories/systems/special features etc..	Vendor to submit			
2.10.2.7	Fast & user-friendly <u>Graphic Simulation</u> for checking of program prior to actual running & <u>Block-Search</u> with calculation while running the program should be pre-installed in the CNC system in addition to all other required/recommended features.	Vendor to offer			
2.10.2.8	Additionally, a QWERTY keyboard and optical mouse should also be properly interfaced and suitably inoused in the system's panel on covered sliding type tray for editing/input of programs by programmer.	Vendor to offer			

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2.10.2.9	Loading of S7 on hard disk & provision of ON screen PLC ladder display and servo wave forms display on the CNC System.	Vendor to offer			
2.10.3	HAND HELD UNIT:				
2.10.3.1	Hand Held unit (auxiliary pendant) Type B-MPI of Siemens make or equivalent, with jog axes/spindle inching/ hand-wheel and sufficient length of interfacing cable), which can be taken near to the chuck for job setting and similar other purposes.	Vendor to offer			
2.10.4	MANUAL CONTROL				
2.10.4.1	Complete manual control of machine with required switches / keys should be provided on operator's panel for selection of required axis, axis direction, cutting feed, table rpm, cutting feed on/off, display of axis position values etc, for manual machining operations without using CNC program,/ CNC option MANUAL TURN (of Siemens control or equivalent from Fanuc control) / MDI mode. Diagram / Sketches for switches / keys provided on operators pendant should be submitted.	Vendor to offer			
2.11	UPS FOR CNC SYSTEM :				
2.11.1	UPS unit including Siemens UPS module SITOP with rechargeable battery of sufficient time and having provision for unattended automatic shutdown feature for Windows operating system & also to suit feature for automatic retraction of tool during threading in case of power failure to avoid damage to job/tool.	Vendor to offer			
2.12	MACHINE LIGHTS				
2.12.1	Machine Lights for sufficient illumination of complete working area including operator's panel should be provided for clear visibility.	Vendor to offer			
2.12.2	A magnetic base portable spot light with sufficiently long cable should also be provided.	Vendor to offer			
2.12.3	Any lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to offer			

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2.12.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to offer			
2.12.5	Flashing/Rotary type light indicating end of cutting, program stop, alarm etc. at a easily visible & suitable place.	Vendor to offer			
2.13	AIR CONDITIONERS				
2.13.1	Air Conditioners with Dehumidifiers of suitable/ sufficient capacity and proper drainage pipes for condensate, are to be provided for all Electrical/ Electronic Panels/ Cabinets including operator's Panel considering specified ambient conditions. Detailed specifications of the same are to be submitted. The Air Conditioners are not to be mounted on top of the panels.	Vendor to offer and submit details.			
2.13.2	In case of order, Vendor to confirm to supply the following information about Air Conditioners and Chiller Unit (s) used in the machine: Type Refrigeration/ Chiller unit. Capacity of the chiller 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 (Width Plate type/ Coil type) Functional requirement of temperature of Cooling Oil to be maintained between range T1 to T2. Type of temperature indicator/ controller used in the chiller unit with complete specifications.	Vendor to confirm			
2.14	HYDRAULIC SYSTEM (Details should be Submitted by the Vendor)				

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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, preferably, 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 and electric heating (Electric heating, only if required) 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)	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			
2.15	FIRST FILLING OF OILS				
2.15.1	First filling of all required Oils & Grease etc. for the machine, voltage stabilizer, isolation transformer & air-compressor 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			
2.16	COOLANT SYSTEM				

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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 as well.	Vendor to offer			
	a) Recirculating Type Flood Coolant System	Vendor to offer			
	b) Air coolant system	Vendor to offer			
	c) High Pressure Coolant thru Spindle	Vendor to offer & confirm			
2.16.2	All attachments, tool holders, boring bars, cassettes, adapters etc. shall have the provision so that coolant is available directly at the tool-cutting tip.	Vendor to offer			
2.16.3	Coolant collection and recirculation system should be leak proof & perfect to avoid any spillage on shop floor, trenches for cables & foundation pit of the machine etc. In case, any leakage is found, it shall be corrected by vendor. Additionally, suitable equipment should be provided at deepest point of foundation pit to pump out collected oil/coolant up to shop floor.	Vendor to offer & confirm			
2.16.4	Coolant Filtration System: Recirculating type coolant system with Vacuum Rotary drum type Coolant Filtration System and magnetic separator. The filtration system should be mounted at shop floor level, if possible with provision to avoid leakage/spillage of coolant.	Vendor to confirm and submit details.			
2.16.5	Coolant Flow Diagram showing filters, pumps, valves, tanks etc.	Vendor to submit			
2.16.6	Coolant pumps & motor details etc. for all types of coolant variants	Vendor to inform			
2.16.7	Coolant Tank Capacity	Vendor to inform			
2.16.8	Pressure & rate of flow of coolant for different coolant variants for turning operations should be furnished in the offer. The coolant should be able to reach tool tip at full pressure.	Vendor to inform			
2.16.9	All types of coolant variants should be switchable through program as well as manually by push buttons provided on the Operator's control panel.	Vendor to offer			

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2.16.10	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 offer			
2.16.11	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Vendor to offer			
2.17	REQUIREMENT FOR ELECTRICAL EQUIPMENT				
2.17.1	Power Supply will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All types of switches, cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine/control cabinets including Voltage Stabilizer, Isolation Transformer & Air Compressor etc. , shall be supplied by the vendor.	Vendor to accept & offer			
2.17.2	Tropicalisation: All electrical / electronic equipment shall be tropicalized.	Vendor to offer			
2.17.3	All electrical & electronic control cabinets & panels should be dust and vermin proof.	Vendor to offer			
2.17.4	All electrical components in the cabinets should be mounted on DIN Rail.	Vendor to offer			
2.17.5	All electrical / electronic panels to be provided with adequate door locks. All electrical & electronic panels including operator's panel should have sufficient illumination and power receptacles/plug points of 220Volts, 5/15 Amp AC with on/off switch. All electrical adapters/receptacles, fittings, consumables etc. should be Indian or should have compatibility with Indian equivalents.	Vendor to offer			
2.17.6	All motors shall conform to IEC or Indian Standards	Vendor to offer			
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 offer			

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2.17.8	Vendor should ensure the proper earthing for the machine and its peripherals/accessories. Any material requirement for the same should be informed with foundation design/drawings. The vendor can take earthing connection from the nearest column of the production shop.	Vendor to offer			
2.18	SAFETY ARRANGEMENTS Following safety features in addition to other standard safety features should be provided on the machine:	Vendor to offer			
2.18.1	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 offer			
2.18.2	A detailed list of all alarms / indications provided on machine should be submitted by the supplier.	Vendor to submit			
2.18.3	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 offer			
2.18.4	All the rotating parts used on machine should be statically & dynamically balanced to avoid undue vibrations & noise.	Vendor to confirm			
2.18.5	Emergency Switches at suitable locations as per International Norms should be provided.	Vendor to offer			
2.18.6	Oil & water pipe lines should not run with electrical cable in the same trench.	Vendor to offer			
2.19	ENVIRONMENTAL PERFORMANCE OF THE MACHINE : The Machine should conform to following factors related to environment :	Vendor to offer			

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2.19.1	Maximum noise level shall be 85 dB(A) at normal load condition, 1 meter away from the machine with correction factor for back ground noise, if necessary. This will be measured as per international standards like DIN 45635-16, if required. Supplier to demonstrate compliance to noise level, if so required.	Vendor to confirm			
2.19.2	There shall not be any emissions from the machine except fumes of cutting fluid during machining.	Vendor to confirm			
2.19.3	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			
2.21.4	No hazardous chemicals shall be required to be used in the machine.	Vendor to confirm			
2.21.5	If any safety / environmental protection enclosure is required it should be built in the machine by the vendor.	Vendor to confirm			
2.21.6	Paint of the machine should be oil / coolant resistant and should not get peeled off and mixed up with coolant.	Vendor to confirm			
2.20	In-cycle hour counter with reset facility for counting spindle & axis running time, machine idle time, machine under maintenance time etc. and display the counted data on CNC display on video pages created by vendor.	Vendor to offer			
2.21	Portable Data Input Output Device : Portable unit or its equivalent for bi-directional program & data transfer between the offered unit & supplied system and as well as standard PC available at BHEL works, using floppy drive or its equivalent, should be offered with all required hardware, software, interfaces, cables, protection cover etc.	Vendor to offer			
3.0	CHIP CONVEYOR				

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3.1	An elevating type chip conveyor to carry both short and curly chips efficiently and effectively to the chip bin on shop floor (on left side of the machine) should be provided at appropriate location. Two Chip bins of appropriate size of Indian make, with wheels & handle for movement, should also be supplied. Drg. of chip bin showing its size/shape is to be submitted.	Vendor to offer			
3.2	Type of chip conveyor	Hinged type or superior			
3.3	Width of conveyor	Vendor to inform			
3.4	Elevation of chip conveyor for chip bin	Vendor to inform			
3.5	Material of chip conveyor (should be rust resistant)	Vendor to inform			
3.6	Provision for smooth collection of chips from all-around table to the conveyor and for avoiding clogging of chips should be provided. Removable Grill/Mesh type rigid covers should be provided above some portion of the chip conveyor, to enable machine operator's access to chip conveyor from shop floor for disposal of scattered chips on shop floor, if any, through chip conveyor. Details for the same should be submitted by vendor.	Vendor to offer			
3.7	Operation of chip conveyor (forward & reverse) should be possible through push buttons on operator's panel and also near chips disposal point/chip bin.	Vendor to offer			
3.8	Layout showing location of chip conveyor should be submitted.	Vendor to submit			
3.9	two Chip bins of appropriate size of Indian make, with wheels & handle for movement, should also be supplied. Drg. of chip bin showing its size/shape is to be submitted.	Vendor to offer			
4.0	SERVO VOLTAGE STABILIZER				
4.1	Oil / Air Cooled Servo Controlled Voltage Stabilizer (of reputed Indian make e.g Neel Mumbai) suitable for complete machine, its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions.	Vendor to offer with details			

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4.2	Make	NEEL, Aplab or Auto Electric			
4.3	Model, Rating & Input/Output Voltage etc.	Vendor to inform			
4.4	Monitoring device with cutoff facility for under/over output voltage, Devices for load current measurement, MCCB at input for overload/short circuit protection. (Details to be submitted)	Vendor to offer			
4.5	Spares Package for Servo Voltage Stabilizer, with item-wise breakup, are to be recommended and offered by the vendor in sufficient quantity for 2 years of trouble free operation considering three shifts continuous running of the machine. Detailed list is to be submitted. Price of unit quantity of each item is to be quoted.	Vendor to offer			
5.0	ULTRA ISOLATION TRANSFORMER				
5.1	Ultra Isolation Transformer (of reputed Indian make) suitable for complete machine , its drives, controls, PLC etc. for unbalanced load & supply conditions considering specified power supply & ambient conditions.	Vendor to offer			
5.2	Make	NEEL, Aplab or Auto Electric			
5.3	Model, Rating & Input/Output Voltage etc.	Vendor to inform			
5.4	Monitoring device with cutoff facility for under/over output voltage, Devices for load current measurement, MCCB at input for overload/short circuit protection. (Details to be submitted)	Vendor to offer			
5.5	Catalogue of the Isolation Transformer shall be submitted with the offer.	Vendor to submit			
6.0	PNEUMATIC SYSTEM				
6.1	AIR COMPRESSOR				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
6.1.1	Independent Air/Oil cooled, Screw Type Air Compressor (of reputed Indian make Elgi, Chicago Pneumatic or Ingersol Rand) with refrigerated type Dryer & Filter of suitable/sufficient capacity with all required accessories for the total compressed air requirements of the machine & accessories and to suit required air quality should be supplied. The system should be so designed to have additional provision and required accessories so that BHEL compressed air supply (having pressure 5-6 bar with little moisture/dirt content) could be used as and when required. The compressor unit should be suitable for continuous duty considering specified power supply & ambient conditions..	Vendor to offer			
6.1.2	Capacity (Discharge Air Flow & Pressure, Motor Power etc.)	Vendor to inform			
6.1.3	Refrigerant used	Vendor to inform			
6.1.4	Output Air Quality (Pressure Dew Point in degree Celsius, Residual mist/oil content in ppm etc.). It should be odor-free.	Vendor to inform			
6.1.5	Noise level	Vendor to inform			
6.1.6	Flow diagram	Vendor to submit			
6.1.7	Spares Package for Air Compressor, with item-wise breakup, are to be recommended and offered by the vendor in sufficient quantity for 2 years of trouble free operation considering three shifts continuous running of the machine. Detailed list is to be submitted. Price of unit quantity of each item is to be quoted.	Vendor to offer			
6.2	COMPRESSED AIR POINTS				
6.2.1	Compressed Air Point with connections for Air Coolant System mentioned at Sl. No. 2.16.1	Vendor to offer			
6.2.2	Suitably located Compressed Air Point near machine table with manually operated ON/ OFF Valve and flexible pipe of suitable length for cleaning of workpiece, tools and work area etc.	Vendor to offer			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
7.0	TOOLINGS * Price of unit quantity of each offered item should be quoted. * For inserts, price for ten inserts should be quoted. * Each type of Tool Holder is to be offered with 50 nos. of suitable inserts. If same insert is to be used for more than one holder, then the offered quantity should be 100. * Vendor may recommend and offer any other type of tool holders/adapters/cassettes in addition to tooling items mentioned below considering specified requirements/applications and submit their details. * Ordering quantity for all tooling items shall be decided by BHEL at the time of ordering. * LH - Left Hand / RH - Right Hand				
7.1	TOOL HOLDERS Drawings/Sketches of the offered tool holders are to be submitted with the offer.				
7.1.1	Cassette type tool holder for external turning.	Vendor to offer			
7.1.2	Cassette type tool holder for internal turning.	Vendor to offer			
7.1.3	Cassette type tool holder for LH and RH facing.	Vendor to offer			
7.1.4	Conventional tool holder for 40*40mm tool shank with direct clamping of tools for internal / external turning and facing operations with provision for clamping 32*32mm shank tools with packing pieces.	Vendor to offer			
7.1.5	Eccentric Boring Bar dia. 250 boring bar with length. 500mm with conventional type of tool holding for 40*40mm shank tools and with provision of 32*32mm shank tool both for turning and facing positions.	Vendor to offer			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
7.1.6	Centric Boring Bar dia. 250 boring bar with length. 500mm with conventional type of tool holding for 40*40mm shank tools and with provision of 32*32mm shank tool both for turning and facing positions..	Vendor to offer			
7.1.7	General adapter for turning	Vendor to offer			
7.2	PRESETTABLE CASSETTES (to suite above cassette type holders). Drg. No. R6300-0965 of RH Cassette is enclosed for vendor's reference.				
7.2.1	LH cassette for 40*40mm tool shank, Length approx. 230 mm, with provision for clamping 32*32mm shank tools also with packing pieces.	Vendor to offer			
7.2.2	RH cassette for 40*40mm tool shank, Length approx. 230 mm, with provision for clamping 32*32mm shank tools also with packing pieces.	Vendor to offer			
7.2.3	LH long cassette for 40*40mm tool shank, Length approx. 430 mm, with provision for clamping 32*32mm shank tools also with packing pieces.	Vendor to offer			
7.2.4	RH long cassette for 40*40mm tool shank, Length approx. 430 mm, with provision for clamping 32*32mm shank tools also with packing pieces.	Vendor to offer			
7.3	TOOLING FOR MACHINING OF PROVE-OUT COMPONENTS	Vendor to offer			
7.3.1	FOR THE MACHINE No. 1 (WITHOUT MILLING SPINDLE AND C AXIS)				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
7.3.1.1	All types of required tools, inserts, holders, special fixtures/clamping elements,measuring instruments (if required) etc. in sufficient quantity for all types of operations like turning, grooving, boring operations etc., as recommended by the vendor should be offered for complete machining of proveout components to meet required drawing accuracy & surface finish . These tooling items shall be in addition to the tools mentioned above at Sl. No. 7.1 & 7.2. List of offered items with quantity is to be submitted. Separate Package Price for recommended tools etc. for each proveout component is to be quoted.	Vendor to offer			
7.3.1.2	Complete fixture, clamping elements with setting scheme for complete machining of H.P.Inner Casing.	Vendor to offer			
7.3.1.3	Four Nos. of extension blocks of height 500mm for 4 vices/jaws.	Vendor to offer			
7.3.2	FOR THE MACHINE No.2 (WITH MILLING SPINDLE AND C AXIS)				
7.3.2.1	All types of required tools, inserts, holders, special fixtures/clamping elements,measuring instruments (if required) etc. in sufficient quantity for all types of operations like turning, grooving, boring,drilling and milling operations etc., as recommended by the vendor should be offered for complete proveout machining to meet required drawing accuracy & surface finish . These tooling items shall be in addition to the tools mentioned above at Sl. No. 7.1 & 7.2. List of offered items with quantity is to be submitted. Separate Package Price for recommended tools etc. for each proveout component is to be quoted.	Vendor to offer			
7.4	ADDITIONAL TOOLING REQUIREMENTS				
7.4.1	Mounting details of each type of toolings to be explained & submitted with the help of drawings / sketches.	Vendor to submit			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
7.4.2	Offered tooling system to be rigid to carryout machining without undue vibration, which can effect job accuracy and surface finish in extreme machining conditions like max. overhang of ram etc. .	Vendor to confirm			
7.4.3	In case of order, manufacturing drgs., catalogues & source of all tooling items should be submitted by vendor.	Vendor to confirm			
7.4.4	Supplier should offer all tools & inserts with latest cutting geometries & grades to achieve high productivity and cutting parameters.	Vendor to confirm			
7.4.5	All supplied tool holders, boring bars, cassettes etc. shall have built in system for the coolant so that coolant is available directly on the cutting tip during all possible operations like grooving, turning etc. Provision for external coolant should also be provided.	Vendor to offer			
7.5	Tool Storage Cabinets (4 nos.) of reputed (Indian) make having covered heavy duty drawers of suitable sizes with lock facility to store offered tooling items etc.	Vendor to offer			
8.0	DIAGNOSTIC SYSTEMS				
8.1	TELE-DIAGNOSTIC SERVICE				
	Tele-diagnostic service should be provided through International telephone lines along with required Hardware / Software for the supplied CNC system to access both CNC and PLC. 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. Help guide should be provided for use of the system/service.	Vendor to offer			
8.2	FAULT DIAGNOSTIC SYSTEM :				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
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			
8.3	Help guide should be provided to use both diagnostic systems	Vendor to offer & submit			
9.0	LEVELING & ANCHORING SYSTEM				
9.1	Complete set of anchoring materials including foundation bolts, nuts, washers, fixators, leveling shoes etc for alignment of table/ram and to fix the machine to the foundation should be supplied. Details to be submitted.	Vendor to offer			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
10.0	TOOLS FOR ERECTION, OPERATION & MAINTENANCE				
10.1	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 by the vendor. List of such tools should be submitted with offer.	Vendor to offer			
10.2	Set of Test Mandrels/Cylindrical Bars for checking table run-out & alignment of ram etc. should be supplied with protection boxes.	Vendor to offer			
11.0	AUTOMATIC TOOL CHANGER	Vendor to offer			
11.1	Type	Vendor to inform			
11.2	No. of storage locations(to suit all the offered tool holders and boring bars)	Vendor to inform			
11.3	Tool selection method - Random	Vendor to confirm			
11.4	Maximum Tool Overhang out of different Holders in both directions i.e. radial & axial.	Vendor to inform			
11.5	Maximum Permissible Weight on each Pocket.	Vendor to inform			
11.6	Maximum Permissible Weight on Complete ATC.	Vendor to inform			
11.7	The Machine operation should be possible with or without referencing ATC.	Vendor to confirm			
11.8	ATC Drawing should be submitted with the offer.	Vendor to submit			
11.9	Provision for loading/unloading of different holders on ATC using overhead crane, if required.	Vendor to offer			
11.20	Provision for holding Milling Head ,Universal Milling Head and Milling Adapters on ATC for Machine No.2 with Milling Spindle and C axis.	Vendor to offer			
12.0	CHIP & SPLASH GUARD				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
12.1	Movable Chip / Splash Guards of sufficient height and made of rust resistant material, should be provided all around the Table(on front side of machine columns) to avoid spilling of Coolant and scattering of Chips on Operator's Panel and Shop Floor. Front part of splash guards should be provided with safety glass for clear visibility, if required.	Vendor to offer			
12.2	Additionally a fixed type of splash/ chip guard of atleast full turning height should be provided on rear side of machine i.e. around rear portion of table between columns .	Vendor to offer			
12.3	Movable splash guard should have interlock for table rotation. Opening of guards on front side of table should suit maximum possible size of the job which can be loaded on the table. The guards should not provide any hindrance with complete vertical movement of crossrail/ATC on both sides of the table.	Vendor to confirm			
12.4	Drawing of Chip/Splash Guards showing total height, layout and other details of the same should be submitted.	Vendor to submit			
13.0	ACCESSORIES				
13.1	Auto Focus Video Camera: Auto focus video camera with zoom facility shall be provided on the ram/ tool holders internally connected with color monitor fixed on operator"s panel to view tool while machining and also as an aid for setting of casings. camera eyes/lens and connecting cables shall be safe guarded against heat, chips, coolant, dust etc. to maintain clear visibility of the tool in these conditions. Suitable sockets for power connections shall be provided for both positions(ram and tool holders).Clamping details of camera on different tool holders shall be shown on drawings of tool holders.	Vendor to offer			
13.2	Spare for Video Camera: Complete Spare System of CCTV including monitor interface unit & camera	Vendor to offer			
14.0	SPARES :				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
14.1	Itemised breakup of mechanical, hydraulic, electrical and electronic spares used on the machine in sufficient quantity as per recommendation of Vendor for 2 years of trouble free operation on three shifts continuous running basis should be offered by vendor. The list to include following, in addition to other recommended spares: (Unit Price of each item of spare should be offered)	Vendor to offer			
14.1.1	Mechanical & Hydraulic Spares : Following Spares are to be offered.	Vendor to offer			
14.1.1.1	Pumps used on machine i.e Hydraulic / Hydrostatic, lubrication, coolant and oil cooling - recirculating system (1 no. each type).	Vendor to offer			
14.1.1.2	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		\	
14.1.1.3	Pressure switches, flow switches used in Hyd / Lub / Pneumatic/ coolant circuit. (1 No. of each type)	Vendor to offer			
14.1.1.4	All types of regenerative type filter inserts (10 No. of each type)	Vendor to offer			
14.1.1.5	All types of Disposable type filter inserts (30 nos. of each type)	Vendor to offer			
14.1.1.6	All types of Accumulators with charging kit (1 no. of each type)	Vendor to offer			
14.1.1.7	One set of belts (including timing belt) used in the machine.	Vendor to offer			
14.1.1.8	One set of seal kits used in different hydraulic & pneumatic cylinders in the machine.	Vendor to offer			
14.1.1.9	One set of hose pipe with end connection used in the machine.	Vendor to offer			
14.1.1.10	All types of couplings used with different pumps (1 no. of each type) & pressure sleeves used in machine.	Vendor to offer			
14.1.1.11	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			
14.1.1.12	One set of pneumatic filtration / condensate drain system.	Vendor to offer			
14.1.2	Electrical /Electronic / CNC Spares : Following Spares are to be offered.	Vendor to offer			
14.1.2.1	Limit Switches/ Micro Switches (2 Nos each type)	Vendor to offer			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
14.1.2.2	Relays (2 Nos each type)	Vendor to offer			
14.1.2.3	Contactors (2 Nos each type)	Vendor to offer			
14.1.2.4	RTD temperature transmitter (1 No each type)	Vendor to offer			
14.1.2.5	Proximity Switches (5 Nos each type)	Vendor to offer			
14.1.2.6	Push Buttons (5 Nos each type)	Vendor to offer			
14.1.2.7	Indicating Lamps (10 Nos each type)	Vendor to offer			
14.1.2.8	Semiconductor Fuses (5 Nos each type)	Vendor to offer			
14.1.2.9	Special Fuses (5 Nos each type)	Vendor to offer			
14.1.2.10	Circuit Breakers (1 No each type)	Vendor to offer			
14.1.2.11	Main Power Switch (1 No each type)	Vendor to offer			
14.1.2.12	Encoders (1 No each type)	Vendor to offer			
14.1.2.13	Scanning Heads for Linear Scales (1 No each type)	Vendor to offer			
14.1.2.14	Wave shape unit/ EXE unit (1 No each type)	Vendor to offer			
14.1.2.15	PCU module (Hard disk loaded with Ghost of the machine after final commissioning)	Vendor to offer			
14.1.2.16	NCU module	Vendor to offer			
14.1.2.17	Operator's panel with Display Unit	Vendor to offer			
14.1.2.18	I/O Cards for PLC (1 No each type)	Vendor to offer			
14.1.2.19	Servo Motors for Feed Drives	Vendor to offer			
14.1.2.20	Power Module & Control Cards for Main Drive as well as Feed Drives (1 Nos each type)	Vendor to offer			
14.1.2.21	One each of the following items : CNC Power Supply, I/R Module, NCU BOX, Machine Control Panel, Hand Held Unit/ B-MPI, Any other auxiliary drive , if used, Complete Proportional Valve Controller, if used.	Vendor to offer			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
14.2	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 confirm			
14.3	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			
14.4	Repair service contract with supplier of offered CNC system for service & spares for motor drives & CNC Unit etc.	Vendor to offer			
15.0	DOCUMENTATION : Three sets of following documents (Hard copies) in English language should be supplied along with the machine	Vendor to offer			
15.1	Operating manuals of Machine & CNC system	Vendor to offer			
15.2	Programming Manuals of Machine & CNC system	Vendor to offer			
15.3	Detailed Maintenance manual of machine and supplied systems.	Vendor to offer			
15.4	Maintenance Interface & commissioning manuals, PLC programming manual for CNC system, Interface & commissioning manuals for spindle ,feed drives and auxiliary drive. I	Vendor to offer			
15.5	Manufacturing drawings for all supplied clamping jaws and its lead screws, tool holders, coolant connections adapters, fixtures etc.	Vendor to offer			
15.6	Catalogues, Operation & Maintenance Manuals of all bought out items including drawings, wherever applicable.	Vendor to offer			
15.7	Detailed specification of all rubber items and hydraulic/lube fittings	Vendor to offer			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
15.8	Operating Manuals, Maintenance Manuals & Catalogues for supplied accessories viz. Voltage Stabilizer, Isolation Transformer, Air-Compressor, etc.	Vendor to offer			
15.9	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			
15.10	PLC program, NC data & PLC data on CD.	Vendor to offer			
15.11	Complete back-up of PCU-50 or equivalent (in case of Fanuc) hard disk on GHOST CD and clear written Instructions to take back-up and reloading of a new hard disk.	Vendor to offer			
15.12	Complete list of parts/items(Bill of materials) used in the machine in English language.	Vendor to offer			
15.13	Electrical Schematic Diagrams, Wiring Diagrams, Junction Box Layouts, Connector Diagrams and Cable Layouts of the machine in English.	Vendor to offer			
15.14	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			
15.15	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to offer			
16.0	PROVEOUT MACHINING OF BHEL COMPONENT				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
16.1	<p>Drawings of proveout components are 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 shall submit CNC programs prior to start of erection of Machine at BHEL works.</p>	Vendor to accept & offer			
	<p>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.</p>				
16.1.1	<p>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.</p>	Vendor to accept & confirm			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
16.1.2	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 to confirm			
16.2	Prove Out Component for the machine No.1 (without C axis and Milling Spindle): The drawings (7 nos.) of proveout component H.P.Inner Casing 500 MW , as listed below, are enclosed :				
16.2.1	The list of Component Drawings: 1. H.P.Inner Casing Drg.No.0-10502-09000 (2 sheets) 2. Groove Plan Drg.No.9-10107-41051 3. T-Groove Drg.No. 4-101-07-41012 4. T-Groove Drg.No. 4-101-07-41013 5. T-Groove Drg.No. 4-101-07-41014 6. Casting Drawing No.01050209901	Vendor to accept			
16.2.2	Material of H.P.Inner casing : CREEP RESISTANT ALLOY STEEL CASTING WITH IDENTIFICATION NUMBER FOR INTERNAL COMPONENTS(G17CRMOV510) TEMPERATURE >540 <566DEG.C	For vendor's information.			
16.2.3	Prove out machining shall include all types of turning / grooving operations as per drawings of H.P.Inner Casing and its groove plan.Groove Plan drawing shows both rotor and casing parts out of which only casing part is to be considered.All operations in proveout machining shall be performed using CNC Programs supplied by vendor.	Vendor to accept & offer			
16.3	Prove Out Component for the machine No.2 (with C axis and Milling Spindle):				
16.3.1	The drawings (5 nos.) of 3 nos. proveout components , as listed below, are enclosed :				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
16.3.2	<p>The list of proveout components (3 nos.) and enclosed refence drawings are as follows:</p> <ol style="list-style-type: none"> 1. End Shield Machined, Drawing No. 0-139-37-01006 (Reference Drawing No. 0-139-36-01004 of End Shield (Fabricated)) 2. Wound Armature Drawing No. 0-143-03-01013 3. Diode Wheel -A (-VE) Drawing No. 0-143-10-01001 (Reference Drawing No. 3-143-10-00009 "Carrier Hub Forging" rough machined forging) 	Vendor to accept			
16.3.3	<p>Material of Proveout components :</p> <ol style="list-style-type: none"> 1. End Shield Machined Drg. No. 0-139-37-01006: Fabricated End Shield as per enclosed drawing no. 0-139-36-01004,made out of plates of Carbon Steel of tensile strength 400 N / Sq. mm, shall be provided by BHEL 2. Wound Armature Drawing No. 0-143-03-01013: Wound Armature is assembly of Electro Technical Sheet (ETS) Steel stampings of 0.5 mm thickness assembled together by one no. Press Rings at each end. Material of ETS is Cold Rolled Non Grain Oriented Sheet steel of grade M 310 -50A as per DIN EN 10106. Material of Press Rings assembled at ends is Nodular Graphie Iron Casting EN-GJS-500-7, Material No. 0.7050 EN1563. 				
16.3.3 contd.	<p>3. Diode Wheel -A (-VE) Drawing No. 0-143-10-01001: Rough machined forging of Alloy Steel 26 Ni Cr Mo V115 (0.2% Proof Stress 735 N / Sq. mm and Tensile Strength 1000 N / Sq. mm (min.) as per enclosed drawing no. 3-143-10-00009 shall be provided by BHEL.</p>	Vendor to accept & confirm			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
16.3.4	<p>The following points to be noted regarding machining of proveout components. All operations in proveout machining shall be performed using CNC Programs supplied by vendor. :</p> <p>1. End Shield Machined Drg. No. 0-139-37-01006:</p> <ul style="list-style-type: none"> - Only turning operations shown in the drawing shall be carried out during proveout. - Turning operations are to be carried out in two stages. First leaving 0.5 mm machining allowance per surface for finish machining. End Shield will then be removed from machine, dis-assembled in two halves and joining surfaces of the two halves shall be finish machined by BHEL removing 0.5 mm allowance provided on each joining surface. Two halves shall then be assembled by BHEL. End Shield will then be finish turned as per drawing dimensions. 	Vendor to accept & offer			
16.3.4 contd.	<p>2. Wound Armature Drawing No. 0-143-03-01013:</p> <ul style="list-style-type: none"> - Only bore (Dia. 400 / 399 mm) of the Wound armature (Bore length = 95 + 906 + 95 = 1096 mm) shall be machined during proveout, maintaining dimensions and accuracies as per the drawing. - Assembled Wound Armature will be assembled (hanged) inside a Turning Fixture of height 1650 mm by BHEL, for the turning of bore. - During machining, RPM of table should be low (Approx. 20 RPM), as the assembly of Wound Armature in the Turning Fixture is not so rigid. <p style="text-align: center;">- As</p> <p>"Wound Armature" is having Electrical Winding, Coolant or Oil should not be used during machining.</p>	Vendor to accept & offer			
17.0	TRAINING				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
17.1	<p>Four BHEL Persons should be trained at vendor's works for the area & period given below:</p> <p>(a) CNC Programming for the machine, measuring system etc. (Period 3 weeks)</p> <p>(b) Electrical, Electronic & CNC maintenance for machine & other supplied equipments (Period 2 weeks)</p> <p>(c) Mechanical & Hydraulic maintenance of the machine & other supplied equipments (Period 2 weeks)</p> <p>(d) Operation of the machine & other supplied equipments (Period 2 weeks)</p> <p>Pre-dispatch inspection (ref. Sl.No. 22.1) 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.</p>	Vendor to offer			
17.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	For vendor's information.			
17.3	Competent, English speaking experts shall be arranged by the vendor for satisfactory & effective training of BHEL personnel.	Vendor to accept & confirm			
17.4	Vendor should commit & offer to organize training of Electronics Engineer and Programmer at the CNC System Manufacturer's works/training school for advanced features and specialized training, if so required by BHEL.	Vendor to offer			
17.5	Training charges, if any, for training requirement at Sl.No. 17.1 & 17.4 should also be quoted on per Man-day basis so that training charges can be derived for the agreed period & persons, in case of any change.	Vendor to offer			
18.0	FOUNDATION				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
18.1	<p>Vendor shall submit the preliminary layout drawings for getting BHEL's approval within one month from the date of Letter of Intent (LOI) or Purchase Order, whichever is earlier.</p> <p>Complete Foundation Design including details viz. static / dynamic load details etc. and final layout drawings shall be submitted by the supplier within two months after getting BHEL's approval for Preliminary layout Drgs..</p> <p>The layout should consist of all requirements pertaining to complete machine including space requirement for Voltage Stabilizer, Isolation Transformer, Air compressor, Chip Bin & all other accessories/ attachments/ offered items.</p> <p>BHEL shall construct complete foundation for the machine under supervision of supplier and at vendor's responsibility.</p> <p>Vendor should arrange equipments required for the testing of foundation, if required by the vendor.</p> <p>The vendor shall also indicate detailed specifications/requirement of earthing material, grouting compound and grouting procedure etc. for foundation bolts of the machine.</p>	Vendor to accept & offer			
18.2	<p>Tentative Soil condition data at BHEL, Hardwar is as detailed below:</p> <p>a) The value of allowable bearing capacity is 11 ton/sq.m (Lowest obtained from shear and settlement criteria at 4.2m depth). The gross value of bearing capacity may be adopted as 17 ton/sq.m for an assumed footing size of 4m x 6m at a depth of 4.2m.</p> <p>b) The value of Angle of Internal Friction may be adopted as 32deg at 4.2m depth.</p> <p>c) The Coefficient of Elastic Uniform Compression (Cu) may be adopted as 3.0 kg/cubic cm at 4.2m depth for 10 sq.m or more contact area of foundation.</p>	For vendor's information.			
19.0	ERECTION & COMMISSIONING				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
	<p>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.</p> <p>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 100 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.</p>	Vendor to confirm			
19.1	Erection & Commissioning of Voltage stabilizer, Isolation Transformer , Air Compressor and other accessories/attachments with all electrical & mechanical connections shall also be responsibility of the vendor.	Vendor to offer			
19.2	Successful proving of BHEL components by the supplier shall be considered as part of commissioning for the machine . All tests, as mentioned at Sl. No. 22.0 (Machine Acceptance) and testing/demonstration of tele-diagnostic service etc. shall also be part of the commissioning activity.	Vendor to offer			
19.3	Tools, Tackels, Test Mandrels, instruments and other necessary equipment including Laser equipment required to carry out all erection & commissioning activities should be arranged and brought by the supplier.	Vendor to accept			
19.4	Commissioning spares, required for commissioning of the machine within stipulated time, shall be brought by the supplier on returnable basis.	Vendor to accept			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
19.5	All cover plates, plates for chutes for chips flow etc., required for the machine and its peripherals/accessories shall be supplied by the vendor.	Vendor to accept			
19.6	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to submit			
19.7	terms & conditions for Erection & Commissioning should be furnished in detail separately by vendor along with offer.	Vendor to submit			
19.8	Portion, if any, of the machine, accessories/attachments and other supplied items where paint got rubbed or peeled off during transit or erection should be repainted and matched with the original adjoining paint by the vendor. For this purpose, the vendor should supply sufficient quantity of touch-up paint of various colours/shades of paints used. The vendor shall ensure performing touching after commissioning but before final acceptance.	Vendor to offer			
20.0	ACCURACIES				
20.1	GEOMETRICAL ACCURACIES				
20.1.1	Geometrical Accuracy Tests shall be in accordance with relevant & prevailing international standards viz. DIN 8609 / ISO 3655 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 offer			
20.1.2	Table Flatness	Vendor to inform			
20.1.3	Table Radial Runout	Vendor to inform			
20.1.4	Table Axial Runout	Vendor to inform			
20.1.5	Cylindricity of turning	Vendor to inform			
20.1.6	True roundness of turning	Vendor to inform			
20.1.7	Facial run-outs	Vendor to inform			
20.1.8	All other accuracies to conform to specified standard (Latest Revision) or Suppliers Test chart whichever is finer and more accurate.	Vendor to inform			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
20.1.9	All the Geometrical accuracies including test pieces machining for turning and milling operations etc. should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and again during Erection & Commissioning at BHEL Works. Test pieces are to be supplied by vendor for test pieces machining both at vendor's works & at BHEL's works. Drawings of test pieces to be submitted with the offer.	Vendor to offer, confirm & submit			
20.1.10	Vendor to confirm clearly that it will be possible to machine proveout components to specified drawing accuracies with above mentioned machine accuracies.	Vendor to confirm			
20.2	POSITIONING & REPEATABILITY ACCURACIES (Should be measured as per VDI/DGQ 3441 - Latest Revision) CHECKING BY USING LASER INTERFEROMETER.				
20.2.1	Positioning accuracy in X axis (Pa) per 1000 mm	± 0.005mm or 0.01mm			
20.2.2	Positioning accuracy in Z axis (Pa) per 1000 mm	± 0.005mm or 0.01mm			
20.2.3	Repeatability in X axis (Ps)	0.007mm			
20.2.4	Repeatability in Z axis (Ps)	0.007mm			
20.2.5	Positioning accuracy over entire traverse in X axis (Pa)	Vendor to inform			
20.2.6	Positioning accuracy over entire traverse in Z axis (Pa)	Vendor to inform			
20.2.7	Total positioning error along X & Z axes per 1000 mm (P)	Vendor to inform			
20.2.8	Total positioning error along X & Z axes over entire traverse (P)	Vendor to inform			
20.2.9	Vendor to confirm clearly that it will be possible to machine proveout components to specified drawing accuracies with above mentioned machine accuracies.	Vendor to confirm			
20.2.10	All the Positioning and Repeatability accuracies should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and again during Erection & Commissioning at BHEL Works.	Vendor to offer			
21.0	AMBIENT CONDITIONS & THERMAL STABILITY				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
21.1	Total machine including all supplied items should work trouble free and should give specified accuracies under existing power supply and ambient operating conditions, as mentioned below at Sl. Nos. 21.2	Vendor to accept & confirm			
21.2	Power Supply (AC): Voltage = 415V +10% / -10% of fluctuations , Frequency= 50Hz +3 / -3 , No. of phases = 3 phase with neutral. Ambient Operating Conditions: Temperature = 5 to 45 degree Celsius , Relative Humidity = 95% max.	Vendor to accept & confirm			
21.3	Ambient Operating Conditions: Temperature = 5 to 45 degree Celsius Relative Humidity = 95% max. 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 without any temperature controlled enclosure/shop. Max. temperature variation is 25 deg Celsius in 24 hours.	Vendor to accept			
21.4	Thermal Stability: Thermal Stability of the complete machine and all supplied items keeping in view the specified Ambient Conditions, accuracies, requirements of BHEL components and trouble free operation of the machine should be ensured by vendor. Since the machine shall be installed in shop with operating conditions as per Sl.No. 21.2, the vendor shall ensure achieving the drawing accuracies on the job throughout the year. Vendor to confirm that machine is suitable for above and details of provisions on the machine for the suitability should be furnished by Vendor.	Vendor to offer & confirm			
21.5	The machine should be suitable for continuous operation to its full capacity for 24 hours a day and 7 days a week throughout year. Vendor to ensure and confirm the same.	Vendor to offer & confirm			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
22.0	MACHINE ACCEPTANCE (Tests/Activities to be performed & demonstrated by Vendor)	Vendor to accept & confirm			
22.1	Tests/Activities to be carried out at vendor's works on the machine before dispatch :				
22.1.1	Demonstration of specified/offered Geometrical accuracies as per test chart/standard and specified values.	Vendor to accept & confirm			
22.1.2	Demonstration of specified/offered Positioning accuracies as per test chart/standard and specified values.	Vendor to accept & confirm			
22.1.3	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 & confirm			
22.1.4	Demonstration of all features of the machine, control system & accessories	Vendor to accept & confirm			
22.1.5	Machining of test piece as per AFNOR/ISO/NAS for turning operations etc. Vendor to supply test pieces.	Vendor to accept & confirm			
22.2	Tests/Activities to be carried out at BHEL works while commissioning the machine :				
22.2.1	Demonstration of specified/offered Geometrical accuracies as per test chart/standard and specified values.	Vendor to accept & confirm			
22.2.2	Demonstration of specified/offered Positioning accuracies as per test chart/standard and specified values.	Vendor to accept & confirm			
22.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to accept & confirm			
22.2.4	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 & confirm			
22.2.5	Demonstration of all features of the machine, control system & accessories to the satisfaction of BHEL for efficient and effective use of the machine.	Vendor to accept & confirm			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
22.2.6	Demonstration by actual use of all supplied accessories to their full capacity for required applications.	Vendor to accept & confirm			
22.2.7	Machining of test piece as per AFNOR/ISO/NAS for turning operations etc. Vendor to supply test pieces.	Vendor to accept & confirm			
22.2.8	Successful machining of proveout components to required drawing accuracies as per Sl. No. 16.0.	Vendor to accept & confirm			
22.2.9	Two weeks of supervision by Vendor of independent operation of machine by BHEL after job proveout.	Vendor to accept & confirm			
22.2.10	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 & confirm			
23.0	PACKING				
	Sea worthy & rigid packing for machine, control and all other supplied items to avoid any damage/loss in transit. All small loose items should be suitably packed in boxes.	Vendor to offer & confirm			
24.0	GUARANTEE				
	Guarantee for complete machine and all supplied accessories/attachments/equipments/items for 24 months from the date of acceptance of the machine.	Vendor to offer			
25.0	GENERAL				
25.1	Machine Model No.	Vendor to inform			
25.2	Total connected load (KVA)	Vendor to inform			
25.3	Total Space required (Length, Width, Height) for complete machine, accessories/attachments and other supplied items like Voltage Stabilizer, Isolation Transformer & Air compressor etc.	Vendor to inform			
25.4	Painting of Machine / Electrical Panels : RAL 6011 Apple Green (Polyurethane Paint)	Vendor to offer			
25.5	Total weight of the machine	Vendor to inform			
25.6	Weight of heaviest part of machine	Vendor to inform			
25.7	Weight of the heaviest assembly of the Machine	Vendor to inform			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
25.8	Dimensions of largest part of the machine	Vendor to inform			
25.9	Vendor to submit reference list of customers where similar machines have been supplied mentioning broad specifications of the supplied machine i.e. Model, CNC System, Table Dia, Max. Turning Dia, Max. Turning Height, RPM, Load Carrying Capacity, Main Drive Rating and detail of accessories/attachments, if any, etc.	Vendor to submit			
25.10	Detailed catalogues, sketches/drawings/photographs pertaining to the offered machines and accessories/attachments/items should be submitted with the offer.	Vendor to submit			
25.11	Hydraulic, Pneumatic & Oil pipings should be preferably metallic except places where flexible pipings are essential. All the pipes required for the same shall be supplied by the vendor.	Vendor to confirm			
25.12	All Cables and Hoses etc. should be well supported & protected in trays/brackets/drag chains etc.				
25.13	Ladder is to be provided to access the machine elements located at the top of the column.	Vendor to offer & confirm			
26.0	QUALIFYING CONDITIONS				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
	<p>Only those vendors (OEMs), who have supplied and commissioned at least one CNC VERTICAL BORING MACHINE of same (Table diameter 4M, Load Capacity 80Tons & Max Turning Height 4M) or higher sizes in the past ten years (on the date of opening of Tender) and referred machine is presently working satisfactorily for more than one year (on the date of opening of Tender) after commissioning, should quote. However, if referred machine (s) has/had been supplied to BHEL, then the machine should be presently working satisfactorily for more than six months (on the date of opening of Tender) after its commissioning and acceptance in BHEL. The following information should be submitted by the vendor about the companies where referred machine (s) have been supplied. This is required from all the vendors for qualification of their offer.</p>	Vendor to accept and confirm			
26.1	Name of the customer / company where similar machine is installed.	Vendor to inform			
26.2	Complete postal address of the customer.	Vendor to inform			
26.3	Month & Year of commissioning.	Vendor to inform			
26.4	Parameters of machine(s) supplied (Table diameter, Max. Turning Height, Table Load Carrying Capacity) and application for which the machine is supplied.	Vendor to inform			
26.5	Name and designation of the contact person of the customer.	Vendor to inform			
26.6	Phone, FAX no. and e-mail address of the contact person of the customer.	Vendor to inform			
26.7	Performance certificate from the customers regarding satisfactory performance of machine supplied to them (Original Certificate or Through E-mail directly from the customer). The original performance certificate may be returned after verification by BHEL, if required.	Vendor to submit			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
26.9	BHEL reserves the right to verify information submitted by vendor. In case the information is found to be false/incorrect, the offer shall be rejected.	Vendor to accept & confirm			
27.0	NETWORKING				
27.1	Machine control should have necessary hardware and software for interfacing with gigabit Ethernet Local Area Network with 100 MB/sec through UTP cables for NC program and other related data transfer. This network to be connected to wide area network/Internet. The networking should have following capabilities:	Vendor to offer			
27.2	The machine shall appear as a node in the Entire Network. (Network Neighborhood)	Vendor to offer			
27.3	The program transfer shall be by simple copy and paste method provided sharing access is allowed between any PC and the machine across the network.	Vendor to offer			
27.4	The program transfer between CNC system and network should also be possible in CNC Mode.	Vendor to offer			
28.0	MACHINE MONITORING SYSTEM (MMS) SIGNALS				
28.1	Following MMS signals would be made available on a specifically earmarked terminal strip. These MMS signals would be sourced from a SIMATIC S-7 PLC output card separately.	Vendor to offer			
28.2	Control ON	Vendor to offer			
28.3	Cycle ON	Vendor to offer			
28.4	Spindle Running	Vendor to offer			
28.5	Feed Active (Any of the axes moving)	Vendor to offer			
28.6	M30 (Program Stop)	Vendor to offer			
29	OPERATOR'S PLATFORM				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
29.1	It is should be independent motorised type, movable / adjustable in vertical and horizontal directions. It should be able to reach almost to center of the Table in horizontal direction. Interlocks should be provided for its horizontal / downward movement against rotating Table and against the job (rotating or stationary) to avoid collision / accident. Positions of the gates provided in the platform for Operator's convenience should be informed by the Vendor . Drawing / Details of the Operator's Platform should be submitted. A 15 Amp. Plug Point with ON/ OFF switch is also to be provided on the Platform.	Vendor to offer			
29.2	Horizontal movement of complete Platform.	Vendor to inform			
29.3	Vertical movement of complete Platform to cover total turning height.	Vendor to inform			
29.4	Height of Platform Railing.	Vendor to inform			
29.5	Weight Capacity of the Platform.	Vendor to inform			
29.6	Minimum Position of Platform from Shop Floor.	Vendor to inform			
30.0	MEASURING SYSTEM :				

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
30.1	Automatic job measuring system with measuring cycles, calibration system and all types of probes / styli 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.			
30.2	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.			
30.3	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 , 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.Vendor to furnish detailed description of the system along with offer	Vendor to offer with details.			
30.4	Spares Package for the Automatic Tool Offset Measuring system for 2 years trouble free working should also be offered.	Vendor to offer with list.			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
31.0	ADDITIONAL FEATURES ONLY FOR THE MACHINE NO.2 (WITH MILLING SPINDLE AND C AXIS)				
31.1	C - Axis				
31.1.1	Maximum continuous speed of C - axis	Vendor to inform			
31.1.2	Minimum continuous speed of C - axis	0.001 RPM			
31.1.3	No. of indexing positions for C -axis	360000			
31.1.4	Minimum increment in C - axis	0.001 Degree			
31.1.5	Table clamping mechanism for C - axis (Drawing to be submitted)	Vendor to inform			
31.1.6	Clamping force available on each clamp and no. of clamps	Vendor to inform			
31.1.7	Feed Back system - Heidenhain Encoder (Details should be submitted)	Vendor to inform			
31.1.8	Details of C - axis Servo Motor like torque, rating, type and make etc.	Vendor to inform			
31.1.9	Price of C - Axis should be offered separately	Vendor to confirm			
31.2	MILLING, BORING and DRILLING SPINDLE				
31.2.1	Machine should be equipped with Milling Spindle provided in the RAM	Required			
31.2.2	Power of spindle drive	30 KW (or more)			
31.2.3	Details of spindle drive viz. type, make, model, rating, torque etc.	Vendor to inform			
31.2.4	Spindle speed (infinitely variable)	5 - 2000 RPM (Approx.)			
31.2.5	Power / torque/ speed diagramme of spindle drive should be submitted	Vendor to inform			
31.2.6	Possibility of thread whirling by helical interpolation should be confirmed	Vendor to inform			
31.2.7	Clamping details for mounting milling head and Attachments should be submitted	Vendor to inform			
31.2.8	Clamping force available for clamping of Attachments	Vendor to inform			
31.2.9	Mounting of Milling Heads and Attachments should be automatic through programme as well as manually through Push Buttons	Vendor to confirm			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
31.2.10	Milling Heads should be equipped with both external and through spindle coolant system	Vendor to confirm			
31.2.11	Tool mounting and clamping should be automatic through programme as well as manually through Push Buttons	Vendor to confirm			
31.2.12	Price of "Milling, Boring and Drilling Spindle" should be offered separately	Vendor to confirm			
31.3	CNC UNIVERSAL MILLING HEAD				
31.3.1	"CNC Universal Milling Head" should be offered to enable complete milling, drilling, boring and threading operation on "Diode Wheel" Drawing No. 0-143-10-01001 (Proveout component) at different locations and angles as per drawing accuracy & surface finish."CNC Universal Milling Head" should be suitably mounted on the automatic tool changer (ATC) or on suitably located separate station for fully automatic mounting / dismounting & clamping / unclamping through program and manually also using push buttons provided on operator's panel. All operations of the "CNC Universal Milling Head" should be programmable for milling, drilling, boring and threading operations on different surfaces. Details with relevant drawings/catalogue of offered unit to be submitted.	Vendor to offer			
31.3.2	Power	30 KW			
31.3.3	Max. torque	Vendor to inform			
31.3.4	Speed range (infinitely variable)	1 - 2000 RPM (or beyond)			
31.3.5	Tool shank / spindle taper	BT - 50			
31.3.6	Automatic swiveling through programme as separate axis through AC Servo Motor	+90 Degree to -90 Degree in vertical plane			
31.3.7	Minimum increment for automatic swiveling	0.001 Degree			
31.3.8	Swiveling accuracy	+ / - 10 Seconds			
31.3.9	Tool clamping force	Vendor to inform			

SL. NO.	DESCRIPTION OF BHEL REQUIREMENT	REQUIRED	OFFERED	DEVIATION	REMARKS
31.3.10	Automatic tool clamping (by programme as well as manually through push buttons) shall be provided	Vendor to confirm			
31.3.11	Maximum cutter diameter	Vendor to inform			
31.3.12	Maximum cutter weight	Vendor to inform			
31.3.13	Maximum height for milling with Universal milling Head	2500 mm			
31.3.14	Power - Torque - Speed diagramme	Vendor to inform			
31.3.15	Dimensional details and weight of Head	Vendor to inform			
31.3.16	Coolant System: Internal (thru spindle) & external coolant with requisite flexible pipes on its snout	Vendor to confirm			
31.3.17	Pull Studs for mounting the Head and for mounting the tools in the taper of the Head shall be supplied by the vendor	Vendor to confirm			
31.3.18	Price of 'CNC Universal Milling Head" should be offered separately	Vendor to confirm			
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