



BHARAT HEAVY ELECTRICAL LIMITED

UNIT'S ADDRESS

UNIT'S PHONE NOS.

CONTACT PERSON'S NAME/DESIGN./PHONE NO.

E-MAIL (FROM PURCHASE DEPTT.)

Enquiry No. : E-588-08-0004-69-1

Due Date : 26/09/2008

Supplier Qtn. No. _____

Date. : _____

SPECIFICATION CUM COMPLIANCE CERTIFICATION FOR
CNC TURN MILL CENTRE

NOTE:-

1. Vendor must submit complete information against clause no. 24.0 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.

ADDRESS OF THE SUPPLIER :		ADDRESS OF THE INDIAN AGENTS :			
TELEPHONE NOS.:		TELEPHONE NOS.:			
FAX NOS.:		FAX NOS.:			
E-MAIL ADDRESS :					
SCOPE: SUPPLY, ERECTION & COMMISSIONING OF CNC TURN MILL CENTRE (INTEGRAL SLANT BED) COMPLYING WITH SPECIFICATION AS BELOW					
Sl.No	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
1.0	PURPOSE & WORKPIECE MATERIAL				
1.1	Purpose: (Operations/Jobs involved)	External Turning, Boring and Drilling,reaming and milling,grooving in Bore and outer dia of components			
1.2	Work Piece Material: (Material detail, Hardness etc.)	Work Piece Material: The machine shall be suitable for machining of casting/ forging to Specn. ASTM A216 Gr. WCC, GRADE : 40 Ni Cr Mo 65 /AISI 4340, IS2004 CL.3, CLASS 4, DIN EN 10269 – 1999 Gr: 20CrMoVTiB 410 , HARDNESS 180 to 320 BHN			

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2.0	SPECIFICATION:	Integral Slant bed			
2.1	MACHINE CONFIGURATION: The Turn Mill Centre should have three axes, namely X (vertical travel turret), Z (longitudinal travel fo slide), C (Spindle indexing). Machine housing totally enclosed	Vendor to specify			
2.2	CAPACITY & SIZE :				
2.2.1	Max.Turning Diameter (Between centres)	1000 mm			
2.2.2	Max.Turning Length	3000mm			
2.2.3	Max. Weight of Work-piece between centres without steady	2500kgs			
2.2.4	Max. Weight of Work-piece:				
	a) Only in chuck Minimum	1500Kgs			
	b)In chuck with tail stock support	4000kgs			
	c) In head stock with one steady rest Minimum	3000kgs			
	d) In head stock with two steady resst Minimum	5000kgs.			
2.2.5	Min. & max. bore diameter	Vendor			
2.2.6	Max boring depth	500mm			
2.2.7	Admit between centres (ABC) / Center Distance {Machine should be capable of facing at maximum length}	Vendor to specify			
2.2.8	Center Height	Vendor to specify			
2.2.9	Swing over bed (SOB)	Vendor to specify			
2.2.10	Swing Over Carriage (SOC) Minimum	Vendor to specify			
2.2.11	Distance of center of gravity from face plate, in case the workpiece is held only in chuck	Vendor to specify			
2.2.12	Face plate Diameter	Vendor to specify			
2.2.13	3 jaw self centrring hydraulic hollow chuck with matching cylindrer and with one set hard and soft JAWS	φ800mm			
	Maximum and Minimum Chucking diameters with single set of jaws.				
	a) External	φ800mm			
	b) Internal	φ100mm(Min)/Vendor to Specify			

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2.3	C- AXIS				
2.3.1	Independent fully programmable C-axis should be provided for positioning,interpolation and claming at exact angular position.	Vendor to offer and confirm			
2.3.2	Maximum contineous speed of c-axis	15 rpm			
2.3.3	Mmnimum contineous speed of c-axis	0.005rpm			
2.3.4	Minimum increment in C-axis	0.005°			
2.3.5	Details of C-axis servomotor like torque ,rating,type.make etc.	Vendor to specify			
2.3.6	Details of clamping sysytem of -axis	Vendor to specify			
2.3.7	Clamping force for indexing	Vendor to specify			
2.3.8	Torque of the drive	3200 Nm			
2.3.9	Clamping Torque	Vendor to specify			
2.3.10	Transmission mechanism	Vendor to specify			
2.3.11	Minimum Power of live tools contineous duty cycle	10KW			
2.3.12	Holding Torque(Through Hydraulic)	1100Nm			
2.3.13	Max..drilling capacity in steel 60kgs.sq.cm	Vendor to specify			
2.3.14	Max..Tapping capacity in steel 60kgs.sq.cm	Vendor to specify			
2.3.15	Max milling cutter size without adjacent tools	Vendor to specify			
2.3.16	Max.Milling cutter size with adjascent tools	Vendor to specify			
2.4	HEAD STOCK				
2.4.1	Spindle Motor Rating (Min.) AC, S1 Contineous Duty	47kw			
2.4.2	Spindle Motor Make (Either Siemens or Fanuc), Model etc.	Vendor to specify			
2.4.3	Spindle Bearing Type & Diameters (Radial & Axial)	Vendor to specify			
2.4.4	Spindle nose details (Drawing to be submitted)	Vendor to specify			
2.4.5	Spindle speed (Infinitely variable)	50 to800rpm			
2.4.6	Detail of speed ranges (Selectable through program)	Vendor to specify			
2.4.7	Max. permissible torque at face plate	Vendor to specify			
2.4.8	Torque/Power/Speed diagram of spindle motor	Vendor to specify			
2.4.9	Head stock center, either 60° and 90° with cover plate to cover the space when headstock center is removed.	Vendor to specify			
2.4.10	Spindle bore diameter and its depth from chuck face	Preferred φ130mm(Min)/Vendor to specify			
2.4.11	Live centre details	Vendor to specify			

Sl.No	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
2.5	X-AXIS (Cross Travel of Turret Head):				
2.5.1	Axis Resolution	0.001 mm			
2.5.2	Vertical travel	600 mm			
2.5.3	Traverse Range	600 mm			
2.5.4	Feed rate (Infinitely variable)	0.5-2500 mm/min			
2.5.5	Rapid traverse rate	5 m / min or more			
2.5.6	Feed force	Vendor to specify			
2.5.7	Ball screw Dimensions (mm)	Vendor to specify			
2.6	Z-AXIS (Longitudinal Travel of Machining Head)				
2.6.1	Axis Resolution	0.001 mm			
2.6.2	Longitudinal travel	Vendor to specify			
2.6.3	Feed rate (Infinitely variable)	0.5-2500 mm / min			
2.6.4	Rapid traverse rate	5 m / min or more			
2.6.5	Feed force	Vendor to specify			
2.6.6	Ball screw Dimensions (mm)	Vendor to specify			
2.7	MACHINE BED				
2.7.1	Type of bed	Itregrel slant bed			
2.7.2	Type of guide ways and detalis (Without Hydrostatic)	X anb Z axis linear roller guides. Tail stock and steady rests on box guide			
2.7.3	Hardness of guideways	Vendor to specify			
2.7.4	Details of lubrication system provided on Spindle and all axes	a) Centralised lubrication at all linear guideways and standard rotational bearing points b) Oil sump lubrication at C- axis worm gear c) Oil recirculating lubrication at 2-speed gear boxes for headstock- and milling main drive d) Oil sump recirculating lubrication at turning / milling / boring unit e) Grease/Oil mist lubrication for headstock main spindle bearings			
2.7.5	<u>Metallic Telescopic Covers</u> of rust resistant material should be provided with wipers for X & Z axes guide ways. Joints of telescopic covers should be so sealed to avoid mixing of coolant & hydrostatic oil is to be provided.	Vendor to specify			

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2.8	FEEDS AND DRIVE SYSTEM:				
2.8.1	Feed drives/motors X & Z axes [AC servo motors] Either Siemens or Fanuc digital type (detail of model, make, type etc. should be submitted)	Vendor to Submit			
2.8.2	Feed back system: a) For X & Z axes. Heidenhain linear scales with pressurised compressed air cleaning (Details should be submitted). b)For C-Axis Heidenhain Rotary encoder	Vendor to Submit			
2.8.3	Details of System to ensure zero backlash for X & Z axis	Vendor to Submit			
2.8.4	Mechanism for locking X , Z & C axis	Vendor to Submit			
2.8.5	Maximum feed force in X and Z axes	Vendor to Submit			
2.8.6	Maximum Torque in X and Z axes	Vendor to Submit			
2.9	STEADY RESTS :				
2.9.1	Steady rests 2 nos as below	Vendor to specify			
2.9.2	Self Centering hydraulic roller steady rest minimum size(1 no.)	50-200mm			
2.9.3	Range of supporting dia for Roller Steady Rest.	Vendor to specify			
2.9.4	Weight carrying capacity per steady(Static)	1000kgs			
2.9.5	Self Centering hydraulic roller steady rest minimum size(1 no.)	150-250mm			
2.9.6	Range of supporting dia for Roller Steady Rest.	Vendor to specify			
2.9.7	Weight carrying capacity per steady(Static)	2000Kgs.			
2.9.8	Swiveling type upper portion of steady rests for job loading/unloading (Details should be submitted)	Vendor to Submit			
2.9.9	Mounting of Steady Rest on Base shall be through quick-clamping fastener (Details should be submitted)	Vendor to Submit			
2.9.10	Convex and Cylindrical Roller for above steady rests as spares	Vendor to Submit			
2.10	TAIL STOCK :				
2.10.1	Motorised movement on bed by Push Buttons on Tail Stock	Vendor to specify			
2.10.2	Quill Travel	Vendor to specify			
2.10.3	Quill movement (motorised) Independent	Vendor to specify			
2.10.4	Quill diameter	Vendor to specify			

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2.10.5	Tail stock centre - Both 60° and 90° (Drawing to be submitted)	Vendor to Submit			
2.10.6	Detail of Positive Clamping & Unclamping of tail stock on bed	Vendor to Submit			
2.10.7	Max thrust on the Quill	Vendor to Submit			
2.10.8	Tail stock travel speed	Vendor to Submit			
2.10.9	Tail stock Bore Taper(With integrated bearing)	Vendor to Submit			
2.11	CARRIAGE/ CROSSSLIDE :				
2.11.1	Z-axis travel	Vendor to specify			
2.11.2	X-axis travel (specify movement beyond center i.e. X -ve side)	Vendor to specify			
2.11.3	Cutting force available at the carriage	Vendor to specify			
2.11.4	Layout showing extreme positions of the all axes movements	Vendor to specify			
2.11.5	Carriage to clear chuck, tailstock and all steady rests (should be confirmed)	Vendor to Confirm			
2.12	TOOL POST :				
2.12.1	Type of Tool Post: Turret with stationary/Rotary tools with no. of positions	12			
2.12.2	Type of Tool Holders for Turret / Tool Carriers / Boring Bar holders/Rotary tool holders etc. (if VDI type then specify its no.)	Disc,VDI 60 External turning 6nos,Boring holders with round shank 6nos.,Rotary Tools for drilling and Milling 6 nos.			
2.12.3	Tool shank size for different tool holders	32x32 (Preferred size 40x40)			
2.12.4	Model, make & type of turret	Vendor to specify			
2.12.5	Provision for coolant to reach upto tool tip in all types of tool holders	Vendor to specify			
2.12.6	Mechanism for indexing / selection of tool location	Bidirectional shortest path			
2.12.7	Automatic operation / selection / indexing of turret through CNC program	Vendor to specify			
2.12.8	Additional manual operation / selection through push buttons	Vendor to specify			
2.12.9	Drawing of tool post	Vendor to specify			
2.13	CONSTRUCTION:				
2.13.1	Vendor to furnish details of material, hardness & constructional details including explanatory drawings of various components/assemblies like Headstock, Steady Rest,Chuck, Tailstock, Carriage, Tool post, Machine bed, Feed Transmission system, Feedback system etc.of the machine.	Vendor to Submit			

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2.13.2	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			
2.14	OPERATION AND CONTROL SYSTEM:				
2.14.1	OPERATOR'S PANEL:				
2.14.1.1	Swiveling and sliding type operator's panel having complete CNC and machine control system with TFT of required configuration shall be provided on the operators platform for safe, convenient and efficient operation from both left and right sides of tool post. All switches should be within reach of operator of average height (Indian) for easy operation. All displays/indications should also be conveniently placed accordingly. Layout showing complete details should be submitted.	Vendor to confirm & submit Photograph and layout			
2.14.2	CNC SYSTEM & FEATURES :				
2.14.2.1	Make : Siemens 840 D	Siemens latest 840D CNC system			
2.14.2.2	Type : PC based latest version	Latest model			
2.14.2.3	Model: (Latest version, as available at the time of ordering, should be supplied).	Latest model/Specify			
2.14.2.4	Details of Standard features	Vendor to specify			
2.14.2.5	Details of optional features, recommended by vendor.	Vendor to specify			
2.14.2.6	Details of other optional features (should be selected by indenter)	Vendor to specify			
2.14.2.7	The system should have full alphanumeric keyboard, TFT colour display(10.4" or more), additional draw-out type Querty Key Board and mouse in suitable enclosure, RS232C serial interfaces, parallel interface for printer, COM port for telediagnosics, network ready with LAN, electronic hand wheels for all axes, Flash cord unit for data input/output, hard disk of sufficient capacity (Largest size available at the time of order shall be supplied), graphic simulation and preinstalled system software & other required softwares etc.(Details should be submitted by Vendor)USB Port withmemory stick 512MB	Vendor to Submit			
2.14.2.8	Eathernet card supporting TCP/IP protocols and proveout without internal LAN with necessary software.				
2.14.3	MANUAL CONTROL :				
2.14.3.1	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 spindle rpm, cutting feed on/off, display of axis position values etc, for manual turning operation without using CNC program, CNC option MANUAL TURN & MDI mode. Diagram / Sketches for switches / keys provided on operators pendant should be submitted.	Vendor to Submit			

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2.14.4	HAND HELD UNIT:				
2.14.4.1	Hand Held unit, Type B-MPI of Siemens make or equivalent alongwith sufficient length of interfacing cable is to be offered with complete details.	Vendor to Submit			
2.14.5	UPS FOR CNC SYSTEM:				
2.14.5.1	UPS of 30 minutes for CNC system with inbuilt cooling and charge status display (Battery charging /discharging time should be specified by vendor)	Vendor to specify			
2.15	MACHINE LIGHTS:				
2.15.1	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 & Submit Details			
2.15.2	A magnetic base portable spot light with sufficiently long cable should also be provided	Vendor to offer & Submit Details			
2.15.3	Any lights required in the foundation/ pit area shall also be foreseen and supplied by the vendor.	Vendor to offer & Submit Details			
2.15.4	All light fittings, consumables, adapters/receptacles should have compatibility with Indian equivalents	Vendor to offer & Submit Details			
2.15.5	Flashing / rotary type End of Cutting and Program Stop Light.	Vendor to offer & Submit Details			
2.16	AIR CONDITIONERS:				
2.16.1	Air Conditioners with Dehumidifiers of suitable / sufficient capacity to be provided for all Electrical / Electronic Panels / Cabinets including Operator's Panel considering specified ambient conditions. Detailed specifications of the same are to be submitted.	Vendor to offer & Submit Details			
2.17	HYDRAULIC SYSTEM : Details should be Submitted by the Vendor				
2.17.1	Make Rexroth / Vickers Sperry or equivalent from a reputed manufacturer. (Details to be submitted)	Vendor to offer Confirm			
2.17.2	Filtration System, Details should be submitted.	Vendor to offer Confirm			
2.17.3	Failure indication	Vendor to offer Confirm			
2.17.4	Automatic shut off provision, Details should be submitted.	Vendor to offer			
2.17.5	Hydraulic pump capacity (flow / pressure)	Vendor to offer			
2.17.6	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 Provide			
2.18	COOLANT SYSTEM :				
2.18.1	Coolant System with all accessories for following variants shall be provided. Selection of all the variants shall be through program and push buttons provided at operators panel as well.	Vendor to offer			
2.18.2	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 offer & confirm			
2.18.3	Coolant Flow Diagram showing filters, pumps, valves, tanks etc.to be submitted with the offer.	Vendor to Submit			

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2.18.4	Coolant pump & motor details etc. including pressure & flow of coolant for operations like turning, boring and centre drilling.	Vendor to offer & confirm			
2.18.5	Coolant Tank Capacity	Vendor to specify			
2.18.6	The coolant tank should be fitted with skimmer for regular cleaning of coolant from contamination with tramp oil.	Vendor to offer			
2.19	ELECTRICAL :				
2.19.1	415V + 10% / -15%, 50HZ +/-3 Hz, 3 Phase AC (3 wire system with out neutral) Power Supply will be provided by BHEL at a single point near the machine, as per layout recommended by Vendor. All types of cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine/control cabinets, shall be the responsibility of vendor. Requirement of grounding/earthing with required material details should be informed by vendor well in advance so that same could be incorporated during construction of foundation.	Vendor to confirm & specify			
2.19.2	Tropicalisation: All electrical / electronic equipment shall be tropicalized	Vendor to confirm & specify			
2.19.3	All electrical & electronic control cabinets & panels should be dust and vermin proof				
2.19.4	All electrical components in the cabinets should be mounted on DIN Rail	Vendor to confirm			
2.19.5	All electrical and electronic panels including operator's panel should be provided with fluorescent lamps for sufficient illumination and power receptacles of 220Volts, 5/15 Amp AC. All adapters/receptacles should have compatibility with Indian equivalents.	Vendor to confirm			
2.19.6	Motors shall conform to IEC or Indian Standards	Vendor to confirm			
2.19.7	All cables moving with traversing axes should be installed in caterpillar / Drag chain. Additionally, all the cable trays required for laying of cables should be included in the offer.	Vendor to confirm			
2.19.8	Vendor should ensure the proper earthing for the machine and its peripherals.	Vendor to confirm			
2.19.9	In-cycle hour counter with reset facility.	Vendor to confirm			
2.20	SAFETY ARRANGEMENTS:	Vendor to confirm & specify			
	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 should be submitted by the supplier.	Vendor to submit			

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	3. All the pipes, cables etc. on the machine should be well supported and protected. These should not create any hinderance to machine operator's movement for effective use of machine.	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 should be provided.	Vendor to confirm			
	6. Oil & water pipe lines should not run with electrical cable in the same tray / trench.	Vendor to confirm			
	7.Machine shall be provided with Automatic Door Lock System	Vendor to confirm			
2.21	ENVIRONMENTAL PERFORMANCE OF THE MACHINE :	Vendor to confirm			
	The Machine should conform to following factors related to environment :	Vendor to confirm			
	(a) Maximum noise level shall be 85 dB(A) at normal load condition, 1meter 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 asked for.	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			
3.0	CHIP CONVEYOR :				
3.1	A chip conveyor to carry both short and curly chips efficiently and effectively to the chip bin (on tailstock side) should be provided on tail stock of the machine. Two Chip bins of appropriate size of Indian make, with wheels & handle for movement, should also be supplied.	Vendor to submit			
3.2	Type of chip conveyor	Automatic Chain conveyor			
3.3	Width of conveyor	Vendor to specify			
3.4	Elevation of chip conveyor for chip bin	Vendor to specify			
3.5	Material of chip conveyor (should be rust resistant)	Vendor to confirm			

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3.6	Provision for smooth flow of chips through bedways to the conveyor and for avoiding clogging of chips should be provided. Grill/Mesh type rigid covers should be provided above 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 submit			
3.7	Operation of chip conveyor (forward & reverse) through push buttons on operator's panel and at Chip Conveyor	Vendor to confirm			
3.8	Layout showing location of chip conveyor should be submitted.	Vendor to submit			
4.0	SERVO VOLATGE STABILIZER:	BHEL Scope			
4.1	Rating	Vendor to specify			
5.0	ULTRA ISOLATION TRANSFORMER:	BHEL Scope			
5.1	Rating	Vendor to specify			
6.0	PNEUMATIC SYSTEM:				
6.1	AIR COMPRESSOR:				
6.1.1	Independent Air Compressor (of reputed Indian make) with refrigerated type Dryer & Filter of suitable capacity for the total compressed air requirements of the machine & accessories and to suit required air quality should be supplied. The system should be so designed to have additional provision and required accessories so that BHEL compressed air supply having pressure (4 to 6 ata) could be used as and when required. The compressor unit should be suitable for continuous duty.	Vendor to specify			
6.1.2	Make & Model of Air Compressor	Vendor to specify			

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6.1.3	Make & Model of Refrigerated Air Dryer	Vendor to specify			
6.1.4	Capacity (Flow, Pressure & KW)	Vendor to specify			
6.2	COMPRESSED AIR POINTS:				
6.2.1	Compressed Air Point with manually ON/ OFF Valve and flexible pipe of suitable length for work piece cleaning.	Vendor to confirm			
7.0	TOOLINGS:				
7.1	List of all types of required tool holders.	External tool holders 6 nos,Boring bars with round shank 6 nos,Rotary drilling and milling holders 12 nos.			
7.2	All types of cutting tools, tool holders, adapters, sleeves, probes/stylii etc. recommended by vendor in sufficient quantity for complete machining of proveout of ONE component.	Vendor to specify			
7.3	Additional set of SOFT Jaws	Vendor to specify			
8.0	MEASURING SYSTEMS:				
8.1	Automatic Job Measuring System	Vendor to specify			
8.1.1	Automatic wireless job measuring system from reputed manufacturers like Renishaw, Marposs, Heidenhain etc. Shall be quoted. The supplier shall furnish the details of the measuring system along with the quotation. Itemized break up of the system shall be furnished.	Vendor to specify			
8.1.2	The supplier shall quote software and measuring cycles for the system. The system shall perform automatic measurement of the following in a Single Program using the Measuring Cycles. (1) Series of Inside Diameters (2) Series of Outside Diameters (3) Series of Step positions and Step Widths and Groove Depths (upto 100mm Depth) There shall be a provision for offline measurement programming.	Vendor to specify			
8.1.3	There shall be a provision that, in case of an unwarranted trigger, the machine shall stop automatically to avoid probe damage.	Vendor to specify			
8.1.4	The system shall facilitate formatted display of the nominal, tolerance, actual and deviation results in a Screen. The printer required for the same shall be quoted. Sufficient number of ports and driver software to transmit the formatted measurement data over LAN and to the printer shall be available.	Vendor to specify			
8.1.5	Suitable accessories to calibrate the Probe for Diameter and Step / Groove Measurements shall be quoted. There shall be provision to position the calibration accessories at a convenient place in the machine. Details of the calibration set up shall be furnished along with the quotation. Appropriate automatic Calibration cycles shall be quoted.	Vendor to specify			

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8.1.6	Supplier shall furnish the details of the accuracy and repeatability of probe measurement (of diameters, steps and grooves.)	Vendor to specify			
8.1.7	Supplier shall quote the spares of the measuring system for 5 (five) years of trouble free operation. This shall include a minimum of 10 (ten) stylus and one probe head apart from other spares of this system recommended by the supplier.	Vendor to specify			
8.1.8	Supplier shall train BHEL Engineers in using the measuring system (with actual demonstration on the job) and writing measurement programs. The training on measuring system to be provided at OEM works, during Pre-dispatch Inspection (at Supplier's works) and during commissioning (at BHEL works).	Vendor to specify			
8.1.9	Supplier shall prove out the measuring system by measuring all the machined dimensions in the prove out component and printing a formatted measurement report for the same. Suitable measuring program for the prove-out component shall be prepared by the supplier. The source code of this sample program shall be explained to BHEL Engineers during training.	Vendor to specify			
8.2	Automatic Tool Offset Measuring System with measuring cycles, calibration system etc suitable for all types of tools recommended for prove-out components. Vendor to furnish detailed description of the system along with offer.	Vendor to specify			
9.0	DIAGNOSTIC SYSTEM	Vendor to offer & submit details			
9.1	TELE-DIAGNOSTIC SERVICE :	Vendor to offer & submit details			
9.1.1	Tele-diagnostic service should be provided through International telephone lines along with required Hardware / Software package for the supplied CNC system for remote diagnosis and correction of the problems in both CNC System and PLC of the machine. 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 & submit details			
9.2	FAULT DIAGNOSTIC SYSTEM:				
9.2.1	Supplier's own diagnostic system with required hardware and software should be supplied and installed on the CNC system. This should include customised auto-diagnostic system with supporting hardware and software which shows detailed cause and remedy for the fault on the display with full video diagnostic help for faults related to mechanical and electrical maintenance.	PLC soft ware debugging. PG/PC unit for diagnostic purpose for maintenance with necessary soft wae and Hard ware.			
9.2.2	Help guide should be provided to use both diagnostic systems	Vendor to offer & submit details			

Sl.No	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
10.0	LEVELING & ANCHORING SYSTEM				
10.1	Complete anchoring system including foundation bolts, anchoring materials, fixators, leveling shoes etc should be supplied	Vendor to offer & submit details			
11.0	TOOLS FOR ERECTION, OPERATION & MAINTENANCE :				
11.1	Special tools and equipment required for erection of the machine shall be brought by the vendor. Necessary tools like Torque Wrench, Spanners, Keys, grease guns etc.for operation and maintenance of the machine should be supplied. List of such tools should be submitted with offer	Vendor to confirm			
11.2	Test mandrel for checking spindle run-out & alignment of headstock/tailstock etc. should be supplied	Vendor to confirm			
12.0	SPARES:				
12.1	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. (Unit Price of each item of spare should be offered)	Vendor to offer			
	a) Mechanical & Hydraulic Spares: All types of Pumps, Valves, Pressure Switches, Transducers, Flow Switches, Filters, Seals, O-rings, Hydraulic Hoses etc.	Vendor to offer			
	b) Electrical /Electronic / CNC Spares: All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers, Main Power Switch, Encoders, Scanning Heads for Linear Scales, MMC module, NCU module, Operator's panel with Display Unit, Floppy Disk Unit, I/O Cards for PLC, Servo Motors for Feed Drives, Power Module & Control Cards for Main Drive as well as Feed Drives etc.	Vendor to offer			
12.2	All types of spares for total machine and accessories should be available for atleast ten years after supply of the machine. If machine or control is likely to become obsolete in this period, the vendor should inform BHEL sufficiently in advance and provide drawings of parts / details of spares & suppliers to enable BHEL to procure these in advance, if required	Vendor to offer			
12.3	Recommended set of spares for all attachments are to be offered with details.	Vendor to offer			
12.4	Vendor to confirm that complete list of spares for machine and accessories, along with specification / type / model, and name & address of the spare supplier shall be furnished along with documentation to be supplied with the machine	Vendor to offer			
13.0	DOCUMENTATION : Five sets of following documents (Hard copies) in English language should be supplied along with the machine in original	Vendor to offer			
13.1	Operating manuals of Machine , CNC system,drives&motors	Vendor to offer			

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13.2	Programming Manuals of Machine & CNC system	Vendor to offer			
13.3	Detailed Maintenance manual of machine with all drawings of machine assemblies/sub-assemblies/parts including Electrical / Pneumatic/ Coolant / Hydraulic circuit diagrams. All Assembly/ Sub Assembly Drawings shall be supplied with the part list also	Vendor to offer			
13.4	Maintenance, Interface & commissioning manuals for CNC system, spindle & feed drives.	Vendor to offer			
13.5	Manufacturing drawings for all supplied tool holders, coolant connections, tailstock center, adapters, sleeves, fixtures etc.	Vendor to offer			
13.6	Catalogues, O&M 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 Automatic Tool Offset & Job Measuring Systems, Air-Compressor and all supplied Accessories.	Vendor to offer			
13.9	PLC program print-outs with comments in English.	Vendor to offer			
13.10	PLC program on CD, NC data & PLC data on CD+C329	Vendor to offer			
13.11	Complete back-up of hard disk on GHOST CD and clear written Instructions (3 copies) to take back-up and reloading of a new hard disk.	Vendor to offer			
13.12	Complete Master List of parts used in the machine shall be submitted by the vendor.	Vendor to offer			
13.13	One additional set of all the above documentation on CD ROM, wherever possible.	Vendor to offer			
14.0	TRAINING				
14.1	BHEL Persons should be trained at supplier's Works for mutually agreed period in the area of (a) CNC Part Programming / Technology, Use of all CNC Features, Programming for Measuring Systems & supplied accessories etc. (b) Electrical, Electronic & CNC maintenance for machine & other supplied equipments (c) Mechanical & Hydraulic maintenance of the machine & other supplied equipments (d) Operation of the machine & other supplied equipments.	Vendor to offer			
14.2	Air-fare, boarding & lodging for the trainees shall be borne by BHEL.	Vendor to offer			
14.3	Competent, English speaking experts shall be arranged by the vendor during training for satisfactory & effective training of BHEL personnel.	Vendor to offer			
14.4	Vendor to quote for training on per man per week basis	Vendor to offer			

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14.5	Vendor should commit to organize training of Electronics Engineer and Programmer at the CNC System Manufacturer's works for advanced features and specialised training if so required by BHEL	Vendor to offer			
15.0	FOUNDATION :				
15.1	Vendor shall submit the preliminary layout drawing for getting BHEL's approval within one month from the date of Letter of Intent (LOI) / P.O. whichever is earlier. Soil condition data will be furnished by BHEL along with the approval. Complete Foundation Design including details viz. static / dynamic load details etc. and Final Layout drawings shall be submitted by the supplier within three months after getting BHEL's approval. The layout should consist of all requirements pertaining to complete machine including space requirement for Voltage Stabilizer, Isolation Transformer, Air compressor, Chip Bin & any other accessories. BHEL shall construct complete foundation for the machine under supervision of supplier and at supplier's responsibility. Vendor should arrange equipments required for the testing of foundation, if required by the vendor. The vendor shall also indicate detailed specifications of grouting compound and Grouting procedure etc. for foundation bolts	Vendor to confirm			
16.0	ERECTION & COMMISSIONING				
16.1	Supplier to take full responsibility for carrying out the erection, start up, testing of machine, it's control & all types of other supplied equipment , machining of test pieces etc. Service requirement like power, air & water shall be provided by BHEL at only one point to be indicated by supplier in their foundation/layout drawings. Other requirements like crane and helping personnel shall also be provided by BHEL. Details of these requirements should be informed by vendor in advance.	Vendor to confirm			
16.2	Erection & Commissioning of 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 20 (Machine Acceptance) shall form part of the commissioning activity.	Vendor to confirm			
16.4	Tools, Tackels, Test Mandrels, instruments and other necessary equipment including Laser equipment required to carry out all above activities should be brought by the supplier.	Vendor to confirm			
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			

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16.6	All Cover Plates required for the machine and its peripherals including pits, if any, shall be supplied and installed by the vendor. The plates should be sourced from India	Vendor to confirm			
16.7	Portion, if any, of the machine, accessories and other supplied items where paint has rubbed off or peeled during transit or erection should be repainted and merged with the original surrounding paint by the vendor. For this purpose, the vendor should supply sufficient quantity of touch-up paint of various colours of paint used.	Vendor to confirm			
16.8	Schedule of Erection and Commissioning shall be submitted with the offer.	Vendor to submit			
16.9	Charges, duration, terms & conditions for E&C should be furnished in detail separately by vendor along with offer.	Vendor to offer			
17.0	ACCURACY TESTS:				
17.1	GEOMETRICAL ACCURACIES :				
17.1.1	Geometrical Accuracy Tests shall be in accordance with ISO 1708 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	Head Stock Spindle run out: (Radial & Axial)	Vendor to confirm			
17.1.3	All other accuracies to confirm to ISO 1708 (Latest Revision) or Suppliers Test chart whichever is finer.	Should be tested by Vendor			
17.1.4	Tail stock Quill taper run-out	Vendor to specify			
17.1.5	Cylindricity of turning	Vendor to specify			
17.1.6	True roundness of turning	Vendor to specify			
17.1.7	Facial run-outs	Vendor to specify			
17.1.8	All the above accuracies should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and during Erection & Commissioning at BHEL	should be tested by Vendor			
17.2	MACHINE POSITIONING ACCURACIES & REPEATABILITY: Should be measured as per VDI/DGQ 3441 (Latest Revision) using LASER INTERFEROMETER.				
17.2.1	Positioning accuracy in X axis (Pa) per 1000 mm	0.01mm			
17.2.2	Positioning accuracy in Z axis (Pa) per 1000 mm	0.01mm			
17.2.3	Positioning accuracy in C- axis (Pa)	0.01deg.			
17.2.4	Repeatability in X axis (Ps)	0.0075mm			
17.2.5	Repeatability in Z axis (Ps)	0.0125mm			
17.2.6	Repeatability in C- axis (Ps)	0.005°			

Sl.No	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
17.2.7	Positioning accuracy over entire traverse in X axis (Pa)	Vendor to specify			
17.2.8	Positioning accuracy over entire traverse in Z axis (Pa)	Vendor to specify			
17.2.9	Total positioning error along X,Z&C axes per 1000 mm (P)	Vendor to specify			
17.2.10	Total positioning error along X, Z&C axes over entire traverse (P)	Vendor to specify			
17.2.11	All the above accuracies should be demonstrated to BHEL engineers during pre-acceptance at Suppliers works and during Erection & Commissioning at BHEL Works	Vendor to specify			
18.0	AMBIENT CONDITIONS & THERMAL STABILITY :				
18.1	Total machine including CNC system and all supplied items should work trouble free and efficiently under following operating conditions. Power Supply: Voltage: 415 V +10% / -15% Frequency: 50 Hz +3%, - 3% No. of phases = 3 Ambient Conditions: Temperature = \pm 5 to 45 degree celsius Relative Humidity = 95% max. (Vendor to confirm that machine is suitable for above and details of provisions on the machine for the same are to be furnished by Vendor)	Vendor to 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	The machine, including attachments and accessories, should be suitable for 24 hrs. continuous operation to its full capacity for 24 hour a day and 7 days a week throughout. Vendor to ensure and confirm the same.	Vendor to confirm			

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19.0	PROVEOUT OF BHEL COMPONENTS :				
19.1	Drawings of proveout components are enclosed. Vendor to submit preliminary process, time study & tool list recommended by them along with the offer. Change in process/tools may be mutually discussed and agreed. Complete machining of prove out components shall be done by Vendor at BHEL works to the specified design accuracy and surface finish, using cutting tools and CNC programs to be provided by the vendor to prove the machine after complete erection, tests & test piece machining etc. Material for the proveout components shall be provided by BHEL. Vendor should submit the CNC programs, setting schemes, process sheets, tooling layouts, time studies etc. in advance for the prove out components. Vendor shall be fully responsible for machining of proveout components as per drawing and other requirements specified by BHEL to the full satisfaction of BHEL. Clarifications, if any required by vendor, regarding accuracy requirements of the proveout components, whether specified or not, should be discussed and cleared by vendor during initial technical discussions.	1) Main Vertical Shaft Drg.No. 26117600008/06 Matl : Ni Cr Mo 65/ AISI 4340 Hardness 260 -320 BHN. 2) Main Vertical Shaft Drg.No.16110000239/05 Matl : Ni Cr Mo 65/ AISI 4340 Hardness 260 -320 BHN.			
19.2	During proveout, all tools shall be set by using supplied Tool Offset Measuring System and final job inspection shall be done by supplied Job Measuring System. Vendor shall be responsible for any deviation/rejection in proveout component due to wrong machining or malfunctioning of the machine during proveout machining and also for the delay in machining due to improper recommended tooling etc. The cost of such deviation / rejection, if any, shall be refunded by the vendor to BHEL.	Vendor to confirm			
20.0	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 accuracies as per test chart.				
20.1.2	Positioning accuracies as per VDI-DGQ/3441	Valuas offered against clause no.17.2 should be demonstrated.			
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.				
20.1.4	Demonstration of all features of the machine, control system & accessories				
20.1.5	Machining of test piece as per AFNOR/ISO . Vendor to supply test piece and tooling for it's machining.				

Sl.No	DESCRIPTION FOR BHEL REQUIREMENT	SPECIFIED / TO BE CONFIRMED BY	OFFERED	DEVIATIONS	REMARKS
20.2	Tests/Activities to be carried out at BHEL works while commissioning the machine :				
20.2.1	Geometrical accuracies as per test chart.				
20.2.2	Positioning accuracies as per VDI-DGQ/3441	Values offered against clause no.17.2 should be demonstrated.			
20.2.3	Full load test to demonstrate the maximum power & cutting capacity of the machine.	Vendor to accept & 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 & confirm			
20.2.5	Demonstration of all features of the machine, control system & accessories to the satisfaction of BHEL for efficient and effective use of the machine	Vendor to accept & confirm			
20.2.6	Demonstration by actual use of all supplied attachments and accessories to their full capacity.	Vendor to accept & confirm			
20.2.7	Machining test piece as per AFNOR/NASA/ISO Vendor to arrange Test pieces and tooling for it's machining.	Vendor to accept & confirm			
20.2.8	Job Proveout machining.	Vendor to accept & confirm			
20.2.9	Two weeks supervision of independent operation of machine by BHEL after job proveout	Vendor to accept & 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 & confirm			
21.0	PACKING:				
21.1	Sea worthy & rigid packing for all items of complete machine, CNC System, all Accessories and other supplied items to avoid any damage/loss in transit. When machine is despatched in containers, all small loose items shall be suitably packed in boxes	Vendor to confirm			
22.0	GUARANTEE :				
22.1	24 months from the date of acceptance of the machine.	Vendor to comply			
23.0	GENERAL :				
23.1	Machine Model No.	Vendor to specify			
23.2	Total connected load (KVA):	Vendor to specify			
23.3	Floor area required (Length, Width, Height) for complete machine & accessories	Vendor to specify			
23.4	Painting of Machine / Electrical Panels : RAL 6011 Apple Green (Polyurethane Paint)	Vendor to specify			
23.5	Total weight of the machine	Vendor to specify			
23.6	Weight of heaviest part of machine	Vendor to specify			
23.7	Weight of the heaviest assembly / sub-assembly of the Machine	Vendor to specify			

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23.8	Dimensions of largest part/ sub-assembly/ assembly of the machine	Vendor to specify			
23.9	Vendor to submit , along with offer, reference list of customers where similar machines have been supplied mentioning broad specifications of the supplied machine i.e. Model, Swing Over Carriage, Center Distance, Load Carrying Capacity, Main Drive Rating, CNC System etc	Vendor to specify			
23.10	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			
24.0	REFERENCE LIST / QUALIFYING CONDITIONS :				
24.1	Only those Vendors (OEM), who have supplied and commissioned at least one CNC TURN MILL CENTRE of same or higher sizes (Max. Turnining Diameter, Max. Turning Length, Max. Wt. of Work Piece between centres without Steadies, Max. Wt. of Work Piece (a) Only in Chuck-min. (b) In Chuck with Tailstock support (c) In Head Stock with one Steady Rest-min. (d) In Head Stock with two Steady Rests-min. , Min. and Max. Bore Diameter, Max. Boring depth) for similar applications in the past ten years (On the Date of Opening of tender) and such machine is presently working satisfactorily for more than one year after commissioning (On the Date of Opening of tender), should quote. However, if such machine(s) has/had been supplied to BHEL, then such machine should be presently working satisfactorily for more than six months after its commissioning and acceptance (On the Date of Opening of tender) in BHEL,	Vendor to accept and 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 and application for which the machine is supplied.	Vendor to inform			
	5. Name and designation of the contact person of the customer.	Vendor to inform			
	6. Phone, FAX no. and email address of the contact person of the customer.	Vendor to inform			
	7. Performance certificate from the customers regarding satisfactory performance of machine supplied to them (Original certificate or through e-mail directly from customers) . The original may be returned after verification if required	Vendor to submit			
	8. BHEL reserves the right to verify the information provided by vendor. In case the information provided by vendor is found to be false/incorrect, the offer shall be rejected.	Vendor to note			

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25.0	OTHER FEATURES:				
25.1	NETWORKING:	Vendor to confirm			
25.1.1	Machine control should have necessary hardware and software for interfacing with gigabit Ethernet Local Area Network with 100 MB/sec through UTP cables for 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 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			
	b) The program transfer between CNC system and network should also be possible in CNC Mode.	Vendor to confirm			
25.2	MACHINE MONITORING SYSTEM (MMS) SIGNALS	Vendor to confirm			
25.2.1	Following MMS signals would be made available on a specifically earmarked terminal strip. These MMS signals would be sourced from a SIMATIC S-7 PLC output card separately.				
	a) Control ON	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			